

Valter Nelson Noronha Alves

SOUND DESIGN GUIDANCE AS A CONTRIBUTION TOWARDS THE EMPOWERMENT OF INDIE GAME DEVELOPERS

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UNIVERSIDADE DE COIMBRA

Valter Nelson Noronha Alves

ORIENTAÇÃO NO DESENHO DE SOM COMO CONTRIBUIÇÃO PARA A CAPACITAÇÃO DOS CRIADORES DE JOGOS INDEPENDENTES

Tese elaborada para satisfação parcial dos requisitos para obtenção do grau de doutor em Ciências e Tecnologias da Informação, especialização em Interação Humano-Computador, orientada pelo Professor Licínio Gomes Roque e apresentada ao Departamento de Engenharia Informática da Faculdade de Ciências e Tecnologia da Universidade de Coimbra.

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Abstract

Currently, expertise in sound design in games is mostly tacit and held by senior professionals, who are not numerous and who typically work for resourceful teams that are able to afford them. Indie game developers, usually working with low resources, often have to cope with lack of expertise in sound design.

We propose to provide guidance for the empowerment of non-expert practitioners to perform sound design in games, assuming the impracticality of integrating sound design experts in their teams. This empowerment also implies leveraging the literacy in this specific domain, hence providing abilities to communicate and participate in the conception of possible explorations. Such abilities could also be beneficial to the broader audience of game developers, where it could create the conditions for expert sound designers to be invited more regularly and earlier into game projects.

Our proposal is composed of several contributions. First, we present an operative adherence to a holistic practice of sound design, embedded in game design, in which the exploration of sound is performed in the early phases of ideation and addressed by its purposefulness to the game experience. Then, we present an initial set of design guidelines for sound design in games, which include multidisciplinary concepts and insights. Our observation of game design practitioners using these guidelines led us to also propose a lower-level of guidance: a pattern language for sound design in games, representing recurrent sound explorations found in games of recognized quality. In its current state, version 2.0, the pattern language consists of a network of 81 candidate design patterns, publicly available through the wiki soundingames.com. We also present a deck of cards for sound design in games, which was originally developed for research purposes as way to audit the participation of the patterns during design phenomena, but which eventually evolved into an end-user interface with the pattern language.

Through experimentation, we gathered indicators that the proposed guidance can empower non-expert practitioners. The experiments also informed revisions to the proposals and contributed to refine our understanding of the research problem. We conclude this dissertation by presenting the conditions that we have been developing to open the body of knowledge to the community of practice, for discussion and appropriation.

Resumo

O conhecimento pericial em desenho de som em jogos é, atualmente, majoritariamente tácito e mantido por profissionais experientes que não são numerosos e que trabalham para equipas que possuem recursos para os contratar. Os criadores de jogos independentes, usualmente a trabalhar com escassos recursos, têm frequentemente que lidar com a falta de conhecimento especializado em desenho de som. Propomos fornecer orientações para a capacitação de praticantes não especialistas em desenho de som em jogos, assumindo a impraticabilidade de integrar especialistas com essa competência nas suas equipas. Esta capacitação implica também fomentar a literacia neste domínio específico, promovendo, assim, competências para comunicar e participar na concepção de explorações de som. Tais capacidades também podem ser vantajosas no âmbito mais amplo dos criadores de jogos, junto do qual poderiam criar as condições para que os especialistas em desenho de som fossem convidados com mais regularidade, e mais cedo, para os projetos de criação de jogos.

A nossa proposta é constituída por várias contribuições. Começamos por apresentar uma operacionalização holística da prática de desenho de som, incorporada no desenho de jogos, em que a exploração do som é realizada nas fases iniciais da ideação e é apreciada em função do seu propósito para a experiência de jogo. Seguidamente, apresentamos um conjunto inicial de linhas orientadoras para o desenho de som em jogos, que incluem conceitos e influências multidisciplinares. A observação que fizemos da utilização dessas linhas orientadoras, por parte de praticantes em desenho de jogos, levou-nos a propor também orientação de mais baixo nível: uma linguagem de padrões para desenho de som em jogos, representando explorações de som recorrentes em jogos de reconhecida qualidade. No seu estado atual, versão 2.0, esta linguagem de padrões consiste numa rede de 81 padrões candidatos, publicamente disponíveis através da wiki soundingames.com. Apresentamos também um instrumento na forma de um baralho de cartas para o desenho de som em jogos, que foi originalmente desenvolvido com fins de investigação, como forma de auditar a participação dos padrões durante a atividade de desenho de jogos, mas que evoluiu para se tornar uma interface entre a linguagem de padrões e o utilizador final.

Com base em experimentação, reunimos indicadores de que a orientação que propomos pode capacitar praticantes não especializados. Os exercícios realizados também

informaram revisões às propostas e contribuíram para aumentar a nossa compreensão da questão em investigação. Concluimos apresentando condições que temos vindo a desenvolver para abrir esta base de conhecimento à comunidade de prática, para discussão e apropriação.

Keywords

Acoustic ecology, Deck of cards, Design guidelines, Design patterns, Empowerment, Game audio, Game design, Independent video game development, Indie games, Pattern languages, Small game developers, Sound design in games.

Palavras-chave

Capacitação, Criadores de jogos independentes, Desenho de jogos, Desenho de som em jogos, Desenvolvimento independente de jogos, Ecologia Acústica, Jogos *indie*, Linguagem de padrões, Linhas orientadoras, Padrões de desenho, Som em jogos, Videojogos.

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To my family.

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Acronyms and Abbreviations

DSR	DESIGN SCIENCE RESEARCH
HCI	HUMAN-COMPUTER INTERACTION
NPC.....	NON-PLAYER CHARACTER (SEE GLOSSARY, P. 209)
PC.....	PLAYING CHARACTER (SEE GLOSSARY, P. 209)
SfD	SCIENCE FOR DESIGN

Conventions Adopted in this Document

The following is a set of miscellaneous conventions that we adopted along this document. They represent compromises that we found reasonable and convenient for the sake of readability.

“Game” means “Video game”. We use the shorter form “games” to refer to “video games” or “computer games”. Other kinds of games, e.g. board games, are not discussed in this thesis. Also, that is the form usually adopted in expressions such as “game design” or “indie games”. Plus, the term “video” suffers from visual biasing, which in a thesis on sound is interesting to circumvent whenever a satisfactory, well understood, alternative exists.

“Indie”. We use the qualifier “indie”, short for “independent”, to refer to a category of game development teams that is relevant for our rationale. In most of the cases, what is being implied is the reduced number of people in the team and the low budget that excludes, for instance, hiring specialists to perform tasks such as sound design. This implication is not strictly rigorous (see Glossary, p. 209) but the term is commonly used in that sense, in the domain. Our second best option would be to use the expression “small developers”, also a common adoption, but we also found it limited and sometimes depreciatory.

“Sound” versus “audio”. We opted not to be normative in distinguishing the meaning of the terms “sound” and “audio”. Instead, in each particular circumstance we adopted the term that is most consistent with the respective context. Different authors have argued and adopted disparate distinctions (see Glossary, p. 209). Though such discussion is relevant, it is not central to the research question. The fact that this is an interdisciplinary research and that we found different adoptions, being coherently used in the vocabulary of the distinct contributing fields, was also germane to our decision.

“Videos” means “videos with audio”. We often allude to multimedia snippets that we trimmed from recordings of gameplay sessions. We refer to them as “videos”, or “video examples”, although they actually contain video *and* audio. This adoption is certainly a compromise, particularly when considering the focus of this thesis. It may seem contradictory, or at least contributing to the perpetuation of the prevalence of visuals over the auditory component (see Section 2.1) in common discourse. Yet, we found that the available alternatives (“multimedia”, “media clip”, “audio and video”, etc.) were either uncanny or, paradoxically, contributing to set the two modalities apart instead of integrating them.

Chapter 1

Introduction

In this chapter we provide a first pass over the whole course of our research. The aim is to allow the reader a first appreciation of the full contents of the thesis before going into details. We also contextualize our publications relevant to this research. Further information on those publications is provided in Appendix A. The formal structure of the document is presented at the end of the chapter.

1.1 The course of this research

Scarce exploration of sound in games

This research started with the acknowledgment that the exploration of sound in the broad panorama of game development is far from its potential, especially beyond strict sonification and superimposition of music. A literature review allowed us to understand the context leading to this fact. Current cultural bias towards the visual modality and short mindfulness for sound in the wide scope of human-computer interaction, including in what refers to scientific research, are parts of such context.

Paucity of guidance in sound design for indie game developers

The literature review also revealed the paucity of guidance in the field of sound design in games as part, and result, of such context. This finding became one of the pillars of the motivation for this research. We learned that expertise in sound design in games is mostly tacit and held by senior professionals. These experts are not numerous and typically work for resourceful teams that can afford hiring them. Indie game developers, usually working with low resources, often have to cope with lack of expertise in sound design in their projects.

Sound designers report that they are involved too late in projects

The study of the characteristics of the work and sensitivities of the expert sound designers, documented mainly through interviews and testimonies, revealed fundamental aspects that would shape our mindset for the research to come. These professionals often report their struggle to let other stakeholders realize that the practice – and results – of sound design suffer from being left to a phase of the development cycle

when there is no longer room to fit explorations that might take full advantage of the potentialities of sound.

As a consequence, instead of actual sound *design* these professionals are often left with few more to contribute besides the mere sonification of the game. Actually, this is a claim that we found to be transversal to other domains where sound design is part of the production cycle, namely in the movie industry.

Relevance of indie game development

Meanwhile, a further study of the contrasts between the established practices in the big production teams and the mass of indie developers highlighted the strategic relevance of the latter. The magnitude of such a community and the distinctive character of their initiatives are aspects that evidence great potential.

*Research Question, focusing on
the empowerment of non-expert practitioners to perform sound design in games*

This set of realizations gave us the confidence to invest in a research question that aims at providing guidance for the empowerment of non-expert practitioners to perform sound design in games, hence being able to take full advantage of the potential of sound in their projects. The goal of such an empowerment is twofold. First, it should enable non-experts to *perform* sound design on their own in scenarios where having an expert sound designer is not an option. This goal serves, in particular, the mass of indie game developers mostly working in small and low budget teams.

Second, and thinking of the broader community of game designers, empowerment in sound design should also come from leveraging the literacy in this specific domain. In addition to augmenting the *awareness* for potential contributions of sound to the overall product design, this should provide the abilities to *communicate* and to more actively *participate* in the conception of possible explorations. In turn, this awareness may create the conditions for expert sound designers to be invited more regularly and earlier into game projects.

Embracing a designerly approach to research

Considering the characteristics of our research question we understood that we would be better served by designerly methodologies, in lieu of a more positivistic approach. To start with, we needed a methodology that would allow us constructing knowledge while

experimenting with different approaches to design. But we also needed meaningful ways to validate the proposed guidance. Since our goal is to create conditions for human transformation (empowerment), the ultimate appreciation of the guidance depends on the meanings that people will construct around that guidance, in the complex context in which it will eventually become used. Thus, we needed a human-centred approach for such validation.

Design Science Research as main research approach

We adopted *Design Science Research* (Hevner & Chatterjee, 2010; Vaishnavi & Kuechler, 2004; 2008), hereafter DSR, as our main research approach. This allowed us to build knowledge along an emergent process, with intermediary outcomes, incrementally redesigned according to their respective evaluations.

Science for Design as support for second-order understanding

Additionally, in *Science for Design* (Krippendorff, 2006), hereafter SfD, we found the theoretical support for the formulation of a second-order understanding of the guidance being designed, i.e., an *understanding of the understanding* held by those who may be stakeholders in the evolution of such guidance. It also gave us a better perception on the role of the community in the life cycle of a design, and in the relevance of all stakeholders – not just the strict target of the design.

Interest in a holistic approach to sound design

Our first progress, while tackling the research question, was the maturation of a mindset that became ubiquitous in all following developments. From testimonies of expert sound designers, we started to grow the understanding that genuine exploration of sound implies the *opportunity* to address sound in a holistic way. Sound not only ought to be understood as an organic entity, rather than an amount of “sounds” wedged together, but it only makes true sense when it is meaningfully intertwined with the other aspects of the game design, including its mechanics.

Acoustic Ecology as support to a holistic understanding of sound

Our development of such mindfulness for the contextual dimension of sound led us to meet and embrace the discipline of Acoustic Ecology and its fundamental concept of soundscape (Schafer, 1973, 1994; Truax, 1995, 2001). Acoustic Ecology provided us with

a robust body of knowledge upon which we constructed our mindset and our research contributions.

Sound design embedded in game design

Eventually our whole mindset evolved into an *approach* to sound design, which characterizes our research contributions and regarding which we gained increased confidence along our endeavour. This approach consists of not only *thinking* about, but actually *performing* sound design embedded in the game design activity. We were encouraged by the realization that the holistic perspective that is convenient for giving consequence to such intents may, in fact, be quite common in teams of small dimension, as it is the typical case of the greatest target of our research contributions.

Proposal of seven Guidelines for Sound Design in Games

To further contribute to the aim expressed in our research question we envisaged the conception of Guidelines for Sound Design in Games. We proposed a set of seven Guidelines conveying holistic recommendations of good practice. We felt encouraged by evidences that these Guidelines were well received and appreciated by other researchers (Alves & Roque, 2009b, 2011d; Audio Mostly, 2009).

The Guidelines were synthesized under the influence of an interdisciplinary appreciation for the role of sound in perception and experience, which included concepts and insights from Acoustic Ecology and Acoustics, and considerations identified in publicly available interviews and other influent texts on the potential of sound explorations. The Guidelines cover: choosing elements with inherent potential in terms of sonic expressiveness; using the changes in sonic expressiveness to support an emotional script; integrating sound as an instrument for action in the environment; controlling events through the interpretation of their sonic expressions; integrating the players' context in the soundscape; and, exploring entrainment as tool to influencing emotional states.

With the intent of experimenting with these Guidelines we developed a prototype exercise involving a group of game design students (Alves & Roque, 2011d). The reflections allowed by this exercise would become determinant for the course of our research. Specifically, the exercise made us realize that although the participants revealed to understand and to be sympathetic with the concepts expressed by the Guidelines, this level of guidance was not particularly effective in terms of generating specific ideas to

feed the creative process. We interpreted this as being related to the high level of abstraction of this form of guidance, which did not provide beginners with an expedite and tangible enough way to propel the design specification. Also included in those reflections is the recognition of an operational bottleneck that follows the design phase, which is the unavailability and/or inability to produce the actual sound files that would allow designers to materialize their specifications.

A Pattern Language as complementary lower level guidance

We conjectured that a complementary lower level of guidance, carrying similar semantics as those expressed by the Guidelines, might augment the effectiveness of the approach. We found in the formalism of *Pattern Languages* (Alexander, 1979; Alexander et al., 1977) a match for such a requirement. Pattern languages have proved favourable in disparate domains with comparable concerns of empowerment of non-expert practitioners to access the body of knowledge and progressively participate on novel solutions.

One other precious advantage of pattern languages and the respective design patterns is that they are prone to promote the dissemination of the *vocabulary* of the domain also with positive repercussions in the communication among experts and non-experts. Additionally, pattern languages offer the conditions for the authorship of the body of knowledge to be transferred and continuously updated by the community of practice, which not only contributes to the desired appropriation but also provides the support for the longevity of the project.

The approach that we found feasible for the synthesis of the patterns was to harvest recurrent sound explorations in games of recognized quality, under the lenses of the same mindset that supported the synthesis of the Guidelines. Accordingly, we built each candidate pattern from concrete examples of the represented exploration.

A seminal collection of design patterns to test feasibility

To illustrate the feasibility of the endeavour, we proposed a seminal collection containing seven design patterns (Alves & Roque, 2010c). The particular selection of patterns featuring the Seminal Collection served several research intents, including testing the boundaries of the formalism's adequacy to range from higher-level patterns to those close to the implementation of specific sound explorations. The formalism

proved to offer the conditions for us to translate examples of guidance at multiple abstraction levels.

Confining strictly to the design level

Later, while building upon such findings, we came to a decisive moment, when we realized that, after all, although technically possible and potentially useful, we should not, in the scope of this research, cover the whole spectrum of knowledge levels. Namely, we realized that the kind of knowledge that we might inscribe in patterns covering the implementation level is not as scarce and hardly available as regarding the design level. For instance, several referential books and Web contents explain how to produce and process specific sounds (e.g. Ament, 2009; Viers, 2008).

Furthermore, considering the multitude of particular specific sounds and the variants that are known to have been developed to achieve them, accepting the endeavour of translating all such knowledge into the format of patterns, would result in a gigantic collection of long patterns, which in turn would render the effort unachievable in the time constraints of this research. Plus, that kind of knowledge, though undoubtedly important, is not essential to the empowerment in sound *design*. As such, we set that we would centre our approach at the design level. Consequently, for instance, we deprecated the pattern *Horse Hooves* that we had previously included in the Seminal Collection, since it focused on production techniques.

Harvesting contexts of use, not just the sounds being used

One other aspect that we wanted to test with this Seminal Collection was the ability to grasp the contexts of use together with the explorations of sound. We found that a way to accomplish such effect is to embrace the *purpose* of the sound explorations, as opposite to what is heard, not only while harvesting but also when documenting and choosing the names for the patterns.

Indeed, what we harvested, in most of the patterns that are currently distilled in the collection, is a context of use of sound, accompanied by distinctive examples of its operationalization. For instance, the pattern *Imminent Death* (introduced in the Seminal Collection) represents a gameplay situation, and its identification does not explicitly refer the use of sound. The *examples* included with the pattern are the ones that put to evidence the instrumentality of the exploration of sound in serving such a delicate

moment of the gameplay. We would come to find evidences, later in this research, that this approach not only addresses sound design in a holistic way, but also can be used as a creativity instrument for *game* design – namely game design sensitive to the exploration of sound.

Growing and refining the pattern collection

As soon as we had these fundamental aspects clear in our minds, the collection of patterns started to bloom. Our major harvesting approach was to actually *play* games and systematically document our findings in terms of particular explorations of sound and their contributions to the experience. We videographed the gameplay sessions so that we could then trim the short pieces that currently constitute the respective library of examples, and subject them to further evaluation by designers, experts and beginners.

To augment the effectiveness of this effort we also considered precious hints from fellows with an educated appreciation for videogame culture, as well as published game reviews, both regarding the selection of games and the identification of noticeable examples of sound design. Later, when we started presenting this research to other people, in disparate circumstances, some suggested pertinent additions to the collection.

Although so many patterns sprung up naturally during the harvesting phase, that was an immense and time-consuming activity. Yet, we found it strategic to come to a satisfactory representation of the network of design patterns, capable of nurturing the interest of the community on the overall proposal, and working as a convincing debut for an open discussion. During the phase of growing and refining this collection we dealt with several challenges, including specifying the relationships between the patterns, refining the patterns' names so that they effectively represent their meaning, and selecting the exact pieces of gameplay to use as examples.

The need for an expedite way to audit the usage of the patterns

The need to experiment with the usage of the design patterns in a game design scenario inspired a way to audit the participation of the patterns during design phenomena. We conjectured that such purpose might be achieved by representing the set of patterns in the form of a card deck as part of a setting that would allow tracing the discussion associated with the manipulation of the cards in a design case.

*A Deck of Cards as an instrument to
foster the practitioners' contact with the patterns*

While designing the cards with such auditing purposes in mind, we started pondering their value beyond our immediate research needs, as *tokens* that could foster and support the contact between our target audience and the Pattern Language. We came to the understanding that a promising approach would be to adopt an assumedly minimalist approach to the design of the cards, while providing users with the chance to access additional information from the remaining body of knowledge, should they find it pertinent. Yet, despite their minimalism, the cards were designed to stand for themselves. That is, they should make sense when detached from the more extensive contents that they represent.

The Deck of Cards (hereafter also referred to simply as the Deck) is made available as a downloadable PDF, with instructions to ease printing and cutting. This availability is consistent with our support to the community's appropriation of the proposed body of knowledge.

A website supporting the design patterns

The development of a wiki website was adopted as the natural candidate to maintain the full body of knowledge related to the design patterns. Again, making the contents available online is also aligned with our earlier intents to eventually opening them to the community of practice.

For the mediation between the cards and the website, a QR-Code was included in each card. The QR-Code is intended to play a double role. First, as expectable, the code allows a user to launch the proper webpage from a camera-enabled device. Second and perhaps more strategic, we expect that these codes help to characterize the cards as *partial views*, allowing the audience to appreciate them as such. That, in turn, for instance, helps to avert possible tensions arising from the fact that the cards, aiming to address sound, are strictly graphical.

The website as a development tool

The Wiki proved to be instrumental not only to present the information, as intended, but also as a tool for the development of the Pattern Language. This began to be evident when we started migrating the pattern specifications that we already had as text forms and became even more noticeable thereafter. The expedite management of relating

contents was an important catalyst in the course of checking, growing and refining descriptions and relationships among the diverse sound explorations. This systematic exercise of enhancement of the Pattern Language, together with the accumulated familiarity with sound explorations gained from the experimentations with games, permitted reformulations and additions of new patterns.

Version 1.0 of the Pattern Language for Sound Design in Games

We called “version 1.0” to a state of development of the Pattern Language that we considered to be a satisfactory network of design patterns, considering our research goals and the degree of coverage of sound usage in gameplay that we had collected by then. Version 1.0 consisted of 68 design patterns. A Deck for this version of the Pattern Language was meanwhile concluded, containing one card for each pattern.

An inspection exercise of the cards, in version 1.0 of the Deck

In order to refine this Deck, we conducted a first inspection exercise with five participants (Alves & Roque, 2011c). This exercise did not involve actual design. Instead, participants observed and commented on each of the cards according to a set of questions aiming at the identification of foremost difficulties in terms of perception and content interpretation. We collect valuable data using what proved to be an efficient approach, consisting of organizing the questions in four rounds and providing instructions on how to write the answers on the cards themselves, next to the aspect being inspected. The analysis of the data allowed us to inform important revisions to the Deck and to the Pattern Language.

A game design exercise, using version 1.0

We conducted one other exercise, still with version 1.0 of the Pattern Language, this time actually involving a game design activity (Alves & Roque, 2011a, 2012a). For this exercise, we prepared a setting involving a workspace with marked regions for specific purposes and meanings attributed to the use of cards/patterns, and videographed the whole session. We intended this setting to be favourable to both auditing and the practice of design. The examination, coding and classification of the recordings allowed us to register more than 830 events, which, in turn, provided us with a rich basis for analysis of how, in that particular circumstance, the participants related to the Deck and how the Deck influenced the design phenomenon.

The observations were very encouraging and allowed us to gain confidence on the Deck as a tool to assist sound design in game design. Sound explorations were considerably represented in the resulting game design concept. Still, the discussion was not dominated by sound itself, which we interpreted as an indicator of a genuine integration of sound in the game design, in line with our expectations. This can constitute evidence that the use of this pattern language may stand suitable as an instrument that eases creativity in game design in a broader sense, although requiring further research. We also identified important information that supported improvements to the Deck, to particular cards and patterns, and to the setting used during game design.

soundingames.com

During those experiments, participants did not explore the full extent of information available for each of the patterns, for several reasons, including the methodological decision of studying the standalone use of the Deck of Cards, and the fact that we still had some technical aspects to address before getting the Wiki online. The Wiki, hosted as *soundingames.com* (Alves & Roque, 2012b), was eventually presented to the scientific community during the Audio Mostly 2011 Conference.

Presentation of versions 2.0 of the Pattern Language and the Deck

Meanwhile, version 2.0 of the Pattern Language was released, integrating the corrections and insights from the previous experiments. In addition to those revisions, version 2.0 received 13 new patterns, some of which resulting from suggestions from other researchers, totalling 81 design patterns. The Deck itself contains 77 cards, since we decided not to represent 4 specific patterns as cards, based on reflections following the former experiments.

On the continuation...

This study has been prolific in presenting further opportunities of research and development, which we are pursuing. We aspire to be able to incite an appreciation for this thesis that implies to understand our contributions as part of a bigger map that they are helping to unroll. Our most immediate venture will be to publicly release the Pattern Language to the community of practice. We are confident that the adoption of the Wiki will favour this step, both technically and regarding the predisposition of the audience to recognize and embrace it as a social tool. We are detailing a strategy and tuning the technical features to open the Wiki to distributed intervention. Concurrently, we are

promoting and studying further cases of use of the guidance in game design, occurring in diverse conditions.

1.2 Structure of this document

This document is organized in eleven chapters, plus appendices. In Figure 1.1 we depict their profile in terms of five major categories of contents: supportive theory, rationale, research contributions, experimentation, and deliverable outputs. For the sake of simplicity, we are not representing all sections in this depiction. We left out those that we considered not to be critical for the understanding of the representation.

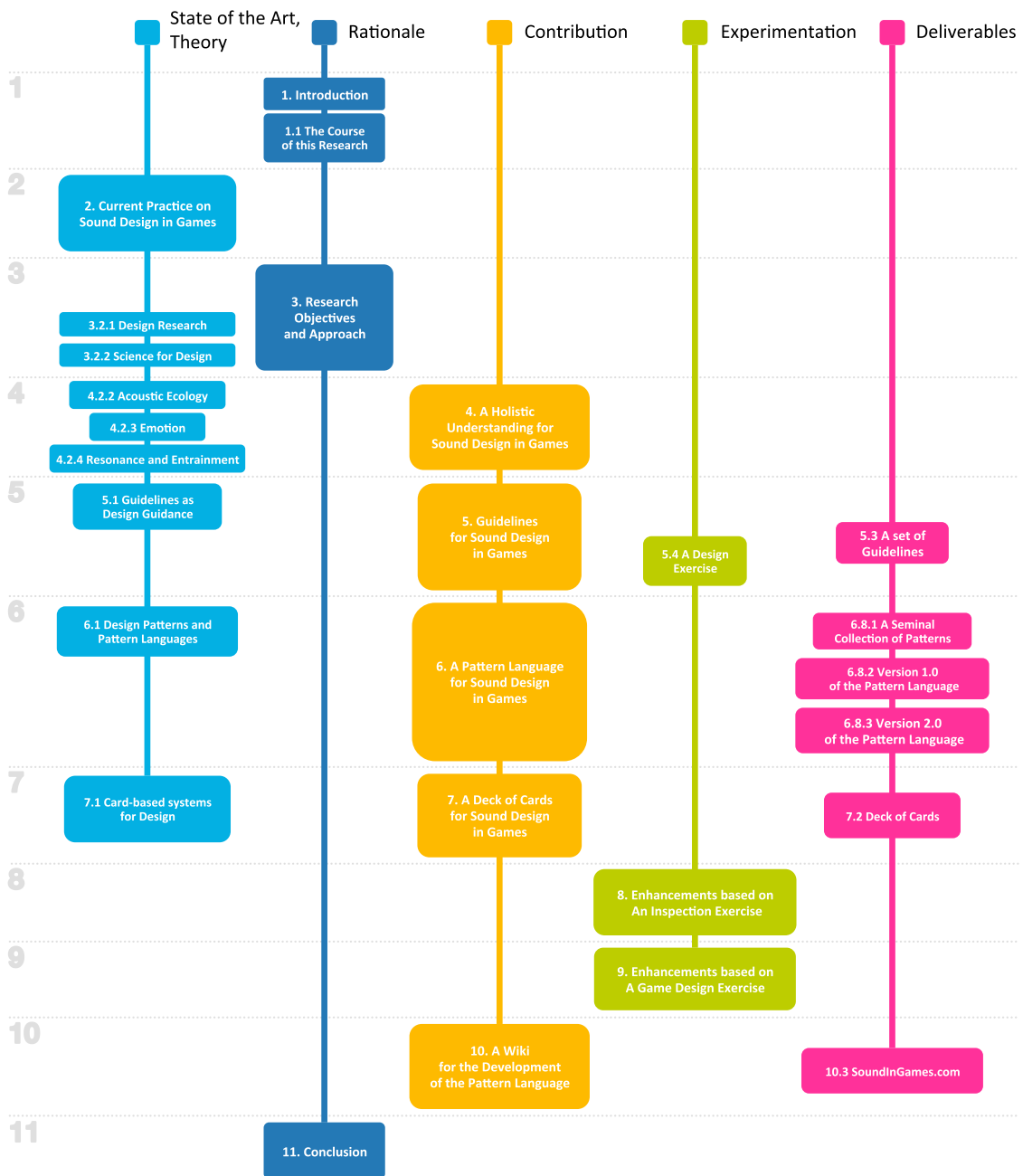


Figure 1.1. Chapters' profiles in this document

Perhaps the most noticeable aspect is that the supportive theory, instead of being grouped in a single earlier chapter is distributed along the thesis. This is in conformance with the interpretation of the DSR. We had, in fact, to append new components to our literature review along the path of research to face the redirections of the course of research. We found that the presentation of the supportive theory *in context* with the respective transitions permits a more effective exposition.

This introductory chapter (Chapter 1), and namely the previous section, provided a brief narrative of the research voyage, aiming to offer the reader a first overview and to ease the reading of the rest of the thesis where each of those aspects will be revisited in more detail. Chapter 2 provides a contextualized characterization of the current practice on sound design in games, and emphasizes the pertinence in countering the lack of guidance for non-experts. Chapter 3 presents our research objectives, configured by such a situation. It describes how we applied a methodological framework, combining DSR and SfD, to approach our research. It also includes further arguments on the relevance of the research, its key challenges, boundaries and limitations.

Chapters 4, 5, 6, 7 and 10 constitute our research contributions. Chapter 4 presents a contribution to a holistic approach to the practice of sound design in games. Chapter 5 introduces a set of Guidelines for Sound Design in Games and a critical reflection on an experiment consisting of a design exercise influenced by the Guidelines. Chapter 6 complements the guidance for sound design in games with a Pattern Language. It presents the Pattern Language along its three main stages to date: the Seminal Collection, version 1.0 and version 2.0. Chapter 7 presents the development of a Deck of Cards as a contribution both to research and to the dissemination of the Pattern Language.

Chapter 8 and Chapter 9 consist of the presentation and analysis of exercises involving the Pattern Language and the Deck of Cards. The former refers to an exercise of inspection aiming at the enhancement of the Deck of Cards, with benefits extending to the Pattern Language. The latter presents an experiment with the Pattern Language, in game design, assisted by the Deck of Cards.

Chapter 10 presents a Wiki for the Pattern Language, which has had multiple contributions to our research. It also emphasizes the potential of this instrument in

supporting the community's appropriation of the body of knowledge, as part of our strategy for disseminating results and inciting future development.

The Conclusion chapter wraps up our contributions to answer the research question. It also reveals an agenda of immediate concerns and future work, some of which is in fact already underway.

Chapter 2

Current Practice on Sound Design in Games

Sound design in games is in its infancy (e.g., Alves et al., 2011; Bridgett, 2012; Novak, 2008). It is still a practice almost reserved to a limited number of experts in the game industry (Marks, 2009; Sider, Freeman, & Sider, 2003) who have typically made their own way through the field in the absence of a structured body of knowledge (Deutsch, 2003). In this chapter we characterize this scenario, in relation to the socio-cultural context and the kind of attention dedicated to sound in influential fields such as cinema and Human-Computer Interaction (HCI).

2.1 Sound mindfulness in the broader socio-cultural context

It is commonly accepted that hearing is the second most important sense in our lives, after sight. Visual impairment may even promote it, along with touch, to the prevalent sense (Faulkner, 1998). However, saying that hearing is “number two” does not give an accurate perception of its actual significance, because it hides some important aspects, like the distance to the “winner” sense. Also, this common tendency to assess senses as competitors clouds, *a priori*, a whole range of analyses and opportunities (Erlmann, 2004, p. 7; Schell, 2008a, p. 351; Thom, 1999).

The auditory interaction once was a prevailing modality in human communication. It used to be crucial as a survival tool, to perceive the environment, to support learning, and to pass on memory and culture. Currently it is often relegated to minor roles in the context of our own social and cultural preferences. Modern and namely occidental cultures favour visual stimuli over others modalities (Hall, 1976; Levin, 1993; Macaulay, Benyon, & Crerar, 1998; Paulin, 2003).

Auditory literacy

Such cultural conditioning is having consequences in several fundamental layers, and namely in auditory *literacy*. Truax (1999) makes this argument very clear when he exemplifies that whereas every child in school is familiar with the meaning of “white light”, most people will never know what “white noise” is. The absence of an auditory education induces people to the alienation of this sensory component.

2.2 Sound mindfulness in the broader context of human-computer interaction

In the context of interaction between humans and computers, the situation is not particularly different. Generally, interaction happens over almost exclusively visual interfaces (Brewster, 1994; Bussemakers & de Haan, 2000; Ekman et al., 2005; Frauenberger, 2007, 2009; Hermann & Hunt, 2005; Leplâtre & McGregor, 2004). Some authors mention the resemblance between current audio development and the early days of video (Walker & Kramer, 2005).

Although sound is not completely absent in typical application interfaces, it does not yet have an essential role in the interaction (Follett, 2007; Frauenberger, 2009; Macaulay et al., 1998). Moreover, unlike graphics, which are fundamental for the usage of such applications, usually it is not even important whether sound is turned on or off. Naturally, this is not supposed to be understood as an absolute truth because we can indeed spot some relevant exceptions, including those solutions that have been developed with the purpose of granting accessibility to visually impaired people (AudioGames.net, 2012a, Ekman et al., 2005; Raman, 1994).

Under-explored as research topic

Perhaps the most important analysis to be made regarding such status is that the minor role of audio in interaction research is not dictated by limitations on auditory possibilities but on the under-exploration of the topic (e.g., Leplâtre & McGregor, 2004). An important milestone for audio research, namely in the scope of computer technology, was the *Sonification Report* in 1997 (Kramer et al., 1997). This document became an emblematic reference and settled the first systematizations on the field itself. It resulted from a request by the National Science Foundation to an interdisciplinary team from the International Community for Auditory Display ([ICAD], n.d.). The report supported the establishment of sonification as a *discipline*. It also provided readers with an appreciation for its potential to facilitate communication and interpretation of data, and to answer a variety of scientific questions.

Other remarkable scientific contributions in the field of HCI have targeted the integration of sound into interfaces (e.g., Brewster, 1994) and the design of auditory displays for delivering information (Frauenberger, 2009). Also, the *objective* aspects of

the use of sound in interaction are no longer the sole concern. Subjective aspects, namely affective ones, are also starting to get attention (e.g., Coleman, Hand, Macaulay, & Newell, 2005; Effrat, Chan, Fogg, & Kong, 2004; Leplâtre & McGregor, 2004). Still, the topic lacks a consistent body of theory, which is evidenced by the paucity of clear guidelines or best practices. Conspicuously, this kind of support *exists* and is widely known in what respects to the visual modality.

The consequence of the scarcity of supporting theoretical guidance is profound. It means that there is a natural discouragement to the integration of audio in the design, or that, when it is done, it calls for the best judgment of people involved, not necessarily leading to reasonable solutions (Brewster, 1994, p. 7; Frauenberger, 2007). As an illustration, we recall the case of a producer who, only after having its product in the market, understood that the sound that had been chosen to mark the conclusion of a particular task was making people believe that something was wrong, whereas it was supposed to be congratulating them, which in turn was having implications for the user experience (Effrat et al., 2004).

2.3 Sound mindfulness in games

Within the global context of human-computer interactions, the specific case of interaction in games is recognized to be one in which sound is more systematically applied (Coleman et al., 2005; Follett, 2007; Leplâtre & McGregor, 2004). Nevertheless, it is also acknowledged that relevant sound design in games is still far from its potential (e.g., Collins, 2007; Denooz, Thom, & Buck, 1998; Novak, 2008; Peck, 2001, 2007; Wilhelmsson & Wallén, 2011).

A noticeable indicator of the limited exploration of sound in games is the common perception that “sound in games” is a matter that concerns those games which explicitly use sound as the object of play – namely, *music games*, including *rhythm games* and *pitch games* – or those that have no visual component, i.e. *audio games*, or, even more extremely, games for the visually impaired. Although those genres and subgenres do explore sound earnestly, the kind of explorations implied represent a slight sample of the possible contributions of sound to the players’ experience. Moreover, game reviews, when referring to sound, almost invariably comment strictly on the soundtrack and on the *realism* of the sonification, as if there was not yet lieu to a system capable of classifying other dimensions of the role of sound. Still, it is noticeable that there has been

an increasing interest in broader aspects of sound, and that there are awards specifically targeted to the use of sound (e.g., BAFTA, 2011; Develop Awards, 2012; Game Developers Choice Awards, 2012; Independent Games Festival, 2012).

Actual sound *design* would have to be substantially further undertaken, in the general panorama of games, for consumers to grow a deeper appreciation and develop expectations regarding the role of sound. Yet, too often, the presence of sound in games confines to the overlaying of music and to sound effects for action feedback, in an insipid imitation of the kind of sound design that is practiced in cinema (Bridgett, 2012; Deutsch, 2003; Hug, 2011).

Influences from cinema

In fact, nowadays, practices on game sound – and on many other aspects of bigger game development projects, for that matter – are strongly influenced by those from the movie industry (Deutsch, 2003; Droumeva, 2011; Novak, 2008). Still, although that knowledge transference is understandable and legitimate to some extent (Bridgett, 2010; Larkin, as cited in Marks, 2000), it is crucial to understand that fundamental disparities exist between the two media that both impose and propose distinct approaches (Collins, 2007; Hug, 2011; Wilhelmsson & Wallén, 2011). It is exactly in this difference that resides the most prospective development. Ultimately, it is needed knowledge on how to compose sound attending to game scenario specificities including nonlinearity, dynamicity, and the need for variability (Collins, 2008a, 2008b; Deutsch, 2003; Ekman, 2008; Marks & Novak, 2009; Stevens & Raybould, 2011). For instance, the perception of the repetitiveness of the background music and sound effects is an aspect that frequently leads players to lower the volume after a while (Novak, 2008).

Purposefulness of sound design

Additionally, the exploration of sound in some interactive experience must not end up being confused with the mere placing of sounds on top of things (Bridgett, 2012). Sound design is not about searching for excuses to use sound; instead, it is about designing ways in which sound may contribute to the purpose of the game experience. To put it another way, in this context, sound is a means, not an end; it is not about fitting, it is about profiting. Failing to understand this may grow negative associations to the use of sound, or at least, it enlarges the user's perception that sound is expendable (Brewster, 1994, p. 7; Marks, 2009, p. 237).

Sound has the potential to have an objectively relevant or even leading role in the way a game is played (Collins, 2007; Jørgensen, 2006; Wilhelmsson & Wallén, 2011), i.e., in the *gameplay*. For instance, in *stealth games*, sound is not only useful for perceiving other characters' closeness but, more importantly, the playing characters' own noises, such as their footsteps, can denounce them to the enemies (Stevens & Raybould, 2011, p. 122). This is a very important diegetic aspect, because it is interpreted as truly auditory *interaction*. It is not just about displaying auditory stimuli: from the player's perspective, the characters really *act* through sound. Also, sound can be designed in ways that it works at the unconscious level to *relevantly* affect the unfolding of the emotional script along the experience (Collins, 2008a; Effrat et al., 2004; Farnell, 2010; Novak, 2008) – and that is also one aspect that more recent games exhibit.

2.4 The atypical distribution of expertise in sound design in games

The characterization of the current situation regarding the use of sound in games tends to become confusing when it is argued that sound is *seldom* purposefully explored and, at the same time, examples of *existing* sound mastery are given to complete the argumentation. In fact, to comprehend the current state of art in the use of sound in games it is first necessary to acknowledge the existence of two very distinct realities. Sound design in games can be roughly characterized by two extremes with little in between. On one corner we have “triple-A” titles conceived by mature and resourceful teams where the work of sound designers is perceptible and often appreciated. On the opposite corner we have games where sound is either absent, poorly explored or, what is worse, leading people to wish it was not there (Marks, 2009; Novak, 2008). In between we can find rare examples of admirable sound design, but they are precisely that – exceptions. Though this description is somewhat oversimplified, it serves the purpose of emphasizing that the merit of the use of sound in a game is highly correlated with the engaged participation of a sound designer in the production process.

Moreover, the current state of development of both fields, game design and sound design, dictates that when we refer to sound designers – as in the previous sentence – we are thinking about someone who is an expert in sound design and who possibly does that as a profession. We are not talking about someone who, apart from other competences in game design and development, also has some know-how to make some

upright sound design. That is, under the circumstances, sound design is the craft of specialized professionals, not a faculty of whoever has the need and the will to perform it. It may be worth recognizing that although it is relatively easy to know someone who possesses the capabilities to perform basically all (other) roles in a small game project – including designing the diverse aspects of the game, doing some fairly neat graphics, coding, setting up a server to put a game online, etc. – it is not that easy to find someone who also can do suitable sound design.

2.5 Scarce guidance on sound design in games

The set of circumstances described in the former sections evidences the nature of the major obstacles to the availability of informed sound design in the space of small endeavours. On the one hand, small projects don't have a budget that permits to hire one of the scarce sound design professionals who have the know-how to do it. Actually, to a certain extent, hiring a sound designer in such conditions, would dictate that the project could no longer be "small". On the other hand, such know-how is held by those experts in a predominantly *tacit* way, which in part is a consequence of how they built that knowledge themselves. That is, existing knowledge is unstated and circumstantially maintained by the senior practitioners that have built and refined their own solutions and possibly benefited from contact with practitioners with similar profile (Fay, in Marks, 2000, pp. 408-409). The body of knowledge in the field is not organized in a way that it allows the community to easily access the experts' wisdom – nor it provides the conditions for the experts to share such wisdom, for that matter. One conspicuous sign of the lack of an exploitable body of knowledge is the unavailability of explicit guidance (p. 410; Grimshaw, 2008, p.11) for the broad community of practice.

The distance imposed by this impasse contributes to the maintenance of a sense of alienation regarding the exploration of sound in the wide scenario of game development, which also expands to the consumers (Collins, 2008a). As an example, a group of researchers conducted an experiment with the purpose of studying an approach to pervasive games over mobile phones. They opted to use a game mainly supported by audio. The researchers reported that some players failed to understand the game either because they did not have the sound on, or because they turned it off as soon as it started playing. The observations from that study are far more complex and rich but the point is that some individuals not even conceived that sound could have a meaning in the experience (Ekman et al., 2005).

2.6 The pertinence of indie game development

After saying this, we ought to make clear why we are putting so much emphasis on indie projects and non-expert capabilities to design sound. There are several fundamental reasons. To start with, since sound can be so relevant in games, it makes sense that the “average” developer is able to master it. Waiving the design of sound, with basis on illiteracy, or to avoid the risks of uniformed practice, is simply not a reasonable or acceptable condition.

Second, those “average” developers actually represent the *large majority* in the universe of potential game creators. So, the pertinence of making a meaningful change is magnified by their expressiveness in number.

Third and adding to the relevance of the undertakings of such majority, despite possibly holding weaker know-how and certainly shorter resources, these projects often trade complexity and refinement for more innovative approaches and creativity, which, to a certain extent, seems not be so resource dependent (Campbell, 2012; Denooz et al., 1998). A common statement, shared both by indie and industry practitioners, is that the mainstream production is governed by the exhaustive exploitation of currently lucrative trends, leaving little margin for risky experimental approaches (e.g., Adams, E., 2010, p. 66; Brathwaite & Schreiber, 2009, p. 147; Campbell, 2012; Novak, 2008). Indie game development, by allowing for experimental game design (Holopainen & Björk, 2003), represents an opportunity for creators and players to meet and to grow embryonic and differentiated sensibilities (Brophy-Warren, 2008).

2.7 Limitations felt by expert sound designers

Sound designers are typically called in the end of the project

As the former paragraph started to unveil, the practice of sound design in mature teams is not exempted of limitations, according to the experts’ testimonies. One other common claim, which is most relevant for this study, is that sound designers are only involved in the projects near the end of the production chain (Bridgett, 2012; Childs, 2007; Collins, 2008a; Deutsch, 2003; Marks, 2009; Novak, 2008; Schell, 2008a). Incidentally, this is a commentary that is transversal also to the much more mature domain of movie production (e.g., Denooz et al., 1998; Allen, 2004, p. 109; Thom, 1999, 2003).

It seems manifest that other stakeholders share a fundamental misconception and a diminished assessment of sound designers' potential contribution (Denooz et al., 1998). In the customary workflow, sound designers are expected to “put sound on things”. Although such task does need great expertise and is afterwards widely recognized as being crucial to the overall appreciation of the product, it does not leave much room for actual *design*. Usually, the game concept is by then already closed or in a too advanced state to make it possible to revise earlier steps of the development. Consequently, sound designers are limited in their ability to influence the integration of sound explorations that require redesigning other aspects of the game to allow the participation and proper intertwining of sound in the overall solution (Holowka, 2009).

Communication issues

One other testimony, which may correlate to the former, is that there are barriers in the *communication* of sound related matters, between the several stakeholders and the sound practitioners. Some of such difficulties are attributed to the features of the domain, e.g. when describing the specific characteristics of a certain sound (Farnell, 2010, p. 110-113). Other difficulties relate to the lack of a common vocabulary to refer to the concepts implied (Alves et al., 2011; Farnell, 2010; Wilhelmsson & Wallén, 2011, p. 101). Reports on cases that did not suffer from these types of problems evidence the consequent advantages and reinforce the rarity of the occasion (e.g., Bridgett, 2007). Due to the singularity of the respective achievements, they became praised and are often regarded as case studies.

Chapter 3

Research Objectives and Approach

In this chapter we expose our research objectives and argue our options regarding methodological support. The chapter begins with the presentation of the research question, the research goals and the research outcome. Next, we refer to the specificities of the context in which the research happened, so that we can reason on the choice of the methodological framework.

We subsequently present the two main methodologies supporting the research: *Design Science Research* (Hevner & Chatterjee, 2010; Vaishnavi & Kuechler, 2004; 2008), here referred to as DSR; and *Science for Design* (Krippendorff, 2006), here referred to as SfD. After providing a brief theoretical introduction on each of them, we proceed to the exposition of how they were explored in this particular endeavour. To ease our rationale we first describe the application of DSR to introduce the trajectory that led us to the research output presented in this thesis.

Then, we characterize such output under the lenses of SfD and build the idea that for the work being presented to make its way through its life cycle, beyond the timeframe of this thesis, it is fundamental to convince potential stakeholders of its meaningfulness. The arguments at our disposal for that intent have the form of “semantic claims”, as defined by SfD. In turn, for semantic claims to be convincing, we have to exhibit their *validity*. As such, we then present examples of what we consider to constitute demonstrative validity, interpretative validity and, those that constitute our major arguments, experimental validity and methodological validity (Krippendorff, 2006). The substantiation of the methodological validity justifies a subsequent section on the methods applied along the research trajectory presented beforehand. We conclude the chapter with a summary of the pertinence of the endeavour and with references to the main methodological challenges and to the boundaries and limitations of the study.

3.1 Research objectives

Our research is motivated by the observation that current expertise in sound design in games is mostly a self-acquired proficiency held by senior sound designers. The broad

community of indie game developers (IndieGames.com, 2012) face scarce know-how and restrictive budgets (Kuchera, 2011), when trying to integrate sound in their games.

The research question

The empowerment of game design practitioners, to perform sound design on their own, could unfold great potential not only in terms of immediate outcomes but also regarding innovative ideas and further expansion of the body of knowledge. Following this motivation, we formulated our research question.

Research Question: “How to provide guidance for the empowerment of non-expert practitioners to perform sound design in games?”

Two research goals

The aim of the empowerment referred in the research question is twofold. We express this idea in the two following goals.

Goal 1: Emancipating non-expert practitioners to perform sound design in games, on their own, assuming the impracticality of integrating a sound design expert in their teams.

Achieving this goal would contribute to face the unavailability of an expert in sound design, in a way that such conditions would not compromise the exploration of sound in the projects. As explained, this intent does not mean to diminish the relevance of expert sound designers; after all, the guidance being made available is based on the experts' knowledge. Instead, it aims to face, in a knowledgeable way, the scenarios where the absence of such experts is a given.

Goal 2: Introducing the concepts and vocabulary of the domain of sound design, in a way that lets non-expert practitioners become capacitated to participate and communicate ideas, including with the experts.

This goal may seem less pragmatic but it is potentially as strategic. Literacy is arguably a requisite for empowerment of individuals, as it has been emphasized in disparate contexts (e.g., Freire, 1967, 2000). Moreover, the “ability to talk about design [and] . . . discuss problems in a designerly way” is “an important indication of membership in the community of designers” (Krippendorff, 2006, p. 32).

We argue that an initiative that improves the stakeholders’ auditory awareness and literacy potentially reflects on the quality of sound design, be it in indie teams or in the industry. That is, the proposal also applies to mainstream game creators who, becoming literate in the use of sound, would augment their awareness and certainly their appraisal for sound design. Moreover, providing these protagonists with literacy on the sound domain should allow them to carry on a *dialogue* with sound designers. Both these aspects can lead stakeholders to summon sound designers earlier and more often. In turn, those conditions should also allow game designers to *participate* along with the sound designers in their creative process. So, this is an opportunity to operate a meaningful change also in the industrial mainstream, not just in the universe of indie developers.

It is fundamental to understand that the actual accomplishment of these goals may only occur, and become observable, in the medium to long term. It depends on the effective engagement of the stakeholders in transforming the proposed guidance into *meanings* (Krippendorff, 1989, 2006); because, ultimately, practitioners follow the meanings they recognize and insert into the body of knowledge, not the body of knowledge per se.

Such mindset guided the development of the proposal here presented. We hope readers find value in the work resulting from this endeavour but this thesis can be best appreciated if it is understood as a “first stage”, a stage of preparation for the opening of the body of knowledge to the community’s appropriation. In that sense, this thesis reports the most convincing argument and the best conditions we could build, to wave to the community and to nurture their interest in taking the endeavour to a higher level of consequence.

The research outcome

The same mindset is relevant for the way we state our research *outcome*, in this document. Whereas our ultimate research outcome relates to empowerment, the scope of this thesis leads us to present it as the set of conditions that we propose, and which we

built, through research, with that purpose. Namely, we present a set of research contributions, including complementary forms of guidance, with accompanying body of knowledge and associated instruments.

3.2 The adopted methodological framework

The research question and goals, presented in the previous section, reveal several aspects that configure the space of options regarding research paradigm, methodologies and methods. One first relevant observation is that the research question calls for presenting the targeted public with something – guidance – that, as we stated before, does not yet exist. So, it is implied that the answer needs to be *designed*. This is most relevant because it directs us to the realms of a science of the artificial (Simon, 1996), as opposed to natural science.

Furthermore, we could not know a priori what would be an interesting proposal regarding the contents of the desired guidance. Actually, we could not even know what would become an interesting format (or combination of formats) for such guidance. That is, we faced the double challenge of studying the interest of an approach that we would still have to construct (Cross, 2008, pp. 13, 20). This led us to seek for “designerly ways of knowing” (Cross, 2007; Figueiredo & Cunha, 2006), and namely for an approach that could answer to the ontological question – “what can be known” – in phenomenological terms, i.e., in such a way that “we know the world by interacting with it in an emergent process that changes knowledge as we keep interacting” (Figueiredo & Cunha, 2006, p. 72).

DSR

We adopted a *DSR* methodology (Vaishnavi & Kuechler, 2004; 2008), exactly by the possibility of “learning through the act of building” (Kuechler & Vaishnavi, 2008, p. 1). Also, *DSR* conveniently allows plasticity in the research process, of which one conspicuous evidence is the chance to *advance* by restating and retaking former steps in a defined sequence, even if that means reformulating the problem itself.

sfd

As explained in the previous section, the research question and the expressed goals also emphasize that our concern is beyond the absolute relevance of a resulting body of knowledge. Our ultimate concern – *empowerment* – implies the *transformation* of

people, namely of those who may be able to create *meanings from and on* that knowledge. Consequently, we are as interested in the understanding of the object of knowledge as we are in the stakeholders' understanding of that understanding. That is, we have the need to accommodate both first-order and second-order understandings. The latter demands a human-centred design, based on the meanings that stakeholders recognize and build into the artifact (the guiding body of knowledge), and encounters a methodological answer in *SfD* (Krippendorff, 2006), which has been characterized as a new foundation for design, or a *semantic turn*.

In the following subsections we present the methodological features of both DSR and SfD. In the sequence, we will refer to their application in our study.

3.2.1 Design Science Research

The tackling of our research challenges calls for a methodology that permits us to experiment with different approaches to design, as part of an effort to explore the relationships between specific adoptions and the effects achieved, and hence to refine our own understanding of the problem as we interact with the solutions being built (Cross, 2008; Schön, 1991). We recall that our expected research outcome is guidance that may constitute support for further development and contribute to better design practice. *DSR* is a research approach that fits these needs (Hevner & Chatterjee, 2010, p. 5).

DSR “involves the design of novel or innovative artifacts and the analysis of the use and/or performance of such artifacts to improve and understand the behavior Such artifacts include - but certainly are not limited to ... human/computer interfaces and system design methodologies or languages” (Vaishnavi & Kuechler, 2004, para. 2).

Phases in DSR

DSR consists of an iterative process that includes several phases, each with a specific output. The phases are *Awareness of Problem*, *Suggestion*, *Development*, *Evaluation*, and *Conclusion*. The respective outputs are *Proposal*, *Tentative Design*, *Artifact*, *Performance Measures*, and *Results*. The complete sequence of phases may be iterated and it is also possible to iterate inner cycles of that sequence (Vaishnavi & Kuechler, 2004; 2008).

DSR starts with an *Awareness of Problem* from which a *Proposal* is generated for a new research effort. The *Proposal* may be either formal or informal. From that *Proposal*, a

Suggestion presents a *Tentative Design*, for which creativity is desirable. These two initial phases are intimately connected. For instance, the *Proposal* may already contain a *Tentative Design*, particularly if it is formal. Conversely, if a *Tentative Design* cannot be *suggested*, the *Proposal* is dropped (Vaishnavi & Kuechler, 2004).

Once a *Tentative Design* is *suggested*, it is implemented through the *Development* of an *Artifact*. Depending on the nature of the *Tentative Design*, the *Artifact* can assume several forms. The implementation can be dull and, contrary to what happens in the preceding phase (*Suggestion*) where novelty is relevant for the design, novelty in the construction of the *Artifact* is not a concern (Vaishnavi & Kuechler, 2004).

The *Artifact* then goes into *Evaluation*, in order to get *Performance Measures*. *Evaluation* may be both quantitative and qualitative. The criteria for *Evaluation* are the implicit expectations that were subjacent to all early stages. It is also possible that these criteria are explicitly stated, back in the *Proposal*. Deviations from those expectations are then thoughtfully registered and tentatively explained. This means *Evaluation* contains a “sub-phase” of *analysis* of the behaviour of the *Artifact*. At this point the researcher adds up the information learned during all phases and possibly engages in another, more informed, “round” (Vaishnavi & Kuechler, 2004).

When *Performance Measures* satisfy desired criteria, it makes sense to proceed to *Conclusion* with presentation of achieved *Results*. Actually, it is conceivable to conclude the research effort even if deviations still exist in the *Evaluation* phase, if a satisfying result is reached. Moreover, even possible “anomalous behavior that defies explanation and may well serve as the subject of further research” may be argued to be an interesting result (Vaishnavi & Kuechler, 2004, Conclusion:).

Forms of DSR resulting artifacts

Artifacts resulting from DSR may have several forms including *Constructs* (or *Concepts*), *Models*, *Methods*, and *Instantiations* (March & Smith, 1995). *Constructs* introduce new vocabulary for the communication of problems and solutions in a domain. *Models* relate *Constructs* through propositions or statements, in representation of a situation characterized by a problem and the space of solutions. *Methods* refer to guidance to search a solution space in order to solve problems, and can range from formal process definition to informal description of best practice approaches (Hevner, March, Park, & Ram, 2004). *Instantiations* are used to demonstrate the feasibility of the

implementation of *Constructs, Models* or *Methods*. *Instantiations* allow “concrete assessment of an artifact’s suitability to its intended purpose” and they also “enable researchers to learn about the real world, how the artifact affects it, and how users appropriate it” (Hevner et al., 2004, p. 79).

Philosophical assumptions of DSR

To conclude this characterization of DSR we will refer to its philosophical assumptions according to Vaishnavi & Kuechler (2004, Table 3). In terms of *ontology*, that is, about what can be known, it embraces “multiple, contextually situated alternative world-states[,] socio-technologically enabled”. Regarding *epistemology*, that is, what is knowledge and what knowledge can we get, it consists of “*knowing through making*: objectively constrained construction within a context [and] iterative circumscription reveals meaning”. Concerning how we can build such knowledge, the *methodology*, it is “developmental [and] measures artifactual impacts on the composite system”. Finally, the question about what is the value of the knowledge being built, *axiology*, it values “control; creation; progress (i.e. improvement); understanding”.

3.2.2 Science for Design

We resorted to SfD (Krippendorff, 2006), in this research project, as a complement to DSR. SfD is a “systematic collection of accounts of successful design practices, design methods, and their lessons, however abstract, codified, or theorized, ... [in] continuous rearticulation and evaluation within the design community” (Krippendorff, 2006, p. 209). SfD is proactive, human-centred, and detached from the natural sciences paradigm.

Appropriateness of SfD

SfD is concerned with projecting a design into the future, by introducing desirable changes in the (present) world, without being limited by theories of what has been proven from the past and by generalizations to the limits on what can be done. In that sense, SfD departs from conventional science, and specifically from positivist science.

Perhaps the crucial aspect in recognizing the appropriateness of SfD is to first realize the context for which it exists: *design*. This is, at the same time, the crucial aspect for the recognition that a positivist science, alone, is not appropriate to fully comprehend the respective phenomena. In both cases, a proper understanding of design is demanded

and, most importantly, how it works, starting by realizing that it does *not* always work according to causal models. *Humans* make design work – in some way – and “causality is incompatible with human agency” (Krippendorff, 1989; 2006, p. 68; Simon, 1996). A design evolves through a life cycle, which is influenced by its characteristics but is highly dependent on the *meanings* that users find in it and construct for it.

Second-order understanding of meanings

In turn, meanings, being held by others, cannot be observed directly, that is, through first-order observation, nor an imposition of observer-independence allows for a *dialogical* research, that might allow inferring variations in perception other than the observer’s. Inescapably, “those who inquire into others’ understanding ... must *include themselves in the conversations* in which second-order understanding is to surface” (Krippendorff, 2006, p. 70).

It is also important to realize that although, when referring to “designers”, one may mean actual *professional* designers, and possibly industrial professional designers, it is the activity of design that is being implied, not exactly the practitioner’s actual profession. What is even more important, “there are many professions that engage in design activity without calling themselves designers – engineers, managers, medical professions, politicians, even architects – not to forget ordinary people who organize their future with creativity and purpose.” (Krippendorff, 2006, p. 47).

Methods in SfD

SfD pursues its own paradigm of inquiry and ways to generate practical knowledge (Krippendorff, 2006). It presents methods for *creating spaces of possible futures*, which include *Brainstorming*, *Reframing*, and *Combinatorics* (pp. 213-221); methods for *inquiring into stakeholder’s concepts and motivations*, which include *Narratives of ideal futures*, *Surveys and structured interviews*, *Unstructured interviews*, *Focus groups*, *Observational methods*, *Protocol analysis*, *Ethnography*, *Triangulation of methods*, *Stakeholder participation in the design process* (pp. 221-230); and methods for *Human-centred design*, which include *(Re)designing the characters of artifacts*, *Designing artifacts that are informative of their workings*, *Designing original artifacts, guided by narratives and metaphors*, *Designing human-centred design strategies*, and *Dialogical ways to design* (pp. 230-260).

It also presents methods for *validating design claims*. These methods are particularly important because, apart from the cases when it is already possible to assess *post factum* information, the validity of an artifact can only be argued, not proved. That is, an artifact in its early life is, pragmatically, a set of semantic claims. In fact, its consequence is yet to happen and, according to the rationale above, it will depend on human agency, which cannot be entirely predicted (Simon, 1996, p. 147). The formulation of claims is pertinent since they are the evidences that a designer may use to convince stakeholders to engage in the prosecution of the artifacts' life (financially also, if a budget is implied). Methods for arguing the validity of artifacts that are yet to make their way into the "real" world differ on their supporting argumentation, which include *Demonstrative validity*, *Experimental validity*, *Interpretative validity*, *Methodological validity*, and *Pragmatic validity* (Krippendorff, 2006, pp. 263-267).

Validity criteria

Demonstrative validity consists of showing how an artifact would work and aspects of its value, through the use of demonstrations. Different kinds of demonstrations have different merits, but they also have some typical limitations. Most noticeably, they usually demand that people complete the dimensions that are (often inconspicuously) omitted, while trying to imagine themselves as users.

Experimental validity allows people to actually interact with an exemplar of the artifact, such as a prototype. This is a major advantage over *Demonstrative validity* since the interaction can yield unexpected evidences, either in support of or against the designer's original claims. The major limitations of *Experimental validity* lie not on the artifact "side" but on the subjects', who must be sampled in order to represent all stakeholders involved. Sampling may leave unapparent but relevant stakeholders out and, what is worst, sampling size hardly allows the foundation of a social network.

Interpretative validity argues a design based on the other disciplines' bodies of knowledge, which have to be interpreted, reframed and rearticulated, before they can be used to support a design claim. These adaptations are particularly delicate when the available knowledge represents generalizations and records of past observations, and occludes atypical situations, the relevance of tacit context, and disruption opportunities. Nonetheless, for instance, even though the continuity predictable from available

generalizations may be ineffective in supporting projections of disruptive design (Simon, 1996, p. 147), it may still be informative and provide valuable insights.

Methodological validity argues an artifact based on the validity of selection and application of the methods the designer used to achieve it. Three kinds of evidence of *Methodological validity* were suggested (Krippendorff, 2006, p. 266). One is *the number and kinds of alternative futures, versions or approaches* the designer examined to get to the artifact being proposed. This reveals the ground covered and allows others to critically examine its acceptability, or to spot blatant omissions. Another possible kind of evidence is *the number and feasibility of paths*, which relates to examining the pros and cons of the life cycles of the alternatives, from the present to each of the futures that have been considered. This includes thinking of resources needed and of the impacts on the lives of all those conceivably implied, in a holistic, ecological way. Finally, the other possible kind of evidence of *Methodological validity* is *the numbers and kinds of stakeholders consulted* or represented by their backgrounds, cognitive abilities and aspirations. Semantic claims ought to be qualified, substantiated, or demonstrably convincing to the communities of stakeholders to which they apply. That in turn suggests how likely a community would understand, use and feel at ease with the artifact.

Pragmatic validity exists when stakeholders exhibit understanding and commitment to support or use the proposed design. Such involvement is exactly what the success of the design depends on. Even such kind of evidences has limitations. Not only it is conceivable that it can result from injudicious enthusiasm, e.g., misled by short-term only perception of value, but also it may reflect the sensitivity of part of a community that is benefited at the expense of others who are not necessarily aware of it.

As introduced, *post factum* validity, despite being the ultimate proof of the validity of a design, is reserved to artifacts for which it is also possible to observe them “working its way through its life cycle, and succeeding in the ecology of artifacts” (Krippendorff, 2006, p. 267). That is, this kind of validity is incongruous with early stages of the life of an artifact.

3.3 Application of the selected methodologies

The approach to research in this study can be characterized by a combination of DSR and SfD. The moments of *Evaluation* of the artifact were perhaps the most recurrent situations when we felt the need to intersect the two methodologies. We were interested in performing *Evaluation* according to the agenda of DSR, using the methods of evaluation suggested in the scope of SfD, as we further describe in Section 3.4.

Events in our DSR

In Figure 3.1 we expose the research events along the study, evidencing the application of DSR. We performed two iterations of DSR (whose phases are mentioned in the leftmost column). The first iteration started with the *Awareness of Problem* that we presented in Chapter 2 (and in particular in Section 2.5): in short, the lack of guidance for non-experts to perform sound design in games. Our *Suggestion* was that design guidelines could contribute for the empowerment of non-expert practitioners to perform sound design in games. We consequently *developed* a set of Guidelines. In order to perform a first *Evaluation* of their contribution to the empowerment of practitioners we observed a group of prospective game designers while creating a game prototype under the influence of these Guidelines.

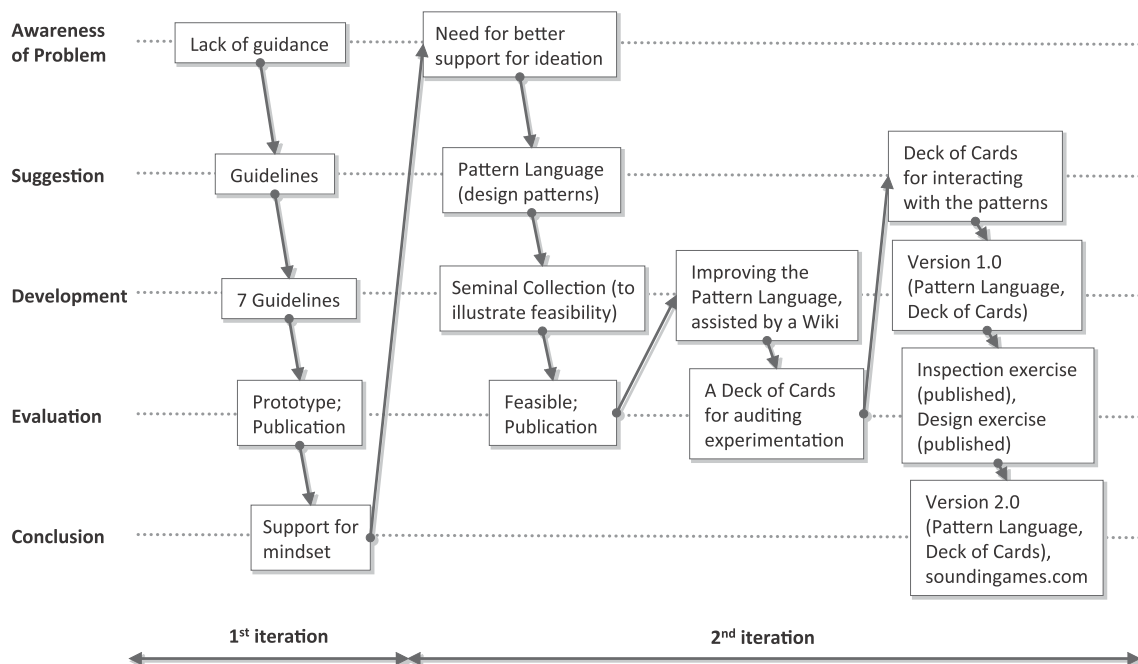


Figure 3.1. Application of Design Science Research in this study

We *concluded* that the participants were sympathetic with the concepts expressed by the Guidelines and that they devoted attention to the exploration of sound in the resulting prototype. However, the experience provided by this exercise also revealed a component of the original problem that we did not anticipate. The guidance, to be effective, should provide more expedite ways to support ideation. Namely, we noticed that during the exercise, and particularly in the early phases, the participants did not find support to go from the concepts expressed in the Guidelines to specific ideas that they might adapt or adopt.

So, we decided to reformulate our *Awareness of Problem*, and engage in a second iteration. Our (revised) *Suggestion* was that a pattern language based on the Guidelines we formerly synthesized could present practitioners with specific examples of existing application of the respective concepts. We then *developed* a seminal collection of design patterns, to test the feasibility and also to assess the receptiveness and feedback of the research community. The *Evaluation* of this *Development* mainly consisted of the realization that our *Suggestion* was indeed feasible, the publication in a scientific conference, and informal feedback from other researchers. While involved in that phase, we considered that instead of concluding this second iteration, there would be great potential in the possibility of getting back to the phase of *Development* and improving the Pattern Language. Such decision turned out to be important because we were able to accomplish that intent far beyond our initial expectations. That became even more noticeable when we started to use a wiki website as an instrument to manage the redaction and relationships among the design patterns.

Meanwhile, when pondering a setting to perform the *Evaluation*, we considered the interest in having a deck of physical cards that would represent each of the patterns and whose manipulation, in the context of a design session, would allow us to audit the practitioners' usage of the patterns. After some time exploring possible designs for those cards, we realized their potential beyond the usage for *Evaluation* purposes. Namely, we pondered using them assumedly as an "end-user" interface for the Pattern Language, both as a tangible form of communication of the concepts and as a possible instrument supporting sound design. We consequently, interrupted this *Evaluation* phase to incorporate that new interface in our *Suggestion*, and proceeded to its *Development* under the revised purpose.

Even more rewarding was that, while working on the representation of each pattern (to design the respective card), the added “intimacy” brought by the need to study the best possible translation to that alternate form allowed a great deal of improvement in the whole collection, both in terms of adjustments to our prior conceptions, and in the identification of new related patterns. This was a conspicuous instance of the inherent potential of DSR to provide “designerly ways of knowing” through the *Development* of the artifact.

The *Development* process, of both the patterns and the respective cards, was extended until we came to a state that we called “version 1.0”. The *Evaluation* that followed consisted of two different exercises. We conducted an inspection exercise to the Deck, card by card, aside from its prospective usage in design (Chapter 8); and we conducted one other exercise, involving the actual usage of the patterns/cards in a design session (Chapter 9). As part of the *Evaluation*, reflection on each of the exercises was published in scientific conferences. For the *Conclusion* of this iteration, we integrated what we could learn from the *Evaluation*, in the form of “version 2.0” of the Pattern Language and Deck. We also took the chance to make some additions that we developed concurrently. The Wiki for Sound Design in Games, which in the meantime was made public as *soundingames.com*, was updated to reflect this new version.

With the *Conclusion* of these two iterations we consider to have completed what we called above the “first stage” of the broader project we wish this thesis to be part of. As we will have the opportunity to reveal, in Chapter 10, the Wiki can become our prime interface with the stakeholders that we are enticing to engage in the next stage.

3.4 Validity of the semantic claims

The artifact being proposed, as result of the “first stage” described in the previous section, needs to be considered in terms of *what it is likely to mean and allow to the community*. In SfD discourse, the answers to such questions are called “semantic claims”. In turn, it is the presentation of the validity of such claims that can be used to convince the stakeholders to get involved in the prosecution of the project. Krippendorff (1989) reveals that most designers spend 80% of their time convincing others to get involved in their creations (p. 28).

Along our study we used several of the methods that SfD identifies as supportive of the validity of semantic claims (Krippendorff, 2006). The fact that we were also conducting DSR and that we consequently transformed our proposal along time, made it pertinent to adjust the validity methods accordingly. We can distribute the rationale of the pieces of validation along this study among *Demonstrative*, *Interpretative*, *Experimental* and *Methodological* validity. Yet, our commitment was predominantly with the latter two.

Demonstrative validity

Demonstrative validity was our purpose in two particular moments. One of them was intended to be achieved with the output of the first game prototype resulting from the experimentation with the influence of the Guidelines for sound design on the game design process. As explained before, the observations carried out along the development of that exercise ended up diverting such intent to a second plane when we realized that the exercise was also unveiling the pertinence of completing the guidance (the Guidelines, at that time) with some more concrete assistance to ideation (which turned out to be the Pattern Language). Still, we are making available the resulting design specification of that exercise as an illustration (or a *demonstration*) of a design exercise influenced by the Guidelines, for research purposes (Appendix B). The other moment when we acted towards a demonstrative validation of a debuting proposal was the Seminal Collection of patterns, an intermediary step in the second iteration, aiming at the demonstration of what the further development of a pattern language could become.

Interpretative validity

Interpretative validity was important especially in the debuting of the proposal and in the creation of the overall mindset. Our proposal is inherently multidisciplinary and based on insights from the interpretation of the disciplines being considered. An exemplary case is the way we explored concepts from Acoustic Ecology in the domain of sound design in games. One other domain from which we consistently substantiated components of our claim was sound design in cinema. We dedicated great thoughtfulness to this interpretation, since the resemblances ought not to elude the disparities between the two specific domains – games and cinema. A third important example in which we resorted to *Interpretative validity* was in building the argumentation for the *potential* of a pattern language in the particular domain of sound design in games. One of the components of that argumentation is the comparison with

the success that such approach achieved in *other* domains where similar concerns and goals were observed.

Experimental validity

Experimental validity was our aim when conducting the game design exercise that we report in Chapter 9. Namely, we wanted to observe whether the proposed guidance – in the case, the Pattern Language, assisted by the Deck of Cards – could afford meaning to a team of practitioners engaged in a game design session. More specifically, we wanted to collect evidences for whether, in that particular circumstance, these non-experts exhibited empowerment to perform sound design, how they related to the guidance, and what behaviours and expectations emerged.

We gave a lot of thought to that experiment. The creation of the Deck of Cards, for instance, is a conspicuous evidence of our attention to the preparation of the data gathering: the Deck was originally conceived to allow us a way to audit the practitioners' interaction with the patterns, when eventually examining the videographed session. Another sign of our attention to this exercise is the extensiveness of the registration of elemental events occurring during that session, which in great part was motivated by the richness of the available data (also Chapter 9). We did this documentation of relevant events in more than one pass because we recognized new needs and opportunities along the analysis.

One other dimension of our argumentation that relates to *Experimental validity*, particularly in the case of the Pattern Language and its facilitator tools (Deck of Cards and Wiki) is the fact that we invested in making these proposals available and functional beyond mere demonstrative purposes. That way, others who may be interested, including the target audience, can also experiment with them and find arguments in support of or against the claims we advance.

Methodological validity

Methodological validity is also part of our argumentation for passing to the stakeholders the message that the artifact we are making available is not a mere demonstration. We want stakeholders to trust our commitment to the quality of the body of knowledge that we are making available. Our aim is that such perception of rigour leads those stakeholders to consider worthwhile engaging in the exploration and improvement of

what is being presented. Failing to make stakeholders feel the *current* value of the body of knowledge accompanying the proposal, may jeopardize its subsistence, due, for example, to the perception of a supposed long distance still to go until reaching an enjoyable artifact, or to impasses on who would first move in order to make the project take-off.

We argue *Methodological validity* with two kinds of evidence from what we did: *number and kinds of alternative futures, versions or approaches*; and *numbers and kinds of stakeholders consulted* (Krippendorff, 2006; also introduced in Subsection 3.2.2). Regarding the *number and kinds of alternative futures, versions or approaches*, we propose to the stakeholders the narration of the course of the DSR, as revealed in Section 3.3 and summarized in Figure 3.1. Also, we expect that, since this proposal was designed to remain open to evolution, it also keeps open the accounting of what can still come to constitute “alternative futures, versions or approaches”.

Regarding the *numbers and kinds of stakeholders consulted*, we argue with the way we explored the *methods for inquiring into stakeholder’s concepts and motivations* (Krippendorff, 2006; also introduced in Section 3.2.2), to which we dedicate the next section. The appropriateness of our exploration comprises, to start with, our selection from within such available methods; but it also comprises the *extent* of their application, in strategic situations. Examples of the latter include the extensive coverage performed in the second iteration while developing the Pattern Language (also included in the next section).

3.5 Inquiring into stakeholder’s concepts and motivations

In the following subsections, we revisit moments of the course of research that we have been presenting, rearranged under the lenses of the methods that we want to emphasize, namely *Narratives of ideal futures*, *Observational methods*, *Ethnography*, *Survey and structured interviews*, and *Stakeholder participation in the design process*. The subsections follow the organization and terminology suggested by SfD, introduced in Subsection 3.2.2.

3.5.1 Narratives of ideal futures

In several decisive moments, our proposal was influenced by insights that are *Narratives of ideal futures* (Krippendorff, 2006, p. 222). We found such narratives in testimonies

from several categories of stakeholders, including professional sound practitioners, mainstream and indie game developers, players, researchers in sound for games (e.g., Alves et al., 2011; Childs, 2007; Marks, 2009; Novak, 2008). We also found such kind of narratives in other domains that we came up to find contributory to the building of our proposal (e.g., filmsound.org, n.d.; Sider et al., 2003). These narratives both identify broad ambitions, as in: “here are ... films with excellent sound.... Our challenge is to meet this level. Games don’t sound like that” (Peck, 2001, p. 1); and suggest specific ideas such as: “bringing awareness of sound needs to the people that pay the bills” and “bringing more film post-production techniques into game audio” (p. 2).

Even in communications that are not particularly targeted to game design, practitioners from other specific domains, namely from the neighbour domain of cinema, often characterize aspects of what sound design *should be* that are as pertinent to game design. For instance, this David Lynch’s (2003) quotation resonates with needs identified in game design: “what’s bad is to be forced to get a composer too late ... and not have a dialogue – a good dialogue – with the composer, so that you could be caught where you’re just putting in music that doesn’t sit inside the film. It’s just an overlay and it’s worst than having no music at all.” (p. 51). The insights we borrow from Acoustic Ecology, as another example, though almost invariably come in a format that requires reinterpretation to fit game design, carry a message of how design would be, if done ideally, and sometimes even explicitly present arguments such as “people *should* value the soundscape, specifically a balanced one” (Wrightson, 2000, p.13).

The formulation of the Guidelines we proposed (Chapter 5) exhibits an evident orientation towards ideal futures, both in intent and in the supportive discourse. They advise innovation in the practice, as opposed, for instance, to being corrective or selective among current alternatives. Although in the design patterns this discourse may not be as evident, the mindset is there. The patterns were distilled along an endeavour that implied observing the work of experts, tacitly under the lenses of those Guidelines. These design patterns are, to a certain extent, a reframing of the Guidelines into the recurrent solutions found in the work of expert designers.

3.5.2 Observational methods

Direct observation “can be particularly useful to discover whether people do what they say they do, or behave in the way they claim to behave” (P. Järvinen, 1999, p. 96). In fact, for example interviews, particularly when structured, may not be as effective in

providing data on matters occurring at the unconscious level, such as emotional aspects and tacit conducts.

Observational methods (Krippendorff, 2006; Martin, B. & Hanington, 2012; Sharp, Rogers, & Preece, 2007) played an important role in the course of our research. We performed several kinds of observation on several kinds of stakeholders. We first resorted to observation when evaluating the proposed Guidelines, in the first iteration. In that instance we collected notes on the evolution of the work of a team of prospective game designers, their relation with the Guidelines, and the fitting of the Guidelines in the game design workflow. Relevant aspects arising in language, both in face-to-face and asynchronous communication, were also valued. The game design specification that the team generated along the exercise complemented our observations.

The adoption of observation as research method would become determining again to the course of our research when we considered evaluating the Pattern Language by recording the video of a game design session under the influence of that language. We did a comprehensive analysis of the video, which was most fruitful (Chapter 9). It allowed us to gather data for a great variety of analysis, including aspects that would hardly arise or become verbalized in an interview, less to say in a structured interview or a survey. It also gave us insights on improvements that we included in version 2.0.

As we already mentioned, before we actually performed such design session, we felt the need to conceive an instrument that would ease the observation of the interaction with the design patterns, when analysing the recorded video. That led us to start working on a deck of physical cards, each representing a pattern in the Pattern Language. Eventually we realized that this instrument, originally just thought to serve research observation, should evolve into an authentic end-user interface with the Pattern Language, as both dissemination and design tool (Chapter 7).

3.5.3 Ethnography

As we will explain later (Chapter 6), in the second iteration of our DSR cycle we felt the need to inquire into sound design expertise to inform the building of the Pattern Language. Since we could not directly address the experts, for practical reasons, we opted instead to observe their work – where such expertise was applied – through the use of the products made available in the market. For that, we engaged in *ethnographic* observation of gameplay sessions of judiciously selected games.

Ethnography is also an observational method, which derives from social anthropology and that has been adapted to design (Coleman et al., 2005; Fetterman, 2010; P. Järvinen, 1999; Martin, B. & Hanington, 2012; Sharp et al., 2007; Shneiderman & Plaisant, 2010). It is mostly used in early, exploratory, phases of design and it “relies heavily on up-close, personal experience and possible participation, not just observation, by researchers” (Genzük, 2003, p. 1).

Autoethnography

This approach became a major characteristic of our methodology, namely because we realized that, in order to properly apprehend the contribution of sound design to the players’ experience, we should actually behave like players. As such, we opted for playing the games ourselves, as opposite to observing others playing either live or through videos of their gameplay sessions. Aarseth (2003), referring to methodological approaches to game analysis, actually puts “playing the game ourselves” as the preferred method for acquiring knowledge about the qualities of gameplay and, through that, of the effectiveness of design. He considers such approach better than, e.g., talking with the developers of the game, or observing others playing, or reading their reports and reviews. He adds to the argument that “unlike studies of films and literature, merely observing the action will not put us in the role of the audience” and that “what takes place on the screen is only partly representative of what the player experiences” (p. 3). Other authors present complementary arguments to the importance of “playing lots of games” (Brathwaite & Schreiber, 2009, p. 9), including to the enrichment of one’s vocabulary and to better supporting ideation (Adams, E., 2010, p. 66).

By experiencing games ourselves, we were able to reduce in one order the understanding of our observations, because we were allowed first-order experiencing, instead of a second-order understanding of other players’ experience. Or, if we use the sound design experts as referential and consider that the sound explorations we identified express *their* understanding – that was exactly the rationale – then, we were allowed a second-order understanding of their understanding of sound design, instead of a third-order understanding.

Being so, our ethnographic venture might be better characterized as *Self-ethnography* or *Autoethnography*, since it essentially refers to self-observation and experience (Chang, 2008; Ellis, 2004). In this document we will not further pursue that distinction, though,

for two main reasons. One is that some authors consider *Autoethnography* as a form of *Ethnography*, the distinction being decided essentially by the researcher's claims (Ellingson & Ellis, 2008). Since, to us, the particularity is not central to the goals of the discussion, the application of the wider concept is as interesting. The other reason is that, although our ethnographic research is mostly achieved through our own experiencing with games, this approach made us apt to *also* engage in another type of ethnography that, despite being executed less exhaustively and methodically, was indeed instrumental. As players we developed privileged conditions to participate and appreciate discussions with and among other players. This allowed us to expand our perspectives, inclusively in the analysis of our own experiences. More influentially, such discussions often provided us with clues on promising games and specific interesting sound explorations, through informal sharing along time. So, although the design patterns and respective examples that we propose represent our harvesting, they also embed other people's knowledge, ethnographically recognized.

Playing as research

There is another relevant factor that naturally led us to ethnographic experimentation: the need for a *comprehensive* research of conceivably interesting sound explorations. We realized that the amount of examples – particularly, *distinct* examples – that we could present to support each of the identified design patterns would be very relevant not only to the consolidation of the patterns but also to provide users with alternative insights as opposed to unwittingly biasing them towards a few solutions or a single reiterated solution. We considered this fundamental, because a common critique that is done to the use of design patterns, in general, is that they may compromise creativity when suggesting *known* solutions. Regardless of the counter-argumentation that may be presented to that issue (e.g., Björk, Lundgren & Holopainen, 2003, p. 10; Lee, Srivastava, Kumar, Brafman, & Klemmer, 2010; Herring, Chang, Krantzler, & Bailey, 2009; Tidwell, 2011, pp. xix, xxi; Vlissides, 1997), we decided to escape that discussion by evidencing exactly the opposite through the identification and presentation of the more varied possible set of examples for each pattern. Again, the engagement required by the thorough observation of sound design explorations in games, obliged an experiencing that became favoured by an ethnographic approach. The more than 7 distinct video examples, in average, that ended up being selected to document each of the more than 80 currently proposed patterns (version 2.0), constitute the distilled data of such ethnographic initiative.

3.5.4 Surveys and structured interviews

We conducted a *structured interview* (P. Järvinen, 1999; Krippendorff, 2006; Sharp et al., 2007) on version 1.0 of the Deck of Cards, involving five participants. This was an exercise of inspection, targeting foremost hindrances and opportunities for enhancement of the cards, in terms of perception and content interpretation. We presented the participants with four rounds of questions, to which they answered directly on each of the cards (see Chapter 8). Version 2.0 integrates the improvements and insights resulting from the respective analysis.

3.5.5 Stakeholder participation in the design process

We consider the adoption of the *Stakeholder participation in the design process*, as a method (Krippendorff, 2006), to be integral to the *Methodological validity* of the proposals' semantic claims. In previous sections, we already referred to the relevance of the experiments that we conducted and the influence that the analysis of the participants' interaction with the proposals had to their maturation.

Additionally, the work presented in this thesis was developed under the principle that the resulting body of knowledge would be communicated as a proposal, and that its meaning in the short-term would have to be realized under its potential for it to become appropriated by the community and eventually become impactful in the medium and long-term. Such appropriation by the community includes, naturally, the engagement in making the proposed design evolve along its life cycle.

Though the time frame for presenting this thesis is not compatible with waiting for medium-term transformations, this method is indeed following its course, with two major evidences. One relates to the timely and explicit statement of this same mindset, which objectively shaped other decisions along the study. The other relates to the adoption and settings of a wiki website, to eventually support the opening of the proposal to edition by the community (Chapter 10).

3.6 Methodologies suggested to users of the guidance

A methodological appreciation is also conceivable regarding the ways the design artifact can be used. In fact, since the artifact has the form of design guidance (and facilitator design instruments), its *use* is also necessarily subject to the application of some design methodology.

We don't wish to be prescriptive regarding the design methods that may be allowed by the use of the proposed guidance – it only makes sense that such aspect is free to evolve alongside with the evolution of the guidance itself. Yet, we can characterize the kind of explorations that we *currently* identified and envisage.

To start with, the design methods propitiated by this guidance are inherently human-centred. More specifically the guidance is pertinent to *Designing original artifacts, guided by narratives and metaphors* and is fit to *Dialogical ways to design* (Krippendorff, 2006). Noticeably, these aptitudes map the two dimensions represented by the research goals we identified in Section 3.1: creation and communication.

As for the method for operationalizing the creation of spaces of possible futures, *Brainstorming* (Krippendorff, 2006) is the one that we opted to experiment with. Yet, to make the proposed guidance more effective, it would be desirable to design a *process* that would suggest exactly how to conduct the brainstorming session (see Subsection 11.3.3).

3.7 Relevance of this research

The pertinence of this research is argued with the creation of conditions for a communitarian involvement in the empowerment of practitioners, through specific guidance and through the leveraging of domain literacy. In addition to the ethical relevance of its emancipatory potential, the meaningfulness of the contribution is amplified by the current scarcity of alternatives and by the numerical expressiveness of the target audience (Chapter 2). Moreover, the reach of a possible transformation affects (and depends on) not only the practitioners but also the other several stakeholders, including the ultimate consumers of the products being designed – the players. In turn, the conditions introduced with this study include a starting body of knowledge in the form of a proposal whose construction was methodologically thoughtful, organized, extensive, and based on evidences from expert practice and narratives of ideal futures.

The possibility of taking advantage of an evolving body of knowledge *even if it is still “in development”* – merit of the adopted methodological support, namely the formalism of Pattern Languages – does not defer the interest of the endeavour to a particular event in the future. Instead, it has the potential to offer incremental interest, while the body of knowledge is improved and while the domain grows itself at the hands of these stakeholders.

3.8 Key research challenges, boundaries and limitations

One of our key research challenges was dealing with the magnitude of the project and with the difficulty in realizing a meaningful checkpoint where to present a scientific contribution, considering that it would not be possible to assess *impact* in the timeframe of the thesis. The adopted solution, of conducting and reporting the research until the moment right before making the body of knowledge available for communitarian appreciation, implied an extended commitment, because we realized that, if the next step would really be making our work becoming noticed and opening it to the community, we should carry it to a reasonable point of development, i.e., to a convincing state, capable of actually conquering the interest of the potential community.

The most noticeable consequence was the pertinence we found in prolonging the ethnographic work of identifying new design patterns and distinctive examples of application in existing games. The whole process, which included the experimentation, the selection and processing of the video clips, the specification of the patterns, the setting of their relationships, etc., was a very demanding, complex, task.

Regarding the communication of our study, namely in this thesis, we felt difficulty in presenting this work in a way that, while scientifically honest when referring to its *current* impact on the target public, does not overshadow its value, namely, when considering the distance travelled since the starting point and its plausibility in supporting relevant transformations in the audience. Furthermore, the stakeholders in the development of the proposed body of knowledge are by no means confined to the scientific community. And although we do not wish to imply that the perception of value of this proposal from the non-scientific community depends on less rigorous marketing, the fact is that a bolder, more emotional messaging of the potential contained in the proposal would, most likely, be more effective in waving for that public's first interest.

In terms of scientific research, it is also important to signal that this thesis can hardly be appreciated from a strictly positivist stance. It adopts a transdisciplinary approach to the research (Adams, R. et al., 2011, pp. 66-67), mostly following a constructivist paradigm (LeMoigne, 2007; Lincoln, Lynham, & Guba, 2011) in support of the design of a holistic answer to the research question, which is intertwined with an emergent enhancement of the understanding of the problem itself. Accordingly, it uses mainly designerly methods of building and evaluating knowledge (Cross, 2007; Figueiredo & Cunha, 2006). These

are, to a great extent, related to a human-centered orientation and to the consequent need to engage in second order understanding; and, as such dismisses, for instance, possible aspiration of presenting generalizations among the research findings (Krippendorff, 2006; Cross, 2008).

Chapter 4

A Holistic Understanding for Sound Design in Games

This chapter presents our first contribution towards answering the research question. The contribution consists of setting a fundamental approach that can confer a holistic understanding (Simon, 1996, p. 170) to the development of design guidance for sound design in games. Consequently, the chapter also provides a contextualization that is essential for the comprehension of subsequent chapters, which are built on top of the principles introduced here.

On the basis of the experts' assertions (Chapter 2), we came to the understanding that proper sound design ought to be addressed holistically. A sound designer must have the chance to consider the project as a whole and ponder how sound will best serve the overall purposes in harmony with all other aspects. We also learned that both such holism and the opportunity to actually *design* sound are compromised by a late involvement of sound practice in the life cycle of games. It is crucial that sound designers become involved in the general design process as soon as it begins. Unless that happens, the range of possibilities will be severely curtailed by whatever other decisions have been taken. This is an aspect that is often underlined by expert practitioners, not only in the field of computer games but also in the influential movie industry (for example, Parker, 2003; Peck, 2001; Thom 2003).

Twofold contribution to holism

Being so, we considered that conferring holism to the proposed design guidance should constitute our primal concern. Our contribution to a holistic sound design is fundamental and twofold. Its implementation involved:

- **providing conditions for sound design to be indeed conducted in early stages of game design.** For that purpose we designed guidance that is usable and useful to the overall ideation process as soon as it starts;
- **providing guidance that embeds itself a holistic understanding of design,** which implied to promote holism not only among sound explorations but also

among those explorations and the other aspects of the game design. For that purpose, we designed the guidance in a way that it embeds holistic explorations and recommendations. In turn, to achieve such a goal, we use an interdisciplinary approach to the collection and (re)synthesis of the guiding body of knowledge.

In the following sections we present the rationale for both these initiatives. We eventually elaborate on the natural suitability of holism in the case of non-industrial game development.

4.1 Sound design as part of game design

As introduced (Chapter 2), experts in sound design consistently refer that the integration of sound in games should happen earlier in the chain of production. In the late phase at which they usually get involved, there are no longer conditions to change fundamental aspects of the game specification to allow for a meaningful contribution of sound (e.g., Childs, 2007; Collins, 2008a; Denoos et al., 1998; Novak, 2008; Thom, 1999; Schell, 2008a).

We propose an approach in which sound design becomes part of the game design. The modification inherent to such approach is profound. It is definitely a matter of mindset, to start with, but it actually implies performing sound design in a different way. We argue that not daring this much and, for instance, confining the approach to change aspects of the game specification to properly fit the contribution of sound (when sound design is finally performed) is a remediation. We consider that sound contributions should be brought into the space of possibilities for game design. Namely, we propose that sound contributions should be brought to the *beginning* of the chain of creation in the form of *game design* possibilities.

Our approach, implemented through the proposals presented in the following chapters, ensures that sound *is considered* in the design of the game. More specifically, it ensures that sound design is *timely* considered, and that it is considered in a *genuine* and *integrated* way. Ultimately, the approach has the potential to present sound based contributions without the need to distinguish them from the others. In practice it should not even be required that designers explicitly assess their prevailing modality.

We understand that, unless that approach is truly embraced, sound design and the other aspects of game design will still be fragmented to some extent. Also, we believe that, if we have the opportunity to propose a change, we ought not to refrain from running for the optimal scenario. Furthermore, we could not yet find pragmatic reasons that might compromise that intent.

Target conditions allow for disruption

Additionally, the fact that we are also primarily targeting a segment of the community where, as argued, the practice of sound design is not yet set up, allows us to be as disruptive as we need in our proposal. That is, the fact that we are not particularly conditioned by a possible need to coexist with an established workflow for performing sound design allows us to address the problem directly in its source.

No need for additional phases

Furthermore, a practical advantage of having sound design embedded in game design is that the concretization of the intents of introducing or enhancing sound design in games does not require any additional phase in the practice. Instead, the challenge for the approach to be feasible is to present the sound design opportunities in a format that practitioners can address at (game) design time. The specifics of our proposal to do so are the matter of the remaining chapters in this thesis.

4.2 Holistic lenses relevant to our proposals

As introduced, a second dimension of our contribution to a holistic sound design in games consists of embedding in the proposed guidance an interdisciplinary body of knowledge that represents itself a holistic synthesis of contributory concepts. Such holism applies not only to sound design, i.e., to the organic of the several explorations of sound, among themselves, but also to its amalgamation with all aspects of game design.

In the following subsections we expose the major concepts that constitute our holistic lenses when collecting the body of knowledge inscribed in the proposed guidance. These include: a classification of all possible sounds participating in a composition according to their semantics; the concept of *Acoustic Ecology* and *soundscape*; the instrumentality of the emotional script to the experience and the neurological basis of emotions, which makes it pertinent, for instance, to tweak the players' physiology by means of techniques such as *entrainment*.

4.2.1 Sound layers and semantics

Considering that being able to think holistically of sound implies acknowledging all sounds that are involved in the design, it is relevant, to start with, to have a categorization that facilitates the management of the attention and development. We have been adopting Nick Peck's (2001, 2007) classification for sound in games, which is borrowed from practice in film. His classification comprises the following “*sound layers and semantics*”: *Music*, *Dialogue*, *Ambiance*, *Sound Effects*, and *Foley*, as presented in Table 4.1.

Table 4.1. Sound layers and semantics (according to Nick Peck)

Layer	Intent
<i>Music</i>	Sets the emotional tone of the scene; tells the audience what to feel
<i>Dialogue</i>	Characters discourse about the action; communicates story, what characters think and what they feel
<i>Ambiance</i>	Sounds of the environment; tells the audience where the action takes place; usually perceived when other layers are absent or low
<i>Sound Effects</i>	Makes abstract or imaginary objects concrete (e.g., sound of a laser sword) by enabling a multisensory perception
<i>Foley</i>	Sound of human actions; makes visual field more believable or enhances perception of ongoing actions

It is important to notice that not all authors and practitioners adopt this same classification. For instance, a typical divergence occurs in the definitions of *Sound Effects* and *Foley*: some authors join this two categories and use some designation to refer to that group – usually *Sound Effects* (e.g., Viers, 2008) – though they recognize and use both designations; others establish a hierarchical relation between them, i.e., one incorporates the other.

Regardless of the possible discrepancies among classifications (e.g., Wilhelmsson & Wallén, 2011), the important is that the consciousness of the multiplicity of sound components helps to structure the agenda of opportunities for exploration. This categorization is also helpful when eventually forwarding the design requisites to the respective workflows of implementation. In any case, this kind of awareness is instrumental to enjoying a holistic assessment of the sounds involved.

4.2.2 Acoustic Ecology

Acoustic Ecology is a discipline that supports the appreciation for a meaningful conception of sound in context (Kallmann, Woog, & Westerkamp, 2007; *World Soundscape Project*, n.d.; Wrightson, 2000). We understand that we can use the concepts inherent to Acoustic Ecology as a tool for sound design, namely for moulding the exploration of sound with insights from an ecological model.

Acoustic Ecology was founded mostly by music composers. It is supported by the central concept of *soundscape* (Schafer, 1973, 1994) and the consequent *composition* (Truax, 1995, 2001). Together, they represent a meaningful body of knowledge with particular emphasis on context, emotion, and interaction between the listener and the environment. The term soundscape means the “sound heard in a real or virtual environment” (Wrightson, 2000, p. 10) considered *as a whole*. A soundscape is an ecologically balanced entity where sound mediates the relationships between individuals and the environment. So, Acoustic Ecology, as a discipline, implies a consideration of how the environment is *understood* by those living within it: regarding sound, the focus is on how it *functions*, not simply how it propagates.

Acoustic environment as a composition

Acoustic Ecology also supports the idea that an acoustic environment can be understood as a musical composition. This emphasis on the concepts of harmony and orchestration is not mere lyricism. Studies on natural environments show balance in level, spectra, and rhythm. For instance, it was observed that “animal and insect vocalizations tended to occupy small bands of frequencies leaving ‘spectral niches’ (bands of little or no energy) into which the vocalizations (fundamental and formants) of other animals, birds or insects can fit” (Wrightson, 2000, p. 11).

The listener's role

Another implication is that the listener *shares responsibility* in composition (Wrightson, 2000). The idea of the listener as a composer is very insightful. First, it gives relevance to the sound the listener himself produces (composes and/or interprets), intentionally or not. Second, and perhaps more impressively, it emphasizes that the user completes the composition by filling the “meaning” that is absent or that is not evident (Truax, 1995). This process of construction is assumed to be personal since the overall context, where an acoustic environment fits, is different for each person.

4.2.3 Emotion

We already stated the scarce consideration that sound has so far received in most designed interactive processes. No less relevant is the fact that most of the efforts on leveraging sound usage have been focused on utilitarian issues. These include complex data display, event monitoring and reinforcement of critical messages, applications for visually impaired people, and interfaces for eyes-free devices. Of course, these are all most noble quests, but they do not explore a very powerful facet of sound, which is its association to emotions (Cunningham, Grout, & Picking, 2011; Farnell, 2010, p. 108).

Research on emotion was not always popular, although theories can be traced back at least to Plato and Aristotle. As an area of research, it has had a low profile for most of the 20th Century and only recently has it had a resurgence in interest (Damasio, 2003; Ledoux, 1998; Nettle, 2006) thanks largely to advances in neuroscience laboratory tools. The fact that it is now possible to have an internal perspective of emotion, rather than dealing with external observations alone, contributes decisively to a new consideration of emotions. To start with, it helps to set apart what is science and what is no more than wishful thinking, allowing for the credibility of the approaches that rightfully find support on the emotional plane. Also, it reveals new opportunities to act according to the physiological observations of emoting processes. But, and possibly more relevantly, recent scientific findings on brain phenomena and on how cognition and emotion are intertwined (Damasio, 2000, 2003, 2005; Lane & Nadel, 2002; Lane, Nadel, Allen, & Kaszniak, 2002; Ledoux, 1998) build support for unprecedented studies that aim to leverage cognitive attributes through the exploration of emotional aspects of the interaction (Norman, 2004).

That said, it seems fair to argue for a more thoughtful exploration of sound, namely in what concerns its potential association to emotions (Cunningham et al., 2011; Ekman, 2008; Follett, 2007; Grimshaw, 2007; Nacke & Grimshaw, 2011; Peck, 2001), with both a focus on purely hedonic purposes and through an exploration of how the achievement of specific emotional states may indirectly contribute to pragmatic goals such as various aspects of performance: efficiency, effectiveness, perception, memory, and so forth. Interestingly, in other disciplines, sound has proven to be notably associated with emotion; relationships between sound and emotion have been traditionally explored in areas like music (Gouk, 2004; Juslin & Sloboda, 2001) and cinema (Peck, 2001; Sider et al., 2003) with a solid body of knowledge.

4.2.4 Resonance and entrainment

One goal inherent to game design is to support engaging experiences. Thus, it is important to reflect on reasons that may lead to a player not becoming engaged with a designed setting. Perhaps it should be recognized that, ultimately, such lack of engagement may be explained by the player's own will and not by flaws in the design process. This is no excuse, however, for ignoring important sound design considerations.

In some circumstances, the deviation from the predicted behaviour derives from the fact that there is no matching between the player's state and some desired state in any particular moment. From Physics, we borrow two related concepts that allow us to describe and to formalize a model to actuate design with the purpose of addressing this circumstance. These concepts are *resonance* and *entrainment* (Augoyard & Torgue, 2005; Pantaleone, 2002; Rosenblum & Pikovsky, 2003; Sonnenschein, 2001), both physical phenomena having repercussions on the psychology and physiology of perception, cognition, and emotion (Atwater, 1997; Huang & Charyton, 2008; Leeds, 2001; Sonnenschein, 2001).

Resonance is the phenomenon in which an object is put into vibration when subject to an exciting frequency (Augoyard & Torgue, 2005, p. 99; Rosenblum & Pikovsky, 2003, p. 405). A resonant system exists when an object is able to make another resonate. It requires a concordance between the exciting frequency and that of the object put into vibration. Natural (or free) resonance occurs when an object vibrates as a consequence of being excited with its own natural frequency. If the object has the ability to vibrate to a variety of frequencies, resonance can be forced. Resonance was said to be "the single most important concept to understand if you are to grasp the constructive or destructive role of sound in your life" (Leeds, 2001, p. 35).

Entrainment, often addressed as rhythm synchronization, relates to the synchronization between oscillatory systems (Granada & Herzel, 2009; Pantaleone, 2002) and it is "so ubiquitous that we hardly notice it" (Sonnenschein, 2001, p. 97). Such synchronization is also inherent to living organisms, not only in individual physiological rhythms but also collectively (Glass, 2001; Granada & Herzel, 2009; Néda, Ravasz, Brechet, Vicsek, & Barabási, 2000). For entrainment to happen, three conditions must be met (Leeds, 2001). Firstly, a system will only entrain another if the latter is able to achieve the same vibratory rate. Secondly, the former needs power enough to prevail over the

latter. Finally, the former needs to keep the same vibratory parameters until the latter is able to entrain.

Entrainment is relevant to communication (Truax, 2001, p. 46) and it has long been explored, particularly in music, with the purpose of inducing specific mental states (Atwater, 1997; Leeds, 2001; Sonnenschein, 2001). In terms of psychoacoustics, the pertinence is to change the rate of the human body's vibrating systems – brainwaves, heartbeat, or breath – according to verified associations between those rates and cognitive and emotional states (Huang & Charyton, 2008; Farnell, 2010, pp. 108-9; Truax, 2001, p. 46; Will & Berg, 2007).

Potential explorations

Whether we opt to explore these concepts literally or as an insightful metaphor, we consider them critical to the exploration of sound in computer games. Notably, they are fundamental to support a model that serves as an aid to understand and, hopefully, to overcome the issue of empathy between a game and its players. For instance, it is conceivable that if we want a player to resonate to a system's desired state we may need to first get the system resonating with the player and then progressively bring the system, and the player along, into the desired state. In turn, we can describe the unengaging circumstances mentioned above as failures to achieve such resonance. One explanation for the failure in the desired matching, derived from the concept's definition, is that the entities – the player and the setting – are in such different states that no resonance can even be forced.

Still, these concepts have the potential to be explored in sound design beyond such figurative interpretation. As explained, resonance and entrainment are indeed related to how the body, as a system, responds to sound stimuli and this is no different from what has been exploited by music through the ages.

4.3 Holism in indie development

An encouraging realization regarding the practicality of the proposal presented in this thesis is that, in the scope of *small* teams, as it is typical of indie development, the holistic perspective on the disparate game aspects is, in fact, inherent – even if not consciously acknowledged. The fact that a very small amount of people (possibly a single person) has to deal with virtually all aspects of the production confers them a global

perspective of the project (Gorman, 2011; Holowka, 2009). Even the possible division of tasks will hardly be such that it compromises the familiarity with, and the influence in, each other's work.

So, paradoxically, it is this scenario that is more likely to propitiate consequence to the experts' aspirations for a holistic perspective that favours the integration of sound. Ultimately, what is needed is the means to nurture and to explore that naturally present attribute. We propose explicitly encouraging small teams to take advantage of it, and we provide the guidance aimed at making them able to do it systematically and informedly.

4.4 On the continuation...

In this chapter, we presented a primary contribution to a holistic approach to the development of guidance for sound design in games, which combines two dimensions. One regards setting the creation of conditions for sound design to be meaningfully carried out as an integral part of game design. This confers the contextualization of the explorations of sound and mitigates the apparatus of the introduction of sound practice in the workflow of design teams who are willing to embrace the potential of sound explorations but who don't have a history of such practice.

The other dimension consists of bringing holistic interpretations of the exploration of sound into the guidance, potentiating, in that way, its further development and embedding in the resulting designs. We exposed a set of concepts that were contributory to the synthesis of the guidance that we propose in this thesis. We also made a point on the compatibility of the holistic approach to design with the inherent features of indie development.

In the following chapters we present the guidance that was built in observance to the holism goals here described. Namely, in the next chapter, we propose a set of design guidelines.

Chapter 5

Guidelines for Sound Design in Games

In this chapter we present a set of Guidelines for Sound Design in Games, as part of our contribution to the synthesis of guidance aiming at the empowerment of non-expert practitioners, according to our research question. The set itself is the deliverable output of our first iteration in a DSR cycle (recall Figure 3.1).

In order to contextualize our option for *guidelines* as a guidance format, we open the chapter with the presentation of the formalism itself and with examples of other existing sets of design guidelines, in fields somehow related to this thesis. We then explain the synthesis that led to the Guidelines that we are proposing for the case of sound design in games, and we proceed to the details of each one of them. The set is constituted of seven guidelines (Alves & Roque, 2009b, 2011d), and embraces recommendations involving concepts that include: Acoustic Ecology; recent studies on emotion, namely the latest findings on neuroscience; and, physical phenomena having repercussions on the psychology and physiology of perception, cognition, and emotion.

We also present a critical analysis on a design exercise carried out by a team of prospective game developers with no prior experience in sound design, which we conducted with the purposes of observing the use of the Guidelines during the design sessions, and of demonstrating a possible practical interpretation of the proposed guidance (Alves & Roque, 2009b, 2011d). We conclude the chapter with reflections that configured the course of our subsequent research.

5.1 Guidelines as design guidance

Guidelines are a form of design guidance, consisting of recommendations of good practice (Kunert, 2009, p.65). Guidelines present assistance to its users in a format that, despite being abstract, still presents “specific goals” (Dumas & Redish, 1999, p. 53) that are distilled for a specific context of use (Kunert, 2009). Although the boundary is not always clear, when design goals are instead expressed as “very broad statement[s]” (p. 53) the guidance is better characterized as *design principles* (Sharp et al., 2007, p.34). Just to make this clear, well-known examples of design principles include: the *Eight Golden Rules of Interface Design*, containing, e.g., a principle titled “Strive for

consistency” (Shneiderman & Plaisant, 2010); the Tognazzini’s (2003) *First Principles of Interaction Design*, e.g., “Readability”; and the *Principles of Design for Understandability and Usability*, e.g., “The principle of Mapping” (Norman, 1988).

Examples of existing sets of design guidelines in near fields

In the remaining of this section, we present examples of existing sets of design guidelines that are available for fields relevant to the context of this thesis. The goal is to perceive: *a)* their adopted levels of abstraction; *b)* typical formats, namely regarding the wording of the guidelines; and *c)* the kind of contained sound explorations, when applicable.

Examples, for Application Interfaces and User Experience

Some of the most well-known guidelines for *interaction* design are those from Apple and Microsoft. Apple (2012a, 2012b) provides several sets of *Human Interface Guidelines* tailored to different scopes, such as Mac OS X and iOS applications. These, in turn, are divided in smaller sets. In the case of the *iOS Technology Usage Guidelines*, there is a subsection addressing sound-related aspects, containing guidelines related to, for instance, the management of audio interruptions, such as “Identify the type of audio interruption your app caused” and “Determine whether you should resume audio when an audio interruption ends”.

In the same way Microsoft (2012a, 2012b) offers, for instance, *User Experience Design Guidelines for Windows Phone* and *Windows User Experience Interaction Guidelines*. The latter comprises a section with sound-related guidelines, including, e.g., “Don’t play loud or harsh sounds frequently”, “For a consecutive sequence of related sound events, play a sound only on the first event”, “Use sounds that are short”, and “Use the built-in Windows system sounds whenever appropriate”.

Examples, for the Web

Another relevant example is the *Research-Based Web Design and Usability Guidelines*, compiled by the U.S. Department of Health and Human Services (2006). It consists of a body of knowledge that has been reviewed and contributed by a wide range of experts. Examples of guidelines included are “Use Video, Animation, and Audio Meaningfully” (the closest one to the theme of this thesis) and “Align Items on a Page”. The publication has foreword by Shneiderman, who characterizes it as “one of the most enduring success stories in user interface design”. It is very interesting to reflect on Shneiderman’s sense of

strategy regarding the *availability* of guidance. Remembering the time when the World Wide Web was emerging and designers embraced guidelines from diverse sources, he says: “Many of these designers had little experience and were desperate for any guidance about screen features and usability processes. Sometimes they misinterpreted or misapplied the Guidelines, but at least they could get an overview of the issues that were important” (p. iii).

Examples, for handheld gaming solutions

Sercu ExperienceLab presented guidelines for the design and evaluation of handheld gaming solutions, for which they examined handheld game machines. The set of guidelines includes “Offer games suited to playing on the move” (Weedon, 2005, p. 2) and “Keep the gamer informed about system resources” (p. 3).

Reid, Cater, Fleuriot, and Hull (2005) also issued a set of guidelines related to mobile experience, in this case for creating *situated mediascapes*, characterized by “the user experience of walking through the physical world and triggering digital media which has been situated in that place for a particular reason by the mediascape designer” (p. 1). They include abundant suggestions for the use of sound with that intent, as sound is “probably the most effective and evocative media for situated mediascapes.” (p. 34). The authors define the following categories of sound: sound effects, music, voice and alerts or alarms. Examples of guidelines that have implications in terms of sound design are “Design soundscapes so that a screen is not necessary” (p. 30) and “Allow the environment and others in”. The latter suggests that “if headphones are given out to users then choose models that do not completely shut out the outside sound” (p. 30).

Examples, for serious games

Pereira and Roque (2009) synthesized a set of guidelines for “the design of serious games, i.e. games with learning purposes, that have requirements of fidelity to the Body-of-Knowledge about the phenomena being modeled and learned” as part of an ethnographic analysis of their development praxis in the design of a game that explores “sociotechnical aspects of the relationship between Human settlements and forests” (p. 1). Examples of those guidelines are “The game model should be balanced in view of the target audience and scenario of use” and “The feedback to the player should be appropriate, guiding and significant” (p. 7).

Regarding examples explicitly devoted to the use of sound, Brewster (1994) presented guidelines to create the sounds for earcons, based on experimentation and studies of literature on psychoacoustics. Examples of included guidelines are “Do not use pitch on its own unless there are large differences between those used” (p. 102) and “When playing earcons one after another use a gap between them so that users can tell where one finishes and the other starts” (p. 103).

The several sets of guidelines analyzed in the previous paragraphs exhibit some common features. Each guideline is typically represented by a short sentence, in a suggestive or even imperative tone, directed to the designer. They focus on pointing out ways to promote design, not on the specifics of implementation. These aspects are relevant to contextualize our proposal, presented in the next sections.

5.2 The synthesis of Guidelines for Sound Design in Games

As introduced in Section 3.3, the approach to our research question (Section 3.1) involved providing a body of knowledge on sound design in games in the form of a set of Design Guidelines. The strategy for gathering such body of knowledge consisted mainly of interdisciplinary literature review, analysis of publicly available interviews and game reviews, and study of computer games. Some of the fundamental ideas involved have already been introduced along Chapter 4, where the main concepts implied in the Guidelines were aligned to fund a holistic base to their synthesis, and even in Chapter 2, where the pertinence of this guidance was exposed. The resulting set of Guidelines is summarized in Table 5.1 and the rationale for each of them is presented in the following section (Section 5.3).

The sources of information comprise relevant stakeholders, including: expert practitioners, such as game designers and sound designers in both game and movie industry; specialized critics and reviewers; and researchers in a broad range of fields. From those sources we collected distinct kinds of knowledge, among which narratives of ideal futures (see Subsection 3.5.1), including experts’ references to desirable practices, and concepts and motivations of the stakeholders. Such aspects are fundamental to an informed basis for the design of a guidance that meets the needs of the target audience.

Table 5.1. List of proposed Guidelines for Sound Design in Games

<p>Guideline 1. <i>Select elements with high sonic potential</i></p> <p><i>Consider sonic potentialities when setting game components such as characters, objects, scenery, script, and gameplay</i></p>
<p>Guideline 2. <i>Select elements whose changes in sonic expression support emotions</i></p> <p><i>When designing the game’s emotional script, evaluate how sound will contribute to it</i></p>
<p>Guideline 3. <i>Allow sound to matter in the game world</i></p> <p><i>Genuinely integrate sound as an instrument for action in the environment by extending the interaction model</i></p>
<p>Guideline 4. <i>Allow meaningful sonic control for intended actions</i></p> <p><i>Allow for making things happen through the input of their eventual sonic expression</i></p>
<p>Guideline 5. <i>Allow integration of player’s context into the soundscape composition</i></p> <p><i>Design the game so that it embraces or even builds around the player, by sensing and integrating acoustic explorations of the non-diegetic context</i></p>
<p>Guideline 6. <i>Consider shared context in multiplayer environments</i></p> <p><i>In multiplayer environments consider sharing acoustic explorations of aspects of the global context</i></p>
<p>Guideline 7. <i>Integrate acoustic elements that support entrainment</i></p> <p><i>Include game components that provide conditions for using entrainment to promote the maintenance or the transition between emotional states</i></p>

We also brought together research and concepts that include: research in sound in games (e.g., Childs, 2007; Marks, 2009; Novak, 2008); studies and practice on game development (e.g., Schell, 2008a) and on the neighbour domain of cinema (e.g., filmsound.org, n.d.; Sider et al., 2003; Thom, 1999); studies on emotion (Subsection 4.2.3), regarding which we have empathy for the neurological approach (Damasio, 2003; Ledoux, 1998; Nettle, 2006) because it provides a less context-dependent way to deal with personal behaviour; the role of context, which allows us to understand the individual as a complex being blended with others, with the environment, with own prior experiences, etc. (Dourish, 2004; Hall, 1976; Moran, 1994; Nardi, 1995); Acoustic Ecology (Subsection 4.2.2), which provides a contextual conceptualization of sound with

emphasis on the affective dimension (Schafer, 1973, 1994; Truax, 1995, 2001); soundscape and soundscape composition, both concepts derived from Acoustic Ecology; resonance and entrainment (also Subsection 4.2.4), two Physics' concepts with repercussions for perception, cognition, and emotion (Augoyard & Torgue, 2005; Sonnenschein, 2001) and that inspire interpretations of emotion management throughout a game experience.

For the conception of these Guidelines, we did not focus on speech-based interaction. Also, although we do not exclude the use of music, we are mainly interested in exploring interaction through *non-musical* sound. In terms of sound layers (Peck, 2001, 2007), this does not mean that we will not be considering dialogue and music because that would ruin our commitment to the holistic approach underpinning our research: depending on the purpose with which specific sound stimuli are added to the composition, they can play a role in any layer. It simply means we are not attempting to contribute guidelines that specifically go into such matters as dialogue generation and interpretation or musical composition in the strict sense.

Guidelines do not prescribe procedures; they establish a mindset

The Guidelines do not prescribe procedures but, instead, establish a mindset that can inform those procedures. In that sense, they state *what* to care about rather than stipulating *how* to do it in a particular instance. But, most of all, they are meant to generate understanding, not to be obeyed.

One cannot design experiences, just the conditions

Somehow in the same vein, it is fundamental to recognize that practitioners do not design players' behaviours or feelings. Instead, what can be designed are the *conditions* that will influence those players into what is intended to be a desired emotional experience (Hassenzahl, 2004). But, again, since those players will always be subject not only to the designed conditions but also to other conditions that constitute their own current context – including manifesting their own will and deciding, for example, not to engage – it is not reasonable to be assertive and didactic about effectiveness. In fact, because games are mostly forms of participatory media, the players are also, to some extent, co-designers of their own experiences.

5.3 A set of Guidelines for Sound Design in Games

In this section we present the rationale and details on each of the Guidelines. The synopses exhibited in Table 5.1 are repeated next to each guideline, for the reader's convenience.

We encourage readers to understand this set as a work-in-progress (in Subsection 11.3.1 we will address the upcoming iteration of these Guidelines, according to the adopted DSR methodology). Our purpose is to contribute to research and to the community of practice by building knowledge that can give us and other stakeholders the confidence to consider it plausible and worth refining, not least for its use value to game sound designers. Therefore, these Guidelines have no claim (yet) of truth-value: instead, their value is strictly instrumental to design research and structuring of a body of knowledge in sound design.

Guideline 1. Select Elements With High Sonic Potential

Consider sonic potentialities when setting game components such as characters, objects, scenery, script, and gameplay.

Casting for sonic potential

It is strategic that the inherent, potential sonic expressiveness is valued when selecting the interaction protagonists in early stages of design (Adams, E., 2010, p. 149; Spanos, 2012; Wilhelmsson & Wallén, 2011, p. 109). This mindset applies to the full extent of the game's components, including objects, characters, script, and features such as the gameplay.

"The mother of all Guidelines"

This guideline can be thought of as the mother of all others here presented: in every and each of them, for the designer to be able to implement the respective idea, a dedicated selection of these components is mandatory. We will avoid stating it as a "prerequisite" because it is not supposed to happen before those ideas are set. Both the selection of the elements and the setting of the ideas that will explore them will profit from a tight process of decision-making along the progression which, in turn, ought to be carried out from the very early phases of the overall design process.

Also important to notice is that it is not about selecting sounds. It is about selecting game elements, taking into account how they will supply the sonic properties that are required to accomplish some design aspect. This distinction is absolutely fundamental. Unless that is kept in mind, then energies will be spent on enlarging the mistake of not *using* sound but *covering* with sound.

Actually, using sound to wrap the elements in a game is not an error per se. Metaphorically speaking, we do prefer our gifts when they come in a nice wrapping paper. Still, that nice paper can be discounted and disconnected from the gift itself: even if we opt to keep the paper, the gift and the paper will still be independent entities, not contributing to the other's accomplishments but being in their separate existences.

Sonic richness expands the space of possibilities

The attentive selection of interaction elements, prizing rich sonic expression, expands the space of possibilities in design time. Such a selection will allow fulfilling the intentionality of the soundscape while maintaining contextual consistency. Also, it should be easier to provide a good auditory perception of the environment if objects in it are identifiable or provide context through their sonic properties.

Creating a dialect to serve the communication model

Choosing and combining acoustic protagonists may be thought of as the construction of a *dialect*, specific to the project and which will allow supporting its communication model. This calls for a creative effort of collecting and combining possibilities. Still, it is useful to be attentive to some opportunities. One is that elements may have different states of sonic expression: roughly, the sound emitted while in customary or natural conditions and the sound emitted when the element is “activated”. In some cases, more states, or even variation in a continuum, may be identified. For example: a squeaky rubber duck has no sonic expression when left alone but possesses a very well known sonic identity when squeezed; conversely, a cicada has a customary expression that ceases when disturbed; a waterfall seems to have the same characteristic sound both on its own and when someone bathes in it; and, a flock of pigeons also emits sound in both situations but these are very distinct (mating and feeding versus alarm and flapping wings). In another vein, if we need a game character to drive fast through the rush-hour traffic, we might consider including a car horn and choose carefully its sound (e.g.,

according to Guideline 3 below). So, there are countless possibilities to explore, depending on what the designer intends to communicate.

Challenges

Although some acoustic elements may be added – or patched – along the project, without overall disturbance, others imply strategic decisions and consequently need to be analyzed in the early stages of design. In the latter case, above, resorting to a siren of some emergency service vehicle would imply the necessity to fit such decision in the design options: even considering that it would be plausible in the scenario, it might be inappropriate if too many other design decisions had been taken.

Finally, a related challenge is to reunite elements, that are coherent among themselves, within the whole project (e.g., Spanos, 2012). For example, unless premeditated, dinosaur roars and bottle pops, would not be compatible, although each one would possibly be associated to ideas that we might need to combine (let's say, angst and repose). It is important to notice that the issue is compatibility, not verisimilitude: for instance, we are happy to hear the bad guys' spaceship exploding in the void, although we know that would be impossible (Carter & Kornreich, 1999).

Guideline 2. Select Elements Whose Changes in Sonic Expression Support or Translate Emotions

When designing a game's emotional script, evaluate how sound will contribute to it.

When designing a game's emotional script, the designer should evaluate how sound will contribute to it (Adams, E., 2010, p. 149; Alves et al., 2011, p. 417; Cunningham et al., 2011; Wilhelmsson & Wallén, 2011, pp. 109-111). As introduced in Subsection 4.2.3, the designer may explore the fact that sound “can have an immediate and unconscious effect on human beings” (Farnell, 2011, p. 108). The designer may also find insights in mature fields such as music (Gouk, 2004; Juslin & Sloboda, 2001) and cinema (Lynch, 2003; Peck, 2001; Sider et al., 2003), where the use of sound to support emotional contexts is a common practice and is well documented.

It is important to notice that we are not claiming that sound should be *the* way to support emotions in games. Sound is *one* way to contribute to that but one way that should not be forgotten, considering its potential and particular strengths for this purpose.

One approach that can be further explored, when selecting each acoustic element according to its association to emotion, is to evaluate it with an emphasis on its ability to support different emotions, that is to say, to express emotional changes through its own sonic alteration. This is not mandatory, since emotional changes may be achieved by resorting to different elements – possibly one to support each different emotion – but it may be advantageous to explore the use of elements capable of supporting *several* emotional states and signalling the correspondent change. That, for instance, may relieve the user from interpreting new sonic elements for their emotive associations, and may provide gains in effectiveness. Moreover, the swapping of distinct sonic elements in the soundscape is more prone to erroneous interpretations, such as motion of their respective sources, although visual information may be enough for disambiguation. Finally, and more relevantly, this approach is more likely to offer continuity and emotional gradations.

Examples

As in Guideline 1, this guideline implies creatively gathering and selecting among possibilities. A few illustrative examples of elements and their possible associate emotional states would be: birds (relaxation, attentiveness, fleeing); weather elements (calm, scaring); baby sounds (joy, tranquillity, agitation, affliction); nice breakable materials (aesthetic contemplation, trespassing, destruction).

Guideline 3. Allow Sound to Matter in the Game World

Genuinely integrate sound as an instrument for action in the environment by extending the interaction model.

Integrating sound-oriented actions

The nature of the interaction, as perceived by the user, should be extended in order to genuinely integrate sound as an instrument for action in the environment (Hug, 2011; Truax, 2001, pp. 34, 110). This is perhaps the most neglected use of sound in computer games. Sound, if used, is predominantly relegated to complement the visual rendering. It serves as output, which is good but just half the idea. In fact, acting through sound makes perfect sense in a system with a bidirectional interface. There is no reason for sound driven actions not to deserve the same kind of appreciation as running, jumping, grabbing, or shooting. Allowing the player to perform through sound, either as a

consequence of some contextualized and meaningful action or by explicitly deploying some sonic event, has the potential to greatly extend the value of the experience. Moreover, it significantly expands the space of possibilities in terms of design of the gameplay (e.g., Stevens & Raybould, 2011, pp. 122, 125).

Reasons for the under-exploration of this kind of approach may be that this is something that could hardly be borrowed from music or cinema – the chief contributors for sound design practices in computer games (Deutsch, 2003). Also, this kind of exploration is commonly neglected in computer application interfaces.

Beyond speech-activated commands

It should be noted that we are thinking beyond speech-activated commands. Speech recognition is not central to our study. Also, the kind of input suggested in this guideline is particularly meaningful if it does not consist of a mere mapping of commands that would otherwise be entered by pressing a key or button. Although the latter may be useful, it doesn't truly represent a change in the interaction itself but only in its activation. In fact, to observe this guideline, the actual activation, at the level of the interface, can still resort to a typical key press instead of true sound input.

In our non-digital lives we often resort to sound to make things happen: we open our way into the crowd by saying "excuse me, excuse me" rather than pushing or shooting; we yell to the annoying neighbour's dog to counter its attack (sometimes it gets worse but we still do it); we cough to make someone notice us; we use the car horn to stop another driver hitting us; we walk more or less loudly according to our intention to make ourselves noticed, even if unconsciously; and so on. Sound plays a huge part as input in the communicational model, not only as dialogue, in a strict sense, but also in more indirect ways. So, we have the means to get inspired about what could be different in computer games. In fact, when put in this way, it seems that it is not about how to let sound in, but rather how to stop forcing it out of the game: how to escape from the bias of visual predominance and derived solutions, and how to allow for more balanced approaches.

Coherence is important

One aspect that we believe ought to deserve careful attention is the construction of a sense of coherence. Truthfully, when we claim the need to consider sound consequences,

we are already addressing the issue of coherence between the value of what is seen and what is – or should be – heard. But let us confine, for now, our reasoning to what is heard: the inclusion of aspects in the game that are sound-driven may turn out to be improper if they reveal an incomprehensibly unequal treatment regarding other aspects that are evident candidates for the same behaviour. This is not about realism – the coherence is relative to the game world, not necessarily to the real world. Instead, it is related to the holistic perspective that is dominant in the notion of the soundscape.

Of course, incoherence can become accepted based on the *willing suspension of disbelief*. The player can indeed adapt to the game's reality where, for instance, a very noisy event does not trigger any kind of reaction from enemies but the slightest imprudence regarding noise in the scope of some other specific event can unleash the devil. Even so, and excluding the merit of well-designed alternate realities, such adaptation demands at least a first effort from the player. That effort has little to do with playing: it is exterior to the gaming experience itself. The player – the game user – gets confronted with the implausible and has to solve it consciously before eventually coming to accept it. In turn, that compromises flow and game immersion. If indeed the required suspension of disbelief comes at a cost with no intended value, just as the player is able to overlook the limitations of a compromised game design, efforts ought to be made to minimize this effect.

Examples

Some examples of the ideas expressed in this guideline can, in fact, be found in a few existing games. In the *Thief game series* – for example, *Thief: Deadly Shadows* (2004) – and *Metal Gear Solid 4: Guns of the Patriots* (2008), both stealth games, some items can be thrown in order to make noise and consequently divert enemies' attention to them. In the latter, it is even possible to knock on nearby objects with similar purpose. In both games, and as is common in the stealth genre, the sound of the character's footsteps can announce his position. Further ideas, some of which can be found in other games, include: whistling to call our dog or horse, as in *Shadow of the Colossus* (2005) and *Red Dead Redemption* (2010); yelling to frighten or as part of the strategy to defeat beasts; clapping hands to scare birds; and so on.

Guideline 4. Allow Meaningful Sonic Control for Intended Actions

Allow for making things happen through the input of their eventual sonic expression.

Triggering events by performing their sounds

This suggestion works as an inversion of the cause-effect relationship in events with a natural or associated sonic expression. As in Guideline 3, this guideline relates sound and acting, however, this time instead of performing some event X and expecting that other events Y are triggered or shaped by its sonic expression, we are suggesting a way to trigger an event Z by performing its own sonic expression. The idea is to allow the player/character to produce the sound that translates the actions that are intended to occur. An interesting collateral effect is that, in this process, the player/character substitutes or participates in the correspondent sound and, consequently integrates into the overall composition. In contrast to the former guideline, in order to cope with this one, it seems relevant to allow for actual sound input.

Beyond voice commands

Conceptually, this differs from strict voice commands in the sense that the input does not reflect an order for something to happen but rather the actual sonic expression of something as if it would be already happening. This is indeed a relevant distinction, with some implications both in format and semantics. One difference is the nature of the emitted message: text versus expression. Another is the timing and duration of the message. In the case of voice commands the order precedes the action and its duration does not depend on that of the action; in the case of the approach we are suggesting, the stimulus and the action are theoretically simultaneous: the action starts as soon as the stimulus is identified (although, in practice, this will imply some latency) and lasts for as long as the stimulus is maintained.

Consequently, there are also differences in the kind of control that is possible for actions that are flexible regarding duration. Also, it is conceivable that we interpret variances in the acoustic parameters along the stimulus (intensity, pitch and so forth) and dynamically shape the action according to preset conventions. Furthermore, there are significant aesthetic differences, for instance, the proposed approach evidences great potential regarding the exploration of the input sound as a component of the game's artistic value. Finally, there are differences in terms of the emotional impact underlying each approach. For example, if we are actually giving orders, as in some war games such

as *Tom Clancy's EndWar* (2008), voice commands may feel more appropriate, while, in some other scenarios, making non-verbal sounds may provide a better experience. Again, we emphasize that we are not arguing the value of one approach over the other – our aim is to contribute to the enrichment of the space of possibilities.

Ludic potential of the interface, too

One final point that should not be overlooked is the potential ludic value inherent to making sounds, that is, in performing at the interface. Thus, not only the ludic meaningfulness of the triggered actions but also the activation itself becomes part of the game. This is a rare opportunity. Typically, the activation level is not conceived of for the purposes of providing fun. There is not much joy in the act of pressing keys at the keyboard, moving the mouse, pushing buttons in controllers and so on (although, to be fair, there is fun inherent to the use of some interface devices such as steering wheel and pedals, musical instrument imitations, and some modern game console controllers and motion sensors). Of course, the design of the sounds that are supposed to be input – a matter that fits into Guideline 1 – has a determinant importance on the kind of achievements that may become possible at this level of the game.

More hypothetical examples

Other hypothetical examples, based on mimetic sounds, would be: driving a cart on a path while avoiding running over crossing animals by producing the sounds of the engine and possibly the emergency brake, gaining focus over a wooden box to move it on a rock floor by imitating the sound it would make and controlling directions with mouse or keys, making a ball jump different heights according to the modulation of some established sound, shooting a gun by vocalizing the shots, shooting different guns using a feature of automatic weapon selection based on their distinctive shot sounds and so forth.

Guideline 5. Allow Integration of Player's Context into the Soundscape Composition

Design the game so that it embraces or even builds around the player, by sensing and integrating acoustic explorations of the non-diegetic context.

Context plays an important role in interaction processes (Dourish, 2004; Hall, 1976; Moran, 1994; Nardi, 1995). Also, sound is both part of that context and a way to express it (Schafer, 1994). It is worthwhile to explore the possibilities in terms of soundscape

composition (Truax, 2001) and, particularly in respect to affective sound (Follett, 2007), allowed by the consideration of the player's context (Loughlin, 2010, para. 7).

Actually, all guidelines here presented were strongly influenced by a constant attention to context. In all aspects – interaction protagonists, emotional support, consequent sound, action through sound – there is always an emphasis on the need to consider a global perspective, both concerning the integration of the different modalities and regarding the different combining approaches in the particular case of sound. The bottom line is that no approach is good unless it fits in the whole. If it does not, either the approach or the whole needs to be adjusted.

This guideline goes a little further in terms of the consideration for context. The argument is that the context is not limited to the game itself. A game is played by someone who actually has – and *is* – context too. So there is no point in trying to figure out how to turn a game into a perfectly designed context piece if we leave out the only element of the context who would possibly appreciate it: the player.

Some concepts that have recently become well-known in game design, such as immersion (Grimshaw, 2008) and flow (Csikszentmihalyi, 2008), emphasize, in different ways, the pertinence of getting the player and the game into the same plane of existence. These approaches focus mostly on the migration of the player into the game. We suggest tackling the same issue in a complementary way, which is somehow the reverse method: to extend the game in order to embrace the player, that is, to build the game around the player.

Challenges

Dealing with context poses complex challenges. Conceptually, all aspects of the player's context matter to whatever is done in the scope of that context. In practice, this has two related implications. One is that, since it is not technically viable to seize all context parameters, it becomes necessary to identify and capture those that are more meaningful, in each particular case. The other is that we cannot afford to neglect some aspect of the context that turns out to be indeed influential to that process, bearing in mind the problem that contextual aspects are inherently non-evident. Another class of challenges is the actual reading of the contextual parameters, which, in many cases, demands the usage of probes or sensors. In turn, this is potentially problematic not only

in terms of the availability of those devices but because some of them can be considered intrusive or uncomfortable to use.

Opportunities

An example of contextual parameters, that we suggest for the sound designer to consider, is the player's ambient sound (as in Cunningham, Caulder, & Grout, 2008; Cunningham et al., 2011), which might be useful to dynamically equalize each of the categories of game sounds according to the expected ability of the player to perceive them. Or, in a more complex endeavour, it might become interesting to integrate the players' ambient sound, or some of its acoustic parameters, into the game's sound. Still, we should not restrict ourselves to sound-to-sound explorations: all possible combinations are relevant to game design, and, at the very least, those that have sound in either of the extremes fit the present guideline. For instance, we are particularly sensitive to acoustic explorations that can be developed upon the players' physiological indicators (Poels & Dewitte, 2006) that may provide hints on the player's *emotional* state. We believe that it would be interesting to consider the potential to dynamically set compositional aspects of sound in game scenarios according to such state, namely to achieve a better resonance. In truth, there are some classical examples of similar exploration in other domains, as evidenced by the relationship between music rhythm and heartbeat (see Subsection 4.2.4). The dual opportunity, of *changing* the player's emotional state by tackling such physiological aspects (namely, heartbeat, breath, and brainwaves) through sound stimuli, is suggested in Guideline 7.

A concern that also deserves some commentary is the possible contradiction between designing the context of a fantasy world and bonding with the context of the real world. Indeed, the player may appreciate being transported to *another* context – the sense of escapism is part of the argument for playing games. Even so, this is not contradictory with the suggestions in this guideline. The *kind* of context that is integrated in the experience and the *way* that context is translated into the experience do not necessarily evidence the bonds in such a manner that they anchor the player to a state or to the consciousness of a real world existence. Ultimately, the designer may decide that the more immersive the current state the less binding there is with the player's outer context. But even then, the ability to evaluate the immersion level will probably require reading certain parameters from the player's current context. Most of all, it seems to be a matter

of dynamically adjusting the components of the context that are the most critical to resonance management.

Guideline 6. Consider Shared Context in Multiplayer Environments

In multiplayer environments consider sharing acoustic explorations of aspects of the global context.

This is an extension of Guideline 5 through the consideration of multiplayer environments. Each player's context may include the perception of aspects of the other players' context. The argument is that, in a multiplayer environment, context is both local and global (Roque, 2005; Grimshaw, 2008). It may be advantageous if each player perceives not only other player's actions but also relevant elements of the context that shaped those actions.

The implementation of this guideline calls for the combination of elements deriving from different players, which, in turn, are captured or integrated according to the techniques mentioned in Guideline 5. Regarding the combination of the stimuli, it is important to be attentive to the insights from Acoustic Ecology (see Subsection 4.2.2) and consider that the design of a shared-context soundscape should support the fitting of individual interventions rather than superimposing their disconnected sounds (Wrightson, 2000).

This approach may be considered with different purposes. For example: aesthetic reasons, taking advantage of aspects of the global complexity; as a mechanism to deliver a sense of presence and of activity of the respective community; as part of the gameplay, making available some aspects and hiding others according to what best serves the game mechanics, etc.

Guideline 7. Integrate Acoustic Elements that Support Entrainment

Include game components that provide conditions for using entrainment to promote the maintenance or the transition between emotional states.

Keeping players emotionally involved along time, as complexity grows and the emotional script unfolds, is crucial for the experience. Entrainment is a valuable means to that end, since it can be used to support the maintenance and the change of emotional states. Entrainment may be eased by progressively moving from one state of resonance into another, and sound is one prominent way to implement it (see Subsection 4.2.4).

Resonance, in this sense, refers to the proximity between a player's emotional state and the expected (or even required) emotional state, at a given moment.

Achieving resonance

Although resonance must be sought during the whole experience, the initial moment – i.e., the first resonant achievement – is particularly challenging. It is clear that it will be harder to go from a state of no resonance (before the experience begins) to a state of resonance than it will be (later) to move between resonance states. The latter situation, being well designed, should allow a more continuous transition.

To address the achievement of initial resonance, at least two approaches can be explored. One is to *speculate* about the initial mindset and emotional state of the player and gently move from there. That is no different from what is done in other forms of communication (e.g., Truax, 2001, p. 46). It is generally a good idea to perform some sort of introduction before getting into the core of the message; still, the contents of the introduction have to be tuned according to the context of the listeners, which frequently has to be estimated. Although this approach is technically simple it may be ineffective due to the lack of indicators about both the starting context and the evolution of the process. So, a second class of approaches, where there is some way to read indicators that permit a better judgment about such aspects (Poels & Dewitte, 2006), will provide more effectiveness. For this purpose, any known technique to dynamically infer a player's emotional state will be useful. We already mentioned, in Guideline 5, techniques that take into account the player's physiological rhythms, namely heartbeat, breath rate, and brain waves because of their potential exploitation in terms of sound. Yet, as introduced in that guideline, reading these physiological indicators, still implies considerable device apparatus, which is likely to be found intrusive and, as such, contraindicated in terms of the experience.

Examples

An example commonly acknowledged in games is the use of strong beats that may increase in rhythm and/or intensity in order to emulate the heart rate that would match a designed emotional state – e.g., in *Deadly Premonition* (2010), *Uncharted: Drake's Fortune* (2007), *inFamous* (2009), *Buzz!: Brain of the World* (2009). Explorations may also be inspired in other fields, since the relationships between emotions and heartbeat, breath rate, and brain waves have long been explored. Well-known examples from

cinema include the breathing sound during a lengthy sequence in *2001: A Space Odyssey* (Kubrick, 1968; Wilhelmsson & Wallén, 2011, p. 111), the screeching violins in the shower scene in *Psycho* (Hitchcock, 1960), and the music accompanying shark attacks in *Jaws* (Spielberg, 1975). Musical examples are Shamic drumming, that induce theta brain waves with consequent approximation to deep sleep and trance state, and Balinese Gamelan, which has a beat phenomenon that generates frequencies of about 4 to 8 Hz and this also targets the theta brain waves. Depending on the intended purpose, these practices may be used to inform game design. Once again, the acoustic elements used to design the conditions for entrainment should fit in with the design of the soundscape according to the concepts covered in Guideline 1.

5.4 A design exercise

In Appendix B we present an example of the application of the Guidelines by a group of developers with no prior experience in sound design in games. The exercise involved a team of five Master's students on a course in game design and development (Alves & Roque, 2009b, 2011d). The team was commissioned with the design, from scratch, of a game influenced by the observance of the Guidelines. This prompted them to think about a game that could exalt features favoured by experiencing and playing with and through sound. The resulting game is a single-player adventure, about a castaway and his rescuing from an island inhabited by fictitious creatures. The gameplay implies gaining the sympathy of the native creatures in order to get their help in calling the attention of some passing ships.

In terms of research, we were interested in observing the practitioners' relationship with the Guidelines, in order to grasp their understandings, difficulties and opportunities for enhancement. We were also intending to eventually refer to the design exercise itself as demonstration of the use of the Guidelines. In that sense, this instance illustrates a possible interpretation of the Guidelines in a design case, keeping in mind that, at this point, its simple observation does not provide the support for a generalization of the results. Still, the experiment allowed us to develop understandings that contributed to inform the succession of the course of research.

Idea reinforced: Guidelines must be timely considered

The critical analysis of both the observation of the *sessions* of game design and their *outcome*, i.e., the resulting game design, provided us with a reinforcement of the idea

that the observance of these Guidelines implies that they must be considered from the early stages of the overall game design process. The Guidelines involve fundamental aspects of the interaction that could hardly be tuned and achieved if too many design features had already been decided. That is an important consideration. We may have the need to put it as a prerequisite or accept the limitation of this effort if used upon an already well-developed design. Although, in this exercise, there were optimal conditions to escape this struggle (the game was designed from scratch), remaining faithful to the principle still demanded tenacity, despite the passionate attentiveness to the Guidelines.

Unfamiliarity with thinking in auditory terms

Ironically, despite all that freedom, it was not particularly easy to come up with a satisfying preliminary idea that permitted to experiment with the set of Guidelines. Actually, that was a time consuming task and a valuable lesson that deserves some commentary. It was evident, for those involved in the game design exercise, that the team was particularly unaccustomed to the opportunity of thinking in auditory terms. For instance, the insights often suffer from too much visual bias. Considering that the auditory possibilities were being experimented with, the team agreed that it was desirable to go beyond a simple mapping to visual elements and worked instead to make the game *truly* influenced by the audio component, on a par with the visual modality.

Guidelines are critical during design, then become embedded

In the early stages of this exercise the team was uneasy about how long the observance of the proposed Guidelines would have to be explicitly carried out. Yet, and although the circumstances of the research did not allow designers to forget about them, once the game design was defined, their requirements became embedded into the whole design and, as intended, subsequent steps related to sound became merely a matter of implementation.

(Un)availability of sound files is an issue, eventually

One difficulty, more operational than conceptual, had to do with which sound files to use. This was not exactly a surprise since we knew beforehand that “sound designers are often limited by having poor, outdated equipment, not enough off-the-shelf sound libraries, but most importantly, not enough time to go out and get new, original sounds for the game project” and that “sound is art [and] to make a game sound artful [...]

sound designers [must] have the time and money to practice their art” (Peck, 2001, p. 1). There are several reasons for us to mention our experiences regarding this practical aspect, in this thesis. First, to note that paucity of existing sounds and lack of time to record new ones were critical factors in this particular exercise. Second, and more important, to note how significant such a bottleneck may be for this kind of endeavour in general. Finally, to acknowledge that, despite the predictability of such difficulties, it would be extraordinarily limiting to condition, a priori, the space of possibilities as a function of the already available sound materials.

Allowing for players to adapt to the model

In terms of the game design that resulted from this exercise, one very interesting aspect that we realized is that the gameplay was designed to include a tacit approach to the problem of the players’ adaptation to the (unusual) interaction model, in terms of both interface and game mechanics. This addresses an early concern: the introduction of uncommon ingredients in interaction, namely those derived from the interaction with and through sound, unless carefully accomplished, can pose difficulties for players. In the case of this exercise, the interaction with the island creatures occurs as an iterative procedure that is, in fact, a learning process (see Appendix B). Most pleasing is that such learning makes sense *inside* and *along* the game: it is not an introductory level with a tutorial goal. In that sense, it is the playing character, not the player, who learns.

The language of known examples

An aspect of the communication among the team that was notorious, and that constituted an instrumental insight, was the systematic use of the “language of known examples”: the participants frequently discussed possible design ideas by reference to existing examples they knew either from games they had played or from other media. Interestingly, other authors remarked exactly that “designers refer much more to the guidelines’ examples than to their text” (Tetzlaff & Schwartz, 1991, as cited in Kunert, 2009, p. 65).

That behaviour led us to recognize two distinct aspects of great importance. One is that having a background as a gamer may be useful for the practice of game design, and specifically for sound design in games. This is not very different from what we already argued in Subsection 3.5.2, only in that occasion we were referring to the interest of playing games as part of the research into gameplay experience, and in particular as part

of the methodology leading to the synthesis of design guidance; now we are referring to its interest for the practice of design itself, possibly through the *use* of such guidance.

Actually, it is reasonably straightforward to comprehend that once one is sensitive to sound design, one develops attentiveness to sound facets when playing games, even unintentionally; and, to a certain extent, that appears to also apply, retrospectively, to the recollection of past game experiences. In any case, the knowledge provided by a critical interpretation of existing games provides a referential basis (Aarseth, 2003) that is relevant when communicating design ideas, and possibly to ideation itself. Even gaming experiences that are perceived as poor, become sometimes most valuable to rationalize what seems wrong and what would be an alternative (Adams, E., 2010, p. 66).

Furthermore, a player's perceptions are strongly influenced by context, which is also shaped by the number and diversity of games played before, amount of time usually dedicated to playing, the number of playing hours in a given moment and so forth. Adding this to the inherent difficulty in grasping other people's contexts, it seems appropriate to say that the more the designer is able to feel like a player, the more the judgments reached are likely to resemble those of other players (even when considering that no two players are equal, nor even that one player remains the same over time).

Finally, a second very important aspect that the practitioners' attention to examples led us to recognize, together with the fact, already mentioned, that they did not find it easy to initiate the creative process, is that the Guidelines would benefit from an intermediary level of guidance that is coherent with their recommendations but that is more expedite in supporting ideation, namely by expressing the concepts in a form closer to examples, as tangible as the ideas that the designers are eager to come up with. Actually, despite the fact that the practitioners were sympathetic with the Guidelines and although their discourse demonstrated that they understood the inscribed suggestions, they did not find in these Guidelines the means to readily populate an according space of possibilities.

5.5 On the continuation...

In this chapter we presented Guidelines for Sound Design in Games, following a holistic approach and drawing up from a multi-disciplinary interpretation of several concepts, including Acoustic Ecology, studies on emotion, including those from the

neurosciences, context engineering, and physical phenomena that can be having repercussions on perception, cognition and emotion. The Guidelines address aspects that include: valuing the acoustic properties of all interaction protagonists and their influence on perception and emotions, while ensuring coherence in the use of sound; conveying meaning to the presence of sound in terms of consequence inside the designed world, including the possibility of acting through sound by performing meaningful actions which have valuable sonic expression; using sound associated to events as an input to control them; integrating the player's context in the sonic composition, including in multi-player games; exploring resonance as a instrument to achieve a binding between the player and the designed intent, and the use of entrainment as a model to create a dynamism along the emotional script.

We also presented a report on a brief design case where those Guidelines were exercised by a team of game developers with no prior experience in sound design. We registered some uneasiness on the part of designers to work with the acoustic field as comfortably as they do with the visual field. Namely, fighting the visual bias that leads to sound merely being an extension of visual representations became a primary task. Difficulties also arose by the realization of lack of sound resources with reasonable audio sampling quality to eventually implement the designed ideas. The communication of sonic design ideas or intentions also revealed complex when compared to drawing visual renderings on paper. We also noticed the instrumentality of evocations of known examples from games and other audio-visual media when communicating those ideas.

The design exercise conducted under the influence of the Guidelines, provided us with insights beyond the goals of observation of the appropriateness of the inscribed recommendations. The observation of the participants' relationship with the Guidelines made us realize that in addition to the fairly high level of those recommendations, which serve the purpose of creating a mindset and pointing directions of possible exploration, a complementary lower level of guidance could participate in a more effective guidance set, easing ideation and minoring the impact of a possible lack of aptitude to explore the auditory modality.

As suggested by the hindrances made evident through the exercise, a promising format for such complementary guidance would promote the use of tangible examples in the discourse, preferably allowing for practitioners to address sound in respect to their contexts of exploration and consequently reducing the need to think of sound per se, as

a means. Noticeably, such extensions are most contributory to the holistic conceptualization of sound design that we have been arguing (e.g. in Chapter 4). In terms of our research course, this conclusion marks the end of our first iteration in the adopted DSR methodology and led us to engage in a second iteration, focused on the development of a Pattern Language for Sound Design in Games, whose report starts with the following chapter.

Chapter 6

A Pattern Language for Sound Design in Games

While working on the proposal of a set of Guidelines for Sound Design in Games, we realized that the high-level recommendations being proposed would benefit from a companion form of guidance that would provide lower-level support, suitable for further fostering ideation (Alves & Roque, 2010c). Considering that we set ourselves aspirations of contributing to the *empowerment* of practitioners through the proposed guidance (Section 3.1), this opportunity assumed great relevance. In accordance with the adopted research framework (and as introduced in Section 3.3), we advanced by working on a suggestion to this new formulation of the research problem, which marked our engagement in a second iteration of DSR (recall Figure 3.1).

We found in *Pattern Languages* (Alexander et al., 1977) a formalism that allowed us to propose a body of knowledge, “concrete enough” (Tidwell, 2011, p. xviii) to serve as a lower-level complement to the Guidelines. This formalism supports observable instances of expertise, fitted in specific contexts of use, and has the conditions to become appropriated by the community of both experts and non-experts.

We also found that resynthesizing guidance expressed as Guidelines in the form of patterns is something that is not unprecedented. “Most user interface guidelines function like patterns, and the pattern form can be used to phrase guidelines in a *consistent format* that leaves room for subtleties” (Borchers, 2001, p. 28) Yet, we opted not to orient the synthesis of the patterns to the process of translation of the Guidelines. Instead we adopted the *mindset* that the Guidelines communicate to identify and to synthesize the patterns. In that sense, the Guidelines may be thought of as the lenses through which we observed and worked on those patterns.

In this chapter we expose our adoption of a Pattern Language and we explain how we built the body of knowledge that is represented in the respective design patterns. We start by presenting the theoretical underpinnings of the formalism, along with a state of the art in terms of its adoption in domains where analogous needs, conditions and goals existed.

Once such introductions are done, we dedicate the remaining of the chapter to presenting the rationale for our proposal, including the description of the methodology used for identification, specification and evolution of the patterns. We conclude presenting the Pattern Language in its three formalized versions, to date: a Seminal Collection, version 1.0 and version 2.0.

6.1 Design patterns and Pattern Languages

Pattern Languages – and the design patterns that constitute them – were introduced by Alexander et al. (1977; Alexander, 1979) as a way to systematize design knowledge in the Architecture domain in a manner that enabled participatory or end-user design. The design patterns are a form of presentation of proven solutions to recurrent problems in a specific context, accompanied by references and assistance on the forces and/or consequences involved in their application (Vlissides, 1997).

Each pattern is referenced by a common name or expression that usually becomes synonym with the concept or solution and, as such, enters everyday domain language among practitioners. The presentation usually follows a template but the definition of the template and the adopted terminology can be authored according to what makes more sense in each endeavour (we will return to this matter in Subsection 6.4.2).

Patterns are, in this way, a synthesis and a translation of knowledge that was not yet formally structured or that was structured in some other format. Namely, a pattern's author may have no relation to the creator of the solution for the problem that such pattern addresses. It may even be the case that a solution is well known and authorship has been lost in time.

*Patterns, collections, languages
and empowerment*

Patterns are gathered in collections. Patterns – addressed by their names – constitute a vocabulary for the domain and if they are organized by specifying their relations, such as interdependency and influence, they may come to constitute a domain *language*. While emerging, a language may not be unique, or may comprise or overlap with other languages. Yet, when it becomes a non-elitist asset to the point of enabling production of discourse and dialogue among stakeholders in a domain, such a language can *empower* different actors to have a stronger participation in design processes and outcomes and,

in particular, it “bring[s] hope of empowerment to a possibly inexperienced, perhaps merely uninitiated, but otherwise capable and creative person” (Vlissides, 1997, misconception 5).

Living body of knowledge

One main characteristic of design pattern collections is that they are a living body of knowledge. The evolution of patterns is an inherent strength of this knowledge representation methodology. A collection is permanently open for additions and each pattern can be challenged, improved or refined. Patterns may meet several states of maturity, often referred to as confidence levels, an indicator that can be explicitly included as a field in the pattern template. A pattern that is not yet fully accepted as so is often classified as “candidate”. The fact that patterns may be drafted, even if their authors are not able to fully prove them, opens the possibility to prior and generative discussion with other practitioners.

Distributed authorship

The emergence of patterns from a collective effort – a result of the contributions from within a community – has several distinctive merits. One is that this distributed authorship conveys a sense of ownership to the participants, and consequently it is more prone to be widely adopted than if guidance was offered by “others”. Also, despite possibly inscribing somebody else’s wisdom, patterns carry the wording and perspective of their proponents, augmenting the resonance in the discourse. This preoccupation with the target audience was made very noticeable in Alexander’s original work, on Architecture, where it is clear that those patterns are directed at common people rather than exclusively to architects. Such a preoccupation is in line with the empowerment argument made previously.

Possible operationalizations

From a technical standpoint, the production process of a pattern language, in a community of practice, can be supported by a customary combination of traditional media (papers and books) and social web media including wikis, blogs, forums, etc. One noticeable example is the initiative in the service-oriented architecture domain (Erl, 2009).

6.2 Examples of existing pattern languages in near fields

Alexander et al.'s (1977) patterns have deserved great attention in a variety of domains. Typically, these domains observe similar concerns and envisage opportunities regarding the empowerment of the respective community of practice.

Well-known pattern languages

Some of the best-known works that adopted and adapted Alexander's formalism include: object-oriented programming (Gamma, Helm, Johnson, & Vlissides, 1995), software systems architecture (Buschmann, Meunier, Rohnert, Sommerlad, & Stal, 1996), interaction design (Borchers, 2001), and interface design (Tidwell, 1998, 2011). They also became referential for those venturing in the exploration of pattern languages.

Pattern languages in HCI

The academic and professional field of HCI has been referencing Alexander's patterns since the late 1980s (Borchers, 2001, p. 26), including in Norman's influential book *The Design of Everyday Things* (1988). In addition to Borchers (2001) and Tidwell (2011), mentioned above, other authors presented pattern languages including for: designing Web interfaces (Scott & Neil, 2009), which relates to the *Yahoo! Design Pattern Library* (2006); designing social interfaces (Crumlish & Malone, 2009); mobile interfaces (Hooper & Berkman, 2011); and interactive television (Kunert, 2009). There are compilations and reviews that specialize on the identification of existing pattern languages, which provide comprehensive listings (e.g., Dearden & Finlay, 2006; Fincher, 2009).

Pattern languages for game design

Regarding game design in particular, Kreimeier (2002) suggested the pertinence of a pattern language aiming at "establishing a formal means of describing, sharing and expanding knowledge" (para. 3). He referred to the *Formal Abstract Design Tools* (Church, 1999) and to the *400 Design Rules* (Barwood, 2001; Barwood & Falstein, 2002; Falstein, 2002) as close groundwork, and he provided some candidate patterns. A pattern language for game design with over 200 patterns was proposed (Björk et al., 2003; Holopainen & Björk, 2003) and later published in book form (Björk & Holopainen, 2004).

Björk and Holopainen's (2004) patterns are grouped in categories such as *Game Elements*, *Resource and Resource Management*, *Information*, *Communications and presentation*, etc. These categories are further divided in subcategories; e.g., *Game Elements* is divided in *Game Worlds*, *Objects*, *Abstract Objects* and *Locations*. Examples of patterns in the category *Objects*, for instance, are *Boss Monsters*, which are used to structure the progress of the game (p.73), and *Pick-Ups*, which are elements designed for players to collect and which may serve several purposes (p. 87).

Hullett and Whitehead (2010) presented patterns for the specific case of designing levels in first-person shooter games. Their goal relates to the fact that “there is no accepted common language for describing the building blocks of level design and the gameplay” and that “there is little formal understanding of [that] process, but rather a large body of design lore and rules of thumb” (p. 78). The patterns are grouped in four categories: patterns for *Positional Advantage*, *Large-scale Combat*, *Alternate Gameplay*, and *Alternate Routes*. An example of a pattern, from the former group, is the *Sniper Location*, which demands particular thoughtfulness from the designer. Another example, from the latter group, are the *Hidden Areas* that are usually designed to be off the main route for rewarding players for exploration.

Pattern languages related to sound

Regarding pattern languages addressing sound, or even just circumstantially referring to sound, examples are rare. Borchers (2001) presented a musical pattern language. This is part of a pattern-based approach consisting of three patterns languages: the first for the application domain, namely for designing and performing pieces of blues music; the second for the human-computer interaction for interactive exhibits; and the third for designing the respective software. Two examples of patterns from the musical pattern language are, the use of the *Pentatonic Scale* to address improvisation (p.93), and the choice of complementary notes – *Blues Notes* – to add tension to the pentatonic scale (p. 95).

Barrass (2003) wrote a group of design patterns for sonification founded on the idea of “functional sounds where the Bauhaus principle that ‘form should follow function’ is particularly apt” (p. 174). He based those patterns on the analysis of a selection of papers presented to the ICAD Conference in the preceding year. Later he was involved in adding 6 new candidate patterns for auditory displays (Adcock & Barrass, 2004).

Examples of these patterns are *SonifiedLineGraph*, which addresses the design of audio-only representations of two-dimensional data sets; and *SystemMonitoring*, which deals with the problem of enabling users to monitor an activity even while engaged in other activities.

Frauenberger (2009) presented an approach, based on patterns, to the design of auditory displays, i.e., to “the design of audio for feedback in human-technology interaction”. His contribution includes “a framework providing methods to capture, apply and refine design knowledge through patterns”, which he calls *paco*, and which “serves as the organizing principle for patterns, artefacts and design problems and supports designers in conceptualizing the design space” (p. 3). Examples of design patterns created in that way include a *Virtual Geiger Counter* to deal with the fact that multivariate and time-varying data are hard to show and understand visually, and the *Overview of Graphs* which presents a solution for providing a quick auditory perception of graphs when they are not visually presented.

6.3 The pertinence of a Pattern Language for Sound Design in Games

There is a strong match between what the formalism of design patterns can offer (Section 6.1) and the current needs and characteristics of the field of sound design in games (e.g., Chapter 2). The know-how is mostly informally held and very unevenly distributed, and there exists a large and active community of indie game developers who could potentially benefit from a dissemination of sound design knowledge. Design patterns can become especially useful to empower inexperienced designers and therefore particularly suitable for promoting and guiding competent sound design in the broad community of indie game developers.

How to build the Pattern Language

Though sound design in games is still a young and developing field, there is great expertise from senior designers, and there is also much research on new topics and consequently new knowledge that is constantly emerging. This state of development shapes the way a pattern language for the domain may evolve.

Several approaches may be combined to build a pattern language. One possible approach is to directly query senior sound designers to elicit their tacit knowledge. They can be

interviewed to talk about their solutions to the recurrent problems they face. Or, one can collect recurrent problems in advance and ask them how would they deal with them. Another less intrusive approach is to analyze their work, through available games, and “harvest” patterns (Björk et al., 2003, p. 4; Björk & Holopainen, 2004). Also, among the growing body of knowledge properly formatted in academic writings, such as conference papers, there are contributions that can be translated into patterns. Furthermore, in some other domains, authors sometimes opted to present their findings directly as patterns and/or to build patterns upon others’ findings. For instance in software engineering (Gamma et al., 1995), where design patterns have become widely adopted by the community of practice, papers discussing or systematizing patterns became a regular contribution in conferences. From those alternatives, the harvesting technique was the most used during the period to which this thesis reports. We will address this matter with more detail in Section 6.6.

Independently of the approach, the creation of patterns should be servant to the idea that they are meant to empower the practitioners, namely novice and inexperienced practitioners. In this case, and coherently to our prior argumentation, those are indie game developers, concerning sound design.

A Pattern Language as collective work

It is fundamental to notice that coming up with a pattern for a recurring problem for which there is not yet a solution is either an absurd or a two-in-one endeavour. Actually a pattern includes – by definition – the specification of a recurring problem *and* a solution that proved (with a certain degree of confidence) to solve that problem. So, that aim would imply to first build a solution and then eventually present it, in context, as a pattern.

Nevertheless, we believe that once we feel empathy for the instrumentality and participative way of building patterns, it is improper to dismiss the value of the identification of a recurrent problem just because the author is not able to identify or even suggest a solution. In fact, the exercise of identifying problems is nontrivial and key to the formulation of solutions. We do agree that, for the sake of rigor, problems alone cannot be classified as patterns but, we argue, it would be very productive to encourage the formatting of the identified problems according to a pattern template – with absent or empty *Solution* field – and putting them in a pool for collective appreciation. A

Confidence Level field, in the pattern template, would be enough to set these instances apart, by adopting a convenient descriptor (e.g., “recurrent problem”).

Actually that kind of contribution can be instrumental to the start up of the community towards elicitation and creation of knowledge. It has the potential of augmenting considerably the number of participants – by allowing an entry level for people that otherwise would not feel confident to actively engage in the debate – and having more design problems revealed. Consequently, more existing solutions could be exposed, and therefore more patterns could be formalized. The cases where the community could not identify existing solutions would present opportunities for new experimental and scientific research. More subtly, that would also allow to transparently accommodate partial contributions according to different participant profiles (particular motivations, sensitivities, abilities, etc.) – it is worth noticing, for instance, that recurrent problems are prone to be first spotted by people who recurrently *play* games, who in turn may not be designers, developers or academics.

6.4 Pattern rationale and format

Next to the conclusion of this chapter, and as soon as we introduce the rationale for the format and adopted synthesis methodology, we will present the lists of patterns according to three main versions proposed to date: the Seminal Collection, version 1.0 and version 2.0. Though only by then such lists may be fully understood, the reader may find pertinence in having a quick look meanwhile, particularly into the list referring to the more recent proposal (Table 6.12 in Subsection 6.8.3, p. 118).

In the next subsection we present the evolution of the format we adopted for specifying the patterns (which some author also refer to as the *pattern template*). The format refers to version 1.0, which was preserved when revising the patterns to version 2.0. For exemplifying the usage of the *fields* according to this format, as in the several tables and figures along the subsection, we opted to present *contents* already updated (that is, as of version 2.0) because the revisions to such contents do not have implications on the format being described, and because we considered to be uninteresting inserting contents less than up to date in the main body of the text (when the revision of the contents itself is not the focus the discussion).

Also, to avoid repetition, when referring to “experiments” in the following subsections, we mean the experiments being presented in the next chapters (Chapter 8 and Chapter 9). These experiments were the basis for the evolution of the Pattern Language from version 1.0 to version 2.0.

6.4.1 Pattern format

Within a collection, all patterns follow a common *format*. Yet, different collections may adopt different formats. Usually, the format structures the patterns by means of fields labelled according to core components. The pattern format is sometimes referred to as the *pattern template*.

Besides the identification of the pattern, adopted formats usually organize its core elements – the recurring *problem*, the *context*, and the proven *solution* – over fields that reflect such structure. Other fields may complement this basic representation. The structure of Alexander’s (1979) patterns, namely, has three main parts, consistently presented in the same sequence: first, an introduction with the name of the pattern, a ranking of validity, a depiction of an application, and a description of the context; then, the central part, with a short statement of the problem, its details, the solution, and an illustrative diagram; and the final part, consisting of references to related patterns.

Such format is not mandatory, though. Other authors did opt for distinct structures, wordings, and order (Kunert, 2009). As Vlissides (1997) puts it, “[pattern styles] are as diverse as the people who write them, perhaps even more so” (para. 12). Some examples of alternative formats use the following lists of fields: *Name, Example* (as many fields as examples), *Using the Pattern, Consequences, Relations* (Björk & Holopainen, 2004); *Title, Illustration, What, Use when, Why, How, Examples*, and *In other libraries* (Tidwell, 2011); *Title, Context, Problem, Forces, Solution, Rationale, Examples, References* (Frauenberger, 2009).

Despite structuring the information in fields, some authors do not exhibit the labels for those fields when presenting the patterns (e.g., Alexander, 1979; Borchers, 2001). The running text confers the patterns a less technical expression, possibly preferable to a broader audience. Yet, the text still contains formatting hints that a knowledgeable reader may use to locate specific components.

6.4.2 Evolution of the format

The pattern format that we have been using since version 1.0 results from gradual adjustments to the one we first adopted when presenting the Seminal Collection (Alves & Roque, 2010c). Table 6.1 presents a comparison between both formats.

Table 6.1. Evolution of the adopted pattern format

Format used in the Seminal Collection		Format used in versions 1.0 and 2.0	
Field	Type of contents	Field	Type of contents
<i>Name</i>		<i>Name</i>	
<i>Context</i>	Description	<i>Synopsis</i>	Shortest possible description
<i>Problem</i>	Description	<i>Relationships</i>	Categorized list
<i>Solution</i>	Description	<i>Description</i>	Description
<i>Examples</i>	Description, just text	<i>Examples</i>	Movies with descriptions
<i>Relations</i>	Description	<i>Additional Comments</i>	Description
		<i>External Resources</i>	Commented list
		<i>References</i>	List
		<i>Revisions</i>	List
		<i>Confidence Level</i>	Expression

Whereas the original format may be closer to the typical presentation, we had the necessity to adapt it through time, so that it would allow us to more efficiently inscribe the gathered information. The changes are threefold: the roll of fields; the distribution of information among the fields; and, the way information is presented inside those fields.

As an emblematic example, the *Context*, which was formerly described in isolation in a specific field, is now presented in two stages, distributed among two different fields: first, it is expressed as a list of (other) patterns that may call for the exploration of the pattern at stake, as part of *Relationships*; then, the broader context, including those relationships, is explained as part of the pattern's *Description*. In order to explain the rationale for that and other aspects of the “maturation” of the adopted format, we will present each of the fields along with the challenges we faced, in the following subsections.

Name

A pattern's name is one of its most sensitive aspects. Ultimately, the name of the pattern will be the expression to enter in the practitioners' *vocabulary* (Borchers, 2001, p. 65;

Sharp et al., 2007, p. 565). In that sense choosing a name is a strategic matter (Gamma et al., 1995, pp. 3, 6).

However, choosing a name for a pattern constitutes a major challenge. Invariably the choice represents a tradeoff among a multitude of aspects. Actually, it takes only two of those aspects to illustrate the potential difficulty: a name must be short *and* capable of representing the contents of the pattern. Gamma et al. (1995) admit that “finding good names has been one of the hardest parts of developing [their] catalog” (p. 3)

We’ve been growing the understanding that it is not interesting to expect that a certain name may become great to refer to the pattern once people understand the contents of that pattern. Our experience, both based on the analysis of the experiments and through informal observations and comments, is that the understanding of a pattern *starts* with the understanding of the name (also in Borchers, 2001, p. 65).

Revealing the solution, possibly in a specific context of use

We opted to orient names towards the solutions that the respective patterns provide (as Borchers, 2001, p.65). Whenever serving several possible contexts of use, the solution may be communicated through the specific approach (e.g. *Grunts, Recordings, Music*). When the solution is tailored to a specific context of use, we preferred adopting such context as the pattern’s name, since it is more revealing and the solution is tacitly associated to it (e.g., *Achievement, Window of Opportunity, Imminent Death, Cutscenes*).

Name length

As expressed before, a par with the need to present revealing names, we also valued their shortness. For instance, a name should be an expression that people are able to integrate in everyday discourse without feeling the need to create a smaller variant. Given that this was a challenge, which we tackled case by case along time, we found it interesting to have an overview on the current distribution of name lengths (version 2.0). As observable in Figure 6.1, most pattern names are constituted by 1 or 2 words, being the maximum 4 words (which is in accordance with Borchers, 2011, p. 65); and, they range from 5 to 22 characters long (median is 11, as marked in orange; mean is 11.3). The length in words may be closer to the point being made here, but we take the chance to also present the length in characters because it will be relevant when fitting the name in some graphical representations (as it will be reported in next chapter).

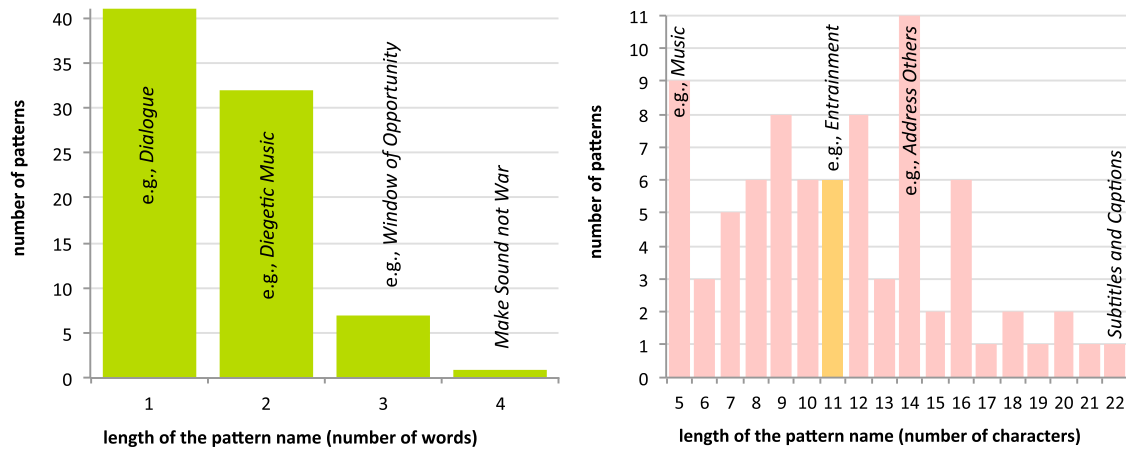


Figure 6.1. Length of pattern names – distribution, according to number of words (left) and number of characters (right)

Omitting “Sound in...” prefix whenever tacit

A dilemma we faced, when naming the patterns, was whether to make explicit *the use of sound*. We opted not to do it, unless it would clearly add to the perception of the concept. As such, for example *Achievement*, *Menus*, *Engagement*, etc. are intended to mean respectively “*Sound of Achievement*”, “*Sound in Menus*”, “*Sound during Engagement*”, etc. We believe that being the Pattern Language associated to sound design, the omission of the prefixes will not constitute a hindrance. We still did not collect any evidence countering this assumption but we recognize this aspect should be better studied.

Abbreviations and coined terminology

To augment readability we avoided using abbreviations in names. PC (for Playing Character) and NPC (for Non-Playing Character) are two exceptions. Namely, we defined the names *Unaware NCP*, *Suspicious NPC* and *Seeking for PC*. Both these initialisms and their respective concepts are well known in the field of computer games. The former refers to the character who is controllable by the player, typically the protagonist; the latter refers to characters who are not controllable by the player. We opted to use these particular initialisms considering that we expect them to be well known by game designers. Moreover, the longer expressions “Playing Character” and “Non-Playing Character” would still require some domain familiarity, and we could not yet find reasonable common language alternatives.

The other exception is the use of the acronym R-A-E-D, in *R-A-E-D Iterations*. R-A-E-D is an acronym we found the need to create, to represent the sequence *Relaxation-Anticipation-Engagement-Decay*, whose iteration the pattern reports. This was the most interesting approach we could find for the pattern's name.

We also had the need to create the expression *Character Soundprint*, to refer to the set of sounds characterizing a PC or NPC. Yet, in this case, we believe the expression is obvious enough not to raise any issues.

No pun Intended

The use of puns and analogies as pattern names is a common practice among pattern authors. They may contribute to comprehension and to memorability. Still, other authors have expressed reservations on their use, considering possible ambiguities (Kreimeier, 2002), and when they are too far-fetched (Borchers, 2001, p. 66) or simply culturally distant for non-native speakers. Since our priority has been to contribute as much as possible to present domain vocabulary, we used the name accordingly and we avoided exploring this alternative.

We keep a single exception in our collection: *Make Sound not War*. The pattern refers to the exploration of sound in gameplay as a way to create alternatives to aggressive conflict. The name is not a strict pun, in the sense that it can still be interpreted literally but, of course, we tried to explore the association with the well known “Make Love not War” motto, for the sake of memorability.

Rigour versus efficiency

We experienced two examples in which, after starting with a name that theoretically would more “accurately” represent the contents, we felt the need to simplify and adopt a form that still retains the concept but releases the user from decoding the more intricate expression. The first example is *Variety*, which we formerly named *Requisite Variety* in regard to the terminology adopted in the field of Cybernetics (Heylighen, 1992), where the concept being explored was first introduced. The other example is *Sound Layers*, which was previously called *Sound Layers and Semantics*. The latter form is more faithful to the message and we had adopted it after its use by sound designer Nick Peck (2001, 2007; as presented in Subsection 4.2.1). In both cases, the “simplified” version was

suggested as being more effective (we will return to this when analyzing the experiments in Chapter 8 and Chapter 9).

We value these examples, not so much in terms of the improvement in their specific cases, but because the respective episodes made us become aware of this kind of issue. As Vlissides (1997) puts it, when referring exactly to the effectiveness of patterns, “what good is a pattern, no matter how well written, if it doesn’t produce a resonance in the human mind?” (para. 19).

Synopsis

While informally discussing the patterns with other people, during the course of our research, we often felt the interest in having a “prepared” shorter version of the respective description to quickly explain the idea in case the name alone would leave doubts. Later, this format would also reveal itself instrumental for outputs such as the Table 6.12, shown in Subsection 6.8.3. To fulfil such need we synthesized the shortest possible sentence that identifies each pattern’s contents. This can also be thought as an extended version of the name.

In many cases we opted for an approach that reveals the solution in context. Still, per-case adaptations, were needed. The span of application of the pattern, for instance, influences how much the synopsis is able to reveal. For example, the synopsis for *Eavesdropping* exposes some detail: “*Adopting behaviours with the intention of gaining knowledge by listening to others’ conversations*”. In turn, the synopsis for *Sound Input* is more wide-ranging: “*The way sound enters the game world*”.

Implying “The contribution of sound...”

Coherently to what we adopted regarding the names of the patterns, we avoided the replication of the introduction “*The contribution of sound...*” in every synopsis, unless we understood it would clearly enhance the message. As such, for instance, “*Signalling something positive*” (in *Achievement*) should mean “*The contribution of sound in signalling something positive*”. Again, we believe this is a reasonable compromise, considering the context. It is also worth noting that this stance is consistent with our holistic approach to sound design. It is the design of the context that leads and intertwines the contributions of each modality, including sound, to build an overall meaningful solution.

One of the major challenges while synthesizing the synopses has been maintaining the coherence regarding the subject of the action. While some synopses are better suited to be represented by a suggestion to the designer, others are more naturally explained by the player's expected behaviour. Examples are "*Replacing original voices, to adapt to other language*" (for *Dubbing*) and "*Performing songs to achieve a purpose*" (for *Sing to Act*), respectively. We opted to allow these variations, provided that they would not incur into ambiguity.

Avoiding recursion

Also, at a certain moment of our research (discussed in Chapter 8) we revised all synopses that reused the name of the pattern in their text. We realized that such circumstance would lead to recursion, and render synopses ineffective when serving the purpose of explaining the name. Hence, for instance, the synopsis of *Foley Music* changed from "*Music made out of foley sounds*" to "*Music exploring sounds of objects or actions*". Still, we maintained a minority of such recursive cases, because we could not find a reasonable alternative. For instance, the synopsis of *Noise* is "*The purposeful use of noise*".

Length

Since length was an important aspect when synthesizing synopses, we present a characterization in Figure 6.2, which includes examples for the extreme and median cases. The median is 47 and the mean is 47.7 (both in the category marked in orange).

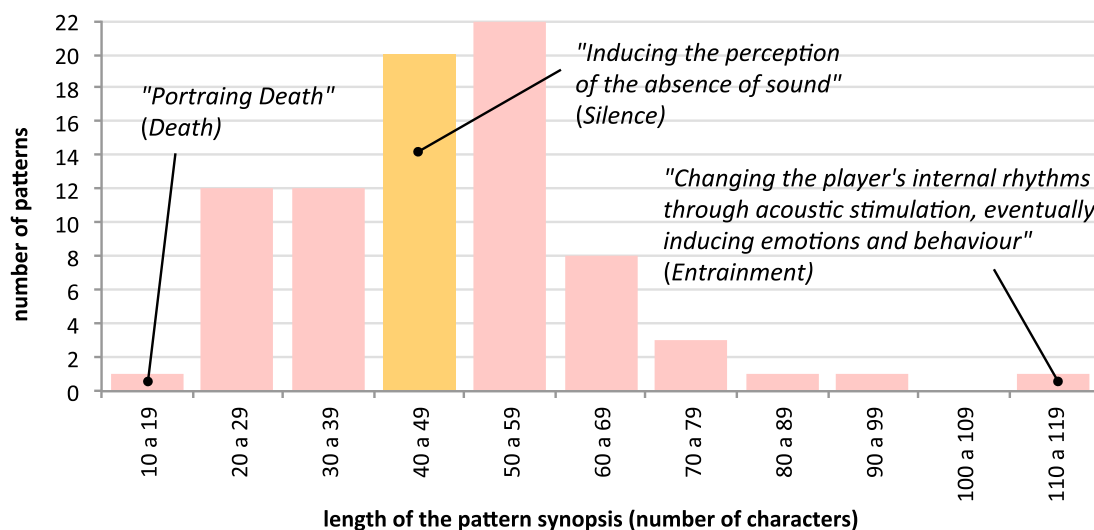


Figure 6.2. Length of pattern synopses – distribution, according to number of characters

Relationships

In a Pattern Language, patterns relate to each other, by definition (Alexander, 1979; Alexander et al., 1977). Actually, it is the grammar created by the specification of such relationships that defines the language, in which the patterns function as the vocabulary (Borchers, 2001).

The field *Relationships* (which was called *Relations* in the Seminal Collection) is the one whose changes more pronouncedly reflect the evolution of the adopted format. *Relationships* is now a categorized list of other patterns with which the pattern relates to. Table 6.2 presents, as an example, the relationships for the pattern *Helper Voice*.

Table 6.2. Partial view of pattern *Helper Voice*, exemplifying the field *Relationships*

<i>Name</i>	<i>Helper Voice</i>
<i>Synopsis</i>	Conveying guidance through the voice of disembodied or remote entities
<i>Relationships</i>	
Context:	<i>Awareness</i>
May relate to:	<i>Narrative, Recordings, Radio</i>
Differs from:	<i>Narrator</i>
Makes use of:	<i>Dialogue</i>
<i>Description</i>	...
...	...

The adoption of this format results from the relevance in having a straightforward representation of the pattern's connections in the network of all patterns (whose depiction will be introduced with Figure 6.4). This was instrumental namely while growing and refining the collection. A prose-like exposition, as we were using in the Seminal Collection, though valuable, was not shown to be efficient to such purposes.

Furthermore, we experienced overload while trying to isolate the narrative description of the relationships from the description of, for instance, the solution. Having a separate description for the relationships was often leading either to redundancy or to unnatural cuts. Consequently, we decided to migrate and embed the *description* of the relationships with the description of other aspects of the pattern, into what is now the field *Description*.

For the categorization of the list in *Relationships*, we distilled a set of labels, along time, which offer a balance between detail and manageability. Typically, while specifying the *Relationships* of a pattern, a suitable subset of those labels is used. In the example in Table 6.2 (above) those were *Context*, *May relate to*, *Differs from*, and *Makes Use Of*.

The wording in the labels tries to reflect the choice of words that would occur in a natural sentence, where the relationship would be explained. Though it is not forceful to comply with the already established labels, we are currently not experiencing reasons not to do so. Nevertheless, we are as willing as before to improve the current set of labels.

Examples of application of the current label set are presented in Table 6.3. As it is possible to observe, we found it convenient to keep close variants of some labels. For instance, the prefix *May* (e.g., in *May call for*) expresses the cases when the relationship, though common, is not prevailing. Perhaps the subtlest distinction is that between *Context* and *Contexts*. The former suggests a conjunction, whereas the latter is better suited for cases when the pattern may be used in the scope of the exploration of any (or some combination of) the listed patterns. These and other aspects are commented in the right most column of the table.

As we show in Figure 6.3, the representation of the relationships in most of the patterns involves 2 or 3 categories (65% in conjunction), though such amount ranges from 1 to 5 categories. The amount of relationships per pattern varies from 1 to 16, totaling 572 expressions of relationship for the 81 patterns (version 2.0). The median is 6 relationships per pattern (marked in orange, in the figure) and the mean is 7.1.

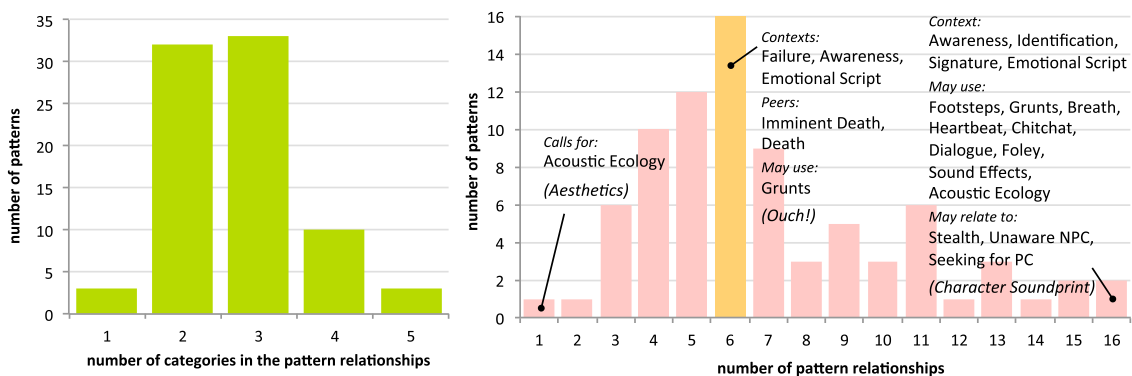


Figure 6.3. Pattern relationships – distribution, according to number of categories (left) and number of relationships (right) per pattern

Table 6.3. Examples of categorized relationships between patterns

Example			Rationale
<i>Pattern</i>	Relationship	<i>Pattern(s)</i>	
<i>Achievement</i>	Context:	<i>Awareness, Emotional Script</i>	Presents the explorations that, in conjunction, constitute the context
<i>Chitchat</i>	Contexts:	<i>Character Soundprint, Emotional Script, Unaware NPC</i>	Presents alternate explorations that may constitute context (either alone or combined)
<i>Foley</i>	Many contexts, including:	<i>Engagement, Character Soundprint, Footsteps, Grunts, Sound Decoys, ...</i>	Exemplifies contexts, when the possibilities are too many to make sense listing them all
<i>Dubbing</i>	Relates to:	<i>Subtitles and Captions</i>	General case of a relationship. Used whenever a more specific relationship is not defined and is not pertinent
<i>Affect Hearing</i>	May relate to:	<i>Ouch!</i>	As above, yet the absence of the relationship is also common
<i>Decay</i>	Peers:	<i>Relaxation, Anticipation, Engagement</i>	Reveals other patterns that may make part of a more complex exploration
<i>No Can Do</i>	Close to:	<i>Failure</i>	Presents a pattern that, despite being different, has similarities
<i>Helper Voice</i>	Differs from:	<i>Narrator</i>	Highlights the distinction and makes clear that they are not redundant
<i>Failure</i>	Contrasts with:	<i>Achievement</i>	Exposes an exploration with “opposite” semantics
<i>Grunts</i>	Compromises with:	<i>Stealth</i>	Reveals a possible contradiction
<i>Sound Effects</i>	Calls for:	<i>Variety</i>	Exposes the pertinence to also explore another pattern
<i>Dialogue</i>	May call for:	<i>Subtitles and Captions</i>	Presents other pattern whose combination is worth pondering
<i>Narrator</i>	Makes use of:	<i>Dialogue</i>	Implies the exploration of other patterns. (“Uses” would be a simpler label but might get confused with “Usable in”)
<i>Title Screens</i>	Often uses:	<i>Music, Sound Effects</i>	As above, but not as implied
<i>Anticipation</i>	May use:	<i>Heartbeat</i>	As above, yet the absence of the relationship is also common
<i>Engagement</i>	May use many, including:	<i>Foley, Sound Effects, Music, Dialogue, Entrainment, Seeking for PC, Shout and Yell, Sonic Weapon</i>	As above, yet the possibilities are too many to make sense listing them all

A depiction of the complete network of relationships may be observed in Figure 6.4. In that representation the nature of the relationships is colour coded in a simplified way, for the sake of perceptiveness: blue arrows represent “hierarchical” dependencies, e.g., *Context* and *May use*; green represent “non-hierarchical” dependencies, e.g., *Relates to*; magenta applies to particular cases of high proximity, e.g. *Peers*, *Close to*; and red represents difference or conflict, e.g. *Differs from*, *Compromises with*. For details on each particular relationship, see instead the respective pattern’s webpage in Appendix D.

Thresholds, subjectivity and far-fetched cases

Both the subjectivity and the existence of not so evident (but relevant) explorations render virtually every setting of relationships potentially arguable. The expression of the set of relationships for a pattern is invariably the outcome of a compromise. Moreover, when thinking under a mindset that favours a holistic attitude, virtually everything is related to everything. So, thresholds are needed – even if subjective – to keep the information manageable and useful. Some concepts are particularly prone to such type of subjectivity. *Narrative* is one example: unless being strict regarding what may contribute to “unfold the game’s story”, the network of connections representing patterns that are considered to be able to “serve” the *Narrative* grow extraordinarily. Other examples include *Emotional Script*, *Gameplay*, or even *Awareness*.

Expressing the context

As revealed in Table 6.1 (above), we ceased to have an explicit field dedicated to the *Context* as we used to in the Seminal Collection and as it is common finding in pattern templates. Usually, a *Context* field is included to refer to “what is above” (thinking in terms of hierarchical levels of abstraction) or what calls for a certain exploration (thinking in terms of development flow) (e.g., Borchers, 2001, p. 52). Our experience with the synthesis of the patterns led us to express those kinds of connections as part of *Relationships*. To keep some acquaintance with common pattern templates we decided to maintain the terminology in the respective labels (*Context*, *Contexts*, *Many contexts including*, as presented above). The description of the relationships referring to context is then presented together (*in context*) with the description of all other relationships, which in turn is amalgamated with the description of other aspects such as possible additional context, the problem and the solution.

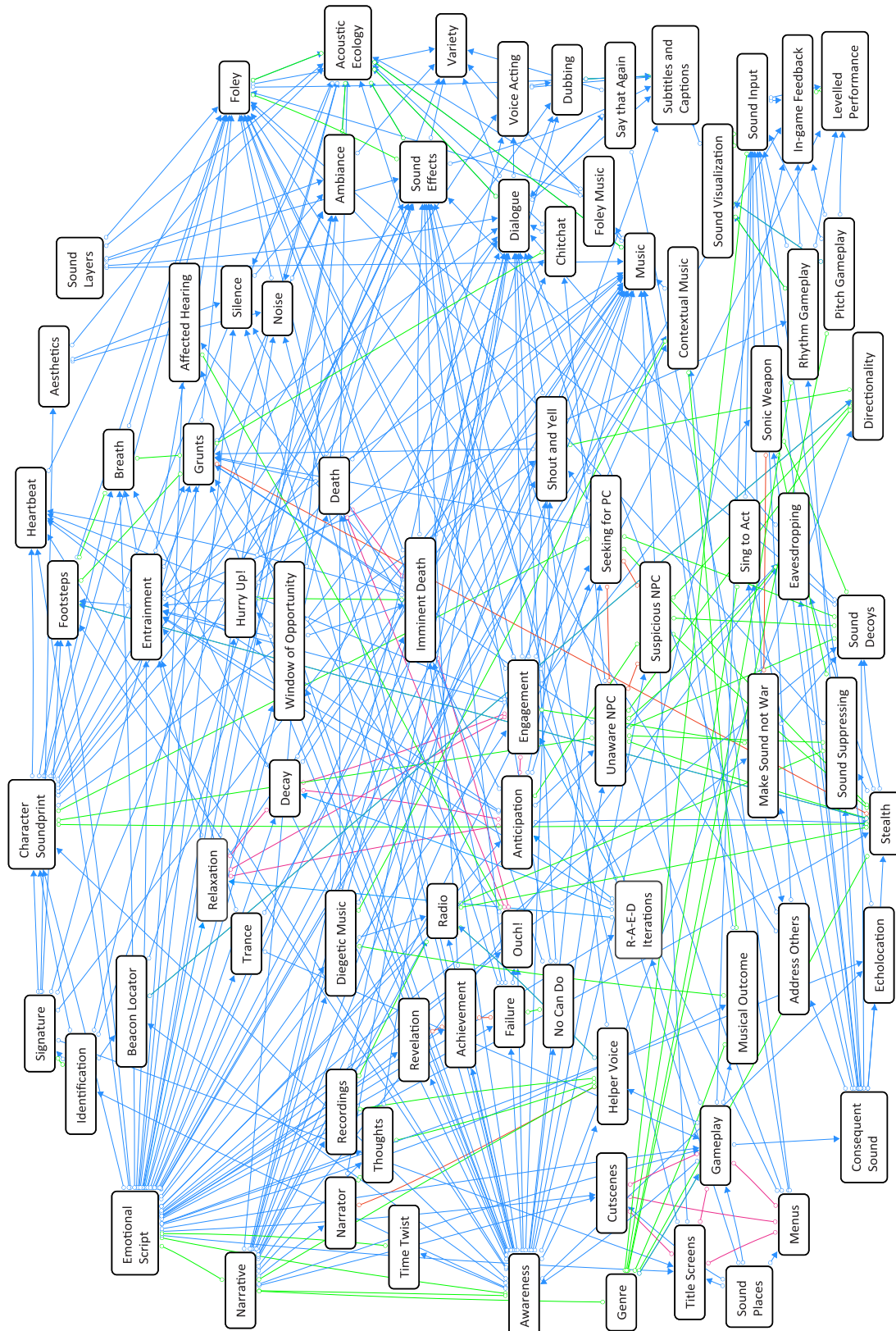


Figure 6.4. Network of sound design patterns as defined by their relationships (version 2.0)

It is worth noticing, regarding such (usual) adoption of the meaning of *Context* in pattern templates, that, in a broader sense, “context” refers to whatever is connected to the exploration; so, in that sense, the context would be the set of *all* relationships. Considering the approach we are using, in practice this distinction is not problematic because all relationships are explained in a similar manner, in the field *Description*, as it best serves the discourse in each case.

Description

As we have been announcing, the field *Description* is where the contents of the pattern are explained. This field intertwines, as convenient to the discourse, the kind of information that we formerly (when presenting the Seminal Collection) would encapsulate in the fields *Context*, *Problem*, *Solution* and *Relationships*. *Problem* and *Solution* were fields we adopted for the Seminal Collection but which we decided to abandon. *Relationships*, which is a field in the current format, identifies the relationships in the form of a list. *Context* is (currently) part of the list in *Relationships*.

We did not find efficient to isolate the description of the context, problem and solution and (other) relationships in separate fields. We noticed that considerable effort was being dedicated to that encapsulation, and the resulting exposition was often impaired either by replication due to the need of indexing aspects in one field to disparate aspects in another field, or by the abnormal cuts in the reasoning.

The adoption of a field accommodating free text, although theoretically may require some more discipline from the author, in order not to leave important aspects uncovered, allows a better articulation of the pieces of information being presented. Actually, this prose-like amalgamation is coherent with Alexander’s (1979; Alexander et al., 1977) original approach. As an example, we present the *Description* field of the pattern *In-game Feedback* (Table 6.4).

Examples

Examples are a core element of a pattern’s presentation. Ultimately, it is through the examples that users understand the plausibility of the pattern. Also, the examples provide the most direct means to expose the solutions currently adopted for the exploration at stake, particularly when presented as videos that the users can play.

Table 6.4. Partial view of pattern *In-game Feedback*, exemplifying the field *Description*

<i>Name</i>	<i>In-game Feedback</i>
<i>Synopsis</i>	Providing indicators on the player's acoustic performance
...	...
<i>Description</i>	<p>Gameplay demanding <i>Sound Input</i>, as in the case of <i>Pitch Gameplay</i>, or requiring some kind of auditory performance such as <i>Rhythm Gameplay</i>, may introduce unfamiliar challenges to players.</p> <p>One interesting approach to deal with this is to provide in-game (diegetic) feedback and assistance. This not only presents a contextualized way to deliver <i>Awareness</i> to players, regarding their actions, but can also play an important role in terms of the game's <i>Emotional Script</i>.</p> <p>In some examples, this feedback promotes <i>positive</i> emotions, which may contribute to: balancing the distress of unachievement; favouring cognition by maintaining the player in a positive mood [1]; and, providing an additional source of entertainment.</p> <p>A complementary way to tackle complexity is to let the players evolve their sound performance through stages of <i>Levelled Performance</i>, similarly to what is commonly done with other gameplay aspects.</p>
...	...

The examples that we have been creating to present in this field consist of short movie pieces, with less than 30 seconds, trimmed from video that has been recorded during game playing sessions. A thoughtful selection of games was used for that effect.

The videos were trimmed so that, in each case, the exploration being studied may be as promptly identified as possible. Also, the short duration of the examples may contribute for a user to be able to check more examples in the same available time.

Due to the relevance of the video examples, we will present more details on the methodological aspects behind their selection and processing, later in this chapter (Section 6.6). In the remaining of this section we will restrict to the rationale of the respective field in the pattern template.

Each video included in the *Examples* field is accompanied by a description referring to the particularities of the respective solution. These specific descriptions are very important because they allow the branching – and specialization – of the common solution presented in the field *Description*.






Together, the specificities of the disparate examples should emphasize *diversity* of opportunities, as opposed to biasing or influencing into a particular solution and consequently, constraining creativity. It is also most plausible that diversity contributes

for users to better grasp the core of the concept and hopefully to provide insights to *innovative* solutions. Though we still need to further study this correlation, we now have favourable conditions to do it.

Currently, we have a database of more than 600 unique video examples, more than 900 if counting with variants. Each pattern has an approximate average of 7.5 examples.

In Table 6.5 we present the possible illustration of the field *Examples* resorting to the pattern *Sound Decoys*. It is also interesting to notice that, even in such an apparently narrow exploration, substantially different specific solutions have been found.

Table 6.5 Partial view of pattern *Sound Decoys*, exemplifying the field *Examples*

<i>Name</i>	<i>Sound Decoys</i>
<i>Synopsis</i>	Using sound to fool the opponents
...	...
<i>Examples</i>	
	<p>Metal Gear Solid 4: Guns of the Patriots: Snake lures an enemy out of his place by throwing an empty magazine into a more convenient location. Knocking on objects is an alternative to attract a NPC, but it requires that the NPC is close enough and the attention is directed towards PC's position.</p>
	<p>Dead to Rights: Retribution: Shadow can bark (either a short range bark or a louder bark) in order to lure enemies to a convenient position.</p>
	<p>Spore Origins: One of the parts, in which the player can invest when upgrading the creature, allows emitting a sound that attracts easy prey. This feature needs to be timely managed because it takes some time to “recharge” (notice the indicator in the bottom-left corner).</p>
	<p>Papa Sangre: In this particular level, noisy chicken may be released to divert the opponents from the PC's position and Footstep sounds. In other levels the PC's own Footsteps can be used to lure an opponent away from a position that needs to be visited (as the <i>Helper Voice</i> suggests).</p>
...	...
	<p>Thief III: Deadly Shadows: Garrett can draw special noisemaker arrows in order to divert enemies.</p>
...	...

Additional Comments

We introduced the field *Additional Comments* to allow placing information that, being relevant, is not central to any other field. In most of the cases, we used it as an extension to the *Description*, for instance when a particular concept is explored in another domain and we find it useful to provide some note or a piece of the respective state of the art. This is illustrated in Table 6.6, regarding the pattern *Awareness*. This example also cites a reference, which, in turn, is located in the field *References*, explained below.

Table 6.6. Partial view of pattern *Awareness*, exemplifying the field *Additional Comments*

<i>Name</i>	<i>Awareness</i>
<i>Synopsis</i>	Sound signalling some relevant aspect of gameplay
...	...
<i>Additional Comments</i>	
	The advantages of sound over (or in combination) with visuals to implement mechanisms of awareness is one of the aspects claimed by pioneer authors who carried a collective initiative to leverage the recognition of sound as a field of research [1].
...	...

External Resources

External Resources is also a place for additional information but it is better fitted to the cases when instead of inserting the information we are redirecting the users elsewhere. Typical examples of external resources include: links to interviews, Web articles, and other materials that somehow complete or back up the argumentation, pieces with resembling examples from other media, namely cinema, etc. This is illustrated in Table 6.7 for the case of *Foley Music*.

References

The field *References* holds a reference list in typical academic style. Calls for references may be inserted in descriptive fields, namely *Description*, *Examples* (in their descriptions), and *Additional Comments*.

Revisions

Revisions keeps a typical log of revisions, for a pattern. It is basically a list of short sentences enunciating what and when was changed, and the values prior and after the change, possibly accompanied by a short reference to the reason for the change.

Table 6.7. Partial view of pattern *Foley Music*, exemplifying the field *External Resources*

<i>Name</i>	<i>Foley Music</i>
<i>Synopsis</i>	Music exploring sounds of objects or actions
...	...
<i>External Resources</i>	
	<ul style="list-style-type: none"> • Matthew Herbert on Life in a Day: “I make music out of sounds” in http://www.youtube.com/watch?v=46de7qPgcyg • Amon Tobin and the Music of “Infamous” in http://www.youtube.com/watch?v=yqWvheuVf6w • Movie scene in chapter “Night Shift”, in <i>Dancer in the Dark</i> (Lars von Trier, 2000) 0:37:22 – song in the factory with participation of foley • Movie scenes in <i>Baraka</i> (Ron Fricke, 1992) E.g. 0:48:16, merging the breathing of the city into music
...	...

Confidence Level

We are not taking advantage of this field yet. It is reserved to contain the confidence level on a pattern, which is a characteristic of the design patterns. Usually patterns are called “candidate” while they do not receive some level of recognition from the community of practice. On this date, the possible classification regarding confidence level among the proposed patterns is to distinguish those that already existed in version 1.0 (which were revised into version 2.0 after the exercises described in Chapter 8 and Chapter 9) from those newly introduced in version 2.0 (as in Table 6.12 in Subsection 6.8.3).

6.5 Pattern classifications

We did not adopt any formal classification for the proposed patterns, to date. We did not yet found cases that evidenced an interesting tradeoff between the costs and the profits of managing such classifications. Yet, we realize that exploring the grouping of patterns according to some criteria is potentially interesting. Other authors adopted such approach in their respective domains (e.g., Alexander et al., 1977; Björk & Holopainen, 2004; Kunert, 2009).

Also and although we are not formally adopting any classifications, we informally acknowledge some possibilities. Since such exercise also helps to characterize the collection, we present some potential classifications in Table 6.8.

Table 6.8. Examples of potential pattern classifications

← Higher level of design <i>Aesthetics, Character Soundprint, ...</i>	Tending towards implementation → <i>Entrainment, Variety, ...</i>
← Clearly referring to a context of use <i>Relaxation, Imminent Death, ...</i>	Tending to describe an usage → <i>Footsteps, Heartbeat, ...</i>
← Broader solutions <i>Awareness, Make Sound not War, ...</i>	Narrower solutions → <i>No Can Do, Time Twist, ...</i>
← Suggesting making sound <i>Sing to Act, Address Others, ...</i>	Dealing with sound → <i>Say that Again, Subtitles and Captions, ...</i>
← Most frequently used <i>Achievement, Music, ...</i>	Not so frequently used → <i>Sound Decoys, Sonic Weapon, ...</i>
← Related to input <i>Sound Input, In-game Feedback, ...</i>	Related to output → <i>Sound Visualization, Dubbing, ...</i>

It is worth noticing that these illustrations hide a potential difficulty with the classifications. While it is fairly easy to present examples representing the extremes, it is not always easy to decide how to classify a particular pattern.

Next, we will present the concept of “aggregator patterns” that, from a certain moment in our research, become useful to distinguish some patterns. Again, this is not exactly an exercise of classification but more the acknowledgment of a property that some patterns possess.

Aggregator patterns

The pertinence for this distinction first emerged while observing game design practitioners using the patterns. Namely, we witnessed issues due to the perception and interpretation of *redundancy* between an aggregator pattern and the patterns being aggregated, in certain scenarios. The issues and the experiments where those observations took place will be explained in the next chapters (Chapter 8 and Chapter 9). We present the concept and the specific patterns, at this moment, for further reference.

We call “aggregator patterns” to those patterns that refer to a set of more specific solutions that are addressed by *other* patterns, without presenting specific solutions themselves. All patterns are not easily classifiable according to this criterion. We

identified a small group of patterns (represented in Table 6.9 as being “borderline”) that, despite framing *some* explorations that are fully addressed by other patterns, are not *strictly* aggregators. That is, they *also* refer to specific (and relevant) explorations that are unique to them.

As of version 2.0, the pattern collection has 4 aggregator patterns (presented in the following subsection). Additionally, 5 other patterns evidence characteristics of aggregation but they also present solutions on their own. Table 6.9 presents this distinction.

Table 6.9. Aggregator patterns, as of version 2.0

Aggregators	Aggregators to some extent (“borderline”)	Not aggregators
<i>Sound Layers,</i> <i>Sound Places,</i> <i>Gameplay,</i> <i>Genre.</i>	<i>Awareness,</i> <i>Consequent Sound,</i> <i>Emotional Script,</i> <i>Make Sound not War.</i>	All others

Aggregators, in version 2.0

Sound Layers refers to the grouping of design decisions according to the semantics of sound. Each of the semantic layers is being addressed as a pattern in the collection: *Ambiance, Foley, Sound Effects, Dialogue* and *Music*.

Sound Places evidences components of a game where sound may appear. These components – *Title Screens, Menus, Cutscenes,* and *Gameplay* – are also patterns in the collection.

Gameplay, in turn, includes all sound relevant for the game mechanics. It works as an “umbrella” for all patterns that explore sound in a manner that it objectively participates, constrains or otherwise influences the rules of play.

Genre, relates to major concepts of sound-driven gameplay. Since version 2.0, two patterns – *Pitch Gameplay* (newly introduced) and *Rhythm Gameplay* (resulting from the renaming of *Play the Beat*) – present well-known types of explorations related to *Genre*.

Regarding the patterns that are only aggregator to some extent, we understood that, while creating their descriptions, it would be more interesting to focus on their specificities than in their aggregative character. The same understanding applies to the selection of the illustrative examples. Namely, if an example that *might* fit one of these patterns is also illustrative of a sub-case of explorations addressed in one other pattern in the collection, then such example should be referred in the latter, more specific pattern, not in the former, more general. Although the observance of this practice is not formally essential, it helps to avoid *inscribing* redundancy in the respective descriptions.

A theoretical alternative, which requires examination in a per-case basis, is to change the name/focus of the pattern so that it refers only to the “uncovered” explorations (the disjoint part). Yet, in practice, finding such names has proven to be a challenge. A variant of this alternative is to treat the disjoint part not as one but as many new patterns as necessary. Still, this is not always interesting because the new patterns being generated may be *too* specific.

6.6 Methodology used for pattern proposal and evolution

The methodology to synthesize the design patterns was influenced by a literature review, testimonies from field protagonists including respected practitioners, critics and reviewers (often through informal channels), and information posted in disparate game forums. Yet, as exposed before (including in Chapter 3), the *main* methodology consisted of a systematic exploration of a multitude of games and on the subsequent phases of processing the recorded gameplay video, while extracting instances of the identified sound design explorations with the intent of presenting them as pattern examples.

The adoption of this *harvesting* technique is in turn grounded in the realization that expertise in this domain is predominantly *tacitly* held by experts, and that methodically inquiring these agents about their know-how would be impractical. Being so, we adopted the approach of observing the experts’ work and resynthesizing patterns based on evidences of application of their expertise. Such approach has proven to be interesting in other contexts facing similar challenges (Björk et al., 2003; Björk & Holopainen, 2004; 2005). The methodology that we adopted, to go from the observation of the experts work to the proposal of a body of knowledge in the form of a pattern

language, implied a persistent examination of the exploration of sound in selected games, accompanied by an incremental effort of both the identification of design patterns and their organization based on the perceived relationships among the respective explorations.

Since the initial phases, we felt the need to maintain our observations and prospective notes in ways that enabled the representation of their *relationships*. In Figure 6.5 we exhibit a detail on an intermediary state of one of the maps we used to hold hints and findings during prospection. The graph depicted in the background is the ancestor of the network we showed in Figure 6.4 (Subsection 6.4.2).

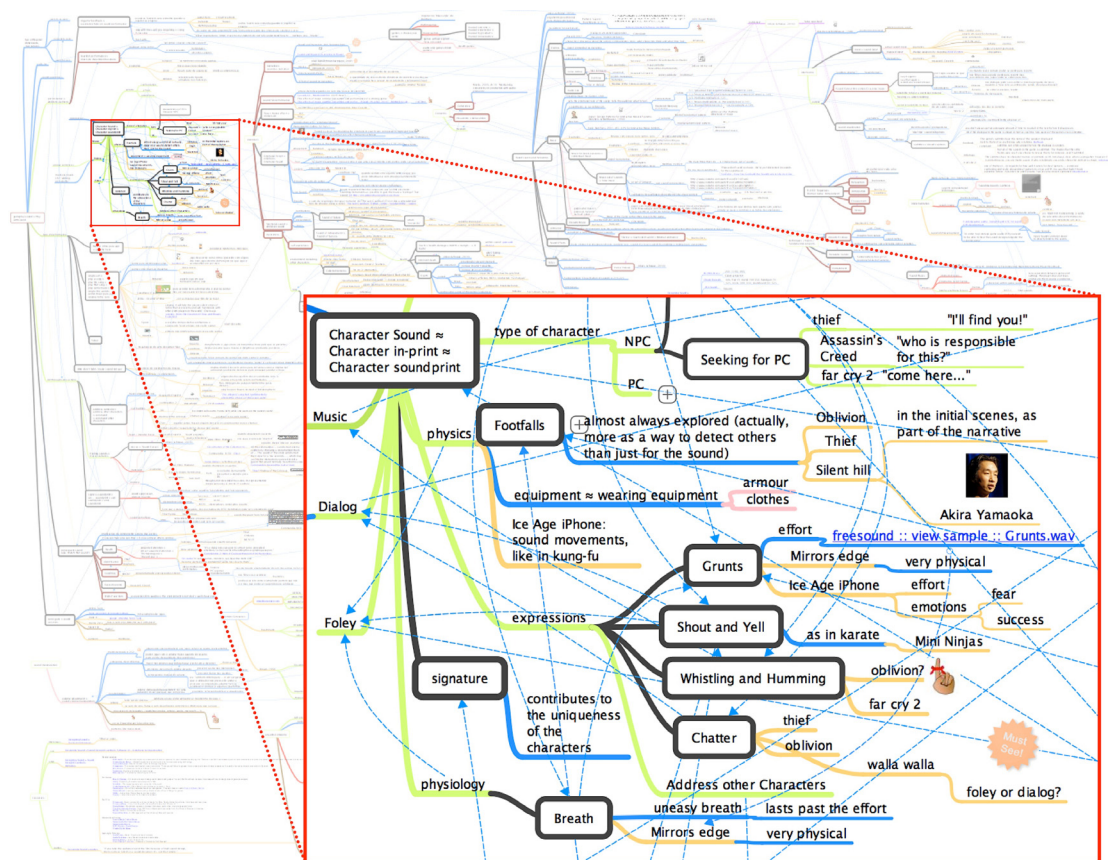


Figure 6.5. Detail of a working version of one of the mind maps that we used to register observations

The amount and assortment of games we felt the need to experiment with was determined by the evolution of the contribution that each additional experimentation was having to: *a)* the building of the collection of patterns; *b)* the delineation of the relationships among those pattern; and *c)* the identification of distinct specific explorations that might exemplify different applications of the concept inherent to each pattern.

We observed a sustained production of samples with potential research interest throughout the experimentation with a considerable number of games (the list will be presented below) before we considered that it would be reasonable a pause in this component of the study. To exemplify the dynamics of this phase, it is worth noticing that, not infrequently, it happened that we came to realize, retrospectively, that a game we had already played included a certain exploration that we were meanwhile identifying in the course of the experimentation with *another* game. In the same vein, when revisiting a game (for some reason), sometimes we end up realizing the existence of examples of exploration of certain patterns which passed unnoticed in a former session. Several reasons may explain this phenomena, including the fact that the latter experiments might indeed exhibit a more comprehensive exploration of the pattern, or because only *after* the earlier experimentation we came to identify the pattern at stake.

Moreover, it is important to recognize that a pattern, by definition, implies recurrence (Vlissides, 1997). So, at least theoretically, it should not be surprising that only after experiencing several times a certain exploration the underlying pattern sprang out to our conscious appreciation.

Game selection

The games were carefully selected according to how promising they were in terms of sound design, either globally or in respect to some specific exploration that we had learned they would include. To augment the effectiveness of the primary identification of games with interest to this research we considered online commentary (e.g. reviews), relevant awards, and precious hints from fellows with educated appreciation for videogame culture. We tried to be inclusive, in terms of game genre, platforms, context of development (e.g., mainstream, indie, experimental), public recognition (blockbusters, cult games), etc.

The list of games from which we grabbed at least one sound design exploration, i.e., an example being included in the field *Examples* of some design pattern, is presented in Table 6.10 (the games' complete references are in appendix, p. 247). The respective platforms include PS2, PS3, Xbox 360, PSP, iPhone, Nintendo 64, Mac OS X and MS Windows.

Table 6.10. List of games from which at least one example was extracted

Games from which we extracted at least one sound exploration exemplifying a sound design pattern (alphabetic order):

Afrika, Angry Birds, Aquaria, Assassin's Creed, Assassin's Creed 2, Beat Hazard, BioShock, Bit Trip Beat, Braid, Buzz!: Brain of the World, Call of Duty: World at War, Chime, Commandos: Beyond the Call of Duty, Crysis, Cut the Rope, Dead to Rights, Deadly Premonition, Demon's Souls, Devil's Tuning Fork, Disney Sing It: Family Hits, Ecco the Dolphin, Edge, Everyday Shooter, Fable III, Far Cry 2, fLOW, Flower, Grand Theft Auto IV, Guitar Hero 5, Guitar Hero World Tour, Half-Life 2, Halo: Reach, Heavy Rain, I Love Katamari, Ice Age 3, Ico, iGadget, inFamous, Katamari Forever, Killzone 2, Lego Star Wars III: The Clone Wars, Limbo, LittleBigPlanet, LocoRoco, Max Payne, Metal Gear Solid 4: Guns of the Patriots, Mini Ninjas, Mirror's Edge, Need For Speed: Undercover, Pac-Man, Papa Sangre, Patapon, Peggle, Penumbra: Overture, pOnd, Portal, Red Dead Redemption, Rez HD, Rhythm Paradise, Rhythm Zone, Sam & Max 301: The Penal Zone, Shadow of the Colossus, Silent Hill, Silent Hill 2, Silent Hill Homecoming, SingStar Queen, SingStar Vol. 3, Sonic the Hedgehog, Spore, Spore Origins, Tap Tap Revenge 3, Tetris, The Binding of Isaac, The Elder Scrolls IV: Oblivion, The Graveyard, The Legend of Zelda: Ocarina of Time, The Misadventures of PB Winterbottom, The Path, Thief II: The Metal Age, Thief III: Deadly Shadows, Tom Clancy's EndWar, Tom Clancy's Splinter Cell Chaos Theory, Tomb Raider Legend, Tomb Raider Underworld, Uncharted 2: Among Thieves, Uncharted: Drake's Fortune, Wolfenstein 3D.

Games from which we did not yet produce videos examples for already identified explorations (for disparate reasons):

Amnesia: The Dark Descent, Aquanaut's Holiday, Crysis 2, Dune 2000, Endless Ocean, Enemy Zero, Fear Effect, Gnilley, Journey, Mortal Kombat: Deception, Otocky, Super Mario, Super Mario 2, Zekkyyo Senshi Sakebrain.

Technology involved in gameplay recording

Most of the video (PS2, PS3, Xbox 360, PSP, iPhone) was acquired through a High-Definition video recorder (receiving Component Video and Stereo Audio or digital audio, whenever possible). For older consoles (including Nintendo 64) we used an analog to digital hardware converter (receiving S-Video and Stereo Audio). For Mac OS X and MS Windows games we used video capture software.

Included video examples

The video examples consist of clips with less than 30 seconds trimmed from recordings of gameplay sessions. Among other aspects, this length should allow quickly focusing on

the particular aspect at stake, and possibly checking several examples without compromising the flow of the design task being performed. Thinking of scenarios in which the videos are offered online, this also reduces the network bandwidth demand. Moreover, 30 seconds is a commonly used limit for video media quotation without infringing on Intellectual Property regulations.

Our criteria for selecting the examples to use in the patterns, among all positive identifications of the proposed patterns in the games we experimented with, were: *a) distinct* specific applications of the sound exploration expressed in a pattern; *b)* applications of a pattern that stand out due to some aspect, e.g., of the implementation (again, non-dominated solutions).

It is important to acknowledge the distinction between such a criteria-based approach and a possible indiscriminate production of video examples for *every* recognized pattern in each of the games we experimented with. That would be an (even more) overwhelming effort that we consider not to constitute an interesting tradeoff in this phase. For instance, patterns such as *Achievement, Music, Failure, Sound Effects, Footsteps, Engagement, Grunts*, can be found in almost all games that were considered. We did not find it interesting to produce video examples for all those *occurrences*.

Although the redundancy and exceeding provision of samples that would result from that alternative approach might not be pointless, the approach we followed provided us with the features that we privileged. Namely *disparity* among the examples selected for each pattern (i.e., not just replication) and, even so, quantity enough to support the recurrence of the pattern.

Actually, our approach provided us with more than 600 unique examples (more than 900 if we also count variations of the unique examples). That means an average of approximately 7.5 unique examples per pattern (for a total of 81 patterns, as we will present in Subsection 6.8.3).

Most interestingly, is that this amount reflects (expressively, to our understanding) the flow of *discovery* that we felt while experimenting with the games. Namely, included in these examples are those corresponding to the moments – which kept happening during the experimentations – when we first became aware of a certain pattern. Once we perceived that the level of productivity was starting to soften, i.e., when we started to realize that we were less frequently identifying new patterns and new distinct exemplary

explorations of already identified patterns, we opted to suspend the harvesting process and refocused our attention on the other ongoing research aspects, including the synthesis and experimentation with the pattern language. In this sense, the methodology served the research purposes, providing us with a potential body of knowledge, materialized in a collection of patterns and the specification of their relationships, and backed up by examples of specific explorations.

Additionally, the whole process from the identification to the trimming of the video examples provided us with fertile moments of analysis and *reflection*. In fact, that started even before, during the experimentation. We frequently found pertinent reiterating a certain gameplay situation in order to completely understand its sound exploration, but also to capture in the recordings a suitable or exemplar instance.

The context in which the subsequent activity of trimming occurred was distinct enough to pose new challenges and to allow new perspectives. Choosing an interesting instance to illustrate a certain exploration from a larger recorded gameplay piece, implied dealing with aspects such as possible ambiguities or any element that, being included, might reduce communicative effectiveness or mislead users from the expected pattern interpretation. The level of thoughtfulness required for this task augmented the “intimacy” with the solutions, which much contributed to the maturation of our understanding of the patterns and their relationships. Also, not rarely, this task led us to important realizations, including the identification of new patterns. For instance, we first realized the pattern *Time Twist*, while working on other pattern’s video examples – not during the respective gameplay sessions – though, retrospectively, we were able to recognize that we had in fact experienced several examples of such exploration during our gameplay sessions.

Another relevant characteristic, stemming from the abundance of examples exhibiting distinctive specific explorations of each pattern, is that it can be interpreted as a strong argument favouring the potential of patterns to open the space of possibilities in design time, instead of, for instance, possibly biasing designers through narrow solutions. We found that through the selected examples we can actually present *diversity*, and it was exactly the perception of such diversity that drove us during the phase of harvesting.

A larger number of examples per pattern may also increase the chances that users find representations of games they already know from their own gaming experience. Though

we did not study the possible influence of familiarity with a game in the perception and understanding of an example, it is worth considering this aspect in further research.

Aftermaths, the total amount of examples – persistently, teleologically, yet *naturally* harvested – and, specifically, the amount of examples per pattern, provided us with additional confidence to argue the meaningfulness of the proposed patterns, and move the research to the next stage. Also, we considered relevant having a satisfactory representation of the explorations presented by the design patterns, capable of nurturing the interest of the community on the overall proposal, and working as convincing debut for an open discussion.

6.7 The pattern collection is *not* a checklist

Before we start *listing* the proposed patterns, it is of paramount importance that we make clear that these patterns are meant to provide the designers with the opportunity to consider *possible* explorations that may (or may not) help them in achieving their design purposes. By no means do we intend to suggest that a good sound design would depend on the exploration of “many” patterns, less to say all of them. The *quantity* of explored patterns is not an indicator of the *quality* of sound design. The quality of sound design depends on the merit of each of the designed explorations in context, not on their number. Actually, not even the *extent* of sound exploration depends on the number of adopted patterns and, more relevantly, excess of explorations can be as damaging as the lack of them.

Moreover, a judicious selection of the design patterns to explore, according to the specificities of an application context, is not even an appeal that is particular of our project. It is a feature of the formalism of pattern languages itself (e.g., Tidwell, 2011, p. xxi).

In the same vein, a large number of available patterns must only be understood as a large space of opportunities. Again, the idea inherent to the patterns is to reveal possibilities for the practitioners to consider in each particular project, not to induce those practitioners to check that the patterns are used.

In fact, we don't even advocate that, *in practice*, a larger number of available patterns – i.e., supposedly, of more opportunities – is better than a smaller number. For instance, depending on how the patterns are used at design time, the number of available patterns

may correlate to the level of attention paid to each particular pattern (we will revisit this matter in Section 9.5).

6.8 Evolution of the proposed Pattern Language

In the following subsections we present the evolution of the Pattern Language since the presentation of the Seminal Collection until version 2.0. We opted to place the complete referential information in appendix (see Appendix C, Appendix D, and Appendix F). Here we present simplified listings only, so that we can focus on the rationale underlying each version.

6.8.1 A Seminal Collection of patterns

We call “Seminal Collection” to the first set of design patterns that we synthesized with the goal of illustrating the potential of the idea of a pattern language as a pertinent design guidance for sound design in games (Alves & Roque, 2010c). The motivation was to get the ball rolling, through the demonstration of exemplificative design patterns that could inspire the evolution of the endeavour.

We prefer to refer to this group of patterns as a “collection”, instead of a “language” as in later versions, because the set was not yet complete enough to support a design *discourse* based on the articulation of the names of the patterns as a vocabulary and on the respective relationships as the grammar. That is, it was not yet possible to “talk sound design” with those few, tentatively formulated, patterns.

The Seminal Collection consisted of seven patterns, as shown in Table 6.11. In the columns to the right, in that table, we summarize the evolution of those patterns since then. To shorten: all but one (*Horse Hooves*) are still part of version 2.0; two of them had their name slightly changed and one other yielded his name to another pattern that was introduced in a later version; all patterns were eventually updated in accordance to the evolution of the pattern template (recall Table 6.1, in Subsection 6.4.2).

The criterion for choosing the particular patterns to appear in the Seminal Collection consisted of introducing key aspects of the construction of an eventual Pattern Language for holistic sound design in games. So, the collection is assumedly a sampling, meant to emphasize specific facets of the application of the formalism.

Table 6.11. Summary of the evolution of patterns contained in the Seminal Collection

Patterns in the Seminal Collection	Main revisions, since then	
<i>Sound Layers and Semantics</i>	Renamed to just <i>Sound Layers</i> , in version 2.0	Currently in version 2.0 Adapted to new pattern format, since version 1.0 (see Subsection 6.4.2)
<i>Sound Decoys</i>		
<i>Imminent Death</i>		
<i>Entrainment</i>	Renamed to <i>R-A-E-D Iterations</i> , since version 1.0. The name “ <i>Entrainment</i> ” migrated to another pattern (related but more fundamental, introduced in version 1.0)	
<i>Requisite Variety</i>	Renamed to just <i>Variety</i> , in version 2.0	
<i>Foley</i>		
<i>Horse Hooves</i>	Deprecated in version 1.0 (see rationale)	

Experimenting with levels of abstraction

To start with, we aimed to highlight the versatility of the methodology in terms of abstraction level. Pattern authors can opt for being more conceptual or closer to implementation, or they can mix abstraction levels. The pattern *Sound Layers and Semantics* defines a high-level categorization of sounds in order to ease managing the complexity and dimension of a project (this is the same concept we introduced in Subsection 4.2.1). To illustrate the other extreme, in terms of abstraction level, we presented a very practical pattern, *Horse Hooves*, which describes an emblematic solution for recording a sound resembling hoofbeats using two halves of a coconut (which is a form of *Foley*). This is a seamless illustration of a pattern that holds the wisdom of all those who, along time, found and have perfected a solution (Viers, 2008) for a recurrent problem, and that has gradually disseminated to the broad community.

Yet, later we came to the understanding that the pattern *Horse Hooves* was beyond the threshold of design guidance that we consider interesting to approach in the scope of this thesis. This pattern contains *implementation* information, mainly; i.e., its contents are not central to design. Furthermore, the body of knowledge in foley production and recording is fairly abundant, through the Web and in books (e.g. Ament, 2009; Viers, 2008), which adds to the argumentation that it is not interesting to encompass the translation of such knowledge in the scope of this research question.

The realization of the importance of focusing strictly on design was very important in guiding our forthcoming identification of patterns. As such, though the pattern was deprecated it served us well.

Testing the expression of relationships

Another aspect that we tested in the Seminal Collection was the kind and the expression of the relationships among patterns. We observed, for instance, that good sense ought to be used when reporting those relationships. Otherwise, being strictly rigorous and coherent with the holistic perspective we embrace, *all* patterns would potentially relate to *all* others. Additionally, we realized that, for the specification of the relationships to be useful, it should be circumscribed to categories such as those that we exposed in Subsection 6.4.2 (and particularly in Table 6.3).

Exemplifying holistic sound design

Yet another aspect being demonstrated was the holistic approach to sound design, as particularly evidenced by *Sound Decoys* and *Imminent Death*, which refers to sound explorations that are not isolated from other aspects of game design. The pattern *Sound Decoys* expresses a contribution of sound design to the definition of a gameplay that features fooling opponents through the use of decoys. The pattern *Imminent Death* deals with the contribution of sound design in avoiding the very specific situation of players letting the playing character (PC) die just because they become unaware of the visual indicator of health status, especially in the heat of the action. Trying to cleanse these patterns for strictly sonic aspects is not only pointless but would compromise the need for a holistic appreciation for sound design.

6.8.2 Version 1.0 of the Pattern Language

The demonstration of feasibility provided by the Seminal Collection, together with the thoughts resultant from the analysis described in the former subsection, encouraged us to work on the growth and refinement of the collection. The developments eventually gave way to version 1.0 of the Pattern Language.

Version 1.0 consisted of 68 patterns, 6 of them upgraded from the Seminal Collection. The (alphabetic) list is: *Achievement*, *Acoustic Ecology*, *Address Others*, *Ambiance*, *Anticipation*, *Audio Logs*, *Awareness*, *Beacon Locator*, *Breath*, *Character Soundprint*, *Chitchat*, *Consequent Sound*, *Contextual Music*, *Cut-Scenes*, *Death*, *Decay*, *Dialogue*,

Diegetic Music, Dubbing, Eavesdropping, Echolocation, Emotional Script, Engagement, Entrainment, Failure, Foley, Foley Music, Footsteps, Gameplay, Genre, Grunts, Heartbeat, Hurry Up!, Identification, Imminent Death, In-game Feedback, Levelled Performance, Make Sound not War, Menus, Music, Musical Outcome, Narrative, No Can Do, Ouch!, Play the Beat, R-A-E-D Iterations, Relaxation, Requisite Variety, Say that Again, Seeking for PC, Shout and Yell, Signature, Sing to Act, Sonic Weapon, Sound Decoys, Sound Design in Games, Sound Effects, Sound Input, Sound Layers and Semantics, Sound Places, Sound Suppressing, Sound Visualization, Stealth, Subtitles and Captions, Title Screens, Trance, Unaware NPC, Voice Acting, Window of Opportunity.

These patterns were formatted according to the template presented in Subsection 6.4.2, which was kept unchanged in version 2.0. Version 1.0 was the one with which we did the experiments reported in Chapter 8 and Chapter 9. The revisions and other findings provided by the analysis of such experiments were integrated in version 2.0, presented in next section. In order to avoid repetition, and considering that such revisions are detailed in Appendix F, we opt to present the patterns already in their version 2.0. That version is briefly described in next subsection and available in Appendix D.

6.8.3 Version 2.0 of the Pattern Language

Version 2.0 consists of 81 patterns, i.e., 13 new patterns were added to version 1.0. Table 6.12 shows a list with their names along with the respective synopses and some observations, namely related to versioning.

We consider that the complete presentation of each pattern is far too extensive to insert in the course of the main text of this document. Hence, we will restrict to this summary, which should also serve as quick reference, and kindly refer the reader to Appendix D for full details.

Table 6.12. List of patterns as of version 2.0, showing names, synopses and observations

Name	Synopsis	Observations
<i>Achievement</i>	Signalling something positive	Introduced in v1.0
<i>Acoustic Ecology</i>	Designing sound in a holistic way, as influenced by the discipline of Acoustic Ecology	Introduced in v1.0
<i>Address Others</i>	Enabling the PC to use sound to address NPCs	Introduced in v1.0
<i>Aesthetics</i>	Defining artistic characteristics common to all sounds	Introduced in v2.0
<i>Affected Hearing</i>	Simulating hearing impairment	Introduced in v2.0

<i>Ambiance</i>	Sounds of the environment	Introduced in v1.0
<i>Anticipation</i>	A phase of gameplay anticipating an engagement	Introduced in v1.0
<i>Awareness</i>	Sound signalling some relevant aspect of gameplay	Introduced in v1.0
<i>Beacon Locator</i>	Items that emit sound to ease their location	Introduced in v1.0
<i>Breath</i>	Perceptible sound of breathing	Introduced in v1.0
<i>Character Soundprint</i>	The set of sounds of a PC or NPC	Introduced in v1.0
<i>Chitchat</i>	Dialogue that is not central to the course of action	Introduced in v1.0
<i>Consequent Sound</i>	Designing the game world so that is sensitive to sound	Introduced in v1.0
<i>Contextual Music</i>	Music specific to particular contexts or levels	Introduced in v1.0
<i>Cutsscenes</i> (was <i>Cut-scenes</i>)	Sound of cinematic pieces	Renamed in v2.0 Introduced in v1.0
<i>Death</i>	Portraying death	Introduced in v1.0
<i>Decay</i>	A phase of gameplay of reestablishment after an engagement	Introduced in v1.0
<i>Dialogue</i>	All kinds of conversation	Introduced in v1.0
<i>Diegetic Music</i>	Music happening in the game world	Introduced in v1.0
<i>Directionality</i>	Exploring the identification of the direction of a sound source	Introduced in v2.0
<i>Dubbing</i>	Replacing original voices, to adapt to other language	Introduced in v1.0
<i>Eavesdropping</i>	Adopting behaviours with intention of gaining knowledge by listening to others' conversations	Introduced in v1.0
<i>Echolocation</i>	Using sound to perceive the environment	Introduced in v1.0
<i>Emotional Script</i>	Sound designed to elicit emotions along the experience	Introduced in v1.0
<i>Engagement</i>	A phase of gameplay of explicit conflict	Introduced in v1.0
<i>Entrainment</i>	Changing the player's internal rhythms through acoustic stimulation, eventually inducing emotions and behaviour	Introduced in v1.0
<i>Failure</i>	Signalling something negative	Introduced in v1.0
<i>Foley Music</i>	Music exploring sounds of objects or actions	Introduced in v1.0
<i>Foley</i>	Sounds of ongoing actions	Introduced in the Seminal Collection
<i>Footsteps</i>	The sound of footsteps (extensible to any kind of being)	Introduced in v1.0
<i>Gameplay</i>	Sound relevant for the game mechanics	Aggregator Introduced in v1.0
<i>Genre</i>	Characteristics of gameplay	Aggregator Introduced in v1.0

<i>Grunts</i>	Utterances associated to physical actions or conditions	Introduced in v1.0
<i>Heartbeat</i>	Perceptible sound of heartbeating	Introduced in v1.0
<i>Helper Voice</i>	Conveying guidance through the voice of disembodied or remote entities	Introduced in v2.0
<i>Hurry Up!</i>	Contributing for the sense of urge in completing something	Introduced in v1.0
<i>Identification</i>	Promoting the recognition of entities through their distinctive soundprints	Introduced in v1.0
<i>Imminent Death</i>	Urging a change of behaviour to avoid death	Introduced in the Seminal Collection
<i>In-game Feedback</i>	Providing indicators on the player's acoustic performance	Introduced in v1.0
<i>Levelled Performance</i>	The progressive sophistication of sound related performative actions	Introduced in v1.0
<i>Make Sound not War</i>	Exploring sound to create alternatives to conflict	Introduced in v1.0
<i>Menus</i>	Sounds in game menus	Introduced in v1.0
<i>Music</i>	All kinds of music heard during the game	Introduced in v1.0
<i>Musical Outcome</i>	Music generated as a by-product of in-game actions	Introduced in v1.0
<i>Narrative</i>	The contributions of sound to unfold the game's story	Introduced in v1.0
<i>Narrator</i>	Resorting to an actual narrator to convey the narrative	Introduced in v2.0
<i>No Can Do</i>	Signalling something impossible	Introduced in v1.0
<i>Noise</i>	The purposeful use of noise	Introduced in v2.0
<i>Ouch!</i>	Signalling a painful or damaging interaction	Introduced in v1.0
<i>Pitch Gameplay</i>	Exploring the tonal accuracy of the player's voiced input	Introduced in v2.0
<i>R-A-E-D Iterations</i> (was <i>Entrainment</i> , in the Seminal Collection)	Iterations of the sequence: Relaxation → Anticipation → Engagement → Decay	Renamed in v1.0 Introduced in the Seminal Collection
<i>Radio</i>	Actual radio receivers with relevant emission	Introduced in v2.0
<i>Recordings</i> (was <i>Audio Logs</i>)	Recorded dialogue, frequently scattered through the game world	Renamed in v2.0 Introduced in v1.0
<i>Relaxation</i>	A phase of gameplay promoting a restful state of mind	Introduced in v1.0
<i>Revelation</i>	Expressing an encounter with something special	Introduced in v2.0
<i>Rhythm Gameplay</i> (was <i>Play the Beat</i>)	Acting in sync with a rhythm	Renamed in v2.0 Introduced in v1.0
<i>Say that Again</i>	Allowing the PC/player to request to hear again	Introduced in v1.0
<i>Seeking for PC</i>	NPC's manifestations of active chasing of the PC	Introduced in v1.0

<i>Shout and Yell</i>	Loud manifestations of hostility	Introduced in v1.0
<i>Signature</i>	Creating a distinctive and memorable association with a sound	Introduced in v1.0
<i>Silence</i>	Inducing the perception of the absence of sound	Introduced in v2.0
<i>Sing to Act</i>	Performing songs to achieve a purpose	Introduced in v1.0
<i>Sonic Weapon</i>	Using sound to inflict damage	Introduced in v1.0
<i>Sound Decoys</i>	Using sound to fool the opponents	Introduced in the Seminal Collection
<i>Sound Effects</i>	Sounds that make abstract or imaginary objects concrete	Introduced in v1.0
<i>Sound Input</i>	The way sound enters the game world	Introduced in v1.0
<i>Sound Layers</i> (was <i>Sound Layers and Semantics</i>)	Grouping design decisions according to their semantics	Aggregator Renamed in v2.0 Introduced in the Seminal Collection
<i>Sound Places</i>	Components of a product where sound may appear	Aggregator Introduced in v1.0
<i>Sound Suppressing</i>	Enabling the reduction of PC generated sounds	Introduced in v1.0
<i>Sound Visualization</i>	Graphical perception of the occurrence of sound	Introduced in v1.0
<i>Stealth</i>	Low profile behaviours that include adopting a small soundprint	Introduced in v1.0
<i>Subtitles and Captions</i>	Text that represents occurring sound	Introduced in v1.0
<i>Suspicious NPC</i>	NPC's behaviours evidencing suspicion for the PC's presence	Introduced in v2.0
<i>Thoughts</i>	Revealing what a character is thinking of	Introduced in v2.0
<i>Time Twist</i>	Using sound to enhance the perception of time manipulations	Introduced in v2.0
<i>Title Screens</i>	Sound during the presentation of a game product	Introduced in v1.0
<i>Trance</i>	Sound contributing to experiencing flow or deep immersion	Introduced in v1.0
<i>Unaware NPC</i>	NPC's behaviours evidencing unawareness of PC's presence NPC's behaviours evidencing that the PC remains unnoticed	Introduced in v1.0
<i>Variety</i> (was <i>Requisite Variety</i>)	Triggering alternate sounds not to compromise the experience	Renamed in v2.0 Introduced in the Seminal Collection
<i>Voice Acting</i>	Performing and recording voices for characters and/or narrators	Introduced in v1.0
<i>Window of Opportunity</i>	Enhancing the perception of a temporary possibility or favourable state	Introduced in v1.0

6.9 On the continuation...

In this chapter we presented the rationale for, and construction of, a Pattern Language for Sound Design in Games. This Pattern Language was developed in the scope of a second iteration in our application of the DSR methodology (see 3.3 and particularly Figure 3.1).

As part of an evaluation phase in the DSR cycle, we found the need to develop a way to ease auditing the use of the Pattern Language in a game design scenario, for research purposes. In the next chapter we describe an instrument originally developed with that intent, which eventually evolved in a most gratifying way, beyond its initial interest to research experiments.

Chapter 7

A Deck of Cards for Sound Design in Games

During the process of refining and growing a Pattern Language for Sound Design in Games, we found the interest in conceiving a representation of the patterns, alternative to the customary referential support in text forms, suitable for expediting and sustaining the interface between the practitioners and the patterns during an actual design exercise. The preliminary purpose of such representation was to allow *auditing* game design exercises influenced by the Pattern Language, aiming at the detection of hindrances and opportunities to evolve the language, and the evaluation of its usefulness for the practice of sound design in games.

A deck of cards assisting research

We conjectured that a *deck of physical cards* could serve both the research intent and the practice of design (Alves & Roque, 2011c, 2012a). Practitioners might appreciate a presentation of potential sound explorations in a format that is literally handy, and researchers, willing to test and evolve the proposed patterns, might explore the usage of cards as part of a setting designed to enhance auditability of the design phenomena.

The purpose expanded towards a design tool

While developing this Deck, we started to realize its potential beyond the initial phases of development of the Pattern Language and the formerly envisaged research goals. Namely, we found that the way the Deck was being implemented opened up the opportunity for it to become a consistent means to communicate the body of knowledge, and that its support to the setting prepared for those initial phases (to be detailed in Chapter 9) constitutes a possible approach to the practice of sound design. So, eventually, the interest in the Deck was assumedly extended to also encompass those, more general, purposes: dissemination and end-user design tool.

In this chapter we present such Deck of Cards. We start by referring to other authors' card-base systems that have been used with design purposes, including in game design and design for playfulness. We then present the main features and rationale for our proposal for sound design in games.

7.1 Card-based systems for design

Physical cards have some advantages when compared to a software tool. Although a software tool may be more flexible, particularly in terms of content, manipulating physical cards promote more immediate social interaction among participants. Technical apparatus including large touch screens could also support such social dimension through shared manipulation of virtual representations, but they are not yet easily available to the target of our contribution – indie game developers. Card manipulation is also more prone to auditing the design events, which is very helpful in terms of research. The associated voiced discussion, naturally emerging from the social interaction, is a rich source of data.

The transposition of a body of knowledge into cards is an opportunity to compartmentalize and digest information into meaningful bits of information that make sense by themselves. Although such compartmentalization may also be well achieved and communicated in book format (e.g., Martin, B. & Hanington, 2012; Lidwell, Holden, & Butler, 2010), there are potentialities inherent to the minimalist representation and to the possibility of reordering and isolating fragments as intended.

7.1.1 Examples of existing card-based systems

There are several examples of card-based systems developed with design purposes, exploring a variety of approaches. In this subsection we present a brief overview based on noticeable examples, so that we can better contextualize our proposal in further sections.

We start by referring to ideation decks that, despite being general-purpose or focusing on application fields that are not directly related to this thesis, constitute interesting references. Moreover, designers may still find this broad or foreign guidance relevant, even if more focused counterparts exist.

General-purpose ideation decks

- *IDEO Method Cards* (IDEO, 2003; Moggridge, 2007, p. 669) are meant to serve as “both information and inspiration ... to support planning and execution of design programs” (IDEO, 2012, para. 2), by representing methods for specific design initiatives and explaining “how and when the methods are best used, and to demonstrate how they have been applied to real design projects” (para. 1);

- *Thinkpak* is “a brainstorming card deck” (Michalko, 2006, subtitle) to support the creation of new ideas. It builds upon the SCAMPER brainstorming technique, which consists of a set of directed questions – the acronym stands for “Substitute”, “Combine”, “Adapt”, “Modify, Magnify, Minify”, “Put to other uses”, “Eliminate”, “Reverse, Rearrange” (Eberle, 1996, pp. i, 6). Additionally, *Thinkpak* provides cards dedicated to the evaluation of the generated ideas.
- *Creative Whack Pack* is a creativity tool with cards featuring different strategies, including finding new information, generating ideas, decision making, and acting (Oech, 1993). The *Innovative Whack Pack* works as an extension to the former pack, introducing epigrams of the ancient Greek philosopher Heraclitus (Oech, 2005).
- *IDECARDS* (2011) is “a set of playing cards designed to enhance creative thinking and design ... to come up with new ideas or change perspectives” that “fits to any kind of ideating” (para. 1-2) including products, services, and events (Kultima, 2011, p. 221).

Ideation decks focusing on other application fields

- *Group Works* cards are based on a pattern language for supporting group processes, such as meetings and other gatherings (Group Pattern Language Project, n.d.), namely for “deliberative/dialogic group processes aimed at goals such as decision-making, input, feedback, visioning, and conflict resolution” (Bressen, 2010, para. 2).
- *Design with Intent: 101 Patterns for Influencing Behaviour Through Design* (Lockton, Harrison, & Stanton, 2010) is meant “for specific application to environmental problems, where influencing more sustainable user interaction behaviour can have a significant effect on resource use and waste” (Lockton, 2012, para. 7).
- *Envisioning Cards* address the “challenge of environmental sustainability” which requires “engaging in problem solving for designs that can influence societies for five-, 10-, or 20-year periods” (Nathan, Friedman, & Hendry, 2009, p. 6).

Before moving to the presentation of card-systems intended for application fields closer to this thesis, it is worth noting that the above examples do not constitute a comprehensive list. Also, we are assumedly not entering into the review of the class of explorations that entails the *creation* of the deck as part of the research and design process, as in the cases of the *Ideation Decks* (Golembewski & Selby, 2010), the *Inspiration Deck Workshops* (Biskjaer, Dalsgaard, & Halskov, 2010, p. 14; Halskov &

Dalsgaard, 2006), the *Video Card Game* (Buur & Soendergaard, 2000), and the cases involving simpler conceptions of the cards as in the *Card Sorting* research method (Martin, B. & Hanington, 2012).

The following are noticeable examples with stronger affinity to the subject of our proposal. They focus on supporting ideation when designing games and designing for playfulness.

Decks in fields closer to this thesis

- *AGD Lenses – The Art of Game Design: A deck of lenses* (Schell, 2008b) is a companion deck to Schell's (2008a) book on game design lenses. Each card represents a lens that is intended to inspire the creative process by presenting a set of open questions for designers to ask themselves.
- *PLEX Cards – Playful Experiences Cards* are “a source of inspiration when designing for playfulness” (Lucero & Arrasvuori, 2010, p. 28). They communicate categories of such playfulness, which may be explored by means of two techniques for ideation that are presented as part of the Deck.
- The GameSpace project proposes three card-based games, for game designers (Kultima, Niemelä, Paavilainen, & Saarenpää, 2008): *VNA – Verbs, Nouns and Adjectives*, “to create shared high level game ideas with minimal effort, aiming at quantity and speed” (p. 13); *GameSeekers*, meant to be used as a table game during which ideas are generated by association to the cards being played; and, *GameBoard*, a competitive idea generation game for two to five players (p. 18).
- *Gamegame* is a card game where the players compete in designing games (A. Järvinen, 2005, 2008, p. 96). The author emphasizes that, in addition to its interest as a design tool, *Gamegame* is useful for game research and interpretation, by dissecting games into elemental pieces.

7.1.2 Features of existing card-based systems

It is interesting to analyze some dimensions of the diversity among the decks presented in the former subsection, beyond the differences in scope and target domain that already became exposed. The identification of the parameters of such diversity is also useful to eventually assist the characterizing of our proposal (as in Section 7.4).

Existing card systems vary, to start with, in terms of the kind of the contents and formalism adopted for the rationale they contain. There are cases of lenses (e.g., *AGD Deck*), design patterns (e.g., *Group Works Deck*), methods (e.g., *IDEO Method Cards*), thinking strategies and epigrams (*Whack Pack*), categories of a framework (e.g., *PLEX Cards*), concepts (e.g. *Envisioning Cards*), etc. In some cases, more than one formalism is represented and overlaid (e.g., in *Design with Intent*, with design patterns grouped by lenses).

Some decks are meant to be explored freely, e.g., “sorted, browsed, searched, spread out, pinned up” (IDEO, 2012, para. 2), skimmed or selected for further consideration (*Envisioning Cards*), and kept close by for reference (e.g., *Design with Intent*). Yet, others imply a process for their usage. If so, the process may be explained through some element accompanying the deck (e.g., *Group Works* and *Thinkpak* have an explanatory booklet), or it can be exposed in special cards (e.g., card number 2 in *Thinkpak*; two special cards in *PLEX Cards*, explaining the envisaged techniques: *PLEX Brainstorming* and *PLEX Scenario*), or it may be also embedded in the cards themselves (e.g., *IDECARDS* and *VNA*).

Somewhat in the same vein, whereas some of these card systems favour the seeding, or even the feeding, of ideas into the creative process, other systems are more prone to guide the *process* of ideation, instead. The former provide contents, with disparate levels of specificity, to be transformed and built into the solution (e.g., *Envisioning Cards*, *Design with Intent*, *Group Works*). The latter provide directions on how to develop the ideas that users bring to and generate during the process (e.g., *AGD Lens*, *IDECARDS*, *Thinkpak*, *IDEO Method Cards*, *Whack Pack*). General-purpose ideation systems tend to fall in this latter category.

Cards often explore or even rely on imagery, as opposed to strictly presenting rationale in text format. It has been argued that the imagery contributes to make rationale more “designer digestible” and that “the images serve to not only inspire new ideas both literally and through reinterpretation, but also serve as references to concepts in the rationale” (Wahid, Branham, McCrickard, & Harrison, 2010, p. 82-83).

As the above quotation also unveils, imagery semantics varies. The two dominant explorations regarding the kind of images included in the cards are *evocation* (e.g., in *PLEX Cards*) and *exemplification* (e.g., in *Design with intent*).

The former exploration – evocation – consists of exhibiting depictions that are not tied to the particular domain of application. Instead, the concept is metaphorically characterized in a potentially familiar context, making it easier to understand and to remember. Also, leading the users to think about aspects of the application domain from outside that context is possibly more insightful and provides a wider framing for the concept at stake.

The latter exploration – exemplification – consists of presenting instances of the actual application of the concept in the specific domain, playing a documentary role. This approach is more direct than the former, in the sense that it does not require a translation and leaves less space for ambiguity.

Colour

Another customary aspect of the graphical presence of cards is the use of colour. Besides the aesthetic contribution, colour is sometimes used for coding categories, either alone (e.g. *VNA*) or in combination with other graphical elements (e.g. *Group Works*, *Design with Intent*, and many others).

7.2 The design of a Deck of Cards for Sound Design in Games

Starting from this section, we will present a proposal for a Deck of Cards for Sound Design in Games. The Deck serves as a companion tool to the Pattern Language that we are also proposing (Chapter 6). It is designed to ease the communication of the Pattern Language and to support design practice. Hence, this Deck is also a contribution to the empowerment of the community of practice, and specifically of the non-expert practitioners.

The Deck also plays a role in research, particularly when integrated in a setting that is favourable to audit the design phenomena, as exemplified in Chapter 9. Still, it is important to notice that the Deck itself does not represent our major scientific focus. Our focus is the guidance, in this case the Pattern Language, and its contributions to design phenomena, specifically in the case of sound design in games. The Deck of Cards

is *one* possible instrument to communicate and play with that language, which, in turn, is relevant to the language's own verification and maturation.

The general appearance of the Deck of Cards, which is similar for versions 1.0 and 2.0, is as presented in Figure 7.1. Each card of the Deck represents the homonymous pattern that we distilled in the Pattern Language.



Figure 7.1. Deck of Cards for Sound Design in Games

No contradiction in being graphical

We were uneasy, at first, with the idea of having graphical cards to refer to *sound*. We sensed a contradiction that, in fact, proved to be only apparent – the cards are just tokens for the message, not the message itself. They are *one* possible implementation that is convenient for the envisaged purposes. Besides, their design includes a link that enables the access to related online resources (Chapter 10).

7.3 Card design rationale

The cards are 86x112mm and double faced, as exemplified in Figure 7.2. Their content maps the corresponding patterns' fields but they were designed so that users are not requested to be familiar with the formalism of Pattern Languages.

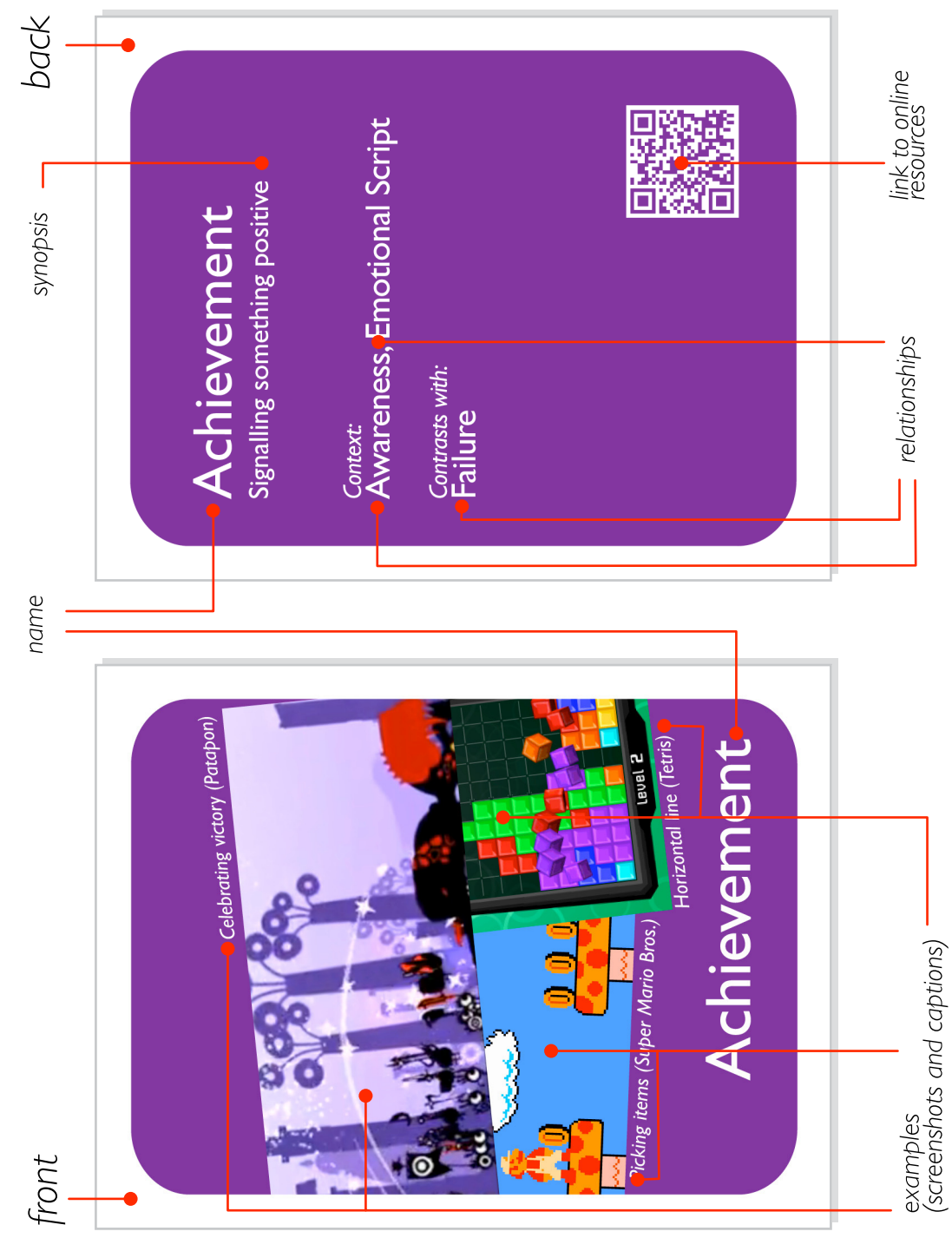


Figure 7.2. Card Layout (full size, exemplified with "Achievement" card)

Front and back faces serve different purposes. The front follows a minimal approach aiming to ease memorization and further identification. The back contains support information, which is by design a partial view of the full resources that may be made available for the corresponding pattern.

Front face

The front face contains the pattern's name and examples in the form of captioned screenshots. The short length of the patterns' names, which we discussed before (Subsection 6.4.2), was important also in this implementation. It allowed us to work on a reasonable compromise in terms of achieving emphasis without requesting too much relative space.

Screenshot selection and composition

Regarding the screenshots, they represent a selection of the examples we could find for the respective patterns (see also Subsection 6.4.2). These screenshots are often cropped to emphasize the relevant aspects. In order to further aid the communication of the idea at stake, each of the screenshots is complemented with a short caption. Captions include the name of the game to facilitate identification.

The selection of the examples to include in the cards was one major challenge. In addition to the early rationale for finding and capturing the exemplary instances (Section 6.6), the specificities of this particular format required a multitude of decisions, both globally and for each particular card. For instance, the *quantity* of examples is a delicate matter. In Section 6.6, we referred to the relevance of the quantity of examples to support the recurrence of a pattern, in line with the theoretical underpinnings of the formalism. In the representation as cards, we considered that it should not be a dominant criterion. The rationale for the Deck of Cards is not the demonstration of plausibility of the patterns and of the methodological robustness of the research that led to its proposition. Instead, our design goal is to expeditiously illustrate the essential of the concepts with a minimal representation.

Constraints and screenshot arrangement

Being so, the challenges faced when selecting the examples to present in the cards are not exactly novel, considering what we discussed in Section 6.6, but they need to be reassessed for this representation. For instance, considering the reduced amount of

images that a card can hold, it becomes more critical to choose between the *best* examples we could find and the examples found in fairly *known* games. The former option is more interesting should the user know those games; the latter is meaningful for a larger number of users. We tended towards the latter because the aim of this initiative is to reach a broad audience. A related but distinct type of decision is to choose only *top best* instances, even if they are akin, or, instead, to prefer *distinct* specific explorations of the pattern, even if that implies also choosing not as excellent implementations. We tended towards the latter because we believe it is more likely to contribute to the expansion of the space of possibilities and to the generation of new ideas.

During the implementation of such criteria, we felt that not all cards would be conveniently represented by the same quantity of examples. Nonetheless, we decided for 3 images in most of the cards (68% in version 1.0; 74% in version 2.0). The minimum is 2 images (in both versions). The maximum in version 1.0 was 5 images; in version 2.0 it is 4 images. In total, the Deck contained 221 images in version 1.0 (for the 68 cards) and it contains 247 in version 2.0 (for the 77 cards).

The exhibition of the examples, being a matter of graphical composition, calls for arrangements that are highly dependent on the contents of the selected images. The adoption of a pretence ad hoc montage of the selected images is a solution that we found interesting to face such constraints, while allowing an interesting aesthetic exploration. Semantically, the scattering symbolized in that montage is also in line with the expected use of the Deck of Cards.

Back face

The back face contains a partial view of the pattern's information. The name of the card also appears in this face to allow identification whenever the card is reversed. The pattern synopsis is included, so that it briefly explains the pattern, in case the name leaves doubts. The categorized list of relationships with other patterns (Subsection 6.4.2) is also included. Optimally, these relationships put the card in context and evidence opportunities of exploration of related cards/patterns. Finally, the back face includes a QR-Code, allowing to access additional resources. In version 1.0 of the Deck, this access was still under development; in version 2.0 each card's QR-Code points to a respective webpage (to be presented in Chapter 10).

The choice of each card's background colour aims to reinforce memorability, through uniqueness, and hence to ease quick identification and location. All colours used are perceptibly distinct. There are no colour codes – e.g., use of colour is not theme based. In addition to uniqueness, we also tried to privilege coherence with prevailing colours in the screenshots. This approach to the use of colour is not scalable, but then the Deck is not meant to be scaled, at least within the current rationale – it may be augmented but not to the point that it stops being effective as a deck. We understand that colour selection itself may have interference in the perception of cards, and we intend to study that aspect later in this research.

A presentation card, with several roles

We also designed a special card, which is meant to function as a “presentation card” for the Deck (see Figure 7.3). It differs from the other cards in the sense that it does not represent specific sound design explorations. Instead, it supports the communication of the overall mindset to which every card is subject. For most effects, this card is not considered when stating the number of cards in the Deck – i.e., though we say that the Deck had 68 cards in version 1.0 or that it has 77 cards in version 2.0, it actually has this added card. The most obvious contribution of this card is to present the name of the Deck and make the version explicit. The back face contains a synopsis, slightly larger than those in the other cards, presenting the set and providing the community with a faithful description to associate to it. This synopsis emphasizes the holistic approach to sound design, namely the embedding of sound design in game design and the influence of Acoustic Ecology.

A code for the mind to read

The front face of the presentation card includes a bloated QR-Code that, paradoxically, plays a subtle role. Though this code can indeed be used to access the online support for the Deck, our design intent is that it works at the subconscious level, by *signalling* that the Deck is a simplified view of the body of knowledge it stands for.



Figure 7.3 “Presentation Card” (version 2.0), scaled 3:4. Left: front face; right: back face

A propos, it is important to notice that we do *not* argue that the use of the Deck requires access to the extended online information. In practice, the use of the Deck is meaningful even without such access. Cards are designed to provide enough information to support communication and design decisions, which is even more manifest as users develop familiarity with the extended contents.

7.4 Discussion on the features of the proposed Deck of Cards

In Subsection 7.1.2 we characterized existing card-based systems, which we had reviewed, in terms of a set of parameters that we identified. In the current section we do an analogous characterization regarding our own proposal.

To start with, regarding contents, each of the cards represents a design pattern from the Pattern Language. Though the contents of the Deck of Cards reflect the formalism of the body of knowledge being transposed, they do not reveal it in a way that would require users to be familiar with such theoretical support.

The cards draw heavily on imagery. We opted for exemplificative images rather than evocative or metaphoric images for a couple of reasons. First, our motivation for proposing a pattern language relates to the interest in complementing the higher level of guidance that we had proposed earlier in the form of Guidelines. We understand that images that contribute as specifically as possible to the guidance are more in line with that intent. Second, the presented images are naturally fit, since they come from actual

examples of application of the respective design pattern, which, in turn, is most coherent with the formalism. The fact that we present several images/examples for each pattern is important to show diversity of alternatives and hence foster creativity; but again, that is something that reflects the theory underlying pattern languages.

Somewhat in the same vein, the contents of the cards are prone to feed ideas to be considered during an ideation session, as opposed to evidencing a process for driving users through ideation. This is not to say that the Deck shall not be subject to a process but that, instead, such process is meant to be exterior to the cards (e.g., as suggested in Chapter 9). Conversely, the Deck is suitable for observation in contexts other than design sessions, e.g., for casual browsing, potentially contributing to growing awareness and familiarity with the inscribed explorations of sound.

Finally, as explained, colour is also thoughtfully explored, namely to convey each card a unique identity. The intent was to enhance memorability and card identification. We did not use any kind of colour-based categorization.

7.5 On the continuation...

In this chapter we presented a Deck of Cards that is meant to serve as a companion tool for a Pattern Language for Sound Design in Games. After a brief overview on noticeable examples of other existing decks supporting design including in the application fields of game design and playful experiences, we presented the rationale for our proposal in the specific field of this thesis.

Exercises in the following chapters

Next, we expose an inspection exercise that we conducted on the Deck in order to identify foremost issues and opportunities to enhance version 1.0. This was an exercise implying close observation of each of the cards in isolation, not yet involving actual usage in a design session. An exercise involving design will be the matter of the succeeding chapter (Chapter 9). The analysis of both the exercises informed revisions to the Deck that are integrated in version 2.0 (for the revisions' log see Appendix F).

Chapter 8

Enhancements based on an Inspection Exercise

We conducted a session (Alves & Roque, 2011c), using a heuristic approach and aiming at the inspection (Krug, 2006; Nielsen & Mack, 1994) of foremost hindrances that the Deck of Cards might pose to users in terms of perception and interpretation of its contents. Besides seeking for an informed basis to improve the Deck, we also sought to understand how other people would react to this instrument, at an emotional level. We collected feedback regarding effectiveness (e.g. recognition of a concept), contents (e.g. level of understanding of a field), format (e.g. perceptibility of the images), and adequacy (e.g. recognition of the pattern in the person's game experience).

This is one of the exercises that informed the revisions to version 1.0, which were integrated in version 2.0 (for the revisions' log see Appendix F). This inspection was not meant to provide any kind of statistical representativeness and no conclusions are projected beyond its scope and its immediate applicability in the identification and clearance of major difficulties.

While the evaluation of the cards did not occur in the kind of context of use they were ultimately designed for – performing sound design – we found this approach beneficial. We considered that the actions of perception and interpretation that we intended to observe take place even without an actual engagement in a sound design exercise.

The inspection session involved 5 participants. The participants' profile is male, 20 to 30 yrs., with a higher-education degree and an educated appreciation for videogame culture. The participants did not have prior contact with the Deck. Participants answered 6 questions, distributed in 4 rounds, as listed in Table 8.1.

Each participant received a deck and wrote the answers directly on the cards, as depicted in Figure 8.1, according to provided instructions. All questions applied to each of all cards. Answers were expressed in scales ranging from 0 to 10, and, in particular cases, cross marks (hereafter X marks) and balloons were used to mark hotspots. The session occurred without access to any kind of online resources. A final open interview complemented the questionnaire. Total session duration was 02h31.

Table 8.1. The list of questions in the inspection exercise

<p><i>1st round – Card face</i></p> <p>Q1.1 “I recognized the concept from the card name”</p> <p>Q1.2 “I found the examples evocative of the concept”</p> <p><i>2nd round – Synopsis</i></p> <p>Q2.1 “I understood the pattern synopsis”</p> <p>Q2.2 “The synopsis changed my understanding of the pattern”</p> <p><i>3rd round – Relationships</i></p> <p>Q3 “I understood the pattern relationships”</p> <p><i>4th round – Experience</i></p> <p>Q4 “I recognize this pattern in my gaming experience”</p>
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Despite the short number of questions, the questionnaire required a considerable amount of assessments from the participants, as expressed in Figure 8.2. Each particular card called for from 7 to 10 numerical evaluations, because Q1.2 applies to each example. Taking into account that the Deck had 68 cards (recall that this was version 1.0), and a total number of 221 examples, each participant was faced with 561 individual evaluations. Nevertheless the total number of non-answers was very low: only 59 (2.1%) out of a total of 2805 (5 participants).

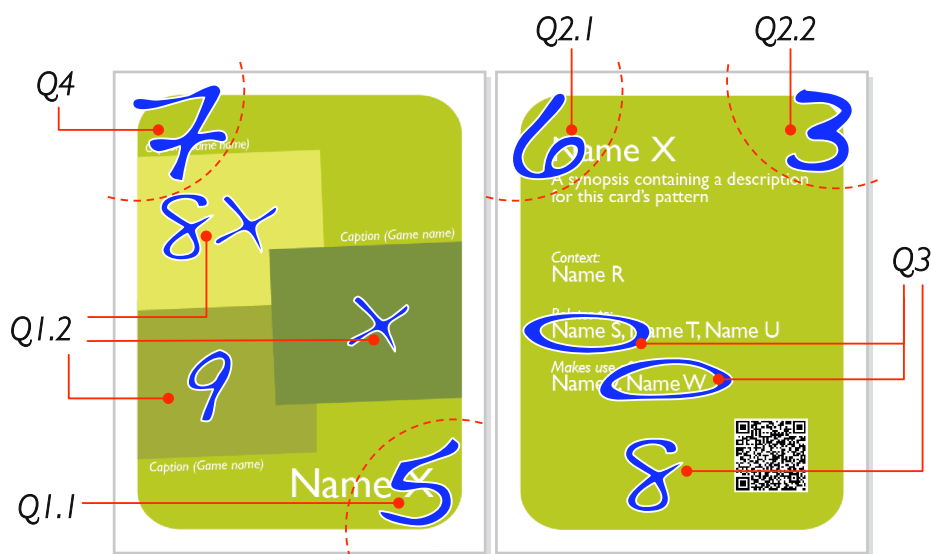


Figure 8.1. Answers to 6 questions, written directly on the cards along 4 rounds

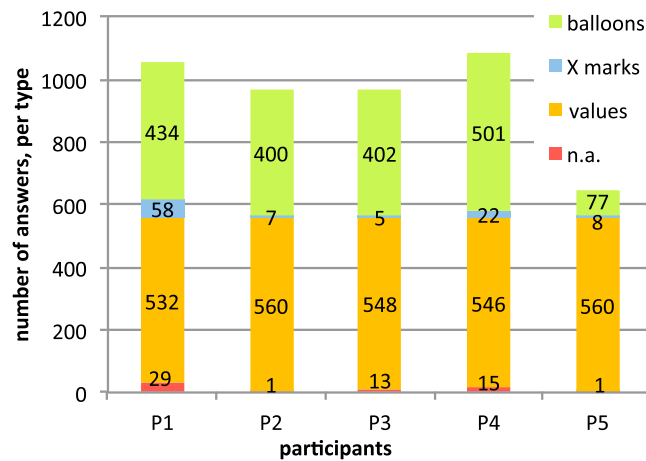


Figure 8.2. Number of answers per participant, according to type of answer

Adding to the numerical answers, questions Q1.1 and Q1.2 also allowed for X marks, to signal problematic circumstances, in the name of the card and in each of the screenshots, respectively. Considering the total 68 names and 221 screenshots, this possibility introduced 289 more decisions per participant. In conjunction, the participants inscribed 100 X marks, which represent 6.92% of the potential 1445. This topic will be developed further in the following sections.

Finally, question Q3 also asked for using balloons highlighting immediately recognized relationships. Considering the number of relationships inscribed in the cards, the balloons implied a minimum of 0 and a maximum of 3 to 20 decisions per card, 564 total for the Deck. The number of balloons that were actually drawn, per participant, can also be observed in Figure 8.2.

8.1 First round – Card face: Q1.1, Q1.2

The charts in Figure 8.3 and Figure 8.4 present the sorting of the cards according to the mean evaluation of Q1.1 and Q1.2, respectively. In the case of Q1.2, the mean refers not only to the set of participants but also to the set of examples, since in Q1.2 participants were asked to evaluate each example individually. Throughout the analysis, we found that sorting cards, as in these figures, was instrumental in perceiving the relative attention to dedicate to each card, and in observing a card's performance along different criteria. In that sense, the category axis is one of the major aspects of interest in these charts. In addition to the mean value of each card, the charts also depict the minimum, maximum and standard deviation of participants' evaluations. The overall mean and standard deviation, for the set of all cards regarding the respective question, are also presented.

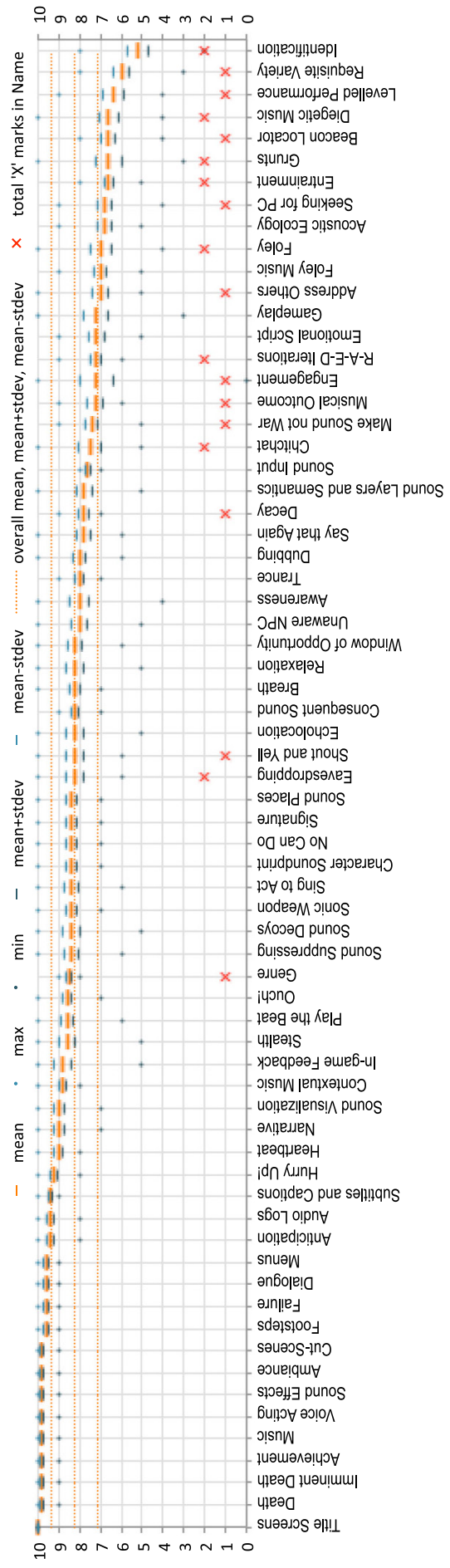


Figure 8.3. Cards sorted by the mean value in Q1.1 and depiction of total X marks on the card's name

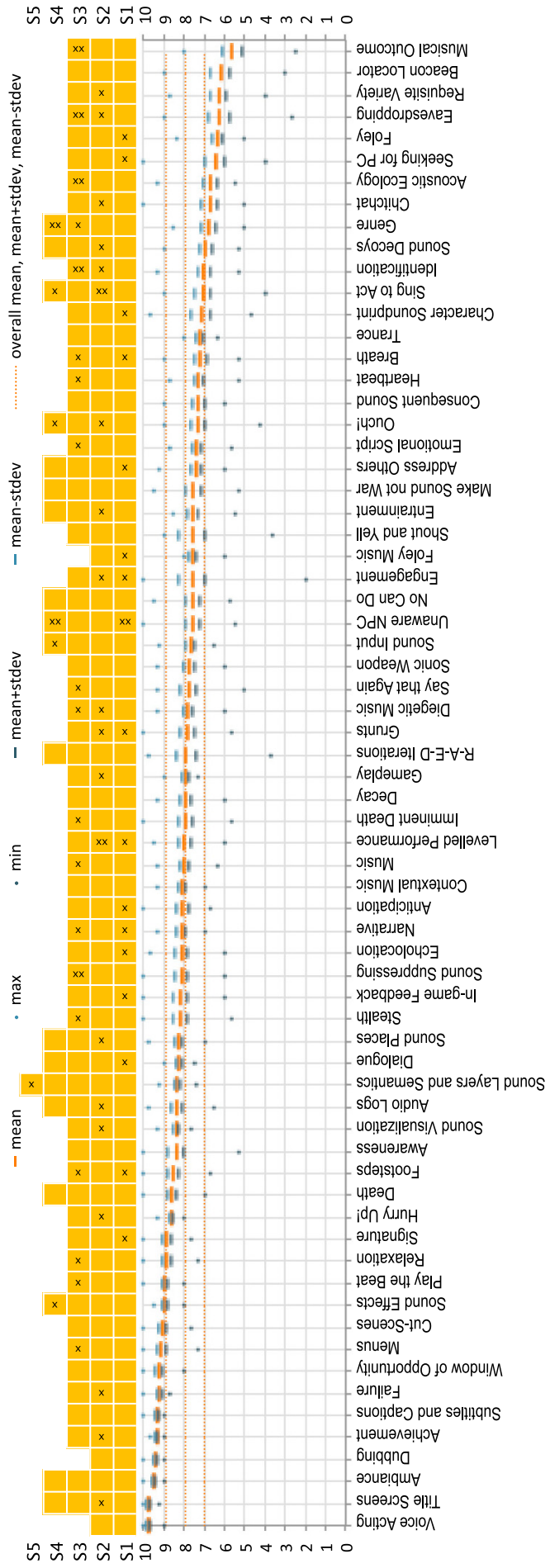


Figure 8.4. Cards sorted by the mean of the evaluations of their screenshots in Q1.2, and depiction of total X marks on each of the screenshots

The charts also present the total *X* marks that participants inscribed in the cards. In the case of Q1.1, participants were asked to mark problematic names. According to the provided instructions, a name should be considered problematic if, regardless of the participant eventually came to understand its meaning, at a certain moment this participant found that name misleading or otherwise hard to decode. The number of participants who marked a name as being problematic can be read in the vertical axis, in Figure 8.3. In order to easily refer to these *X* marks, which are complementary answers to Q1.1, we hereafter refer to them as *Q1.1.x*. In the case of Q1.2, participants were asked to mark screenshots whose image they could not or had a hard time perceiving, from a graphical point of view. In Figure 8.4, we represent the screenshots as stacked orange cells and we populate them with the participants' *X* marks, because it is most useful to relate the marks with the exact screenshots and not only to acknowledge the quantity of *X* marks in the set of all screenshots of a card. The screenshots were coded from S1 to S5. Hence, for instance, the chart allows us to observe that in card *Eavesdropping* (fourth from the right) 2 participants marked a screenshot (S3) and 1 participant marked one other screenshot (S2). We hereafter refer to the *X* mark answers in Q1.2 as *Q1.2.x* when we are addressing the *quantity* of *X* marks on screenshots, and as *Q1.2.%x* when are addressing the *percentage* of *X* marks on those screenshots – the distinction is sometimes relevant because not all cards have the same number of screenshots. We will use #S, hereafter, to refer to the number of screenshots (examples) included in each card.

We observed that the answers to Q1.1 and Q1.2 are highly correlated (0.64; see Figure 8.9¹), which may be explained by the fact that they refer to elements – name and examples – that are graphically close to each other and which, possibly, have mutual influence in terms of the overall perception. The correlation can also be examined in terms of the relative positions of the cards in the two charts – most cards do not shift significantly between the two charts.

We also noticed that in both cases there is a high negative correlation between the cards' mean evaluation and its own standard deviation (0.71 for Q1.1 and 0.70 for Q1.2), meaning that although the participants were in agreement regarding the cards with best evaluations, they tended to disagree regarding cards that achieved worse evaluations.

¹ Although it will only be possible to present Figure 8.9 after its components are introduced, it is worth checking meanwhile.

This is also observable by the growing amplitude between minimum and maximum, from left to right.

Regarding Q1.1.x (X marks in Figure 8.3), it is manifest that 49 of the 68 names (72%) were not found problematic, 11 names (16%) were marked by some participant and 8 names (12%) were marked by 2 participants. The latter were: *Foley*, *Diegetic Music*, *Entrainment*, *Grunts*, *Eavesdropping*, *Chitchat*, *Identification*, *R-A-E-D Iterations*. No name was marked by more than 2 (40%) participants.

Concerning Q1.2.x, from the 221 screenshots in all cards, 53 (24%) were marked as problematic by 1 participant and 10 (5%) were marked by 2 (40%) participants. No screenshot was marked by more than 2 participants. No card contains more than 2 marked screenshots and there is only 1 card with the maximum of 4 X marks – the card *Unaware NPC*, with 2 marks on 2 of its 4 screenshots. Yet, the distribution of X marks per participant was highly unbalanced (Figure 8.5): one particular participant accounts for 52 (71%) of all 73 X marks, while 3 other participants, together, account for only 5 (7%) X marks.

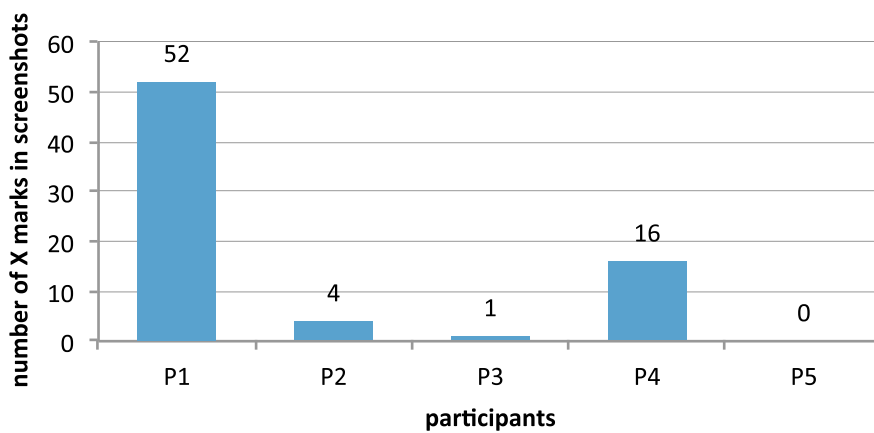


Figure 8.5. Number of X marks on screenshots, per participant

Not surprisingly, Q1.1 correlates with Q1.1.x (-0.65) and Q1.2 correlates with Q1.2.x (-0.36). Yet, the correlation in the latter case, being significant, is comparatively less expressive, possibly due to the irregular distribution per participant, reported in the previous paragraph.

8.2 Second round – Synopsis: Q2.1, Q2.2

The chart in Figure 8.6 presents the mean values for Q2.1 and Q2.2. We opted to use Q2.2 as criterion to sort the cards. We included representations for Q1.1, Q1.1.x, and Q1.2 because they are useful for the following analysis. The dashed lines are the respective trendlines, aiming a better perception.

The observation of the mean values for Q2.1 suggests that the synopses were typically well understood and the observation of Q2.2 suggests that the synopses tended not to change the prior understanding of the patterns. Still, the interpretation of the evaluation of the cards according to Q2.2 requires some commentary. To start with, cards occupying the left side in the chart fit in the situation when the synopsis supported a change in the understanding of the pattern. In that sense we can say that, in those cases, the synopsis was effective and pertinent, and as such it represents an interesting situation. However, if there was a *change* that may also express that in a certain moment the understanding of the pattern was incorrect or incomplete. Consequently, cards that are closest to the left, in Figure 8.6, may represent problematic circumstances, namely in terms of the effectiveness of the aspects analyzed during the first round of questions – Q1.1 and Q1.2.

Regarding the cards that occupy the positions more to the right, they can fit in several scenarios. One reason for the synopsis not to change the understanding of the pattern can be because the participant had indeed understood correctly the concept. But it could also be an indicator of lack of effectiveness of the synopsis. However, since the mean values of Q2.1 reveal that the synopsis tended to be understood, and since questions Q1.1 and Q1.2 also reveal a fair understanding of the information in the front face of the cards, particularly in that region of the chart, we believe that the predominant reason for a card to occupy the right side of the chart in Figure 8.6 is because the card/pattern had already been *well* (“*fully*”) understood. This consideration is reinforced by the highly negative correlations between Q2.2 and Q1.1 (-0.67) and Q1.2 (-0.61) – exposing that the lower the evaluation of Q2.2, the higher the previous evaluation of Q1.1 and Q1.2.

The high correlation between Q2.2 and Q1.1.x (0.62) is also interesting. It may support that problematic names damaged the perception of the concept and that the synopsis assumed a relevant role in correcting those situations.

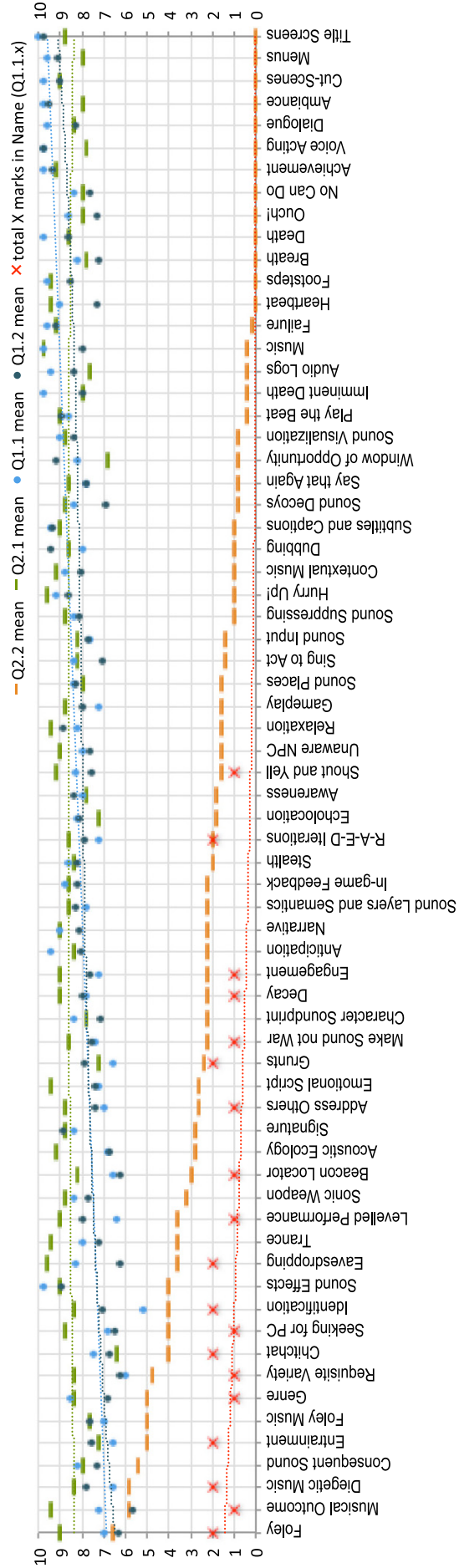


Figure 8.6. Cards sorted by the mean value in Q2.2 and comparison to the mean values in Q1.1, Q1.2 and with the total X marks on the card's name (Q1.1.x)

8.3 Third round – Relationships: Q3

The chart in Figure 8.7 exhibits the cards sorted according to the mean evaluation of Q3 (values from 0 to 10, in left axis). The chart also includes the number of relationships contained in each card, hereafter referred to as $\#R$ (varying from 3 to 20, also in left axis), the mean number of balloons that were marked by the participants, hereafter referred to as $Q3.b$ (also left axis), and the mean *percentage* of balloons that were marked by the participants, hereafter referred to as $Q3.\%b$ (right axis). The distinction between $Q3.b$ and $Q3.\%b$ is particularly relevant because $\#R$ is highly variant.

The most manifest observation in this chart is the very high correlation between $\#R$ and $Q3.b$ (0.95) – the higher the number of relationships included in the card, the higher the number of balloons the participants drew. A balloon around a relationship, according to the provided instructions, is supposed to express the idea “I understood this one, right away!”. When designing the questionnaire we were assuming that few of these balloons would be marked. Yet, participants marked a considerable amount of balloons, as the chart allows to observe. On average, 65% of the relationships in each card were highlighted with balloons. Reasons for this abundance of highlights may be that the relationships tended to be well understood, hence promptly spotted. It could also be the case that they were not so immediately identifiable but participants cared to browse all the relationships and, since drawing a balloon is fairly simple, they end up highlighting a considerable amount of relationships. If so, this may be an interesting indicator that it is conceivable that users read all relationships even when they are numerous – although the observed behaviour needs to be contextualized in these particular conditions.

Another observation is that the evaluation of the relationships, Q3, is highly correlated with the *percentage* of balloons, $Q3.\%b$ (0.85). We do not have records that allow us to say in which order the participants filled in the value and the balloons. Our best judgment is that the participants started by browsing and highlighting the relationships and, after that, they decided an evaluation for Q3, which is likely to be influenced by the visual perception of the percentage of highlighted relationships.

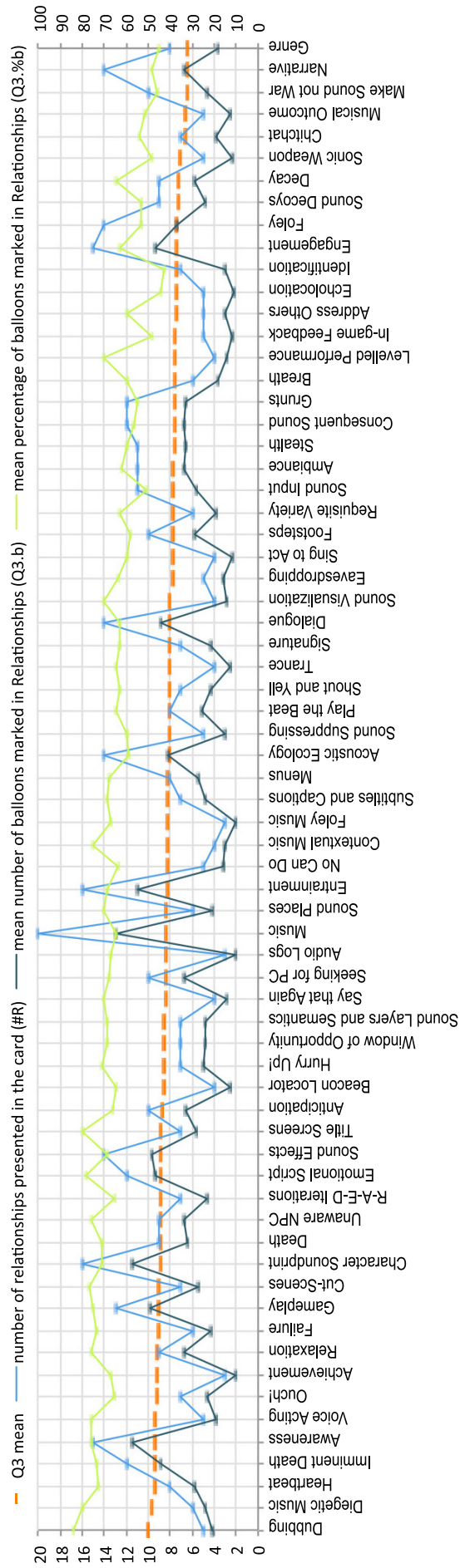


Figure 8.7. Cards sorted by the mean value in Q3, also presenting the mean values (Q3.b) and percentage (Q3:%b) of balloons marked in comparison to the number of relationships presented in each card (#R)

Interestingly enough, there is no correlation between Q3 and #R (0.02), which means that for these participants, the quantity of relationships inserted in the cards did not influence the evaluation. We were particularly apprehensive both regarding those cards where we felt the need to use all possible space to present relevant relationships, and also regarding how the participants would react to the fact that the cards vary so much in number of inscribed relationships. In that sense we find it very favourable that these variables did not correlate negatively.

8.4 Fourth round – Experience: Q4

Figure 8.8 presents the cards sorted by the mean evaluation of Q4, which assesses the recognition of the patterns in the participants' gaming experience. The interpretation of this chart is complex because several factors may concur to the final disposition. The reading of the left part of the chart is the less intricate: if participants signalled that they recognize a pattern in their experience, that asserts that the pattern indeed exists and that the card was effective in transmitting the concept. Yet, as cards tend to fit in the right side of the chart several possibilities may combine. One aspect that is noticeable is that participants revealed increasing disparate assessments as the mean value of Q4 decreases, which is patent in the correlation between Q4 and its own standard deviation (0.82). In the worst case – for the matter of this research – failing to recognize a pattern would be explained by an ill-designed card that, not being able to convey a concept, would consequently fail to match any experience.

Also, it is reasonable to think that, apart from people who end up developing an analytical perspective during the gaming experience, players are not necessarily reasoning about the means that support such experience, so it may be hard to refer to it a posteriori. But more importantly, failing to acknowledge a certain exploration of sound when reporting to prior gaming experience can even be explained by interesting aspects of sound design because, as argued elsewhere (Alves & Roque, 2011d), interesting explorations of sound do not necessarily occur at the conscious level. Nevertheless, we think that the disposition of the patterns along the categories axis mostly maps the *frequency* with which the pattern has been explored in games – some explorations are not used widely enough to have more acknowledgment.

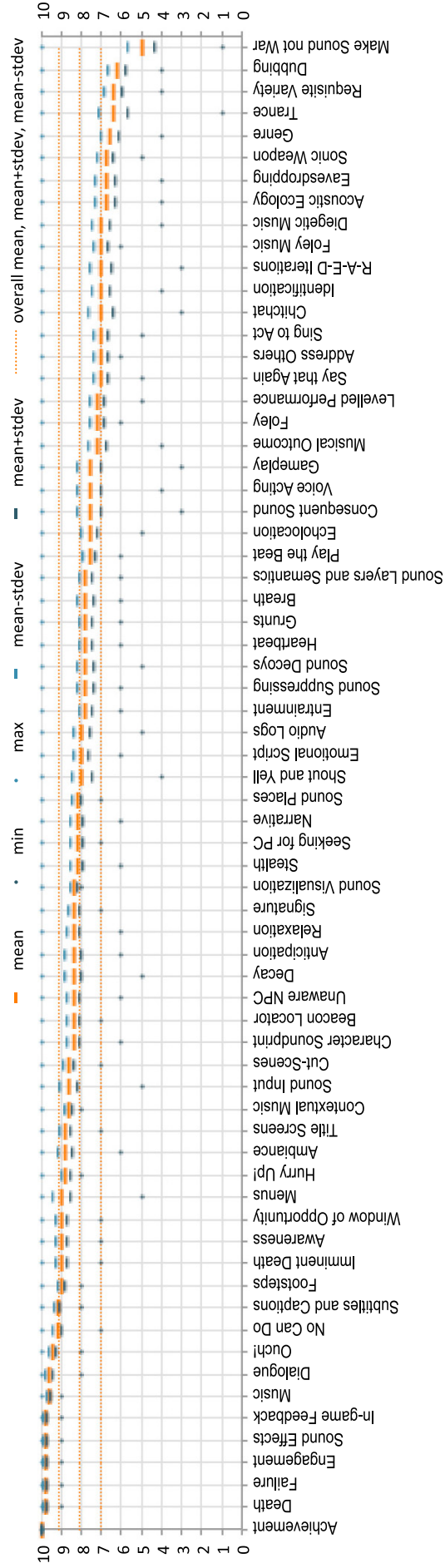


Figure 8.8. Cards sorted by the mean value in Q4

8.5 Open interview

After the participants answered the questionnaire we conducted an open interview in order to grasp additional feedback. The participants expressed a very positive global appreciation of the Deck and its potential contribution to the systematization of sound design knowledge. Participants also voiced compliments to the format and graphical decisions both in terms of aesthetics and usability.

Unfamiliarity with some terminology

One major issue the participants presented relates to domain terminology and to confessed unfamiliarity with some concepts. *Foley*, *Acoustic Ecology*, and *Requisite Variety* were referred as examples. Participants added that in some cases they were able to eventually understand such terms or concepts but often limitedly.

Uneasiness with redundancy

The perception of redundancy was also criticized. For example, the fact that there were some cards that referred to aggregator concepts, that is, that included other concepts that were in turn developed by *other* cards, seemed to cause some uneasiness. This remark surprised us because we had explicitly thought about the inherent overlapping of several concepts and we felt that they would have a positive effect in reinforcing the sense of interconnection between the patterns. Issues with cards containing aggregator concepts were also observed in other scenarios, including the experiment reported in Chapter 9, which eventually led us to deprecate such cards (as further argued in Subsection 9.3.3).

Some recursive synopses

Another critique was that some synopses were recursive relatively to the name, in the sense that they included that name in their sentence. In fact, until that moment, we did not think of synopses as definitions of the names but more as extended versions of those names and, as such, we used the names or close variants whenever we felt it would make sense. Yet this remark made us realize that if a name turns out to be problematic to some user, such practice compromises the effectiveness of the synopsis. This is another aspect whose revisions were integrated in version 2.0.

We asked the participants about difficulties related to screenshots of games that they might not know. The participants seemed to agree that, apart from particular cases, that was not critical. They explained that the contextual info was enough for them to grasp the point at stake.

Suggestions for new patterns

One of the participants suggested candidate patterns, some of which we eventually incorporated in version 2.0 of the Deck. This is one example of interactions that, though happening in the scope of dealing with the instrument, are influential to higher goals of this research, as the improvement of the pattern collection.

8.6 Additional reflections on the inspection exercise

From the analysis we identified important indicators and aspects to revise. One advantage that we found in orienting the product of the analysis to rankings and hotspots was that it informed us on where to focus first, with the purpose of removing bottlenecks and work towards a higher overall appreciation for the instrument and the patterns themselves.

Resorting to a map of all major correlations, as in Figure 8.9, was also instrumental during the analysis. For the sake of usefulness the graph only exhibits correlations above a threshold that we set to be 0.33.

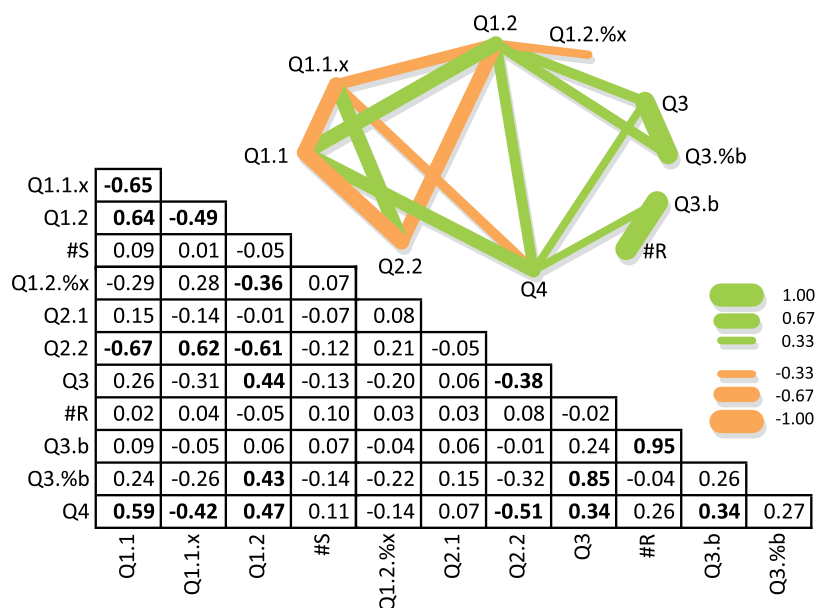


Figure 8.9. Table and depiction of correlations (above 0.33)

One of our aims with the questionnaire was to check if any indicator would suggest that we were using too many examples in the cards. Finding the reverse, i.e., that we should use *more* examples, could be interesting too, but it would tend to be inconsequential because, with few exceptions, we would not be able to pack more examples in the card due to graphical constraints. We did not find indicators suggesting that we should use less examples. The only related indicator is a small *positive* correlation (0.11) between the number of examples, #S, and participants' recognition of the patterns in gaming experience, Q4. Being so, we have no argument against keep using the number of examples that we believe best illustrate the applications of each particular pattern, within our best judgment of the graphical constraints including the arrangements allowed by the pictures' contents, in a per case basis.

Revisions

Considering that examples are such an important aspect of this instrument, and although here we opted for presenting the evaluation of Q1.2 as the arithmetic means of the individual evaluations of the examples in a card, we addressed the revision of examples individually as well. Depending on the case, pictures were enhanced or substituted while retaining the example, or we decided to change the example itself if we predict that it would remain hard to convey the intended meaning.

We were able to revise several other aspects with basis on this exercise. Among them, we emphasize the special attention that we gave to all X marks (Q1.1.x and Q1.2.x), to all cases that evidenced inaccurate perception of the concepts (as those in Q2.2), and to the cards with worse evaluations in each criterion.

8.7 On the continuation...

In this chapter we referred to an exercise of inspection of the Deck, involving a group of participants and a set of questions addressing specific design aspects of the cards. The purpose of this exercise was to identify and support corrections to difficulties regarding perception and interpretation of the cards' contents. This is by no means an exercise with ambitions in terms of statistical representativeness and no conclusions are projected beyond the scope and immediate applicability for revising this instrument.

We analyzed data gathered from the exercise and reported problematic aspects in specific cards. We also referred to the kind of treatment given to each of such critical aspects.

In the next chapter, we will report one other exercise using this Deck, that one involving actual use in design. The analysis of the results of both these exercises informed revisions that were included in version 2.0 of the Deck. Such revisions were summarized in the log file condensed in Appendix F.

Chapter 9

Enhancements based on a Game Design Exercise

We conducted a game design experiment (Alves & Roque, 2011a, 2012a) in order to analyze how, in that particular circumstance, the participants would relate to the Deck of Cards and how it would influence the design phenomenon. Audio and video were recorded and used for later analysis.

The task set for this exercise was to produce a game design specification starting from a “no design concept yet” situation. We did not suggest the participants any kind of goal regarding sound prominence. Also, participants were not stimulated to further explore patterns beyond their immediate understanding.

Workspace: four regions in an A2 sheet

We designed a setting that would be both favourable to the practice of design and convenient for auditing the session. As part of that process, a workspace was drawn over an A2 white sheet of paper, as shown in Figure 9.1. It was divided in four regions with the following names and purposes:

- **Deck:** the starting position, i.e., the set of cards not yet considered during the session;
- **Hand:** set of cards still in discussion, i.e., the cards that are no longer in *Deck* but did not yet reached *Solution* or *Graveyard*;
- **Solution:** set of cards that participants considered to have discussed and for which tangible ideas of exploration were specified;
- **Graveyard:** set of cards that participants discussed and opted not to explore.

The design session involved 5 participants with peer roles. Participant profile is male, 25 to 45 yrs., with a higher education degree and a research interest in game design. Participants sat around the structured workspace, where only one common deck was used, and no access to online resources was explored.



Figure 9.1. Workspace regions and usage during the game design session

One of the participants also acted as occasional facilitator in the deck's interpretation, another tried to help participants in keeping manipulation and utterances audible in the recordings. All participants co-operated in registering design ideas using text and sketches. The session developed in a brainstorm-like fashion, with no constraints regarding order or the management of concurrency among open explorations, but favouring loud voice discussion. Total effective session duration was 02h05.

The ability to reconsider decisions and repositioning cards was a feature of this process. That includes, for instance, retaking the discussion of some card already in *Solution* or *Graveyard*, albeit infrequent. The correctness of card movements was relevant mainly for auditing the design phenomenon, although, since video of the workspace was recorded for analysis, all card movements could be tracked and participant identification was also possible. Still, such correctness also helped to check accordance among the participants, as it was evidenced in (occasional) situations when a card was unwittingly misplaced. Apart from that and since the design outcome is built upon the discourse and notes taken during the process, it may not be so important.

9.1 Results

From the observation of the recorded video we collected about 830 events into a database. This was done in more than one pass because we acknowledged new needs in the course of analysis. In Figure 9.2 we represent the “footprint” of the main kinds of

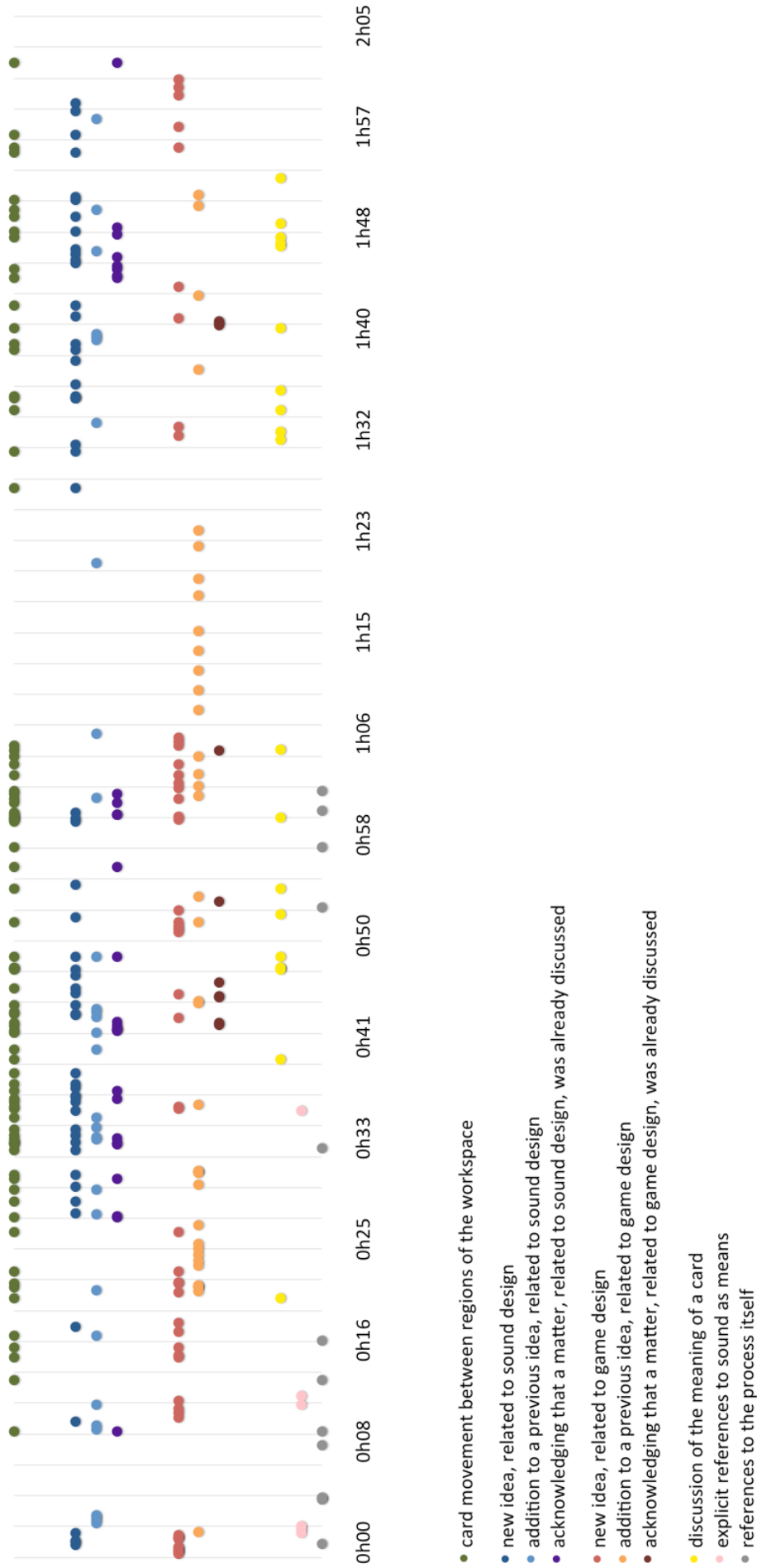


Figure 9.2. Distribution of main kinds of registered events, along time

registered events. These are: design ideas for the game specification; card movements between workspace regions; discussions about the design process itself; discussions related to the interpretation of a pattern; and, the acknowledgement that some design matter was already covered. These “lines” of events will be referred to throughout the remaining of this chapter.

Ideas

In the remaining of this text, we use the term “idea” to identify elemental contributions to the design specification, similarly to what other authors also adopted (Adams, E., 2010, p. 54). We found pertinent distinguishing ideas that can be associated to sound design (e.g., “it cries if you ignore it”) from those that relate to other aspects of game design (e.g., “it crawls through the place”). It is important to emphasize the influence of our holistic perspective on sound design during these classifications. Also, we did not select ideas while we were registering them – all ideas that were agreed among participants, at a specific moment, were considered potentially integral to the game specification. Finally, since accepted ideas are sometimes extensions to others, we found relevant to distinguish between “new idea” and “addition to a previous idea” (e.g., “it cries *really aloud* if you keep ignoring it”).

9.1.1 Development of the design specification

Figure 9.3 depicts the evolution of the number of design ideas along time. A noticeable result is that the number of ideas related to sound design represents 50% of all design ideas. More importantly, sound design ideas were consistently proposed, starting right from the beginning of the exercise. Also, the number of new ideas, both regarding sound design and other aspects of game design, almost always surpassed the number of additions to former ideas. It is interesting to observe that new ideas kept emerging even when closer to the end of the session.

The global rate of ideas per minute was 1.42 (178 ideas in 125min). The evolution of that rate along the session is characterized in Figure 9.4. For this analysis we opted for periods of one tenth of the total session time. One interesting aspect of the comparison between sound design and other aspects of game design is that they swapped dominance along 4 phases (delimited by the 3rd, 5th and 7th tenths).

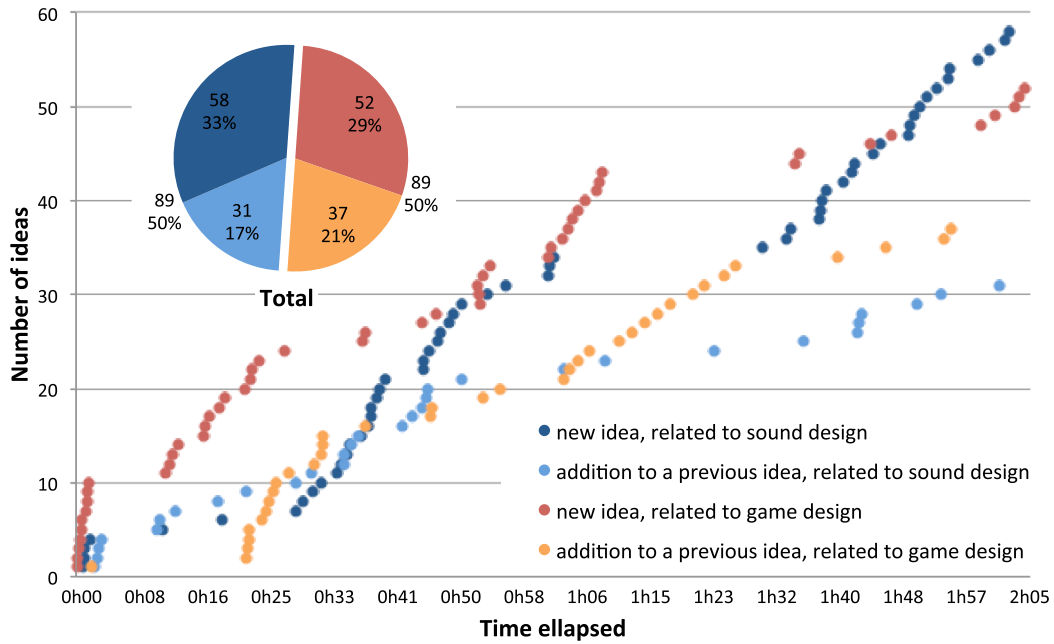


Figure 9.3. Cumulative number of design ideas, by kind

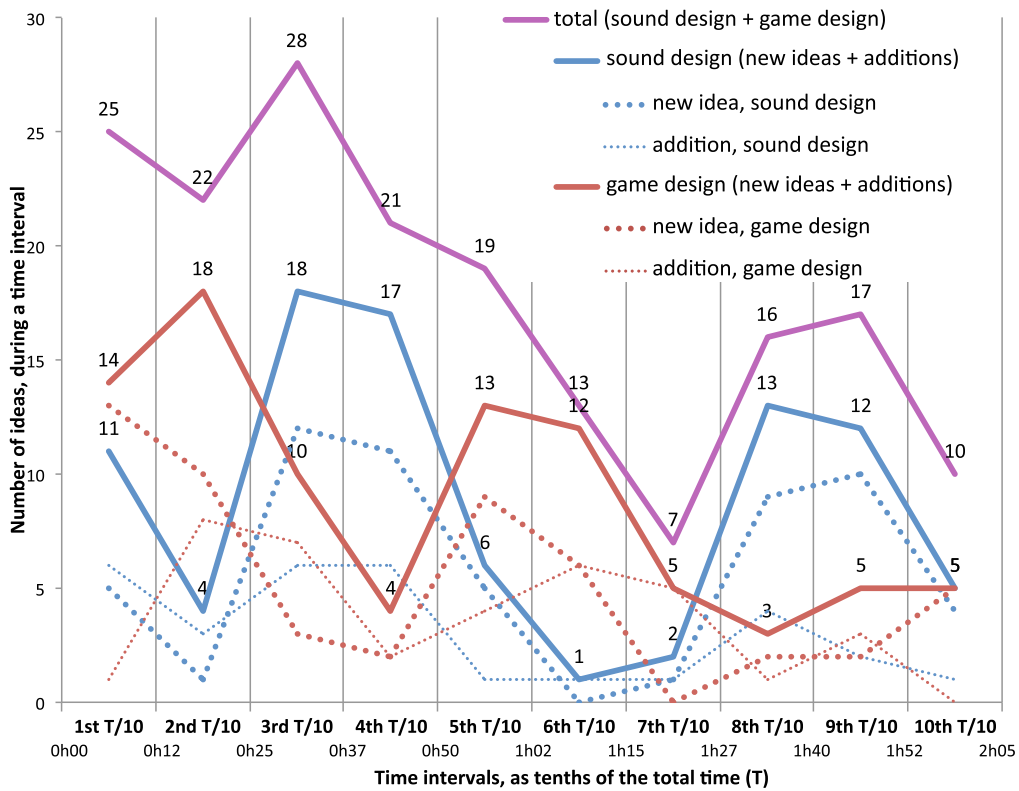


Figure 9.4. Distribution of ideas per interval of time

In global terms, there were two major peaks (3rd and 9th) and the 7th period was the less productive. The dominant theme during this 7th period was the refinement of the definition of the specific identity of the playing character, for which the participants,

although prolific in individual suggestions, found difficulty in coming to consensual ideas. Since we did not classify non-consensual contributions as “ideas” going into the design, that situation became reflected in the statistics. The (consensual) ideas to which the participants eventually agreed upon consisted of additions, i.e., refinements to game design (check it back in Figure 9.3, also).

9.1.2 Usage of the cards

One important facet of the session that we intended to observe was the way the participants related to the cards. Figure 9.5 shows the placement of the cards along time. Closer to the start, most cards were still in *Deck* and, progressively, they reached *Solution* or *Graveyard*. At the end of the session all cards reached those two regions. Meanwhile, cards related to patterns under discussion were held in *Hand*, which had a mode size of 11 cards (8.9 average). *Hand* first reached the mode value at 0h26 and started a tendency to clear off at about 1h27. Participants started to include cards in *Solution* right from 0h13, but only at 0h36 they first moved a card to *Graveyard*. At the end of the session, *Solution* had about twice the cards as *Graveyard*. The quieter interval (between 1h07 and 1h27) coincides with the period that we already mentioned, during which participants struggled to come to an understanding regarding the definition of the playing character’s specific identity.

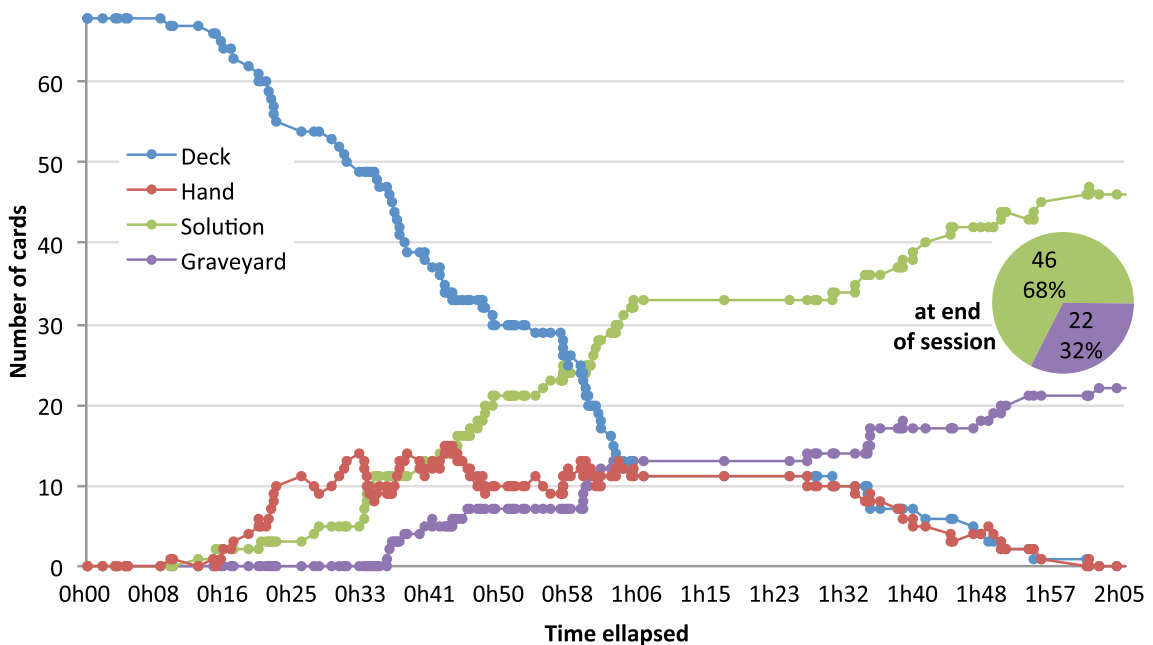


Figure 9.5. Card placement along the design session

A better understanding of card migrations throughout the regions in the workspace is facilitated by Figure 9.6. The two chief movements were from *Deck* to *Hand* and from *Hand* to *Solution*. Still, it is noteworthy that 10 cards reached *Solution* directly from *Deck* because their discussion was fast enough to not propitiate laying them at *Hand*. What is even more noticeable is that, in the case of the cards reaching *Graveyard*, going directly from *Deck* (to *Graveyard*) was the most common movement. Finally, it is relevant to acknowledge that, albeit infrequent, there were not only “sideways” movements from *Solution* to *Graveyard* and vice versa, due to reconsiderations, but also “backward” movements from those regions to *Hand*, due to the recognition of the need for further discussion (9 movements in total, corresponding to the 4 bars closer to the right).

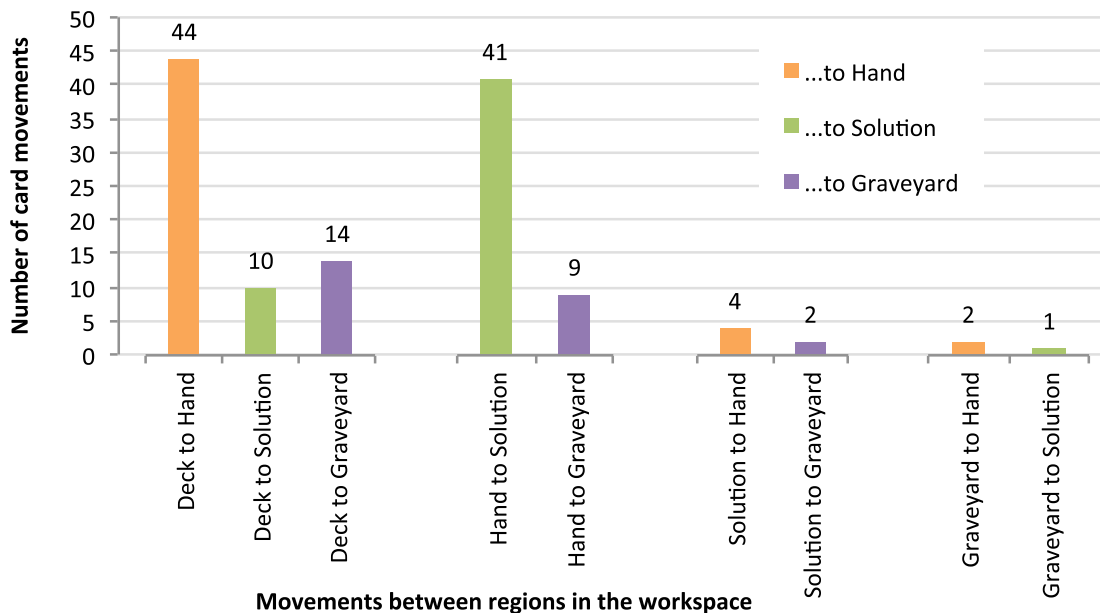


Figure 9.6. Distribution of the number of card movements in the workspace (grouped by origin and coloured by destination)

Actually, we were able to identify three categories of the complete trajectory that cards travelled during their handling. The most expected one, accordingly to the way we set up the workspace, would be from *Deck* to *Hand* and, then, either to *Solution* or to *Graveyard*. As Figure 9.7 allows to verify, that was indeed the path traversed by 57% of the cards. The second most common path (still very expressive, with 30%) consisted of going directly from *Deck* to *Solution* or to *Graveyard*, as a consequence of a quick and definitive decision, which is certainly a fact worth noticing. The third category of paths includes all other cases (13%) when in a certain moment there was some “backward” or “sideways” movement, as those discussed before regarding Figure 9.6.

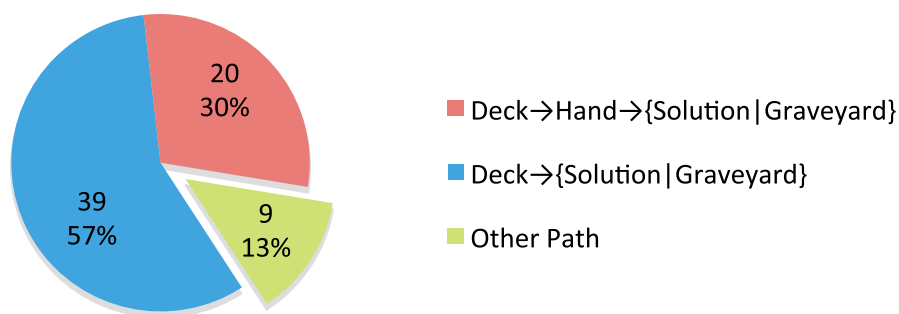


Figure 9.7. Distribution of paths during card movements

Merely examining the trajectories of cards does not provide a comprehensive perception of the temporal *extension* of each card's discussion. Figure 9.8 depicts such aspects. The horizontal bars represent cards in discussion; hence, the size of those bars represents the duration of the discussion. The coloured right end of a bar differentiates the final placement of that card in either *Solution* or *Graveyard*. In the case of the 20 cards that went straight from *Deck* to the final region (depicted in former Figure 9.7), that mark is all that is visible.

The chart also allows to know exactly which cards were being discussed at a certain moment, which is synonymous of knowing which cards were inhabiting *Hand* at that moment. In the same way, it is possible to know which cards were being discussed concurrently (in broad sense) during the period of discussion of some particular card.

The distinction provided by the colours of the bars (blue and orange) will be further presented – and discussed – in Subsection 9.3.1. For now, we are only revealing that blue bars represent cards that are in *Hand* as a consequence of being pushed there by a participant but whose discussion had not yet *actually* started. In turn, the orange bars signal an already started discussion.

The figure also allows acknowledging the order by which the cards were first considered by the participants – which coincides with the order the names appear in the y-axis. If the chart is read left to right and the bar endings are considered, it is also possible to have a perception of the order by which the cards had their discussion concluded.

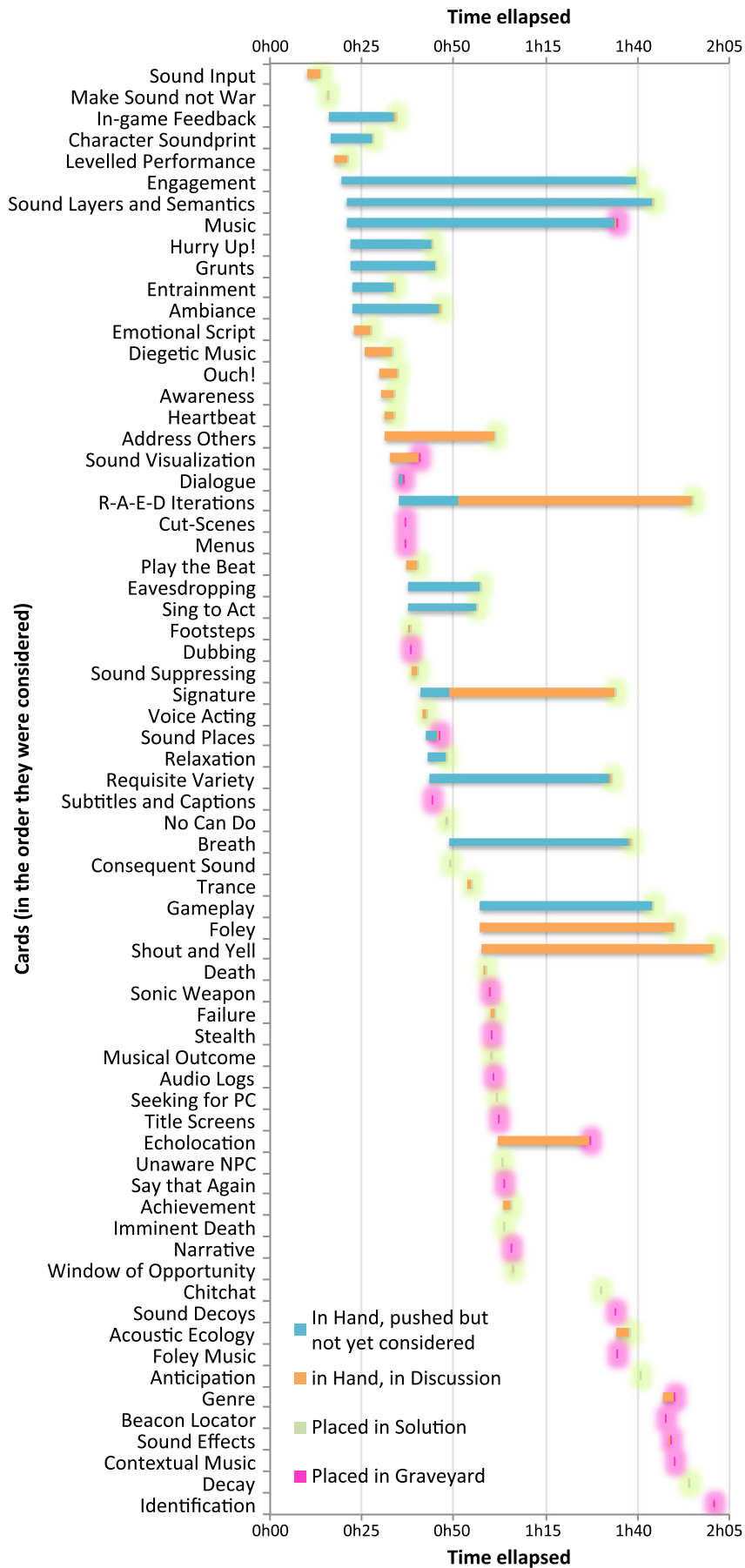


Figure 9.8. Card movements: time taken since leaving *Deck* until final entrance in *Solution* or *Graveyard*

9.2 Discussion

Instrument did not show to be intrusive

From the observation of this experiment, one of the aspects that we can appreciate is that the instrument did not show to be intrusive. Card handling did not pose any perceivable constraints, and only occasionally participants interrupted the flow of design to question some card's contents (recall yellow line from Figure 9.2). The adopted process also seldom posed problems (grey line in Figure 9.2). Yet, in both cases, the exceptions were very pertinent and allowed to identify issues in need of revision, as we will discuss below. Moreover, several results, including the rates of ideas and card movements, allow us to advocate the commitment of the participants along the exercise and, as such, the low disturbance the instrument caused cannot possibly be explained by its reduced use or even dismissal.

Discussion was not dominated by sound itself

Regarding the resulting game design specification, sound explorations are considerably represented, as shown by the relative abundance of sound design ideas. Noticeably, despite that kind of outcome, the discussion was not dominated by sound itself (again recall Figure 9.2, pink line). We consider such behaviour to be a good indicator of a process of performing genuinely integrated sound design, when compared to an approach where the discourse would be focused on finding opportunities or rationale to “insert sounds” into game design.

Holistic approach to sound design

The analysis of the gathered data provides indicators that sound design was holistically approached and interwoven with other aspects of game design, along the session. Figure 9.2 and Figure 9.3 provide different perspectives on the contribution of sound design to the whole set of proposed ideas. They show that both ideas related to sound design and ideas related to other aspects of game design entered the design specification in a complementary and continued way. Additionally, the analysis of the flow of dialogue along the session evidences that the participants discussed each of these contributions homogeneously, as design ideas, without explicitly addressing their nature – sound or otherwise. The distinction that we have been emphasizing throughout this analysis is the

result of our categorization, convenient for research purposes, not the result of the participants' explicit signalling of such differentiation.

The interweaving of sound design with other aspects of game design did not occur just at the scale of the elemental additions to the design specification. As Figure 9.4 reveals, it also occurred at the global scale, with repeated alternation of preponderance of both kinds of ideas (evidenced by the drawing formed by the blue and red lines in that chart).

Despite such alternations, it is noticeable that the continued participation of sound design ideas started from the beginning of the session and endured to its end. This reinforces our interpretation that participants considered sound design as part of game design, as opposed, for instance, to addressing sound design as a starting assignment or as a requirement to conclude the design.

Relation between sound design outcome and the use of cards

A comparative analysis on the rate of patterns discussed and the rate of the ideas generated (for the latter, recall Figure 9.4), along time, reveals worth noticing values. The rate of ideas associated to sound design is significantly correlated with the rates of cards reaching *Solution* (0.64), *Graveyard* (0.60), and *Solution* and *Graveyard* in conjunction (0.63). Actually, even greater are the respective correlations if we only consider the *new* ideas related to sound design (0.69, 0.70, 0.72, respectively). In contrast, the rate of ideas related to other aspects of game design is *not* correlated with such rates (0.08, -0.17, 0.00, respectively). Although correlations do not allow us to establish causality, it is important to acknowledge the relation between the sound design outcome and the use of the cards.

It is tempting to seek for statistics on the number of ideas generated during the discussion of each card. Yet, such statistics would not be possible in the current setting. First, the adopted process does not force participants to follow an agenda imposed by the strict observance of a sequence of cards – on the contrary, participants govern their interests and cards are used to assist, not to direct, their effort. Consequently, it is most likely that occasionally particular explorations of patterns represented in the cards occur prior to the actual contact with the card (as was the case of most of those events marked in Figure 9.2 signalling the acknowledgment of some aspect of design that for some reason happened to be addressed before the contact with the respective card), making it hardly auditable. Second, cards are discussed concurrently, which hinders the

recognition of the card implied. Also, an idea is not the product of a card but of a context, which includes previously considered cards too.

Somehow in the same vein, the meaning of the time that cards take to be discussed (orange bar in Figure 9.8) can be disparate. For instance, while it is true that, in the case of a particular card, a longer time may reveal some kind of issue, in some other case it may be due to the exploration of a greater number of opportunities, or to the interest in exploring related card(s) beforehand. Actually, the *Hand* region in the workspace is intended precisely to accommodate such possibilities. Furthermore, for the purposes of this research, the differentiation of each particular case was possible through the analysis of the recorded video.

One other aspect regarding the use of the cards that we ought to emphasize, and which is a restatement of the same argument that we presented in Section 6.7, is that the number (or percentage) of cards reaching *Solution* is not an indicator of the quality of sound design – not even of the extent of sound exploration. To start with, the quality of sound design derives from the merit of the concrete decisions, for which the quantity of explored patterns contributes nothing. But more importantly, abundance can be as detrimental as deficit. The idea inherent to the Deck of Cards is to present opportunities, not to invite practitioners to adopt them all in each particular circumstance.

9.3 Issues with the process

The next subsections refer to issues that we identified during the process. Some of those issues relate to the interpretation of the workspace regions and of its layout (recall Figure 9.1). The respective analysis led us to evolve the workspace, as we will explain. A different kind of issue relates to cards representing “aggregator” patterns, i.e., patterns that collectively refer to explorations that are contained in other more specific patterns. We opted to discontinue such *cards* because they revealed themselves to be ineffective in context of use. Still, we keep the respective patterns in the Pattern Language.

9.3.1 Interpretation of the workspace regions

We witnessed slightly different interpretations of the four regions marked on the workspace (respective events are included in the grey line in Figure 9.2). Although these situations did not constitute a noticeable problem in this particular exercise, they reveal issues demanding attention.

Solution: two different interpretations emerged during the experiment: *a)* a card enters *Solution* once participants agree that it would be interesting to explore that pattern; *b)* a card enters *Solution* only after specific ideas regarding the exploration of the pattern are agreed, which implies that it stays in *Hand* while being discussed. The former interpretation is possible but more likely to demand further reconsideration and more prone to lead to deficient exploration due to forgetfulness. It also implies further iterations of discussion of selected cards, or else it would only allow a first approach to the design concept specification. The latter is more consonant with the ultimate intended goal; so, that is the interpretation that we are adopting.

In order to reduce ambiguity and to avoid users to have to come to an agreement, we opted to insert a short explanation next to the identification of the region. We extended that approach to the other regions too.

Graveyard: putting a card in the *Graveyard* may have two different meanings: *a)* a concept that users do not intend to explore; *b)* a concept whose *absence* the users are willing to explore. The former corresponds to the anticipated usage – not exploring a concept may be a consequence of not envisaging a possible exploration that fits the exercise or an incompatibility with other design decisions. The latter interpretation is potentially problematic when deciding where to place the card because it can also be interpreted as “solution” and hence can lead the card to be placed in *Solution*.

In practice, there is no pertinence in distinguishing the two cases – it is the retained description of the idea(s) that matters, not the place where the card ends up. This would suggest that there is no point in overloading participants with that kind of distinction. Nevertheless, this is problematic in the event users *acknowledge* the ambiguity and struggle to solve it (it did not happen in this experiment). We still did not find a reasonable solution to this latent problem.

Hand: two concurrent behaviours emerged regarding the use of *Hand*: *a)* displaying the cards whose discussion was initiated but not completed, in a way that they will still share the participants’ attention, even if the discussion temporarily diverts to some other aspect; *b)* a place where some cards may be pushed in order to influence or feed the path of the discussion. From the 44 cards that passed through *Hand* (recall Figure 9.6), 23 were pulled from *Deck* in the flow of discussion (by any of participants), while 21 were pushed by one particular participant that adopted such a role, as shown in Figure 9.9.

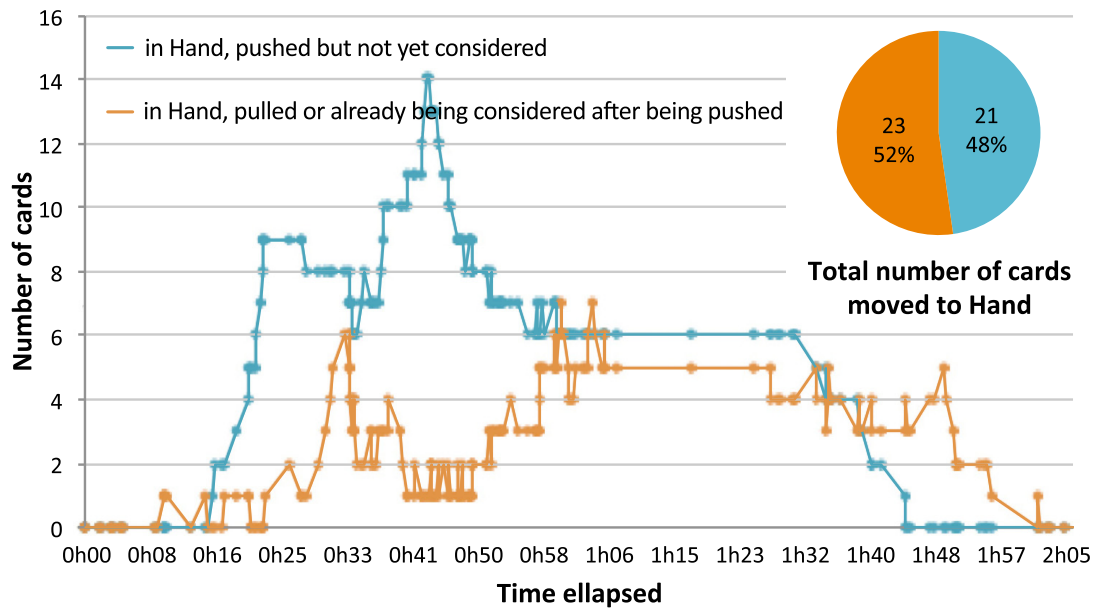


Figure 9.9. Number of cards in *Hand*, according to the way they got there

Analysis of the results shows no pertinence on the latter, during this particular experiment. Typically, the direction of discussion was decided more spontaneously and less predictably, reducing considerably the effectiveness of such modality. Cards that entered *Hand* that way consistently spent a long time there with no consequence, not deserving particular preference over those in *Deck*.

This aspect can now be perceived in Figure 9.8 (presented beforehand) – the quantity of large blue bars, which represent cards pushed to *Hand* and not yet in discussion, is superior to that of the orange bars, which represent cards in discussion. Average latency for cards pushed to *Hand* is 01h00 (0h33 to leave *Deck* and then 0h27 in *Hand*), which is not less than the 0h50 from other cards (these are the times until being first considered, in both cases). Another consequence of these facts is that the “size” of *Hand* (as initially depicted in Figure 9.5) hides a smaller “actual” *Hand*, as expressed in Figure 9.9.

The behaviour of the participants regarding the cards picked to discuss, may as well be an interesting indicator. It may mean that these participants were indeed governing the process and that they were being able to take advantage of the Deck of Cards without letting themselves get constrained by the formalism.

9.3.2 Workspace layout

The workspace we used had four equally sized regions, and *Graveyard* was located after *Solution*, for no special reason (recall Figure 9.1). By observing the way the regions were populated during this exercise, we understood the need for some optimizations and, as

such, we redesigned the layout of the workspace, aiming at: assigning more relative space to the regions where more cards are usually simultaneously considered (namely the *Hand*); avoiding the possible idea of sequentiality regarding *Solution* and *Graveyard*; and accommodating a description in each region (see previous section). The updated workspace is shown in Figure 9.10.

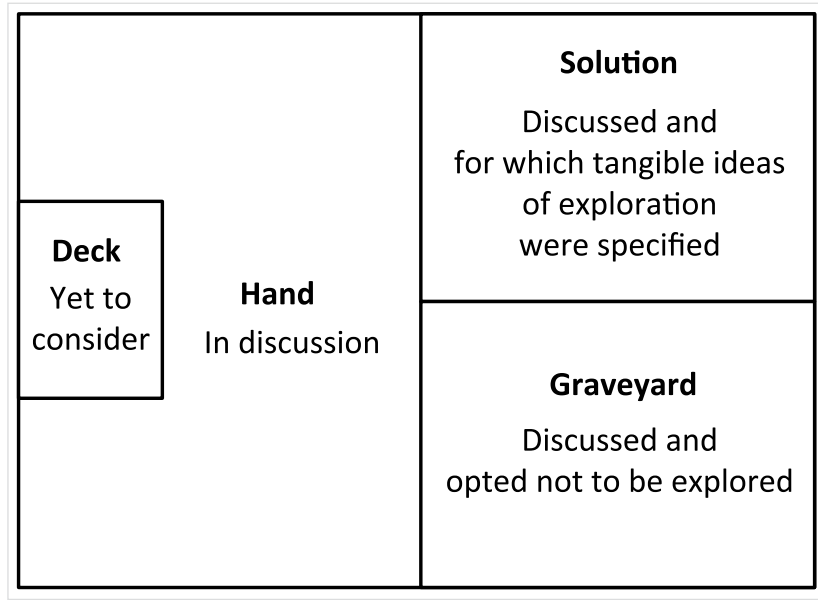


Figure 9.10. The revised workspace (as accompanying version 2.0 of the Deck of Cards)

9.3.3 Ineffectiveness of aggregator cards

We began the design of the Deck of Cards with the idea that all patterns would be presented as a card. Although we were able to do it, we now understand that such a principle is not an absolute. In the context of the adopted process, some categories of patterns tend to be less effective as cards. That is the case of aggregator (or “umbrella”) concepts.

Dealing with aggregator cards evidenced to be disruptive. For example, they were at the origin of one of the very few types of circumstances when participants actually interrupted the flow of design to discuss the cards per se (see yellow and grey lines at Figure 9.2). The cards with this strict aggregator property were *Gameplay*, *Genre*, *Sound Places*, and *Sound Layers and Semantics*. While such cards did work as conceptual placeholders, their use would require some discipline, as they do not easily translate to concrete components of the solution. During the exercise, users learned to be decision makers in whether cards would follow into *Solution* or *Graveyard* according to a debated exploration. Aggregator cards are hard to fit in that model since they inform or

structure, rather than calling for decision-making. Therefore, their placement in the workspace often generated ambiguity. Additionally, the fact that the Deck included both cards for aggregator patterns and cards for contained patterns, introduced some perceived redundancy, as voiced by users.

Aggregator cards were discontinued (their patterns remain)

We concluded that those aggregator concepts are meaningful as patterns but that they are not interesting when represented as cards. We were able to substitute aggregator cards by cards that represent each included pattern. Some of those patterns already existed, and as such the respective cards were already part of the Deck. For example, the existing cards *Ambiance*, *Foley*, *Sound Effects*, *Dialogue* and *Music* can stand for and imply the use of the concept that aggregates them: *Sound Layers and Semantics*. In other cases, dealing with this resolution made us realize patterns missing in the Pattern Language. For example, the cards representing new patterns *Rhythm Gameplay* and *Pitch Gameplay* can retain concepts that would not be covered after removing the card *Genre*. Alternative approaches to the elimination of aggregator cards would be to differentiate these cards, thus requesting a disparate treatment. Yet, the costs of superimposing another layer of information seem, at this point, not to justify the benefit.

9.4 Issues with names

Some cases of subject ambiguity

The names of patterns were generally understood correctly by participants. Still, we identified some categories of problems, which impose reflection and revision. One issue relates to inaccurate interpretations of the subject of the suggested action, including “player” instead of “character”, or vice versa (e.g., in *Relaxation*), playing character instead of non-playing character (e.g., in *Shout and Yell*). Confusion is comprehensible and justified by lack of explicitness. Being so, we decided to work on redefinitions. The kind of solution depended on each particular card and it was subject to preserving other name requisites such as shortness and overall coherence. The list of the respective changes is part of the revision history that is logged in Appendix F.

Unfamiliarity with terminology

Another, more complex, issue relates to the participants failing to understand some names because of (confessed) unfamiliarity with an adopted terminology. This issue,

which we could confirm through the analysis of the recordings, had already been evidenced in the inspection exercise (as introduced in Chapter 8). Some of the identified cases were relatively easy to cope with because we were able to adopt an equivalent alternative. For example, *Requisite Variety* (Heylighen, 1992), which shown to be problematic, was changed to just *Variety*, which is no longer a technical expression and still retains the idea. Other cases, though, will/would imply a less obvious solution. For example, we have found hard to come up with an alternate name to *Foley*. Moreover, even if we would find a suitable equivalent that would ease the first contact with the concept (Peck, 2001), we believe we would fail regarding the goal of bringing this obligatory term into the vocabulary of game design practitioners.

Should synopsis go to the front face?

Our early premise has been that it should be the role of the provided synopsis to solve this kind of problems. Yet, we are pondering if the location of the synopsis (in the back) may be compromising its effectiveness. Observation, during the design session, asserts the value of the synopsis, should it be consulted. But it leaves us with doubt regarding whether it should be instead located in the front of the card. We detected that, when failing to understand a card based on the information presented in the front, users mostly prompted peers or insisted in examining the front face; but once invited to read the synopsis, they went straight to it and quickly understood the concept by themselves, often signalling it with an interjection. Still, we are reluctant to migrate the synopsis to the front because we suspect that it might, in turn, contribute to reduce the front's effectiveness. It would compromise with the intent of keeping the front simple and would also imply to deal with graphical constraints. Deciding on definitely migrating the synopsis to the front would require us to run an experiment to evaluate the tradeoffs. We are considering integrating this aspect as part of our future research, to which we refer in the next section.

9.5 Other aspects requiring further research

Along the previous sections we presented several issues experienced during the exercise and the relevance in researching them further. In the next subsections we will present other aspects that we have recognized but did not yet explore, and regarding which we also find pertinence in extending our study, in further research.

Order of the cards

We tend to believe that the order in which cards are considered may influence a design phenomenon. Still, we are not confident that a particular order would be *better* than other. In a creative process the end is not known at start. There is no way to compare what would be the best path to an end, since different paths will most probably lead to different ends. Yet, it might be worth considering the theoretical implications of starting with a scrambled Deck, versus starting, for instance, with higher-level cards.

Number of cards to explore

In the particular case of the exercise we reported, the Deck was exhausted, by participants' own will, and, indeed, a couple of the potentially more distinctive ideas were proposed while discussing some of the last cards. Nevertheless, we believe that there is no point in extending the Deck exploration beyond the acknowledgment of saturation – as we have been insisting, the goal of the instrument is “to aid” not “to ensure” that every possibility was considered. Actually the Deck itself is, by the very evolving nature of the Pattern Language, incomplete.

Number of cards in the Deck

The size of the Deck, i.e., the number of cards that constitute it, may correlate to its overall effectiveness and/or to the attention dedicated to each particular card. These are pertinent concerns, both currently and considering the plausibility of the addition of even more relevant patterns. This is another hypothesis that we need to research better. We are currently not prepared to argue size relevance or optimal size of the Deck.

Redundancy

The concepts inscribed in the patterns often overlap to some extent, even excluding the case of the aggregator patterns. Actually this is documented by some of the relationships (recall Subsection 6.4.2, and particularly the topic on relationships). So, theoretically, redundancy is inherent. However, in practice and in this scenario – possibly because it is expected to be expedite – participants sometimes sensed redundancy as not interesting (such occurrences are some of the events in the yellow line in Figure 9.2).

9.6 Summary of the game design exercise

We conducted an experiment consisting of a game design session, which provided us data on how, in that particular circumstance, the participants related to the Deck of

Cards and how it influenced the design phenomenon. We identified important information that supported improvements to the Deck, to particular cards and patterns, and to the setting used during game design, which were integrated in version 2.0. The issues that we could identify were very pertinent either to such revising or to the configuration of the next steps of our research following this thesis.

The results of the analysis are also very encouraging and allowed us to gain confidence on the Deck of Cards as a tool to assist sound design in games. The instrument did not show to be intrusive and discussions around explorations of the sound design patterns did not put the emphasis on sound itself. This, we argue, denotes that the specification of those explorations was genuinely integrated into the process of game design, very much in line with our holistic appreciation for sound design in context. We expect this evidence may foster the interest for the use of the Pattern Language among game designers, as an instrument that can ease creativity without pushing towards a sound “biased” design path.

Chapter 10

A Wiki for the Pattern Language

This chapter presents a wiki website (Alves & Roque, 2012b) that was a relevant instrument to the achievement of the outcomes reported in this thesis. It also reveals the conditions that have been created to the step of calling for public awareness and engagement in further developments.

10.1 The life cycle of the Wiki

The development of a wiki website, though foretold since we started adopting the idea of creating a pattern language, gained even more expression when we felt the need to design the online support for the Deck of Cards (Chapter 7). As we will explain in the next subsection, the Wiki would become a fundamental and strategic instrument in the context of this research, with multiple contributions, some in line with our expectations, others more unanticipated.

The Wiki was maintained as an offline tool, running on a local host, while several aspects of the research were still ongoing, including the ethnographic exercise leading to the specification of version 1.0 of the Pattern Language, the design of a Deck of Cards for that version of the language, and the exercises of Deck inspection (Chapter 8) and analysis of pattern use in design (Chapter 9). The Wiki was prepared to be made available online and first publicly presented to the research community during the Audio Mostly 2011 Conference.

The following planned phase in the life cycle of the website will be to open it to the community of practice according to a strategy that we ought to design thoughtfully. Though we are not encompassing the tackling of this phase in the scope of this thesis, the fact that its eventual accomplishment is binding and that it shaped our mindset and decisions along the reported research, compels us to integrate such aspect in the rationale of the contributions of the Wiki.

10.2 Contributions of the Wiki to the Pattern Language

The systematization of knowledge on the Wiki is a strategic piece regarding past and future goals of this project. Its contribution may be presented along three dimensions:

a) structuration role of the Wiki on the development of the Pattern Language; b) participation on the dissemination of the inscribed contents; c) support for openness to contributions from the community of practice.

Contributions to the development

The idea that we would eventually resort to a website dates back to when we decided to work on a pattern language that would be, at a certain moment, subject to the appreciation of the community of practice. Considering our overall purposes we came to choose a wiki platform as the most appropriate support for the kind of strongly associative knowledge structure that was being represented by the Pattern Language.

The actual engagement in the development of the Wiki only materialized in a phase when we had already a considerable number of patterns identified and drafted. Once we started using it, the Wiki rapidly began to have a role far beyond the migration of our findings to an online support, and became critical to the evolution of the writing and structuration of the Pattern Language. It turned into a fundamental instrument to the refinement of the consistency of the collected information, and also to the arrangement of a discourse grounded on the evidences of relationships among the inscribed concepts (see the pattern definitions in Appendix D, particularly their *Description* fields). The opportunity to efficiently manage concurrently developing units of related text also added much to our earlier experience with simple text forms, favouring the further addition of new patterns, while demonstrating noticeable scalability in supporting the pattern synthesis and organization process.

To be rigorous, though only after we committed to the adoption of the Wiki we truly realized its potential and let that influence the organization of the information in the design patterns, the major aspects of the structure of the patterns, had already been influenced by an earlier prospect of adopting some kind of hypermedia presentation. That was the case of the pattern format, presented in Subsection 6.4.2.

One important aspect of the pattern's composition as potentiated by the Wiki is that the *form* of the resulting text is itself part of the message. In fact, the propensity to consistently embed links to the related concepts not only contributes to the navigation along those concepts but also emphasizes the network of interdependencies and the highly contextual character of the design patterns. For instance, a reader's recurrent perception of pattern descriptions exhibiting meaningful links identified along them is

perhaps an even more effective way to convey the idea of intertwining and holism than it is to explain it in abstract terms.

Yet another important aspect regarding the composition of patterns embedding links to other patterns whenever a relationship is to be documented, is that we invariably used the *names* of the linked patterns to display such links, inline, in the sentences. This means that it is possible to integrate the names of the patterns in the domain's discourse, effectively demonstrating and communicating that purpose through familiar use. Our assessment, empirically validated through writing descriptions for more than 80 patterns, is that it is not only possible with the current set of patterns but also comes out *naturally* in discourse. This is a relevant matter considering that one of the design goals for the pattern synthesis in design languages is to provide the practitioners with a *vocabulary* that enables them to communicate the domain concepts.

Contributions to the presentation

As previously exposed, besides its instrumentality to the development of the Pattern Language, the Wiki also serves the purpose of providing the audience with guidance to perform sound design in games, namely through the presentation and learning of such language. In that sense, the Wiki, as a means, is also an important contributor to such a dimension in achieving our research goals.

In turn, the dissemination of the proposed Pattern Language is also materialized by another instrument to which the Wiki provides support – the Deck of Cards for Sound Design in Games. The Wiki's relation to the Deck of Cards is twofold. First, it exposes and makes the Deck available to a larger audience. Second, it assists the users of the (physical) Deck by providing them webpages and resources that are fit to the design calls, namely when accessing through the QR-Codes contained in the cards. This assistance is meant to be as directed as possible and to afford exploration during game design sessions. Virtual representations of the cards are also embedded in the respective patterns' webpages with the double purpose of presenting and extending the use of the physical cards. Several aspects in the interface such as the ability to flip a card, picking a random card, and having a peek at a related card, are meant to better bridge both planes of existence. A physical Deck may be created by printing a PDF file, specially prepared for that effect, available through the Wiki.

The third dimension of contributions to be achieved through the Wiki relates to the openness to the community of practice. Opening the Wiki to the public, and promoting it, is being done at the time of this writing. That is a complex but mandatory step in the continuation of the project beyond this thesis and an important contributor to further accomplishing our research goals, which consequently cannot be taken lightly.

In fact, our investment in several aspects of the already conducted research was assumedly part of a strategy to reach the community's interest. For instance, as stated before, we considered relevant to extend the harvesting of new patterns and of examples for already existing patterns, while we perceived we were still being productive and genuine in that task. Such decision relates precisely to the fact that we found it strategic to come to a satisfactory representation of a network of design patterns, capable of nurturing the interest of the community on the overall proposal, and working as a convincing debut for an open discussion. In Subsection 10.9.2, we expose the current state of our reflections regarding an *overall* strategy for the future of the Pattern Language and the Wiki, as liberated resources.

We believe that the choice of a *wiki* platform is also important to *tacitly* signal our attitude towards the contents. Namely, due to the typical usage of wikis, we expect to be easier for us to convince visitors that this website is an open platform. In that sense, choosing a wiki became economical in terms of characterizing our website to visitors; or putting it in even another way, this kind of platform provides an already culturally established *context* that we otherwise would have to, somehow, communicate more explicitly. In turn, the perception of openness may contribute to foster a positive emotional appreciation for the endeavour, even by those not contributing directly.

10.3 SoundInGames.com

We prepared the Wiki to be first publicly presented to the research community during the Audio Mostly Conference, September 7-9, 2011. We have been adopting that date as the website's "release date". We purchased a domain name – soundingames.com – since we considered this name to be an interesting tradeoff between embedded information and memorability. Making the Wiki publicly accessible required attention to aspects

such as the potential visitors' contextualization, the adopted discourse and the general presentation of pending text and resources.

Contextualization

Regarding providing contextualization to visitors, we opted for an inclusive homepage (see Figure 10.1) complemented with lower-level pages with a discourse more directed to targets with specific interest in the matter, as suggested e.g. by Krug (2006). Specific contextualization includes the theoretical introduction to Pattern Languages, the presentation of the main aspects of this research, and further references. Aspects of the structure of the website will be presented further in this chapter.

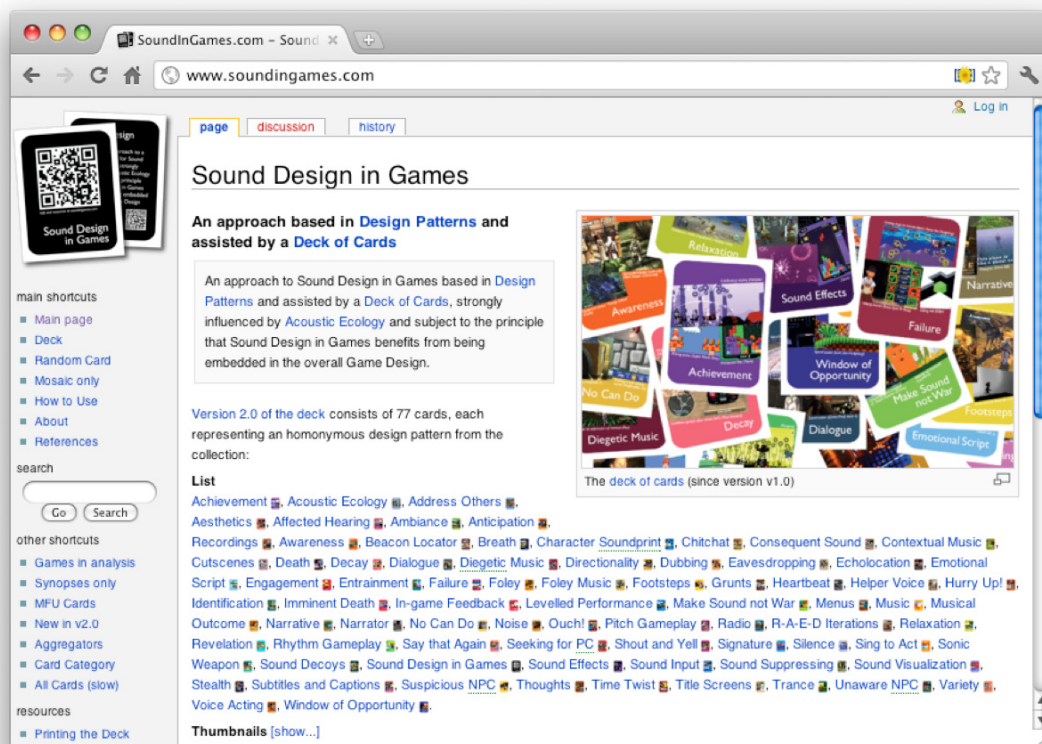


Figure 10.1. soundingames.com (view of the homepage)

Adapting the discourse to the audience

There are several distinct profiles within the potential public of soundingames.com that we target. We think of game designers as the final *user*, considering that they are the knowledge users (and producers) that we expect will be working with the Pattern Language in practice. Researchers who may be interested in this study also constitute a main target. Additionally, it is desirable that the presentation is straightforward enough for the general public to understand and appreciate the contents.

Concerning the way users get to the website, we should expect those querying search engines for “sound design games”, but also those (yet) just seeking for “game design”. We aspire that the latter appreciate the website as a serendipitous discovery. In accordance to what we exposed before (e.g., Chapter 2), the current lack of awareness for the potential of sound explorations in game design can imply that the former query is not the most likely route to soundingames.com. Finally, users who already have a printed copy of the Deck of Cards may get directly to specific webpages after scanning the respective QR-Codes.

We considered that visitors should be able to relate to the presented explorations of sound design without the need to be familiar with the formal concept of Pattern Languages and design patterns. We already have adopted a similar mindset when designing the Deck of Cards, and consequently, such design coherence should also prove convenient for users of the Wiki.

Nonetheless, we refer to the underlying formalism whenever the context requires it or when a deeper theoretical understanding is implied. We were attentive to avoid generating confusion in users, namely regarding the interchangeability of the terms “pattern” and “card” in several contexts (e.g., the “cards’ webpages” are the respective “patterns’ webpages”).

Presenting pending contents

In terms of the presentation of pending contents, we faced a double challenge. On the one hand we want visitors to clearly identify the incompleteness of some aspects, so that, for instance, they are able to perceive it as a *transient state*, and not as a flaw. Furthermore, such incompleteness should function as an “invitation” for the engagement in participatory authorship of the Pattern Language. The explicit signalling of these spots of ongoing edition should contribute to a general feeling of aliveness of the body of knowledge and of the viability of partial contributions. On the other hand, we want the evidence of missing parts not to depreciate the contents already inscribed.

We have been tackling this incompleteness issue in several ways. First, we avoid keeping pending editions that obstruct the appreciation of otherwise “ready” pieces. For that and accepting that we will always have pending contents (which is meant to be a feature, not a problem), we tend to give priority to the resolution of those cases. Second, we carefully post signals where the need for completeness is not obvious, using the notation

“[pending: ...]”, possibly including a very short description of what is missing. The signals also permit to use the local search engine to locate the respective spots whenever dedicating time to the enhancement of the Wiki’s contents. At the moment of this writing, most pending situations relate to filling in the description of some of the already inserted video examples, completing and formatting some included references, and double-checking some reported facts.

In the following sections we will present aspects of the structure and features of the website that have relevance in terms of contribution to achieving our research goals. We will emphasize the patterns’ webpages, the views over the pattern collection, namely resorting to representations of the respective cards, aspects related to the usage of the Deck, and properties of the presentation of the videos exemplifying the occurrence of the design patterns. A characterization of the most relevant webpages in the website, with references to sections containing further details, is provided in Table 10.1.

10.4 Presentation and views

The considerable amount of design patterns and the pertinence of promptly finding one of them, among the others, led us to be particularly attentive to the effectiveness of their listings. We designed two alternative views for the list of patterns, both taking advantage of the fact that the cards’ faces can also be used in the website as graphical representations for the respective patterns. Not only the association between the cards and the patterns is natural, in the sense that the cards were indeed designed as tokens for the patterns, but also such association supports the advantage that becoming familiar with one of the forms may have in recognizing the other.

One of the designed views presents the cards as a mosaic, arranged side by side (Figure 10.2). To further ease the location of a particular pattern we typically sort them alphabetically. The other view is similar to a plain listing, except that a tiny depiction of the card is posted next to the name of each respective pattern (Figure 10.3). The use of these images fulfils two purposes, none of which implying being able to perceive the contents of such minute representations. The first purpose is that they work as *separators* between the names (similarly to bullets), helping readers to promptly perceive the whole piece of text as a list, as opposed to a regular paragraph. The second purpose is to provide a clickable item that allows inspecting the card (in representation of the pattern).

Table 10.1. Characterization of most relevant webpages in soundingames.com

<p>Main</p> <p><i>Homepage</i> (Figure 10.1)</p> <p><i>Deck</i>: views of the Deck in its different versions</p>
<p>Reference</p> <p>Each of the 81 design pattern's webpages (Section 10.5)</p> <p>Each of the 3 fully presented game's webpages (Section 10.7)</p>
<p>Usage in design</p> <p><i>Random card</i>: shows a randomly selected pattern's webpage (Section 10.5)</p> <p><i>How to use</i>: suggestions on how to explore the patterns and the Deck of Cards</p> <p><i>Most frequently used cards</i>: a classification according to the frequency with which the respective sound explorations have been found in games</p> <p><i>Printing the Deck</i>: instructions on downloading and printing the Deck from a PDF file (Section 10.8)</p>
<p>Views (Section 10.4)</p> <p><i>Synopses only</i>: list of all names with synopses</p> <p><i>List of cards</i>: The list of all cards, each represented by its name that links to the respective webpage and a tiny depiction of the card which triggers an overlaid visualization of that card (Figure 10.3)</p> <p><i>Mosaic of cards</i>: view of all card's faces as a mosaic (Figure 10.2)</p> <p><i>Games in analysis</i>: list of games from which examples were selected (Table 6.10)</p>
<p>Information</p> <p><i>About</i>: general contextualization</p> <p><i>References</i>: references, including the authors' publications supporting the presented work</p> <p><i>Contact</i> webpage</p>
<p>Research and maintenance info</p> <p><i>Discussion</i> webpages (Section 10.5)</p> <p><i>Candidate patterns</i>: information regarding patterns being considered</p> <p><i>Revisions</i>: logged revisions (Appendix F)</p> <p><i>Aggregators</i>: information on aggregator patterns (Section 6.5)</p> <p><i>To Do</i> and <i>Wish list</i> (Subsection 10.9.1)</p>

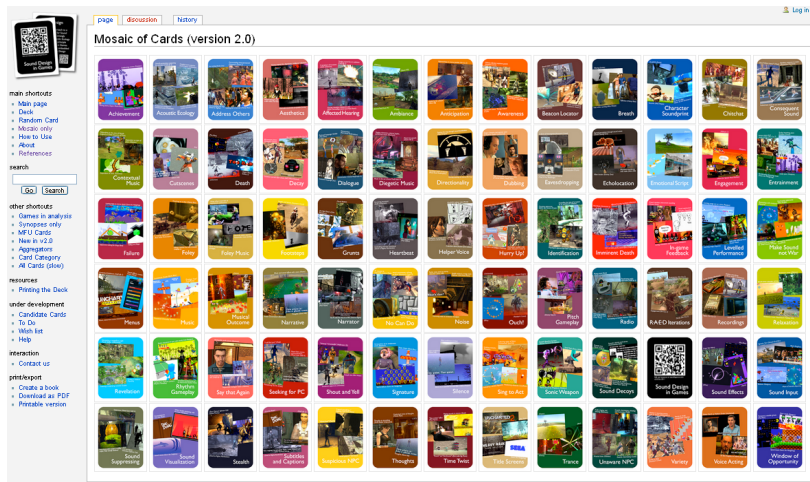


Figure 10.2. The mosaic view of the Deck (with cards in alphabetic order of pattern names)

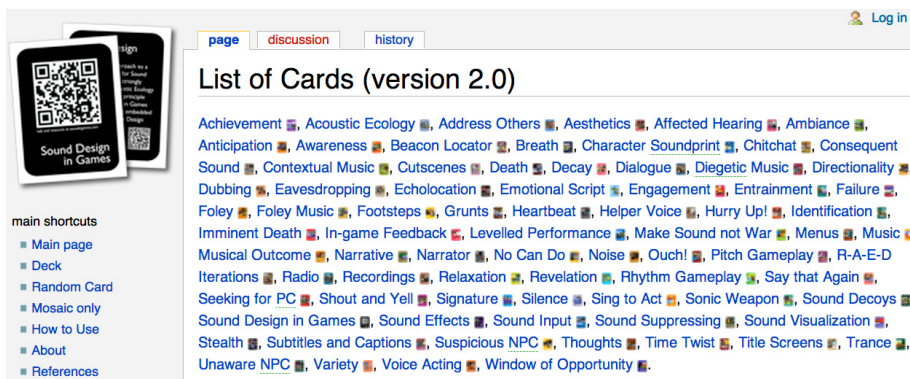


Figure 10.3. A list view of the cards (in alphabetic order)

In turn, the representation of a card offers the link to the respective pattern's webpage, should the user follow that direction. Additionally, it allows flipping the card, which constitutes an expedite way to check the synopsis and the relationships of that pattern. The card is presented in an overlay as exemplified in Figure 10.4.

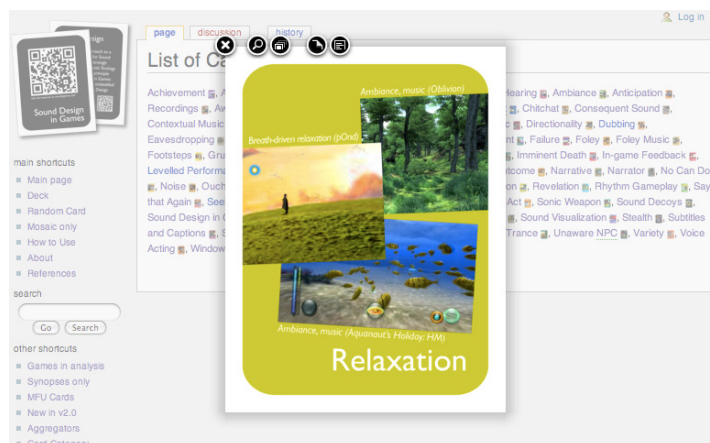


Figure 10.4. An overlaid view of a card (exemplified with *Relaxation* card)

10.5 Patterns' webpages

The patterns' webpages implement the presentation of the patterns according to the format discussed in Subsection 6.4.2. It also serves the goal of allowing visitors to appreciate the contents even if, or while, they are unfamiliar with the theoretical aspects inherent to design patterns.

As observable in Figure 10.5, the presentation of a card is merged into the presentation of the respective pattern. This design decision has several advantages. To start with, it avoids redundancy, when compared to an approach involving separate representations. Besides, it also contextualizes the card in the more complete description of the respective pattern, and it tacitly explains their association. It is worth recalling that one possible scenario of usage of these webpages is in connection with the exploration of the physical cards, by scanning the link on each card's QR-Code. In that sense the depiction of the respective card is expected to reinforce the sense of location. Additionally, we expect that the inclusion of the cards in the webpages contributes to the memorability of the webpages themselves, extending to this context the rationale we adopted regarding the memorability of the cards (presented in Section 7.3).

Finally, the visitors' exposure to the representations of the cards is expected to help introducing the Deck to those potentially interested in further exploration. Aspects such as the inclusion of the iconic depictions of the related cards, in the field *Relationships*, also aim to reveal the existence of "more cards", especially to newcomers. Nevertheless, those icons and the possibility of expanding them to inspect the respective card, and optionally to follow to the corresponding webpage, also play a functional role in the exploratory navigation across webpages as expected from someone learning the language.

Discussion webpages

One interesting feature of wiki platforms, which we are exploring, is that when regular webpages are created, a "twin" webpage, designated *Discussion* webpage, or *Talk* webpage, is automatically associated (observe item number 8 in Figure 10.5). The *Discussion* webpages are very useful to support localized reflection without interfering with the main text. We expect this kind of webpages to become the most used stage for contributions to *soundingames.com*, once it gets disseminated among the community.

The image shows a webpage for 'Sound Decoys' with various sections and annotations. The annotations are as follows:

- 1**: points to the navigation tabs (page, discussion, history) and the main page title.
- 2**: points to the two card images (front and back faces).
- 3**: points to the 'Relates to' section, specifically to 'Sonic Weapon for PC' and 'Sound Effects'.
- 4**: points to the first example video thumbnail.
- 5**: points to the text description of the first example.
- 6**: points to the video player controls for the first example.
- 7**: points to the video player controls for the second example.
- 8**: points to the 'discussion' tab.

The webpage content includes:

- Navigation:** page, discussion, history
- Section:** Sound Decoys
- Contents:** 1 Synopsis, 2 Relationships, 3 Description, 4 Examples, 5 Revisions, 6 External Resources
- Synopsis:** Using sound to fool the opponents.
- Relationships:** Context: Stealth, Consequent Sound, Make Sound not War, Emotional Script. Relates to: Unaware NPC, Suspicious NPC, Seeking for PC, Sonic Weapon. Often uses: Foley, Sound Effects.
- Description:** A customary component of the gameplay is to deal with enemies along the game space. In some situations it is convenient to divert enemies' attention and possibly to influence them to change their positions, either to be able to deal with one at time or to avoid confrontation at all. Diverse forms of **Sound Decoys** can be included in the gameplay. Sound is particularly suitable for integrating meaningful decoy actions since it allows launching the decoy whilst avoiding visual contact. Spaces with reduced visibility also bring advantages both for the plausibility and of the usefulness of the decoy.
- Examples:**
 - Metal Gear Solid 4:** Snake lures an enemy out of his place by throwing an empty magazine into a convenient location. Knocking on objects is an alternative to attract a NPC, but it requires that the NPC is close enough and the attention is directed towards PC's position.
 - Tom Clancy's Splinter Cell:** Chaos Theory: Apart from being able to make noises by throwing objects that he can grab, Fisher can whistle to make an enemy go check the sound.
 - Dead to Rights: Retribution:** Shadow can bark (either a short range bark or a louder bark) in order to lure enemies to a convenient position.
 - Spore Origins:** One of the parts, in which the player can invest when upgrading the creature, allows emitting a sound that attracts easy prey. This feature needs to be timely managed because it takes some time to 'recharge' (notice the indicator in the bottom-left corner).
 - Papa Sangre:** In this particular level, noisy chicken may be released to divert the opponents from the PC's position and Footstep sounds. In other levels the PC's own Footsteps can be used to lure an opponent away from a position that needs to be visited (as the Helper Voice suggests).
 - Thief III: Deadly Shadows:** Garrett can draw special noisemaker arrows in order to divert enemies.
 - Commandos BCD:** All commandos can make a distracting noise by throwing stones to the behind of enemies. Additionally, one of the commandos, Tiny, has an acoustic decoy as part of his equipment.
- Revisions:** introduced in version 1.0.
- External Resources:** References to Tom Clancy's Splinter Cell 'Distraction Camera': IGN Guides. First presentation of pattern **Sound Decoys** in (Alves & Roque, 2010)

Figure 10.5. The layout of the design patterns' webpages (exemplified with *Sound Decoys*)

The fact that the context of *Discussion* webpages legitimates a conversational and formally relaxed writing creates an alternate form of intervention, propitious to posting quick comments and risking statements without major commitment. We have used such webpages ourselves, particularly prior to launching the website, to hold our threads of essays and reservations while we were still studying their implications to the standing body of knowledge. Typical examples of matters whose evolution we developed in the respective *Discussion* webpages include changes to a pattern's name, checking a pattern's meaningfulness considering a possible overlapping with other existing patterns, etc. Though those were indeed language development notes, we still keep some of the threads, for two reasons. One is because decisions often resulted from compromises that are better understood (or recollected) if the respective history is kept available. In that sense, such discussions are part of the rationale. The other reason is to demonstrate how the feature can be used and that other users are welcome to use it.

Although we are referring to *Discussion* webpages in the scope of the pattern's webpages, it should be noticed that this feature is potentially as interesting regarding other types of webpages in the Wiki.

Random card feature

We included a feature (accessible through the sidebar) that allows requesting the webpage for a randomly selected card/pattern. Besides potential usefulness, the sheer existence of this feature may contribute to *signal* the possibility of “flicking through” the patterns as a way to get to know them better or as an uncompromising startup approach while prospecting a specific interest.

10.6 The video examples

The rationale for the harvesting and selection of the video examples was presented in Sections 6.4 and 6.6. In the current section we present design and implementation decisions with relevance for their appreciation.

Sizes, format and hosting

Once trimmed, videos were resized and uploaded in several resolutions so that it is possible to serve an adequate file size and quality according to the scenario (e.g., inline playing of embedded thumbnail versus playing in an overlay). Resizing has also been convenient to cope with some specific circumstances (e.g., iPhone scaling to screen

resolution and maximum playable resolution). We opted to host the videos ourselves (i.e., they are maintained and served from the same host where the Wiki is hosted) in H.264 format. Users are required to use a QuickTime compatible plugin. This may be revised in the future but it has shown to be the best approach by now.

Video presentation

All videos used in the website are shorter than 30 seconds. Among other aspects, the exact length, in each case, should contribute to addressing the particular aspect at stake in a direct manner. A short duration also augments the possibility of checking several examples without compromising the flow of the task being performed. A small amount of overall bytes transferred may also be relevant, depending on the network access conditions.

We offer two modes of playing the video examples with complementary virtues: embedded (number 4 in Figure 10.5) and overlaid (similarly to Figure 10.4). The embedded mode uses smaller files, because we contemplated a smaller resolution version, requiring less network bandwidth, which in turn may be critical for readiness and uninterrupted playback. Playing in overlay is interesting when it is relevant to have a larger or shared visualization. The appropriateness of the playing mode also depends on the client device. For instance, whereas in the iPhone all videos play in full screen, the iPad offers an excellent behaviour while playing embedded files.

Adopted policy on spoilers

“Spoiler” is the name given to any piece of information that reveals to the audience an aspect that consequently compromises the ability to enjoy the referred work as it could happen in the absence of that information. Internet users are accustomed to count on the network etiquette to be spared from spoilers. This applies to any piece of fiction, computer games included. When is unavoidable presenting a spoiler, network etiquette has it that the word “SPOILER” is shown in capitals and that arrangements are made for the user to have the chance not to experience disclosure of the respective information unintentionally. Though it is arguable that virtually every fragment of gameplay may be a spoiler, in the sense that contacting with it beforehand will change what the player already knows when first playing, the classification tacitly applies to more explicit cases that let eventual players realize something that they should find for themselves.

We adopted the policy of avoiding referring to spoiler situations and extracting gameplay video pieces from advanced states of the game, so that the context being presented is not too revealing. Nevertheless, when the explorations of sound design that we identified can only be found in such conditions, we hide the respective description with a “[SHOW SPOILER]” link that needs to be clicked so that the text is exposed and, in the case of videos, we include a “[SPOILER VIDEO]” inscription close to the play button. As a representative example of the extension of this issue, one of the most clear examples we found, so far, of the sound exploration described by the pattern *Directionality*, implies revealing a tricky way to defeat the final opponent character in a particular game (and, along with that, the identity of that character and the setting where the conflict takes place).

10.7 Patterns per game

As introduced, the pattern’s webpages present examples selected from the universe of games being considered. Consequently, they document games that explore the patterns. But they do *not* provide the reverse perspective, i.e., (all) patterns that can be found in a particular game. Presenting examples for all design patterns in the collection that we could find within a particular game exposes several interesting aspects, both for users of the Pattern Language and for research purposes.

All patterns we could find for each of three games

In order to provide such dual perspective, we chose three games and, for each, we presented examples of every pattern from the pattern collection that we could identify. The fact that we performed this exercise with three games, only, resulted from a thoughtful decision. First, we did not want to run the risk of projecting the idea that we were doing “game reviewing” – that would be an unfortunate confusion. Second, we considered that with the three particular games we selected it is possible to illustrate the intended perspective.

The three selected games are fairly diverse in genre and platform, and the excellence of their sound design has been recognized (e.g., Buchanan, 2011; G.A.N.G., 2005; Haynes, 2008; Hoggins, 2011; IGN, 2008; McBride-Charpentier, 2011). *Half-Life 2* is a first-person shooter, released for PC (MS Windows) (2004), Xbox (2005)/Xbox 360 (2007), PS3 (2007), Mac OS X (2010). *Papa Sangre* is an audio first-person thriller, for iOS (iPhone/iPad) (2010). *Patapon* mixes features of rhythm games and god games, for the

PSP (2007). Out the total 77 design patterns already in our collection (we excluded the 4 aggregator patterns in this exercise), we identified 31 in *Half-Life 2*, 36 in *Papa Sangre* and 36 in *Patapon*. In conjunction, 58 of the 77 design patterns (75%) were found, which reveals that the chosen games are also fairly complementary in terms of the particular patterns that they cover.

The compilation exposes the ecology of explorations

For each of the three games, the compilation of all patterns that we could find, in addition to exposing the cases of the patterns that are not exhibited in the respective patterns' webpages (because, as explained, each pattern's webpage only shows the most prominent examples that we could find among *all* games that we analyzed), it permits to contemplate the ecology of the respective sound explorations in the context of the single game. The captions provided with the examples, which include cross-references among the identified patterns, also contribute to document that holistic exposition.

A concern we had, when presenting the compilation of patterns used in each of these games, was to avoid inducing the observer to correlate quantity of patterns with quality of sound design. We expressed this apprehension before, in Sections 6.7 and 9.2 (in different contexts). We certainly chose three games of recognized sound design quality, but it was not based on the *amount* of identified patterns that we intend to exhibit such quality. Being so, while writing these webpages, we emphasized the characteristics of the explorations not their abundance.

Not all interesting sound explorations are patterns

This exercise also provided us with additional reflections relevant to the maturation of our understanding of the Pattern Language. While choosing the examples to exhibit, we sometimes found arguable whether a particular sound exploration should be considered a case of a certain pattern. It is relevant to refer this experience, but only to emphasize that this is a *false issue*. That is, whereas patterns identify types of explorations (recurrent explorations, by definition), by no means the collection of patterns serves the purpose of ensuring that each particular sound exploration fits in some pattern, either because such exploration is not a solution to a recurrent problem (and, as such, a respective pattern was not specified), or because the match is partial and, consequently, asserting the use of the pattern becomes a subjective decision. The clarification of this subject is a fundamental aspect, and it is an example of how preparing this webpage had a collateral

interest in the maturation of our understanding of the Pattern Language and in the ability to communicate it.

As a final note, it is worth referring that by the time we did this exercise we had already conducted thoughtful analyses to these three games, in search of new patterns and of examples that would be selected to illustrate the already identified patterns. So, it was not unexpected that this particular exercise did not contribute itself, collaterally, to the identification of new design patterns.

10.8 Printer-friendly Deck of Cards

The purposes inherent to the conception of the Deck of Cards as an instrument relevant to the community of practice imply that the practitioners can actually be in possession of this object. In this initial phase of the project, we have been producing and delivering the Deck of Cards to those participating in research exercises or revealing interest in using it. Obviously, this approach is not scalable, at least not with the currently available resources. Also, we believe that it makes sense to offer a more immediate and autonomous solution, which allows others to try the Deck of Cards without having to ask or wait for mail delivery. With such intent, we now make available the same PDF file that we use to produce the cards ourselves. It consists of 20 A3 pages, which are prepared to be printed as 10 double-sided sheets (as of version 2.0). Crop marks are included, as observable in Figure 10.6 (for a depiction of the 20 pages see Appendix E). Further instructions and alternative outputs are included in the same webpage where the download link is provided.

Though this approach also requires some effort on the side of those interested, we expect that it will be a relevant alternative. A side aspect, but still one that could be interesting to study, is the impact in the users that the act of crafting the cards (assuming manual involvement in their production) may have in developing an affective relationship and perception of their value. Considering that one characteristic being explored with the use of this Deck is its physicality, which includes the tangible relationship with the object, the question seems pertinent. Not less important, we believe that this availability will also be perceived positively, as a signal of openness and of our commitment with the goals of the initiative, including promoting the appropriation of the body of knowledge by the community.



Figure 10.6. Depiction of the front face of one of the 10 printable double-sided A3 sheets

10.9 Future work

In the next subsections we present some additional aspects deserving further development, adding to those that we have already mentioned along the previous sections. Specifically, we refer to the management of pending enhancements and to the definition of a strategy for the wiki's future.

10.9.1 Fixes, additions and tests

Items in "To Do" and "Wish List" at soundingames.com

We keep a *To Do* list and *Wish List* in a public webpage of the Wiki (accessible from the sidebar). The webpage has the double purpose of letting people know the aspects that we are already aware of, and to evidence that we value the identification of enhancements and that we are interested in tackling them. Most of the items passing through these lists, particularly those in *To Do*, are strictly technical and short-lived, so we will not give them further emphasis here.

Also, we will test the website for user experience and usability. Although we are adopting a platform that is well known and that has been subject to refinement, it is plausible that such kind of tests will expose opportunities for enhancement regarding the structure, exploration of extensions, features we coded ourselves, and the layout of the several elements inside the webpages. The effectiveness of the homepage, both functionally and emotionally, is one other specific aspect that ought to be tested. It is also important that the tests will extend to the support for openness to the community.

10.9.2 Defining a strategy for opening the Wiki to the community

The native features and the extensions available to the wiki platform ensure the basis for expediting collaborative editing and social interaction. Still, opening the Wiki to the community is a matter far more complex than the strict technical ability to do so. It implies the establishment of a clear participation and dissemination strategy that involves addressing several sensitive issues, including the forms of contribution, the criteria for acceptance of contributions, the scope of revision, and our own role thereafter.

Possible forms of contribution that we are considering encompass rating a certain element, inserting localized comments or interpretations, suggesting new contents, and actually entering contents. The choices are likely to be associated to the kind of accountability to be implemented, starting by author admission. Alternatives are allowing anonymous input, requiring self-registration, implementing some admission process, and directly inviting authors. Aspects such as the level of effort needed to become an author and recognition of the authors' identities are expected to have impact on the volume and kind of contributions.

The envisaged *purposefulness* of the contributions is perhaps the central aspect to be defined. Both enhancing the contents and engaging potential practitioners are important dimensions, which do not necessarily call for the same approach. The former points to a more judicious attention to contents, whereas the latter also depends on the perception of the social component. An interesting balance will most likely imply the combination of several possibilities, adjusted to multiple participant profiles. In fact, the sense of community may profit from the perception of an ecology of roles and interests, where some feel qualified to offer know-how, others may have suggestions, criticism and

doubts, and still others appreciate lurking while having access to a resource which is being constructed by peers.

The scopes and stages of intervention are another aspect that needs to be addressed. For instance, contributors may be allowed to edit contents webpages or just the respective *Discussion* webpages. If rating mechanisms will be used they may be either per webpage or more granular (e.g. per example, in the design pattern's webpages).

Finally, we should reflect on our role in curating the Wiki, which also depends on decisions regarding the questions above. We may assume a diversity of roles: main editors, discreet moderators, contributors, just hosts, etc. These curation options may have implications for the perception of, and eventual appropriation by, the community of practice and on the beneficiary of the contributed efforts. Possibly our presence will have to be dynamically adjusted according to the lifecycle of the community, for which an attentive study of the state of the art on community management will become fundamental.

Chapter 11

Conclusions

In this concluding chapter, we summarize our research contributions and present an agenda for future work, revealing questions that this study brought into perspective, which emphasizes that the possibilities here initiated are far from being exhausted. This thesis represents the foundation for a project that evidences the potential to achieve new levels of meaningfulness at the hands of stakeholders in the practice of sound design in games.

11.1 Summary of the contributions

In this section we present a summary of our research contributions. We open with a brief reference to the relevance that this study may have as an element of sensitization of the target audience for the underexplored potential of sound design in games, thus also amplifying the voices of other authors that we have been citing in that respect. Then, we present our proposals, developed to approach the research question. Namely, we will address our main research contributions in terms of ways to provide guidance for non-expert practitioners to become empowered to perform sound design in games.

11.1.1 Sensitization for the potential of sound design in games

As we argued, several factors have belated the awareness for the potential of sound design, including in the broad scope of game development. Almost invariably a search for the words “sound” or “audio” even when performed on guiding works that, at least tacitly, are expected to be comprehensive, returns few or no occurrences (also, Grimshaw, 2008, p. 11). Most certainly, this scarcity is not a manifestation of their authors’ antipathy for the audio modality but just a circumstantial lapse that passes mostly unnoticed because it matches the lack of expectations from a preeminently visual computing culture.

Bringing sound to the space of possibilities, when communicating and designing interaction, implies making potential stakeholders aware of such opportunity. Considering the estrangement dictated by the circumstances, that effort needs to start, precisely, at the fundamental level of sensitization. The contextualization that we provide

to our study, along with the research endeavour, per se, may contribute to such mindfulness.

One particular trace of the kind of sensitization that our work carries is that we escape the temptation of putting sound ahead of other modalities when arguing its interest. Our commitment is with the design of the conditions for users (players) to enjoy the best possible experience, and we are contributing to that by means of one facet that we found noticeably underexplored – sound design. We recognize that it is perfectly understandable that some of the texts praising the role of sound end up inspiring a kind of *prominence* of sound, as part of their circumstantially passionate message. Yet, while such discourse is certainly revealing and enthralling, the frequent overstatement of the claims places the message in the plane of utopia, leaving few chances, less to say tools, for readers to give consequence to the sympathy they might grow for the message. Furthermore, messages pushing sound to the forefront often feel as unbalancing as the situation they try to correct and fail to introduce sound design as an opportunity that can be awakened, to participate as justified in a solution, as opposed to a feature that should be brought in and made itself be heard.

11.1.2 An approach to holistic sound design

Understanding the complimentary role of sound within the overall design creates the conditions to take the idea even further and realize the limitations of interpreting sound disconnected from the context where it occurs and that confers it a purpose. In fact, thinking of sound *in* and *as context* blurs the boundaries of the modality and consequently calls for an inclusive approach that is able to address sound holistically.

Our mindfulness for a holistic approach to sound design stems from thoughts expressed by expert sound designers and it finds a solid theoretical support on the body of knowledge in the field of Acoustic Ecology. This mindfulness has been influential to our study since our early developments. Yet, it was when we could eventually realize its meaning in terms of the guidance that we were developing, in answer to our research question, that it really become consequential. In fact we were uneasy, in early phases of the study, with the idea that for non-expert practitioners to profit from a holistic sound design they would depend on keeping such mindset in their minds while preserving to find ways to explore it. We sensed that, despite the sympathy that these practitioners might grow regarding the holistic approach, sensitization alone might not be effective enough in supporting significant change.

The most fundamental expression of our adherence to a holistic approach to sound design is the proposal of the practice of sound design as part of game design, with implications on the moment it is performed, the embedding in the game ideation process, and the kind of proposed explorations, oriented towards context of use and purposefulness rather than to the modality itself. Actually, along this research we went through moments in which we had to face our own existential doubts on whether we were indeed proposing an approach to sound design or to game design instead. Retrospectively, we are able to understand that this was a false question and that such possible confusion is indeed among the best compliments that this work can receive. We believe that it is the expression of a genuine interpretation of sound design, in line with the aspirations of those who inspired us in the genesis of this study, from disparate relevant fields including Acoustic Ecology, acoustic communication, and the practice of sound design both in cinema and games.

We argue that this holistic understanding is one of the contributions of our research, and it is integral to the guidance that we are proposing. That is, our proposal is not limited to the acknowledgement and reverberation of the pertinence of such understanding; this understanding is really implemented *through* the proposed guidance. Thus, for this holism to be achieved, designers are less dependent on their ability to sustain the mindset or to be attentive to some other additional layer of concern. Instead, if designers will consider the proposed guidance in the ideation process, they will be in fact considering sound in a way that is holistic, based on suggested explorations that are also holistic *by design*.

11.1.3 Guidelines for Sound Design in Games

As argued in the previous section, in a holistic understanding of sound design, explorations of “sound” are not just about “what is heard” during the experience. Several other dimensions are as interesting to design. To start with, there is the interpretation of sound in the game world, which regards the characters’ ability to hear and to make (or to avoid making) sounds for others to hear. Although this sonic world may reach the ears of the player, its meaningfulness extends far beyond that level of appreciation. It matters for the characters’ competences and it contributes to dismiss uncanny handicapped conceptions and to bring overall coherence to the creations. Not less importantly, it expands the design space, creating conditions for innovation.

One other example is the sound that a player can be allowed to produce in order to participate in the game world. Here, it is the performance of sound, and even more fundamentally, the *relevance* of performing sound, that comes to play. Moreover, that sonic participation might not be circumscribed to volunteer and conscious emissions but extend to contextual aspects that can be integrated in the game environment and mechanics.

Yet another possibility is to contemplate acoustic explorations that are not meant to be perceived in the conscious plane but that are effective in communicating messages and in influencing the journey through emotional states. This kind of exploration is particularly meaningful in game design. Getting emoted is one ultimate motivation for playing.

We expressed the encouragement for designers to explore opportunities such as these in a set of Guidelines that we are proposing as part of this thesis. We synthesized these Guidelines with basis on a multidisciplinary review that we found rich in suggestions and insights for promising developments, or narratives of ideal futures, to use a more designerly terminology.

11.1.4 A Pattern Language for Sound Design in Games

We also contributed with a Pattern Language that complements the proposed guidance with tangible suggestions of exploration that represent recurrent design solutions that can be found in existing games. We opted to ethnographically harvest such solutions, as a more convenient alternative to directly eliciting knowledge from the experts, which revealed itself to be feasible and prolific at this phase of the endeavour. We backed up the Pattern Language with an extensive library of judiciously selected examples, which reinforces the pertinence and semantics of the proposals, augments the likelihood that the patterns are well understood, signals diversity of opportunities when implementing a pattern, and supports designer discourse and creativity.

We deliberately invested in augmenting the plausibility of this initiative to become noteworthy and attractive to the community – a requirement for further engagement and eventual appropriation – by growing a meaningful body of knowledge that can be regarded as a worthy starting point. For instance, we expect that these conditions entice early participants to get involved in commenting on pieces of the already proposed body of knowledge, instead of requiring them, at this debuting stage, to fill in their own

contents and then expect others to comment on it. That latter dynamics, though closer to a full appropriation of the body of knowledge, will possibly start emerging only when a sense of community will already be perceptible. Furthermore, it is conceivable that some profiles of contribution will, precisely, consist of (mostly) commenting; so, the sooner we manage to engage such protagonists in dialogue the better.

11.1.5 A Deck of Cards for research and use of the Pattern Language

We designed a Deck of Cards whose initial motivation was to facilitate the auditing of design sessions with research intents. Soon, this Deck revealed the potential to become a more general-purpose tool for the community, as a support to the communication of the body of knowledge and to the practice of design.

We included in this thesis detailed analyses of two exercises of improvement of the Deck and of the Pattern Language that it conveys. These exercises were most fruitful not only in terms of the intended revisions but also for the maturation of our understanding of this form of guidance and of its integration in a game design scenario.

11.1.6 A Wiki for the development of the Pattern Language

We also contributed with a Wiki. The Wiki is a tool thoughtfully designed to support the empowerment of the target audience, allowing the exploration and the eventual appropriation of the body of knowledge. As part of this role, it also works as the repository of the library of video examples, and it backs up the use of the Deck of Cards.

The Wiki also contributed as an ongoing *research* tool. It has been instrumental in incrementally building and revising the structure of relationships in the Pattern Language. Plus, it offers the technical conditions to participate in the maturation of this form of guidance by supporting the continued engagement of relevant stakeholders.

11.1.7 New research questions

In addition to the aspects evidenced in the former subsections, this research also contributed with new questions that were brought forward and that we could only formulate on top of the advancements that we made along the project. We will expose the most prominent of these questions in Section 11.3, devoted to future work.

11.2 Boundaries and limitations

Before proceeding to the presentation of future work, in the next subsections we will identify boundaries and limitations of our current proposal. All of these aspects were already mentioned along the thesis but, considering their character, we opted to revisit them in this chapter.

11.2.1 Limited interest for closed game designs

As we stated before (e.g., Section 4.1), most of the sound explorations that we suggest imply an adequate level of flexibility to design the game in ways that allow such explorations to be possible and meaningful. Hence, many explorations might be ruled out if the sound design guidance is to be used in a project whose game design is already closed or otherwise locked. Although we do not consider this to be a flaw intrinsic to the design guidance, in the sense that it is a direct consequence of one of the virtues that we built in it, it certainly dictates that our proposal will not be as effective in all possible scenarios.

Nevertheless, this aspect, though limiting, is not as critical as it may seem in a first appreciation. To start with, it is unlikely that games that are already implemented will get back to the development phase, to be reedited, for instance to have their sound redesigned; so, our concern should in fact converge to game projects that are *yet* to be implemented. In turn, in this latter scenario, provided that the interested users contact with the sound design guidance before they actually engage in game design, they will likely be aware that this guidance is meant to be used during the process of ideation.

Still, we recognize that users may decide *not* to use this guidance during the ideation phase, for instance because they already have an established workflow for that phase and they don't find a way to combine them. That is one other kind of limitation, which we refer to in the next subsection.

11.2.2 Possible issues when integrating with established design frameworks

The guidance we are proposing, and particularly its instrumental level, e.g., the Deck of Cards, may not fit in, or call for disparate approaches, in case the designers are willing to concurrently use other mechanisms or workflows that somehow conflict with its usage. This issue is related to an aspect that we are addressing as future work (Subsection

11.3.3), which is the definition of a *process* for the use of the guidance that we are proposing.

Some authors suggested settings where cards and other methods are combined (Biskjaer et al., 2010, p. 18), which may be relevant to inform a resolution on specific scenarios. A particular case that would be interesting to research is the conjugation with other design deck for ideation. Naturally, even the choice of that second deck (see Section 7.1 for some alternatives) would certainly have implications on the unfolding of the design session.

11.2.3 Timeframe for the observation of the impact of our proposal

The actual empowerment of the community of practice, towards which we direct our research, can only be observed in the medium to long term. This means that the immediate appreciation of the value subjacent to this thesis has to be done, instead, on the basis of the merit of the conditions created to unfold developments aiming at such empowerment. This a regular scenario in SfD, where the proponents consistently rely on the methodological grounds of their claims to convince project stakeholders to engage and to invest in further development, considering that there is no way to assess or predict the actual evolution of their proposals, because they are highly dependent on human agency and on the meanings that humans may construct around such proposals, which in turn cannot be foretold by causality models (as discussed in Chapter 3).

Still, this scenario is not as familiar in other fields, including in HCI and particularly in a positivist view of science. That tempted us, along the research, to present more definitive evidences of value and appropriateness through the instrument validation experiments presented in this thesis. Yet, we found that more than the current correctness of the body of knowledge, it is interesting to evaluate the conditions created to enable the relevant stakeholders to work on it, and hence the likelihood that such knowledge will *eventually* represent the available expertise. This does not dismiss the importance of building the most plausible possible starting point – and our argument is that we adopted a methodological approach that allowed us to do exactly that – but such plausibility can only be confirmed by the community of practice along the process of appropriation that, as we said, will not happen in the immediate term. Consequently, more than increasing the number and statistical relevance of evaluation exercises performed over the current versions of the guidance, we are urged to push such guidance to a new phase of its life

cycle, where it should find its place in design contexts where its impact will eventually become “evaluable”.

11.3 New questions and future work

Along this thesis we have presented, in context, aspects needing or proposing further research. In the following subsections we expose several other questions that also emerged from the research and that represent future opportunities to study and evolve the current proposal.

11.3.1 Iterating the Guidelines

Although we have not yet perceived any particular evidence of the need for revising the current set of Guidelines, we believe that, considering the developments occurring since they were first proposed, we should perform an additional DSR iteration, aiming at revisiting the foundations of those Guidelines. Our understandings have necessarily matured since then and we have been subject to a multitude of new stimuli that could inform revisions or additions.

Though the relative magnitude of the Pattern Language sometimes eclipses the Guidelines, by no means their importance should get diminished. The Guidelines, as high-level design guidance, can still inform sound design beyond specific problem contexts. Their complementary role in connection with the Pattern Language demands that we remain willing to keep improving them with the same kind of interest that we have been dedicating to the emergence of the Pattern Language.

11.3.2 Charting unexplored sound design spaces

As exposed before, at a certain moment in our research we realized the interest in complementing the higher level of guidance provided by the Guidelines with a lower level, which became a Pattern Language whose patterns were harvested under the same mindset that supported the conception of those Guidelines. That is not the same to say that we tried to find design patterns to represent each of the Guidelines – we found no interest in conditioning our research in such a way. Yet, now that we slowed the synthesis process of the design patterns, we find it relevant to do the *reverse* exercise, in order to understand which patterns are in line with which guidelines, even while accepting that such mapping involves some subjectivity and that many cases will overlap.

More important than the exact affinities identified in that mapping, we have been realizing that while there are guidelines in which several patterns fit nicely, other guidelines seem strikingly unpopulated. Such is the case of Guideline 4 (“Allow Meaningful Sonic Control for Intended Actions”) or Guideline 5 (“Allow Integration of Player’s Context into the Soundscape Composition”).

The interpretation of such disparities may relate to the differences in the kind of message that both these forms of guidance carry. Whereas the Guidelines are strongly influenced by narratives of ideal futures (check e.g., 3.5.1 and 5.2), the design patterns, by definition, consist of recurrent solutions, i.e., solutions that do exist. In that sense, the disparities may contribute to identify areas of sound design that have clearly not been as explored and which consequently represent opportunities for innovation.

We envision that it would be interesting to invest in further study intending to make clearer those uncharted design spaces, and to provide design examples, even if not recurrent, that could inspire designers to venture in their exploration. It is also conceivable that such a study will have collateral contributions to the intent manifest in Subsection 11.3.1 of possible evolutions of the set of Guidelines, should it reveal pertinent adjustments or additions.

11.3.3 Defining a process to use the patterns/cards

We have been considering two main types of usage of the Deck of Cards. One is to leave to the users the possibility of exploring it freely, possibly through browsing and selecting cards based on *ad-hoc* or circumstantial criteria. This is also the approach endorsed by some decks authors in other fields and scopes (reviewed in Subsection 7.1.2). The other approach that we have suggested, which is applicable when doing game design, consists of passing the cards through stages of consideration with the help of a workspace where respective regions are marked (see Figure 9.10 for the current version). We have been considering that during such sessions a brainstorm-like discussion unfolds (as reported in Chapter 9).

It would be interesting to study the possibility of defining a structured *process* for the use of the Deck of Cards. That is, instead of just suggesting “brainstorming”, it could be interesting to design a process including, for instance, stopping criteria to recognize reasonable solutions. This issue is complex. Although such a process could help practitioners who are not knowledgeable on organizing design events, it might also be

harmful if the process constitutes some sort of straitjacket to the flow of creativity, or artificially limits the adoption of the Pattern Language in conjunction with other design instruments.

11.3.4 Allowing for the proposal of antipatterns

Another possibility to ponder, that will be relevant as we open the Pattern Language to the community's consideration, is to allow for contributors to suggest *antipatterns*, too. Antipatterns are like patterns but they identify *bad* recurrent solutions (Borchers, 2001, p. 62; Brown, Malveau, McCormick, "Skip", & Mowbray, 1998, pp. 7, 275).

We recognize three kinds of relevance in that possibility. First, antipatterns are also a valuable form of guidance. They inform practitioners of patterns that they might know but that they have better not to adopt and contribute to disseminate. Second, because it is likely that the kind of rationale that constitutes antipatterns, i.e., the type of criticism that they hold, will attract other profiles of relevant contributors, augmenting social engagement. Third, because the conversion into antipatterns is a proper evolution for patterns that start to be proposed based on the recurrence of their explorations but then are evaluated as harmful. This is an advantageous alternative comparing to simply dismissing such patterns.

11.3.5 Connecting to other pattern collections

One strategic idea that could benefit practitioners, and augment the relevance of the proposal in the long run, would be to anticipate the interest in signalling points of contact with other pattern languages, even if they would not be strictly related to sound or game design. Such networking could develop synergies and other forms of "neighbourhood" between existing pattern languages. Strategically, it could enable the identification of new proposals or additions to our proposal, e.g., addressing special purposes such as the exploration of sound in a particular genre or domain.

This idea can be identified in the way Tidwell (2011) signals the relationship between some patterns that she proposes and others that are complementary and already exist in other authors' collections. Tidwell includes a field in the pattern format, labelled *In Other Libraries*, where she points the reader to those patterns. Although the field *External Resources* in our proposed pattern format might be used to achieve this effect, we recognize that it would be more effective to have a dedicated field for this purpose, so that the particular kind of connection could be promptly identified.

11.3.6 Proposing design principles, too

One of the later realizations in the scope of this thesis is that while we have been explicitly working on guidelines and patterns, we may also have been, concurrently and indirectly, distilling design principles, i.e., guidance at a level more abstract than those of either the Guidelines or the design patterns. Namely, we are considering suggesting that the *holism*, on which we founded all other proposed guidance, is in fact a design principle, in relation to such guidance. Thinking retrospectively, that was indeed its role along this study.

Meanwhile, after we realized that holism can be thought of as a sound design principle and we became aware for this topic, it occurred to us at least one other concept that has been around all the time without ever finding a place of its own, which we have addressed sporadically as *coherence* (sometimes *consistency*). When we were drafting the Guidelines, this concept appeared recurrently but we never figured out how to give it a proper expression. Yet, it was noticeable that it could not be a guideline, for instance, because it was too encompassing to be caught in *one* guideline; so, it end up embedded in the descriptions of several guidelines. Then, when we started composing the design patterns, the need to refer to that concept resurfaced. In the Seminal Collection of patterns we even suggested *Coherence* as a pattern “to be defined” (see Appendix C, in several *Relationship* fields). However, with the evolution of the language, the concept never found its place in that format, which is now possible to rationalize because it belongs to the other extreme, in terms of guidance abstraction levels.

In spite of these realizations, particularly in what regards holism, we opted not to further emphasize the idea in this thesis because we were not yet prepared to give it full consequence. At this time it seems more appropriate to study what other principles we are able to identify and how to integrate this third (higher) level of guidance in the proposed body of knowledge. Though we will need to further research this matter and we cannot yet advance a stronger proposal for design principles for sound design in games, we believe this aspect is definitely worth pursuing.

11.3.7 Reframing contributions in the broader field of HCI

Although the proposed guidance targets sound design in games, we consider that it is an interesting challenge to research the use of the explorations suggested in this guidance as insight into sound design in general-purpose interfaces, in other contexts within the Human-Computer Interaction field. It seems plausible that some of the proposed design

guidelines and patterns would serve non-game interfaces in some previously unexplored manner, complementing other authors' contributions in that area (such as, Brewster 1994; Coleman et al., 2005; Frauenberger, 2009).

We are not suggesting some form of gamification, in which general-purpose interfaces would change to adopt some game-like feature, such as becoming ludic. Instead, we are suggesting that it is conceivable that this guidance, if read as if it were servant to general-purpose interfaces, would identify opportunities not yet pursued.

In fact, it is already possible to identify counterpart explorations, in current general-purpose interfaces, for some of the explorations that can be found in games – namely, those related to awareness. Still, even in those cases, the emphasis is predominantly utilitarian. It would be interesting to study, for instance, explorations that could confer character to interface entities and extend their relationships also to an acoustic ecology, designed to elicit emotions and explore hedonic aspects of the experience.

11.4 Closing thoughts

We have been presenting a study aiming to answer the research question “*How to provide guidance for the empowerment of non-expert practitioners to perform sound design in games?*”. In Section 11.1 we summarized our contributions to answer such question in ways that are also in line with the two goals that we have established (Section 3.1) for the features of that answer. The first goal relates to providing means for the target audience to become able to purposefully explore sound when designing games; i.e., it relates to the emancipation to design sound, assuming the impracticality of involving a sound design expert in a project. The second goal relates to empowering the target audience at the more fundamental level of communication, which implies creating conditions that let the audience become capacitated to address domain concepts and to maintain a discourse that is potentially relevant at many levels. Namely, this second goal should augment the comprehension, the awareness for the related design opportunities, and the ability to discuss ideas and hence to participate in the creative process, including with the experts.

The proposals we presented along this thesis approach the research question through the synthesis of an evolving body of knowledge that provides non-expert practitioners with

sound exploration opportunities. More specifically, practitioners are presented with: *a)* a holistic interpretation of sound design that categorically places the exploration of sound as part of game design; *b)* design recommendations, in the form of guidelines; and *c)* existing examples of specific sound explorations, a vocabulary to address those explorations, and a network of related opportunities, in the form of a pattern language. These components of the proposed guidance are not independent of each other – they represent different levels of design support that we addressed along the course of research, successively integrating the former developments while continuing to mature the whole body of knowledge. In practice this means that, for instance, the proposed Pattern Language already embeds our holistic approach to sound design.

The adoption of DSR as our main research approach gave us the support to grow such proposals along an emergent process, with intermediary outcomes that we could increment and redesign according to the respective evaluations. On the other hand, SfD allowed us to understand the pertinence of a human-centred perspective on the design of such proposals, and to realize that their evolution ought to be understood in terms of human agency. SfD also provided us with methodological support and assisted us on complementing the argumentation of appropriateness of our proposals, particularly in terms of experimental and methodological validity.

A detailed analysis of the experimentation with the proposed guidance in a game design exercise (Chapter 9) provided us with several interesting indicators of the meaningfulness of our proposal. For that, we examined a videographed session and performed an exhaustive registration of elemental events occurring during that session. Among the possible observations, we emphasize the fact that the participants' discourse denoted that, along the session, sound was explored and addressed in terms of its purposefulness for the game design, as opposed to focusing on the medium itself or evidencing a commitment to explore the auditory modality. Other interesting indicators are the consistency with which sound related explorations were discussed and entered the game design specification, since the beginning and until the end of the session. These observations concur to the idea that these participants exhibited empowerment to perform sound design and to communicate sound design ideas. The participants also evidenced holism in the exploration of sound, and the exercise illustrates the participation of sound design in the game design right from the early phases of ideation.

The research attention devoted to the exercises that we performed (see also Chapter 8) reflects our commitment to refine the proposal so that it is compelling to the stakeholders, including to non-expert practitioners. In addition to reflections on the relationship of the participant practitioners with the guidance and on the influence of the guidance on design, the analysis of the exercises informed many revisions to the body of knowledge and supporting instruments (see, e.g., Appendix F). Actually, it was the attention to the preparation of this kind of experiments that was in the genesis of an instrument that meanwhile diverted into one of the most noticeable components of the interface with the body of knowledge: the Deck for Sound in Games.

We also invested significantly in developing the Pattern Language into a state that already includes a network of patterns with which it is possible to experiment, and upon which stakeholders can base the discussion and appropriation. As part of that motivation, we enriched the design patterns with a considerable amount of distinctive examples of exploration. Such abundance not only endorses the recurrence of the patterns but also allows different perspectives on the respective concepts, with potential advantages to the understanding and to ideation.

We are committed to disseminating these contributions, both in terms of practice and further research. We are particularly excited with the fact that, from here, we are able to conceive other research questions (Section 11.3), which also contextualizes the pertinence of this research and endorses the fertility of the exposed ground.

Glossary

Acoustic (or **Acoustical**) may have several meanings depending on the context. In this thesis, the term applies to what pertains to “the sense of hearing” (Truax, 1999). In other contexts, it may be used to refer specifically to the physical aspects of sound, as opposed to those related to its perception (Truax, 1999). Yet another meaning, common in modern Music, concerns to the manipulation of sound, e.g. instrumental sound, without resorting to electronics (Truax, 1999) or without modifying it electronically (“Acoustic”, 2012).

Acoustic Ecology is the study of the relationships between the acoustic environment, or *soundscape*, and those inhabiting that environment, with emphasis on balance and on the sense of the context (Schafer, 1994, p. 271). See also Subsection 4.2.2.

Audio. Several fields and authors have adopted different definitions for this term, particularly regarding its distinction from the term *sound*. An exemplary distinction between the concepts of audio and sound relates to the human ability to hear the respective stimulus. According to that adoption, sound is the mechanical disturbance caused by a vibrating object, which is propagated through a medium as a wave, referred to as sound wave. Humans can only hear sounds whose wave frequency is in the range from about 20 Hz to 20 KHz (“Sound”, 2012). What can be heard is said to be *audible*; and *audio* is the designation used to refer to audible sound (“Audio”, 2011). Considering the interdisciplinary nature of this study, and also that one common adoption is using both terms interchangeably, we opted not to distinguish them in this dissertation and, in each particular case, we used a form that fitted the context (see p. xxiii, in this document).

Audio Game is a game that consists of sound, usually with no visual component. This should not be confused with games for the blind, which also ought to include concerns of accessibility (AudioGames.net, 2012b, 3rd question).

Auditory. Relative to *Audio*.

Auditory Icons relate to the use of “caricatures of naturally occurring sounds” in representation of data and interface entities (Gaver, 1986, p. 167). Their concept contrasts with the concept of *Earcons* (See in this Glossary).

Character Soundprint is an expression we felt the need to create to refer to the set of sounds characterizing a character. Currently, we are also using this expression as the name of one of the patterns in the Pattern Language for Sound Design in Games.

Diegetic is a qualifier applied to something that happens inside the game world, possibly performed and/or perceived by the characters. Non-diegetic, on the other hand, applies to what is external to the game world. A common example is music that, being diegetic, is meant to be understood as if it were played and/or heard by the characters, as opposed to non-diegetic music, which plays “above” the game world and is directed just to the player (Berndt, 2011; Grimshaw 2008; Jørgensen, 2011; Stevens & Raybould, 2011, p. 170).

Design patterns present proven solutions to recurrent problems that occur in a specific context, complemented with references and support on dealing with the forces and/or consequences implied in their application (Alexander et al. 1977; Alexander, 1979; Vlissides, 1997). The design patterns are not only a synthesis of existing knowledge into a format that evidences such components but also a translation of such expertise, in the sense that they are written in a way that is understandable also by non-expert practitioners. The names of the patterns, for instance, play an important role in establishing a domain vocabulary, for the community of practice to be able to address the respective concepts (Borchers, 2001; Gamma et al., 1995). See also Section 6.1.

Earcon are sound stimuli that use “abstract, synthetic tones in structured combinations to create auditory messages” (Brewster, 1994, p. 57). They contrast with the concept of *Auditory icons* (See in this Glossary).

Entrainment refers to the synchronization of oscillatory systems, i.e., to the adjustment of their rhythms (Granada & Herzel, 2009; Sonnenschein, 2001). The phenomenon is also designated as “locking” or “rhythm synchronization” or may be addressed under the umbrella concept of “synchronization” (Pikovsky, Rosenblum, & Kurths, 2003, pp. 21-22). It was first identified by the mathematician and physicist Christiaan Huygens in the 17th century (Augoyard & Torgue, 2005; Pikovsky et al., 2003; Rosenblum & Pikovsky, 2003). See also Subsection 4.2.4.

First-person shooter (FPS) games are combat-oriented games that are played using a first-person point of view, i.e., in which the player navigates and observes the game world as if through the playing character (Adams, E., 2010; Hullett & Whitehead, 2010).

Gameplay refers to how a game is meant to be played, i.e., how players interact with it along the experience, namely in terms of the rules, possibilities, results, challenges and other reasons to interact within the game (Adams, E., 2010; Björk & Holopainen, 2004; Novak, 2008). The characteristics of the gameplay are a main determiner of a game's genre (Castillo & Novak, 2008, p. 85).

Gamification is the use of “game thinking and game mechanics to engage users and solve problems” in a non-game product (Zichermann & Cunningham, 2011, p. xiv).

Indie games, indie developers, independent games, independent developers. Indie games are productions of independent developers, i.e., developers that are not supported by the big publishers in the game industry. Contrary to mainstream games that are developed by big and resourceful teams, indie games are typically developed by small teams that operate with meagre budgets. The circumstances in which independent development occurs is frequently characterized as facilitating innovation and permitting to risk new approaches, in contrast with other priorities that arise in the mainstream production such as the (expensive) technical sophistication and the maximization of previous investments that translates in recurring explorations of previously commercially successful solutions (Campbell, 2012; IndieGames.com, 2012).

Music Game, Rhythm Game, Pitch Game. Games in which the gameplay is dominated by dealing with musical aspects such as rhythm (Adams, E., 2010, p. 399), pitch, or volume, often by interacting with some type of score. Contrary to the case of *Audio Games* (see in this Glossary) graphics are relevant in these games.

Non-diegetic. See *Diegetic*, in this Glossary.

Non-playing Character (NPC). Any of the characters whom the player cannot control. See also *Playing Character (PC)*, in this Glossary.

Pattern Language is a set of interrelated design patterns, supporting a domain discourse in a community of practice and enabling the communication among experts and non-experts alike (Alexander et al. 1977; Alexander, 1979). A pattern language is built “with the idea of empowering [its] users to participate in the design process in mind” (Borchers, 2001, p. 23). See also Section 6.1.

Pattern Collection is a set of *design patterns*. This designation is preferred to *pattern language* when the set is not comprehensive enough or the relationships between the patterns are not yet specified in a way that it is adequate to argue the existence of a language (Borchers, 2001, p. 23; Kunert, 2009, p. 67) – in which the patterns, addressed by their names, would be the vocabulary, and the network of relationships would function as the grammar.

Pitch Game. See *Music Game*, in this Glossary.

Playing Character (PC). The character whom the player controls, typically the protagonist. See also *Non-playing Character (NPC)*, in this Glossary.

Psychoacoustics is a branch of Psychophysics that studies how humans perceive sound (Howard & Angus, 2009), i.e., the relationship between sound stimuli and the interpretation the brain makes of them (Truax, 1999).

Rhythm Game. See *Music Game*, in this Glossary.

Resonance is the phenomenon in which an object is put into sympathetic vibration by finding a concordance between an exciting frequency and its characteristic frequency (Augoyard & Torgue, 2005; Farnell, 2010). Some systems are able to resonate to several, or ranges of, exciting frequencies. The human body, namely, is subject to resonance at many levels, depending on the frequencies to which it is exposed (Augoyard & Torgue, 2005). See also Subsection 4.2.4.

Spoiler is a piece of information that discloses an aspect of a work in a way that it compromises the audience's ability to eventually enjoy that work as it could happen in the absence of such information. See also Section 10.6.

Sound. See *Audio*, in this Glossary.

Sound Design has been used with several meanings depending on the context, ranging from “fabricating neat sound effects” to exploring the use of sound holistically in a way that it also implies seizing the “opportunity to exert any influence on the non-sound crafts” (Thom, 1999, para. 1, 6). In this thesis the term is used as in the latter sense. That is also the understanding patent on the practice of Ben Burtt and Walter Murch, who introduced the term, in 1979, and whose accomplishments “changed forever the way we think about film sound” (para. 1).

Soundscape is a concept that derives from the field of Acoustic Ecology (Schafer, 1973, 1994; Truax, 1999, 2001). It refers to the sound of an environment perceived as a whole, and understood as an ecologically balanced entity that mediates the relationships between the individuals and the environment. See also Subsection 4.2.2.

Sonification is the use of non-speech audio to handle information. An exemplary instrument that fits this definition is the Geiger counter, invented in the early 1900s by Hans Geiger. Kramer et al. proposed the establishment of Sonification as a discipline, in the emblematic *Sonification Report* (1997; Frauenberger, 2009).

Soundprint. See *Character Soundprint*, in this Glossary.

Soundscape composition. Acoustic ecology supports the notion that a soundscape can be understood as a composition: like a musical composition. This inherent harmony and orchestration can be observed in natural environments, e.g., in the balance among animal vocalizations (Wrightson, 2000). Furthermore, soundscapes can be *composed*, for which composers can preserve, enhance or otherwise exploit environmental contexts, according to different intents (Truax, 2001, p. 237). See also Subsection 4.2.2.

Stealth Games constitute a game subgenre, which involves concealed actions and low profile behaviour in order to achieve goals. In terms of feedback from the game world, this type of gameplay implies, for instance, the reaction of the NPC to unsubtle moves (Adams, E., 2010; Björk & Holopainen, 2004, p. 283; Stevens & Raybould, 2011, p. 122).

White noise. A sound in which all audible frequencies have the same intensity (Farnell, 2010, p.136; Truax, 1999).

Willing suspension of disbelief. The term comes from the early 19th century British poet Samuel Taylor Coleridge and refers to the audience's ability to temporarily accept as believable an ordinarily incredible narrative. It has since been widely adapted for the study of computer games and immersive environments (Martin, G., 2012).

Appendix A

Authors' publications related to the thesis

In this appendix we present our publications that relate to this thesis. We explain their relationships and contributions to specific components of the thesis.

Conference paper

A Proposal of Soundscape Design Guidelines for User Experience Enrichment

This paper was presented at the Audio Mostly 2009 Conference (Alves & Roque, 2009b), and represents our first public presentation of the set of design guidelines. The presentation was awarded “Best Presentation” at the conference (Audio Mostly, 2009). The content of the paper relates to this thesis’s Chapter 4 and Chapter 5.

Abstract. Using notions from Acoustic Ecology and recent studies of emotion, the authors synthesize a set of guidelines for soundscape design as part of the broader view of user experience design in computational media. Guidelines are presented and their applicability discussed using a what, why, how contextual framework, ending with initial reflections from a soundscape design exercise for a computer game.

*Book chapter
+ Book chapter (with other authors)*

Guidelines for Sound Design in Computer Games

We were invited to write a chapter for a book on Game Sound (Alves & Roque, 2011d), based on the paper we presented at Audio Mostly 2009. The content of this book chapter relates to this thesis’s Chapter 4 and Chapter 5.

We also participated in an extra chapter in the same book, authored by several authors and debating “what will the player experience of computer game sound be in the future?” (Alves et al., 2011). The content relates mainly to this thesis’s Chapter 2 but also to Chapter 4 and Chapter 5.

Abstract (Alves & Roque, 2011d). The inconsequential exploitation of sound in most computer games, both in extent and nature, contrasts with its prominence in our daily lives and with the kind of associations that have been explored in domains such as music and cinema. Sound design remains the craft of a talented minority and the unavailability of a public body of knowledge on the subject has greatly contributed to this state of affairs. This leads to a mix of alienation and best-judgment improvisation in the broader development

community. A sensitivity to the potential of sound for the enrichment of the experience – with emphasis on game specifics – is, therefore, necessary. This study presents a contribution to the practice of sound design for computer games. An approach to intentional sound design, informed by multi-disciplinary interpretations of concepts including emotion, context, acoustic ecology, soundscape, resonance, and entrainment, is distilled into a set of design guidelines that holistically address the different sound layers.

*Conference paper (national, peer-reviewed)
+ Journal article (national, peer-reviewed)*

Notes on adopting auditory guidelines in a game design case

This paper was presented at the VideoJogos 2009 Conference (Alves & Roque, 2009a). It was later invited to appear in Revista de Ciências da Informação e da Comunicação do CETAC, Prisma.com (Alves & Roque, 2010b). The content relates to this thesis's Chapter 4 and Chapter 5.

Abstract. We present a discussion on a game design exercise strongly influenced by a set of auditory design guidelines. These guidelines reflect concerns that fit into a wider study on how to enrich the user experience through auditory design.

*Conference paper (national, peer-reviewed)
+ Journal article (national, peer-reviewed)*

Empowering independent game developers to perform sound design

This paper was presented at the VideoJogos 2010 Conference (Alves & Roque, 2010a). It was later invited to appear in Revista de Ciências da Informação e da Comunicação do CETAC, Prisma.com (Alves & Roque, 2011b). The content relates to this thesis's Chapter 2 and Chapter 4.

Abstract. Short budgets and logistics of independent game development limit the exploration of meaningful sound design.

Paradoxically, independent development profits from the potential of experimentalist and creative productions of a distributed critical mass, diverse and free of mainstream tenets, with impact on innovation and new paradigms.

It urges to unlock the inherent potential of independent game development to the exploration of sound in games. For that would contribute the empowerment of independent game developers to emancipated and meaningful sound design. Sensitization and guidance are instrumental to such intents.

A Pattern Language for Sound Design in Games

This paper was presented at the Audio Mostly 2010 Conference (Alves & Roque, 2010c). The content relates mainly to this thesis's Chapter 6 and in particular to the Seminal Collection of design patterns presented in Subsection 6.8.1 and Appendix C.

Abstract. Expertise in sound design for games is still a privilege of senior designers. The broad community of independent game developers remains mostly challenged by small budgets and lack of know-how, while trying to integrate sound in their games.

The empowerment of a broad community of developers, by making practical guidance available, could improve the quality of their productions and unleash a massive creative potential, with results in the form of innovative sound design ideas and further development of body of knowledge.

Here we present the argument that there are favorable conditions for a collective authoring of a pattern language in sound design, to be achieved with the inventory, translation or resynthesis of current practice and academic know-know, in a format that is addressable by experts and non-experts alike.

Learning from the effects such a methodology had in other domains where similar concerns were observed, we present a seminal pattern collection with the purpose of illustrating its feasibility and spark the interest of the broad community of sound design.

An Inspection on a Deck for Sound Design in Games

This paper was presented at the Audio Mostly 2011 Conference (Alves & Roque, 2011c). The contents relates mainly to this thesis's Chapter 7 and Chapter 8.

Abstract. In the context of an initiative to empower non-expert practitioners to perform sound design in games, assisted by a pattern language approach, it is helpful to hold an instrument that fosters the contact with the design patterns. With such purpose, we have been working on a deck of cards, which is also subject to an appreciation for sound explorations as an integral part of game design. We present the current rationale for the design of the deck, evidencing its suitability to maintain sound design opportunities at reach, in an expeditious and non-intrusive manner. We also report an exercise of inspection of the deck, aiming at a first refinement through the identification of foremost hindrances in terms of perception and content interpretation.

A Deck for Sound Design in Games: Enhancements based on a Design Exercise

This paper was presented at the ACE 2011 Conference (Alves & Roque, 2011a). It was later selected to appear in a special issue of Computers in Entertainment, CiE ACM (Alves & Roque, 2012a). The contents relates mainly to this thesis's Chapter 7 and Chapter 9.

Abstract. In the context of an initiative to empower non-expert practitioners to perform sound design in games, we have been working on a collection of design patterns and in a deck of cards that function as tokens to those patterns.

The deck serves both practitioners and researchers. Practitioners may appreciate a presentation of potential sound explorations in a format that is literally handy, with no need to be familiar with the formalism of design patterns. Researchers who are willing to evolve such patterns may explore the usage of cards as part of a setting designed to be auditable.

This paper presents the results of a first experiment with the deck in a scenario of a game design session. The goal is to evidence information supporting foremost enhancements to the deck itself, to the process in which it has being explored and audited, and to the inscribed collection of patterns.

Appendix B

A Game Design Exercise under the influence of the Guidelines

In this appendix we present the design specification of the game prototype reported in Section 5.4. We conducted this exercise with the purpose of observing the practitioners' relationship with the Guidelines, in order to grasp their understandings, difficulties and opportunities for enhancement (Alves & Roque, 2009b, 2011d). The design specification itself demonstrates a possible practical interpretation of the proposed guidance. The critical analysis to this experiment was relevant to inform the evolution of our research.

Game Plot and Setting

The game is a single-player adventure, suitable for audiences over the age of 6. It is about a castaway and his rescuing from an island inhabited by fictitious creatures. The plot comprises gaining the sympathy of the native creatures in order to get their help in calling the attention of some passing ships. Two input methods were designed: vocalized sound input through a microphone and, alternatively, the use of keystrokes to model the corresponding programmed sounds.

The game takes place in an island scenario where the playing character interacts with a set of creatures, one at a time, by interpreting their sound manifestations in the context of the game diegesis. As an example, the player has to “gain trust” of a creature by imitating its pitch, its rhythm and so on with two end results: unlocking some progress in the game and training the ability to recognize and reproduce specific sound characteristics, in the context of other sound sources, in order to achieve a specific composition. The coordination abilities thus gained by the player will then be put to a final test in a final setting.

Story

A castaway gets into an island inhabited by strange creatures. He notices that ships pass at a distance and that they might rescue him, but, when he tries to signal his presence by yelling to them, he fails to get noticed. On the island, there are several accessible zones and each zone is inhabited by one species. A species population consists of a bunch of cubs and a parent: The cubs are curious; the parent is neutral though vigilant. The cubs'

behaviour triggers communication-learning episodes where the castaway iteratively tries to replicate their utterances. After a certain number of successful such episodes, the parent becomes receptive to communication and the castaway, combining expressions learned from the cubs, starts a communication process to conquer its sympathy. When he has succeeded, the parent volunteers to accompany the castaway to the beach and to help him to yell for the attention of the ships passing by. While they yell, someone, in one of the ships, appears to have noticed something but assumes it was an illusion because the stimuli coming from the beach were too weak. In each of the other zones in the island the plot repeats: each time a parent becomes a friend, the entire group gathers at the beach for another attempt to catch the attention of the passing ships. With each attempt, the perception grows that the aim is about to be achieved until, after enlisting the aid of a certain number of creatures, the goal is finally reached and the castaway rescued.

Non-interactive (cinematographic) scenes include the arrival at the island and lonely call for passing ships, moving onto the beach accompanied by friendly creatures and yelling to the passing ships, and a ship's crew member wondering about the yelling sounds (this is a distinct scene each time a new creature joins the group).

Gameplay

The castaway moves through the island's zones (there being no predefined sequence) and in each zone there are two types of interaction: with cub creatures and with their parent. All interactions happen between the castaway and only one creature at a time with each interaction comprising an iterative process of alternate interventions in a dialogue. The interaction can be aborted before success is achieved by the player's decision or because a certain number of iterations was reached. There is no enforced order to the interactions but it is mandatory to successfully interact with several cubs before being able to complete with success the interaction with the parent. The dialogue with a cub is initiated and conducted by it while the dialogue with the parent is initiated and conducted by the castaway. The success condition in the relationship with a cub depends on sufficiently matching its utterances and the success condition in the relationship with a parent depends, firstly, on its receptivity to communicate – which, in turn depends on the number of cubs with whom a successful conversation was carried out – and, secondly, on the level of satisfaction to which the castaway can lead the creature in a process where, in response to each castaway's sound sequence, the creature

manifests the correspondent sympathy reaction. The level of sympathy may drop during the interaction with the parent. Every zone in the island shares the same game mechanics: what differs are the sound stimuli.

The relationship with the cubs can be understood as a learning process of the sound stimuli that will eventually allow a successful relationship between the castaway and the cubs' parent. On the other hand, the relationship with the parent is an exploratory exercise of composition through the combination of these stimuli with some room for creativity.

Regarding similarity evaluation criteria of the sound stimuli used in interactions, in a first approach, the following acoustic variables were considered: duration, loudness, and pitch. In practice this means sounds do not have to be strictly identical: they only have to match according to those variables.

Appendix C

Seminal Collection of Patterns for Sound Design in Games [outdated]

This is the original redaction of the Seminal Collection – our debuting set of design patterns for sound design in games. This collection is appended to the thesis (as published in Alves & Roque, 2010c) in order to document that phase, but it should be considered deprecated for other purposes. See Section 6.8 about the evolution of these patterns, and Appendix D for the latest version of the design patterns.

Name: *Sound Layers and Semantics* [outdated; check *Sound Layers* in version 2.0]

Context: In a project with a holistic approach to sound, it is necessary to manage diverse sound purposes that imply different categories of decisions.

Problem: It is hard to manage the amount of decisions and implementation aspects regarding sound to consider in the course of a project. Yet, it is imperative to have an early perception of what kind of sounds can be designed. Also, it is fundamental that coherent treatment is assured for aspects that share close semantic relationship.

Solution: Sounds can be structured in layers according to its semantics and communicative purpose:

- *Dialogue:* characters' discourse about the action; communicates story, what characters think and what they feel.
- *Music:* sets the emotional tone of the scene; tells the audience what to feel.
- *Foley:* sound of actions; makes visual field more believable or enhances perception of ongoing actions.
- *Ambiance:* sounds of the environment; tells the audience where the action takes place; usually perceived when other layers are absent or low volume;
- *Sound Effects:* make abstract or imaginary objects concrete (e.g., sound of a laser sword) by enabling a multisensory perception.

The differentiations evidenced by the layers do not compromise a holistic perspective on the decisions and developments regarding all layers. The idea is not to set things apart but rather to deal with specificities in sound production, exposing the agenda of opportunities (Alves & Roque, 2009b, 2011d), always according to a coherent overall plan. It also helps organizing the job of audio professionals, which is interesting in terms of project management.

Examples: These layers have been presented and adopted by sound designer Nick Peck (2001, 2007). Other authors have evidenced to follow similar structure, in practice. The structure in layers has long been adopted in cinema, which, being a neighbour domain, has inspired several practices in game sound design.

Relations: For example, this pattern calls for further addressing of each level's specificities, which is arranged through the patterns *Dialogue*, *Music*, *Foley*, *Ambiance*, and *Sound Effects*. *Foley* is presented in this seminal collection; the other patterns are to be specified. The concerns expressed in the solution also call for the pattern *Coherence* (to be defined), which includes aspects of overall coherence.

Name: *Sound Decoys*

[outdated; check update in version 2.0]

Context: A customary component of the gameplay is to deal with enemies along the game space.

Problem: In some situations it is convenient to divert enemies' attention and possibly to influence them to change their positions, either to be able to deal with one at time or to avoid confrontation at all.

Solution: Diverse forms of decoy can be included in the gameplay. Sound is particularly suitable for integrating meaningful decoy actions since it allows launching the decoy while avoiding visual contact. It also brings advantages both for the plausibility of the decoy and for its usefulness in spaces with reduced visibility.

Examples: In *Thief* game series (1998-2004), Garrett can draw special noisemaker arrows in order to divert enemies. In *Metal Gear Solid 4: Guns of the Patriots* (2008), Snake can do something similar by throwing empty magazines and additionally he can knock on nearby objects in order to attract an enemy's to a more convenient spot. In *Commandos*

B.C.D. (1999) all commandos can make a distracting noise by throwing stones to the behind of enemies. Additionally, one of the commandos, Tiny, has an acoustic decoy as part of his equipment.

Relations: The fact that only some objects or actions can be used with the purpose of exploring their sonic properties may turn to be improper if they reveal an incomprehensibly unequal treatment regarding other aspects that are evident candidates to the same behaviour. In that sense this pattern relates to the pattern *Coherence* (a pattern to be specified, addressing the overall sense of coherence among adopted solutions).

Name: *Imminent Death*

[outdated; check update in version 2.0]

Context: Many games implement death through decrements in health as a result of repeated injury. Recovery may depend on self-administering some kind of remedy and/or spending time enough without taking damage. Recovery often comes at a cost, so it is inevitable to manage some level of injury.

Problem: Unless there are clear indicators of current health state, a player may inadvertently let the character die just because she was not aware that death was imminent. For that contributes the fact that the player may be so deeply focused in other aspects of the conflict – timing, moves, tool selection, etc. – that her attention is diverted from the health indicators.

Furthermore, both health and death are concepts with profound semantics and prominent association to emotions and values. That, at least, calls for a meaningful signalling.

Solution: Health status can be communicated diegetically. Diegetic indicators have a couple of advantages: they allow a more direct understanding of the situation; and they avoid the need to be attentive to some health monitor.

Diegetic sound is particularly effective in signalling critical health and imminent death. Solutions include using the sound of the heartbeat, which constitutes an evocative and powerful indication of risk, particularly when it becomes the dominant sound. Another very effective approach is suggesting body collapse through the loss of basic perception.

Affecting global sound as if senses (namely hearing) became severely compromised is very indicative of the need to find a remediation for that condition. Moreover, the fact that the player no longer hears the diegetic world not only helps to understand how serious the case is but also, more relevantly, frees the player from the focus in the engagement with the opponents, and gives her a chance to seek a remediation to the character's health. Such techniques can be combined with the sound of accelerated or difficult breathing – also interesting to signal other less lethal circumstances, like intermediate states of injury or the impossibility to keep up with some effort.

Examples: In *inFamous* (2009), when Cole is fighting a group of enemies the hits he suffers are visualized as blood in periphery of the image. When he is hurt close to death, in addition to the increasing blood, his vision gets monochromatic, his hearing gets so affected it becomes difficult to perceive the surrounding sounds, and a very strong heartbeat sound dominates the senses. The remedy for Cole is to get away from the fighting, get some cover until he recovers and then get back to the unfinished business.

In *Assassin's Creed* (2007), the nature of the conflict does not favour an interruption for recovery. In this situation sound helps the player to augment focus and hopefully to perform better, to keep up with the engagement and survive through it.

The sound of the heartbeat is evident in *Uncharted 2: Among Thieves* (2009) and constitutes a powerful indication of risk.

Relations: This pattern is rich in connections to topics addressed in other patterns. Those include: *Self-awareness* (to be specified) that covers general awareness for vital resources, like health kits and ammunition; *Attentiveness* (to be specified) that deals with the necessary management of psychological activation; *Engagement* (to be specified), which specifies a phase that is part of *Entrainment* (in this seminal collection), which, in turn, deals with leading the player through emotional states; and, *Emotional script* (to be specified), since tackling the player through of very primal stimuli in these episodes of near-death is a prominent means to perform meaningful explorations at the emotional plane. Paradoxically, *Imminent Death* may conflict with the pattern *Realism* (to be specified), which may favour the design of death as something that comes at short notice – though that is not a usual design decision.

Name: *Entrainment*

[outdated; check *R-A-E-D Iterations* in version 2.0]

Context: Entrainment can be used to support the maintenance or the change of emotional states, by influencing the player to progressively move from one state of resonance into another. Sound is one prominent way to implement entrainment, benefiting from the way humans resonate to auditory stimuli. The principles of entrainment and resonance have been exploited by music through the ages (Augoyard, 2005; Leeds, 2001; Sonnenschein, 2001).

Problem: Games often consist of sequences of conflicts. The players' experience depends on their interpretation of the emotional script inherent to such formula. That means the design must also contain elements that both evidence the intended emotional states and convey the support for the player to keep up with that intentions.

Solution: The design of conflicts in game often includes iterations of the sequence relaxation-anticipation-engagement-decay. Sound is instrumental in supporting the specificities of each of those four phases, and also in connecting them.

Relaxation is often supported by pleasant or neutral ambiance possibly alternated with calm music. It is the case of *Need for Speed: Undercover* (2008), *Assassin's Creed* (2007), *The Elder Scrolls IV: Oblivion* (2007), *Far Cry 2* (2008), etc.

Anticipation is the most neglected of the four identified phases, possibly because the unpredictability inherent to interactivity implies that the artificial intelligence of the game is able to infer that the player is about to engage in a more activated state. In *Far Cry 2*, when our character slowly approaches some spot occupied by conflicting characters, the music (from the previous relaxation state) fades out and is substituted by a more silent suspense sound. If the character retreats before engaging in conflict the sound from the relaxation state is slowly retaken. If the approach to the same spot is done quickly (running or driving through) the anticipation phase is skipped or simply not given the time to get started. We can say that in *Assassin's Creed* this phase corresponds both to the moments when guards are aware of Altaïr's presence, in which case the sound of the non-diegetic yellow indicator is heard, and to when Altaïr kills some one in stealth mode, which creates the expectative of an even higher state of arousal if his cover is compromised.

The phase of engagement is the most commonly supported by sound. Often the high-

arousal emotional state of the conflict is accompanied by music with accelerated beat, by foley and sound effects of the conflict itself, and frequently dialogues, too. So, apart from ambiance that may be faded out, all sound layers are potentially involved. Yet, sometimes the music is absent (or at least imperceptible) – this may be because the diegetic sound (foley and sound effects) is so intense that it is enough to support the intended arousal, and also because some conflicts last so long that the combination of music and sound effects would eventually lead to fatigue. An interesting case is *Killzone 2* (2009), in which certain chapters have music and others do not.

The decay phase serves the purpose of re-establishing the calm and leading the player to an emotional state that creates the conditions to another iteration. Sometimes decay simply consists of fading out the engagement music that may take several seconds or be rather abrupt. Other times this phase has its own purposeful sound, including music and dialogue. *Metal Gear Solid 4: Guns of the Patriots* (2008) and *Need for Speed: Undercover* are interesting examples because in those games the decay time has a diegetic meaning in the gameplay. In the former it consists of a time – caution phase – when enemies are still attentive and in increased numbers but are no longer actively seeking out Snake. In *Need for Speed: Undercover* there is a “cooldown” period, after evading the pursuing police, during which the car cannot be spotted. Both cases dedicate distinct sound to these phases.

Examples: In addition to the examples mentioned above, *Patapon* (2007) must be referred as a rare example where entrainment is really part of the gameplay. In *Patapon* the player command the warriors by alternately performing particular drum sequences in synchrony with a command beat. In case of well succeed amount of consecutive sequences, the warriors enter “fever mode” which makes them pretty much more effective in combat. The sound during combat is a hilarious dynamic music that includes the sounds of the drums that the player hits and the humorous vocalized repetition of the characters. Keeping resonance with the beat while deciding the next best sequence is the key to success. The emotional state, particularly when in “fever mode”, is so intense that it is hard to maintain resonance for long.

Relations: Due to the specificities of the solutions that are found for each of the four phases identified in this pattern, it makes sense to define distinct patterns for each of them: *Relaxation*, *Anticipation*, *Engagement*, and *Decay*. (*Imminent Death*, already

presented in this seminal collection, relates to *Engagement*.) *Entrainment* contributes to *Emotional Script* (to be specified), which concerns meaningful explorations at the emotional plane.

Name: *Requisite Variety*

[outdated; check *Variety* in version 2.0]

Context: Characters, objects and actions are associated varied sound, including dialogue and foley, for enhanced experience. A common interpretation of the law of requisite variety from the field of cybernetics is that the amount of appropriate selection that can be performed is limited by the amount of information available. More information might be wasted but less information results in arbitrary perceptions, interpretations and decisions (Leeds, 2001).

Problem: The lack of variety in the sounds associated to characters, objects and actions can compromise the experience (Jeanson, 2008). The pertinence of variety extends to several features. In the case of dialogue, variety applies to the text being said and to intonation. If phrases are shared among several characters, variation also applies to voice pitch. If a same character sequentially repeats one particular phrase, variation applies to the time elapsed between iterations, too. In the case of foley, if sound relates to physical reaction to contact, variability may be implied by the possibility of different nature and magnitude of the contact.

Some prejudices may result from a player's perception of the lack of variety. One is that it impairs a possible naturalist approach to immersion. Another is fatigue.

Several factors may influence the perception of the lack of variety, including: the duration of the experience; the time elapsed between successive expositions to a same sound; and, the plausibility of the repetition.

The plausibility of a repetition tends to be smaller for complex or improbable sound. An example, in the case of speech, is an atypical sentence – a joke, for instance. Another example, in the case of foley, is a sound that for some reason fails to be associated to the corresponding source.

Examples: *The Elder Scrolls IV: Oblivion* (2007) features a complex dialogue design. This is a game that can be played for hundreds of hours and includes a huge number of

speech-capable NPC (UESPWiki, 2012). Many of them have at least one unusual line of dialogue.

In *Patapon* (2007), the expressiveness of patapons, which includes sentence-like utterances and sang combat lines, is impressively varied, even though repetition is, by design, key to the gameplay.

In *Need for Speed: Undercover* (2008) the speed of the car when crashing into a trash bin leads to the appropriate sonic feedback. Also, if hitting some citizens' car, sound varies not only with the magnitude and extension of the crash but also in its semantics – a harder hit makes the other driver honk.

In *Silent Hill Homecoming* (2009), for instance when Alex first finds his brother, Josh has four different lines that he answers iteratively in case Alex insists on him to talk.

In games such as *Tetris* (1984) or *Pac-Man* (1980) – where simplicity and repetition is part of design – the lack of variety on sounds is coherent with the lack of variety in the reasons for that sounds to occur.

Relations: This pattern relates to a multitude of others. *Requisite Variety* is indeed instrumental to *Identification* and *Counting* (patterns to be specified). For instance when approaching a room, hearing enemies' voices (and other sounds for that matter) allows to acknowledge their presence before – or instead – visual confirmation. In stealth games like the *Thief* series (1998-2004) this is very helpful. Additionally, if variety in voice pitch is perceptible an estimation of quantity becomes possible. Variety can also be relevant to gameplay if different types of opponents have distinctive chatter or foley, as in the case of *BioShock* (2008) where it allows to readily drawing up the appropriate weapons, before eye contact.

Requisite Variety is also crucial to aspects included in: *Coherence* (to be specified), for example regarding coherence between the variation of reactive sounds of foley and the variations in the other physical aspects of an action; *Plausibility* (to be specified), which covers the acceptability of designed stimuli; or even *Realism* (to be specified). The search for realism in the variations of footsteps in *Assassin's Creed* (2007; Jeanson, 2008), led its designers to use a “footstep system [that] uses more than 1,500 original recorded samples. [They] managed 22 surface materials, with 14 different step intentions — sneak, walk, run, jump, land, pivot, et cetera — including three to eight variations for each

intention per surface” (Jeanson, 2008, para. 18). This description also evidences a relation with the pattern *Foley* (next).

Name: *Foley*

[outdated; check update in version 2.0]

Context: Foley consists of the sounds associated to actions. Foley contributes to make character actions more believable and enhances their perception even while not visible.

Problem: The success of the exploration of sound in a project ultimately depends on the concrete attributions of sounds to the designed elements. The actual availability of sound files, as raw material, and their correct manipulation at the implementation level is crucial to the perception of global quality and to the player’s experience. Foley is one of the layers of sound design for which this aspect represents a bigger challenge.

Sound files are a scarce resource. Additionally, the compatibility of sounds collected from disparate sources is problematic due to differences in acoustic parameters, noise and contextual interference.

Solution: One usual approach is to use “canned sounds” from a library of sounds. However, sound libraries are typically expensive and, if so, prohibitive to small budget developers. Also, simply using sounds from a library limits options to available files. An alternative is to produce and record the needed sounds. This requires equipment, time, and know-how.

Foley is one aspect of sound design that benefits from the mature body of knowledge in movie industry. Guidance on how to produce and record specific foley sounds is fairly available (e.g., Ament, 2009; Marks & Novak, 2009; Viers, 2008).

A characteristic aspect of foley, that has become fairly acknowledged, especially through making-of documentaries, is that, for practical reasons, the sounds recorded often come from objects or apparatus that have little to do with the action being represented. One of the best-known examples – to which the parody in the movie *Monty Python and the Holy Grail* (Gilliam & Jones, 1975) has certainly contributed – is the sound of horse hooves that is achieved by banging two halves of a coconut.

Most of the practice on foley determines that it is assumedly not the realistic. The emphasis is on perception, not so much on veracity. Nevertheless, it is realism that the

foley artist seeks. Variety in foley is one way to serve realism. In that sense recording multiple files for one same purpose provides the resources for designers and developers to properly serve variations of the sound stimulus. The variations can be simple sequences or can be oriented to some criterion (Jeanson, 2008).

The gathering of sound effects is often best done in isolated spaces (Viers, 2008). Unlike the acquisition of images – which can be easily cropped, cut out from context and so on – filtering sound from unwilling elements is difficult and often compromises quality. The capabilities of the available tools for sound cleaning are limited, though there are some recent highly promising developments (Smaragdis, 2009; Smaragdis & Mysore, 2009).

Relations: Relates to *Realism* (to be defined) – foley paradoxically both compromises and aims realism – and *Requisite Variety* (in this seminal collection), as argued. *Foley* is also closely related to *Sound Effects* (to be specified) because techniques used for foley are extensible to sound effects – that is, for sounds of abstract or imaginary objects (as defined in *Sound Layers and Semantics*).

Foley also relates to all patterns detailing how to produce particular foley sounds, as in *Horse Hooves* (next).

Name: *Horse Hooves*

[deprecated]

Context: Horses are one possible element in narratives and games. The sound of horse hooves is an integral part of the perception of a horse – it is hardly omissible.

Problem: It is not practical to record a real horse’s hoofbeats particularly in an isolated setting with the optimal acoustic conditions.

Solution: A very “low tech” technique that proved to be efficient consists of banging two halves of a coconut in each other. For better results bang the coconut halves against a mixture of dirt and straw in a box. Padding the coconuts with foam also improves the sounding.

Hoofbeats can be performed in two ways: the easier “buh-duh-dum” three-step sequence for a gallop; and the true “buh-duh-duh-dum” four-step sequence more noticeable in slower paces (Viers, 2008, p. 255).

There are accounts of other approaches. In *Assassin's Creed* (2007) it was used a real horse hoof with horseshoe, to achieve more realistic movement and weight (Jeanson, 2008).

Naturally, one can use a sound file that someone else previously recorded.

Examples: As said, the use of the coconut sound is documented as a common technique in movie industry.

Games where we can hear horse hoofbeats include *Red Dead Redemption* (2010), *The Legend of Zelda: Twilight Princess* (2006), *Shadow of the Colossus* (2006), *The Elder Scrolls IV: Oblivion* (2007), and *Assassin's Creed* (2007). *Far Cry 2* (2008) includes several other hoofed animals.

Relations: Relates to *Foley* (in this seminal collection)

Appendix D

Pattern Language and Cards for Sound Design in Games, version 2.0

This appendix is provided in the accompanying digital support. Due to its extension and format, we opted not to print its contents along with this main document.

The appendix contains a snapshot of the state of development of the Pattern Language and the Deck of Cards for Sound Design in Games at the time of this writing (version 2.0, presented in Subsection 6.8.3 and Section 7.2). The evolution of the Pattern Language is ongoing; so, the actual contents of the appendix should only be regarded in terms of its strictly documental purposes.

For the most up to date contents, we kindly invite the reader to visit the wiki **soundingames.com** (Alves & Roque, 2012b), from where the snapshot was taken.

Appendix E

Downloadable Printable Deck (depiction)

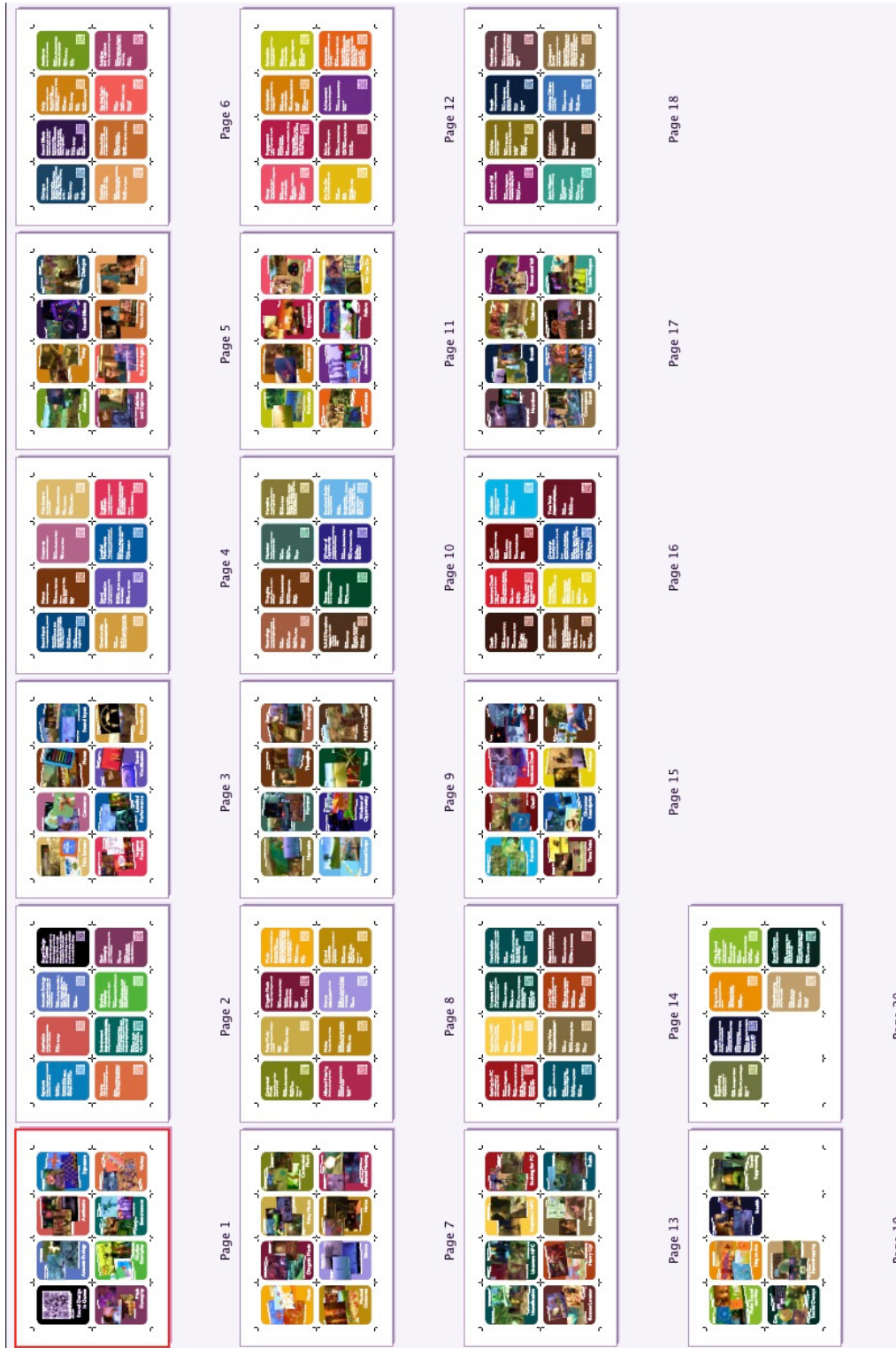


Figure E.1. Depiction of the set of pages as made available for downloading and printing the Deck

Appendix F

Revision History

of the Pattern Language and Cards

List of revisions that occurred between three main moments: the Seminal Collection, version 1.0, and version 2.0. The lines are shown according to the following format:

Object that changed: Kind of change: Where the change was: Result of the action, separated by an arrow like this → when stating how it was before and how it became (Motivation for the change)

For the sake of presentability we are omitting revisions to some fields, namely to *Description, Additional Comments, External Resources, and References.*

Introduced in version 2.0 (since version 1.0)

All cards: Substituted QR-Code: *message “Sound Design in Games, v1.0. Link under development”* → *each card linking to its own webpage* (The website was released after v1.0; see Section 10.1)

All cards: Substituted QR-Code: *Colour: Black QR-Code in white background* → *Transparent QR-Code in white background* (Aesthetical decision)

All cards: Removed Relationships: *all list: Gameplay* (*Gameplay’s* physical card was deprecated)

All cards: Removed Relationships: *all list: Genre* (*Genre’s* physical card was deprecated)

All cards: Removed Relationships: *all list: Sound Layers* (*Sound Layers’* physical card was deprecated)

All cards: Removed Relationships: *all list: Sound Places* (*Sound Places’* physical card was deprecated)

All patterns: Substituted Relationships: *all list: Audio Logs* → *Recordings* (The name changed)

All patterns: Substituted Relationships: *all list: Cut-Scenes* → *Cutscenes* (The name changed)

All patterns: Substituted Relationships: *all list: Play the Beat* → *Rhythm Gameplay* (The name changed)

All patterns: Substituted Relationships: *all list: Requisite Variety* → *Variety* (The name changed)

Acoustic Ecology: Removed Relationships: *Context: Narrative* (Reducing *Narrative’s* aggregateness)

Acoustic Ecology: Removed Relationships: *Context: Sound Design in Games* (*Sound Design in Games* is not being considered a pattern)

Acoustic Ecology: Reordered Relationships: *Context* (More meaningful order)

Acoustic Ecology: Added Relationships: *Contexts: Aesthetics* (*Aesthetics* only entered in v2.0)

Acoustic Ecology: Substituted Screenshots: *Prototype* (More perceptible frame)

Acoustic Ecology: Added Screenshots and Captions: *Half-Life 2* (Very good example)

Acoustic Ecology: Substituted Synopsis: *Designing sound in a holistic way, as influenced by Acoustic Ecology* → *Designing sound in a holistic way, as influenced by the discipline of Acoustic Ecology* (Minor improvement)

Address Others: Removed Relationships: *Context: Make Sound not War* (Reducing *Make Sound Not War’s* aggregateness)

Address Others: Substituted Screenshots: *Ico* (More perceptible frame)

Aesthetics: Introduced Concept: *Aesthetics* (New pattern and homonymous card)

Affected Hearing: Introduced Concept: *Affected Hearing* (New pattern and homonymous card)

Ambiance: Moved Relationships: *Calls for: Acoustic Ecology* → *Relates to: Acoustic Ecology* (Redefinition of the relationships)

Ambiance: Reordered Relationships: *Context* (More meaningful order)

Ambiance: Removed Relationships: *Peers: Foley, Sound Effects, Music, Dialogue* (Since the card *Sound Layers* was deprecated, it wouldn’t make sense to keep calling “peers” to its parts)

Anticipation: Substituted Screenshots: *Far Cry 2* (More perceptible frame)

Awareness: Added Relationships: *May use many, including: Suspicious NPC* (*Suspicious NPC* only entered in v2.0)

Awareness: Reordered Relationships: *May use many, including* (More meaningful order)

Awareness: Substituted Synopsis: *Sound promoting awareness for some gameplay aspect* → *Sound signalling some relevant aspect of gameplay* (Removing recursion in synopsis)

Beacon Locator: Removed Relationships: *Less frequent contexts: Recordings* (Redefinition of the relationships)

Beacon Locator: Added Relationships: *Often uses: Directionality* (*Directionality* only entered in v2.0)

Breath: Substituted Screenshots: *Mini Ninjas* (More perceptible frame)

Character Soundprint: Substituted Screenshots: *Ice Age: Dawn of the Dinosaurs* (More perceptible frame)

Character Soundprint: Substituted Screenshots: *Portal* (More perceptible frame)

Chitchat: Removed Relationships: *Contexts: Narrative* (Reducing *Narrative's* aggregateness)
Chitchat: Substituted Screenshots: *Far Cry 2* (More perceptible frame)
Chitchat: Substituted Synopsis: *NPC's Dialogue that is not central to the course of action*→*Dialogue that is not central to the course of action* (Change of aim)
Chitchat: Substituted Synopsis: *NPC's Dialogue that is not central to the course of action*→*Dialogue that is not central to the course of action* (Change of aim)
Consequent Sound: Reordered Relationships: *May use many, including* (More meaningful order)
Consequent Sound: Substituted Synopsis: *Sound that matters to the gameworld*→*Designing the game world so that is sensitive to sound* (Reducing aggregateness)
Cutscenes: Substituted Colour (Aesthetical decision)
Cutscenes: Renamed Name: *Cut-Scenes*→*Cutscenes* (More appropriate name)
Decay: Substituted Relationships: *Context: Context*→*Contexts* (Redefinition of relationships)
Decay: Reordered Relationships: *Contexts* (More meaningful order)
Dialogue: Moved Relationships: *Calls for: Acoustic Ecology*→*Relates to: Acoustic Ecology* (Redefinition of the relationships)
Dialogue: Added Relationships: *Many contexts, including: Narrator* (*Narrator* only entered in v2.0)
Dialogue: Added Relationships: *Many contexts, including: Thoughts* (*Thoughts* only entered in v2.0)
Dialogue: Added Relationships: *Many contexts, including: Helper Voice* (*Helper Voice* only entered in v2.0)
Dialogue: Reordered Relationships: *Many contexts, including* (More meaningful order)
Dialogue: Removed Relationships: *Peers: Ambiance, Foley, Sound Effects, Music* (Since the card *Sound Layers* was deprecated, it wouldn't make sense to keep calling "peers" to its parts)
Dialogue: Added Screenshots and Captions: *Red Dead Redemption* (Very good example)
Dialogue: Added Screenshots and Captions: *The Sims* (Very good example)
Dialogue: Removed Screenshots and Captions: *Katamari* (The card already had an example of the same kind of exploration)
Dialogue: Removed Screenshots and Captions: *The Elder Scrolls IV: Oblivion* (The example was not being easily understood)
Diegetic Music: Added Relationships: *May use: Radio* (*Radio* only entered in v2.0)
Diegetic Music: Substituted Screenshots: *Silent Hill 2* (More perceptible frame)
Diegetic Music: Added Screenshots and Captions: *Grand Theft Auto IV* (Very good example)
Diegetic Music: Removed Screenshots and Captions: *Rez* (The example was not being easily understood)
Directionality: Introduced Concept: *Directionality* (New pattern and homonymous card)
Eavesdropping: Substituted Captions: *Thief II: The Metal Age: A mission*→*A mission implying eavesdropping* (More perceptible explanation)
Eavesdropping: Substituted Screenshots: *Assassin's Creed* (More perceptible frame)
Eavesdropping: Added Screenshots and Captions: *Crysis* (Very good example)
Eavesdropping: Removed Screenshots and Captions: *Crysis 2* (The example was not being easily understood)
Echolocation: Substituted Captions: *Devil's Tuning Fork: Spacial perception*→*Spatial perception through sound waves* (More perceptible explanation)
Echolocation: Removed Relationships: *Context: Make Sound not War* (Reducing *Make Sound Not War's* aggregateness)
Echolocation: Substituted Screenshots: *Devil's Tuning Fork* (More perceptible frame)
Emotional Script: Removed Relationships: *Context: Sound Design in Games* (*Sound Design in Games* is not being considered a pattern)
Emotional Script: Added Relationships: *May use many, including: Music* (Redefinition of the relationships)
Emotional Script: Added Relationships: *May use many, including: Ouch!* (Redefinition of the relationships)
Emotional Script: Added Relationships: *May use many, including: Imminent Death* (Redefinition of the relationships)
Emotional Script: Reordered Relationships: *May use many, including* (More meaningful order)
Emotional Script: Substituted Screenshots: *LocoRoco* (Zoomed to better perceive the characters' expression)
Emotional Script: Substituted Synopsis: *Sound designed to contribute to the game's emotional script*→*Sound designed to elicit emotions along the experience* (Removing recursion in synopsis)
Engagement: Substituted Relationships: *Context: Context*→*Contexts* (Redefinition of relationships)
Engagement: Reordered Relationships: *Contexts* (More meaningful order)
Engagement: Removed Relationships: *May use many, including: Make Sound not War* (Reducing *Make Sound Not War's* aggregateness)
Engagement: Substituted Screenshots: *Killzone 2* (More perceptible frame)
Engagement: Substituted Screenshots: *Patapon* (More perceptible frame)
Entrainment: Substituted Captions: *Endless Ocean: Scuba breathing inducing pace*→*Scuba breathing pace* (More perceptible explanation)
Entrainment: Reordered Relationships: *May use* (More meaningful order)
Entrainment: Substituted Screenshots: *Endless Ocean* (More perceptible frame)
Failure: Added Screenshots and Captions: *Angry Birds* (Very good example)
Failure: Removed Screenshots and Captions: *Buzz! Quiz TV Show* (The card already had an example of the same kind of exploration)
Foley: Substituted Captions: *Heavy Rain: Knocking on a door* (More perceptible explanation)
Foley: Substituted Captions: *Red Dead Redemption: A moving stagecoach* (More perceptible explanation)
Foley: Moved Relationships: *Calls for: Acoustic Ecology*→*Relates to: Acoustic Ecology* (Redefinition of the relationships)
Foley: Removed Relationships: *Peers: Ambiance, Sound Effects, Music, Dialogue* (Since the card *Sound Layers* was deprecated, it wouldn't make sense to keep calling "peers" to its parts)

Foley: Substituted Screenshots: *Red Dead Redemption* (More perceptible frame)

Foley: Added Screenshots and Captions: *Half-Life 2* (Very good example)

Foley: Removed Screenshots and Captions: *Far Cry 2* (The example was not being easily understood)

Foley Music: Added Screenshots and Captions: *Limbo* (Very good example)

Foley Music: Added Screenshots and Captions: *iGadget* (Very good example)

Foley Music: Substituted Synopsis: *Music made out of foley sounds*→*Music exploring sounds of objects or actions*
(Removing recursion in synopsis)

Footsteps: Removed Relationships: *Contexts: Narrative* (Reducing *Narrative's* aggregateness)

Footsteps: Substituted Screenshots: *Assassin's Creed* (More perceptible frame)

Gameplay: Deprecated Concept: *Gameplay* (Aggregator concept)

Gameplay: Moved Relationships: *May need: Sound input*→*May call for: Sound input* (Redefinition of the relationships)

Gameplay: Added Relationships: *May call for: Helper Voice* (*Helper Voice* only entered in v2.0)

Gameplay: Substituted Synopsis: *All kinds of sound happening and being performed during gameplay*→*Sound relevant for the game mechanics* (Change of aim)

Genre: Deprecated Concept: *Genre*→ (Aggregator concept)

Grunts: Removed Relationships: *Many contexts, including: Narrative* (Reducing *Narrative's* aggregateness)

Grunts: Substituted Screenshots: *Tomb Raider Underworld* (More perceptible frame)

Heartbeat: Substituted Screenshots: *Dead to Rights* (More perceptible frame)

Helper Voice: Introduced Concept: *Helper Voice* (New pattern and homonymous card)

Hurry Up!: Substituted Captions: *Assassin's Creed 2: Door mechanism audible while opened*→*Mechanism audible while active* (More perceptible explanation)

Hurry Up!: Substituted Screenshots: *Assassin's Creed 2* (More perceptible frame + zoomed to better perceive the mechanism)

Identification: Substituted Captions: *The Elder Scrolls IV: Oblivion: Recognizing occupants*→*Foretelling the type of occupant by its soundprint* (More perceptible explanation)

Identification: Substituted Screenshots: *BioShock* (More perceptible frame)

Imminent Death: Added Relationships: *May use: Affected Hearing* (*Affected Hearing* only entered in v2.0)

Imminent Death: Substituted Screenshots: *Half-Life 2* (Zoomed to be more perceptible)

In-game Feedback: Moved Relationships: *Less frequent context: Rhythm Gameplay*→*Contexts: Rhythm Gameplay*
(Redefinition of the relationships)

In-game Feedback: Added Relationships: *Contexts: Pitch Gameplay* (*Pitch Gameplay* only entered in v2.0)

In-game Feedback: Substituted Screenshots: *Guitar Hero* (More perceptible frame)

In-game Feedback: Substituted Synopsis: *In-game Feedback on sound input performance*→*Providing indicators on the player's acoustic performance* (Removing recursion in synopsis)

Levelled Performance: Moved Relationships: *Less frequent context: Rhythm Gameplay*→*Context: Rhythm Gameplay*
(Redefinition of the relationships)

Levelled Performance: Added Relationships: *Context: Pitch Gameplay* (*Pitch Gameplay* only entered in v2.0)

Levelled Performance: Substituted Screenshots: *Aquaria* (More perceptible frame)

Levelled Performance: Substituted Screenshots: *Patapon* (More perceptible frame)

Levelled Performance: Substituted Synopsis: *The progressive sophistication of gameplay performative actions*→*The progressive sophistication of sound related performative actions* (Change of aim)

Make Sound not War: Substituted Captions: *LocoRoco: Waking up creatures*→*Persuading creatures to make way* (More perceptible explanation)

Make Sound not War: Moved Relationships: *Context: Engagement*→*Relates to: Engagement* (Redefinition of the relationships)

Make Sound not War: Removed Relationships: *Includes: Rhythm Gameplay* (Reducing aggregateness)

Make Sound not War: Removed Relationships: *Includes: Address Others* (Reducing aggregateness)

Make Sound not War: Removed Relationships: *Includes: Echolocation* (Reducing aggregateness)

Make Sound not War: Substituted Synopsis: *Sound supporting creative alternatives to conflict*→*Exploring sound to create alternatives to conflict* (More perceptible explanation)

Menus: Substituted Screenshots: *Half-Life 2* (Zoomed to be more perceptible)

Menus: Substituted Screenshots: *Uncharted: Drake's Fortune* (Zoomed to be more perceptible)

Music: Substituted Screenshots: *Everyday Shooter* (More perceptible frame)

Musical Outcome: Added Relationships: *Context: Emotional Script* (Redefinition of the relationships)

Musical Outcome: Added Screenshots and Captions: *Flower* (Very good example)

Musical Outcome: Removed Screenshots and Captions: *Everyday Shooter* (The example was not being easily understood)

Narrative: Substituted Captions: *Flower: Music as Narrative*→*Music and sound effects tell a story* (More perceptible explanation)

Narrative: Removed Relationships: *Context: Sound Design in Games* (*Sound Design in Games* is not being considered a pattern)

Narrative: Added Relationships: *May use many, including: Narrator* (*Narrator* only entered in v2.0)

Narrative: Added Relationships: *May use many, including: Thoughts* (*Thoughts* only entered in v2.0)

Narrative: Added Relationships: *May use many, including: Radio* (*Radio* only entered in v2.0)

Narrative: Removed Relationships: *May use many, including: Acoustic Ecology* (Reducing aggregateness)

Narrative: Removed Relationships: *May use many, including: Chitchat* (Reducing aggregateness)

Narrative: Removed Relationships: *May use many, including: Grunts* (Reducing aggregateness)

Narrative: Removed Relationships: *May use many, including: Footsteps* (Reducing aggregateness)

Narrative: Reordered Relationships: *May use many, including* (More meaningful order)

Narrative: Substituted Screenshots: *BioShock* (Zoomed to be more perceptible)

Narrative: Substituted Screenshots: *Flower* (More perceptible frame)

Narrative: Substituted Synopsis: *The contributions of sound to the narrative*→*The contributions of sound to unfold the game's story* (Removing recursion in synopsis)

Narrator: Introduced Concept: *Narrator* (New pattern and homonymous card)

Noise: Introduced Concept: *Noise* (New pattern and homonymous card)

Ouch!: Removed Relationships: *Contexts: Narrative* (Reducing *Narrative's* aggregateness)

Ouch!: Added Screenshots and Captions: *Uncharted: Drake's Fortune* (Very good example)

Ouch!: Removed Screenshots and Captions: *Dead to Rights* (The card already had an example of the same kind of exploration)

Pitch Gameplay: Introduced Concept: *Pitch Gameplay* (New pattern and homonymous card)

Radio: Introduced Concept: *Radio* (New pattern and homonymous card)

Recordings: Substituted Captions: *Infamous: Dead drops*→*Hidden recordings* ("dead drops")

Recordings: Renamed Name: *Audio Logs*→*Recordings* (More appropriate name)

Recordings: Added Relationships: *May relate to: Helper Voice* (*Helper Voice* only entered in v2.0)

Recordings: Added Relationships: *May relate to: Radio* (*Radio* only entered in v2.0)

Recordings: Substituted Synopsis: *Dialogue recordings, frequently scattered through the gameworld*→*Recorded dialogue, frequently scattered through the game world* (Removing recursion in synopsis)

Relaxation: Substituted Relationships: *Context: Context*→*Contexts* (Redefinition of relationships)

Relaxation: Reordered Relationships: *Contexts* (More meaningful order)

Relaxation: Substituted Screenshots: *Pond* (Zoomed to be more perceptible)

Relaxation: Substituted Synopsis: *A phase of gameplay promoting relaxation*→*A phase of gameplay promoting a restful state of mind* (Removing recursion in synopsis)

Revelation: Introduced Concept: *Revelation* (New pattern and homonymous card)

Rhythm Gameplay: Substituted Captions: *Guitar Hero: Simulated performance of an instrument* (More perceptible explanation)

Rhythm Gameplay: Substituted Captions: *Patapon: Button sequences in sync with steady beat* (More perceptible explanation)

Rhythm Gameplay: Substituted Captions: *Rhythm Paradise: Following a rhythmic pattern* (More perceptible explanation)

Rhythm Gameplay: Renamed Name: *Play the Beat*→*Rhythm Gameplay* (More appropriate name)

Say that Again: Substituted Captions: *Half-Life 2: Repeatable last line (Mini Ninjas)*→*Repeatable last line (Half-Life 2)*

Say that Again: Substituted Colour (Aesthetical decision)

Say that Again: Substituted Screenshots: *Half-Life 2* (More perceptible frame)

Seeking for PC: Added Relationships: *Contrasts with: Suspicious NPC* (*Suspicious NPC* only entered in v2.0)

Seeking for PC: Added Screenshots and Captions: *Metal Gear Solid 4: Guns of the Patriots* (Very good example)

Seeking for PC: Removed Screenshots and Captions: *BioShock* (The example was not being easily understood)

Shout and Yell: Substituted Synopsis: *NPC's loud utterances during engagement*→*Loud manifestations of hostility* (Change of aim)

Signature: Substituted Captions: *BioShock: NPC Soundprint*→*Composition of an emblematic event* (More perceptible explanation)

Signature: Moved Relationships: *Contexts: Identification*→*May relate to: Identification* (Redefinition of the relationships)

Signature: Removed Relationships: *Contexts: Sound Design in Games* (*Sound Design in Games* is not being considered a pattern)

Signature: Added Relationships: *May use many, including: Aesthetics* (*Aesthetics* only entered in v2.0)

Signature: Reordered Relationships: *May use many, including* (More meaningful order)

Signature: Substituted Screenshots: *BioShock* (More perceptible frame)

Signature: Substituted Synopsis: *Memorable association between sound and source*→*Creating a distinctive and memorable association with a sound* (More perceptible explanation)

Silence: Introduced Concept: *Silence* (New pattern and homonymous card)

Sing to Act: Substituted Colour (Aesthetical decision)

Sing to Act: Substituted Screenshots: *Aquaria* (More perceptible frame)

Sing to Act: Substituted Screenshots: *Journey* (Zoomed to be more perceptible)

Sing to Act: Substituted Screenshots: *Patapon* (Aesthetical decision)

Sonic Weapon: Substituted Synopsis: *Using sound as a weapon*→*Using sound to inflict damage* (Removing recursion in synopsis)

Sound Decoys: Substituted Captions: *Commandos BCD: Acoustic Device, stones*→*Acoustic devices and stones* (More perceptible explanation)

Sound Decoys: Added Relationships: *Relates to: Suspicious NPC* (*Suspicious NPC* only entered in v2.0)

Sound Decoys: Substituted Screenshots: *Commandos BCD* (More perceptible frame)

Sound Decoys: Substituted Synopsis: *Using sound to fool the NPC*→*Using sound to fool the opponents* (Minor improvement)

Sound Design in Games: Substituted Screenshots: *QR-Code: message "Sound Design in Games, v1.0. Link under development"*→*soundingames.com* (The website was released after v1.0; see Section 10.1)

Sound Design in Games: Substituted Captions: *Info and resources at <link> v1.0, Dec 2010*→*Info and resources at soundingames.com v2.0, Out 2011* (Update)

Sound Design in Games: Removed Relationships: *Includes: List of relationships* (Redefinition of the relationships: it relates to all others, so it does not make sense to distinguish; also, this is a special case)

Sound Effects: Moved Relationships: *Calls for: Acoustic Ecology*→*Relates to: Acoustic Ecology* (Redefinition of the relationships)

Sound Effects: Added Relationships: *Many contexts, including: Achievement* (Redefinition of the relationships)

Sound Effects: Added Relationships: *Many contexts, including: Failure* (Redefinition of the relationships)

Sound Effects: Reordered Relationships: *Many contexts, including* (More meaningful order)

Sound Effects: Removed Relationships: *Peers: Ambiance, Foley, Music, Dialogue* (Since the card *Sound Layers* was deprecated, it wouldn't make sense to keep calling "peers" to its parts)

Sound Effects: Substituted Screenshots: *Flow* (More perceptible frame)

Sound Input: Added Relationships: *Contexts include: Pitch Gameplay* (*Pitch Gameplay* only entered in v2.0)

Sound Input: Removed Relationships: *Contexts include: Sound Design in Games* (*Sound Design in Games* is not being considered a pattern)

Sound Input: Reordered Relationships: *Contexts include* (More meaningful order)

Sound Input: Substituted Screenshots: *Aquaria* (Zoomed to be more perceptible)

Sound Input: Substituted Screenshots: *Patapon* (More perceptible frame)

Sound Layers: Deprecated Concept: *Sound Layers* (Aggregator concept)

Sound Layers: Renamed Name: *Sound Layers and Semantics*→*Sound Layers* (More appropriate name)

Sound Places: Deprecated Concept: *Sound Places* (Aggregator concept)

Sound Suppressing: Substituted Captions: *Thief: Deadly Shadows: Moss Arrow*→*Moss Arrow, which creates a muffling carpet* (More perceptible explanation)

Sound Visualization: Substituted Captions: *Patapon: Pulsating boarder*→*White boarder, pulsating with the beat* (More perceptible explanation)

Sound Visualization: Substituted Screenshots: *Patapon* (More perceptible frame)

Stealth: Added Relationships: *Relates to: Suspicious NPC* (*Suspicious NPC* only entered in v2.0)

Stealth: Substituted Screenshots: *Dead to Rights* (More perceptible frame)

Subtitles and Captions: Substituted Colour (Aesthetical decision)

Subtitles and Captions: Substituted Screenshots: *Dead to Rights* (More perceptible frame)

Suspicious NPC: Introduced Concept: *Suspicious NPC* (New pattern and homonymous card)

Thoughts: Introduced Concept: *Thoughts* (New pattern and homonymous card)

Time Twist: Introduced Concept: *Time Twist* (New pattern and homonymous card)

Title Screens: Added Relationships: *Contexts: Emotional Script* (Redefinition of the relationships)

Title Screens: Added Screenshots and Captions: *The Path* (Very good example)

Title Screens: Added Screenshots and Captions: *Sonic the Hedgehog* (Very good example)

Title Screens: Added Screenshots and Captions: *Heavy Rain* (Very good example)

Title Screens: Removed Screenshots and Captions: *Ico* (The card already had an example of the same kind of exploration)

Title Screens: Removed Screenshots and Captions: *Spore Origins* (The card already had an example of the same kind of exploration)

Title Screens: Removed Screenshots and Captions: *Super Mario Bros. 2* (The card already had an example of the same kind of exploration)

Trance: Substituted Synopsis: *Sound contributing for trance during the experience*→*Sound contributing to experiencing flow or deep immersion* (Removing recursion in synopsis)

Unaware NPC: Added Relationships: *Contrasts with: Suspicious NPC* (*Suspicious NPC* only entered in v2.0)

Unaware NPC: Substituted Screenshots: *BioShock* (More perceptible frame)

Unaware NPC: Substituted Screenshots: *The Elder Scrolls IV: Oblivion* (More perceptible frame)

Unaware NPC: Substituted Synopsis: *NPC's behaviours evidencing unawareness of PC's presence*→*NPC's behaviours evidencing that the PC remains unnoticed* (Removing recursion in synopsis)

Variety: Renamed Name: *Requisite Variety*→*Variety* (More appropriate name)

Variety: Substituted Screenshots: *Assassin's Creed* (More perceptible frame)

Window of Opportunity: Removed Relationships: *Context: Narrative* (Reducing Narrative's aggregateness)

Window of Opportunity: Substituted Synopsis: *Enhancing the perception of a short time opportunity*→*Enhancing the perception of a temporary possibility or favourable state* (Removing recursion in synopsis)

Introduced in version 1.0 (since the Seminal Collection)

All patterns: Substituted pattern format (The pattern's presentation format was redefined; see Subsection 6.4.2)

All patterns: Removed Relationships: *Horse Hooves* (*Horse Hooves* was deprecated)

Achievement: Introduced Concept: *Achievement* (New pattern and homonymous card)

Acoustic Ecology: Introduced Concept: *Acoustic Ecology* (New pattern and homonymous card)

Address Others: Introduced Concept: *Address Others* (New pattern and homonymous card)

Ambiance: Introduced Concept: *Ambiance* (New pattern and homonymous card)

Anticipation: Introduced Concept: *Anticipation* (New pattern and homonymous card)

Audio Logs: Introduced Concept: *Audio Logs* (New pattern and homonymous card)

Awareness: Introduced Concept: *Awareness* (New pattern and homonymous card)

Beacon Locator: Introduced Concept: *Beacon Locator* (New pattern and homonymous card)

Breath: Introduced Concept: *Breath* (New pattern and homonymous card)

Character Soundprint: Introduced Concept: *Character Soundprint* (New pattern and homonymous card)

Chitchat: Introduced Concept: *Chitchat* (New pattern and homonymous card)

Consequent Sound: Introduced Concept: *Consequent Sound* (New pattern and homonymous card)

Contextual Music: Introduced Concept: *Contextual Music* (New pattern and homonymous card)

Cut-Scenes: Introduced Concept: *Cut-Scenes* (New pattern and homonymous card)

Death: Introduced Concept: *Death* (New pattern and homonymous card)

Decay: Introduced Concept: *Decay* (New pattern and homonymous card)

Dialogue: Introduced Concept: *Dialogue* (New pattern and homonymous card)

Diegetic Music: Introduced Concept: *Diegetic Music* (New pattern and homonymous card)

Dubbing: Introduced Concept: *Dubbing* (New pattern and homonymous card)

Eavesdropping: Introduced Concept: *Eavesdropping* (New pattern and homonymous card)

Echolocation: Introduced Concept: *Echolocation* (New pattern and homonymous card)

Emotional Script: Introduced Concept: *Emotional Script* (New pattern and homonymous card)

Engagement: Introduced Concept: *Engagement* (New pattern and homonymous card)

Entrainment: Renamed Concept: *R-A-E-D Iterations* (The name “Entrainment” migrated to another pattern)

Entrainment: Introduced Concept: *Entrainment* (New pattern and homonymous card)

Failure: Introduced Concept: *Failure* (New pattern and homonymous card)

Foley: Removed Relationships: *Realism* (The intention of defining such patterns was dismissed)

Foley: Added Relationships: *Many contexts, including: Engagement* (Redefinition of the relationships)

Foley: Added Relationships: *Many contexts, including: Character Soundprint* (Redefinition of the relationships)

Foley: Added Relationships: *Many contexts, including: Footsteps* (Redefinition of the relationships)

Foley: Added Relationships: *Many contexts, including: Grunts* (Redefinition of the relationships)

Foley: Added Relationships: *Many contexts, including: Sound Decoys* (Redefinition of the relationships)

Foley: Added Relationships: *Peers: Ambiance* (Redefinition of the relationships)

Foley: Added Relationships: *Peers: Sound Effects* (Redefinition of the relationships)

Foley: Added Relationships: *Peers: Music* (Redefinition of the relationships)

Foley: Added Relationships: *Peers: Dialogue* (Redefinition of the relationships)

Foley: Added Relationships: *Calls for: Acoustic Ecology* (Redefinition of the relationships)

Foley: Added Relationships: *May call for: Subtitles and Captions* (Redefinition of the relationships)

Foley Music: Introduced Concept: *Foley Music* (New pattern and homonymous card)

Footsteps: Introduced Concept: *Footsteps* (New pattern and homonymous card)

Gameplay: Introduced Concept: *Gameplay* (New pattern and homonymous card)

Genre: Introduced Concept: *Genre* (New pattern and homonymous card)

Grunts: Introduced Concept: *Grunts* (New pattern and homonymous card)

Heartbeat: Introduced Concept: *Heartbeat* (New pattern and homonymous card)

Horse Hooves: Deprecated Concept: *Horse Hooves* (Dropped because it contained implementation information, mainly)

Hurry Up!: Introduced Concept: *Hurry Up!* (New pattern and homonymous card)

Identification: Introduced Concept: *Identification* (New pattern and homonymous card)

Imminent Death: Removed Relationships: *Engagement* (Redefinition of the relationships)

Imminent Death: Removed Relationships: *Entrainment* (Redefinition of the relationships)

Imminent Death: Removed Relationships: *Self-awareness* (The intention of defining such patterns was dismissed)

Imminent Death: Removed Relationships: *Attentiveness* (The intention of defining such patterns was dismissed)

Imminent Death: Removed Relationships: *Realism* (The intention of defining such patterns was dismissed)

Imminent Death: Added Relationships: *Context: Failure* (Redefinition of the relationships)

Imminent Death: Added Relationships: *Context: Awareness* (Redefinition of the relationships)

Imminent Death: Added Relationships: *Context: Window of Opportunity* (Redefinition of the relationships)

Imminent Death: Added Relationships: *Peers: Death* (Redefinition of the relationships)

Imminent Death: Added Relationships: *Peers: Ouch!* (Redefinition of the relationships)

Imminent Death: Added Relationships: *May relate to: Hurry Up!* (Redefinition of the relationships)

Imminent Death: Added Relationships: *May use: Heartbeat* (Redefinition of the relationships)

Imminent Death: Added Relationships: *May use: Grunts* (Redefinition of the relationships)

Imminent Death: Added Relationships: *May use: Foley* (Redefinition of the relationships)

Imminent Death: Added Relationships: *May use: Sound Effects* (Redefinition of the relationships)

Imminent Death: Added Relationships: *May use: Dialogue* (Redefinition of the relationships)

In-game Feedback: Introduced Concept: *In-game Feedback* (New pattern and homonymous card)

Levelled Performance: Introduced Concept: *Levelled Performance* (New pattern and homonymous card)

Make Sound not War: Introduced Concept: *Make Sound not War* (New pattern and homonymous card)

Menus: Introduced Concept: *Menus* (New pattern and homonymous card)

Music: Introduced Concept: *Music* (New pattern and homonymous card)

Musical Outcome: Introduced Concept: *Musical Outcome* (New pattern and homonymous card)

Narrative: Introduced Concept: *Narrative* (New pattern and homonymous card)

No Can Do: Introduced Concept: *No Can Do* (New pattern and homonymous card)

Ouch!: Introduced Concept: *Ouch!* (New pattern and homonymous card)

Play the Beat: Introduced Concept: *Play the Beat* (New pattern and homonymous card)

R-A-E-D Iterations: Removed Relationships: *Imminent Death* (The intention of defining such patterns was dismissed)

R-A-E-D Iterations: Added Relationships: *Makes use of: Entrainment* (Redefinition of the relationships)

R-A-E-D Iterations: Added Relationships: *Context: Gameplay* (Redefinition of the relationships)

R-A-E-D Iterations: Added Relationships: *Context: Emotional Script* (Redefinition of the relationships)
Relaxation: Introduced Concept: *Relaxation* (New pattern and homonymous card)
Requisite Variety: Added Relationships: *Contexts: Sound Effects* (Redefinition of the relationships)
Requisite Variety: Added Relationships: *Contexts: Ambiance* (Redefinition of the relationships)
Requisite Variety: Added Relationships: *Contexts: Music* (Redefinition of the relationships)
Requisite Variety: Added Relationships: *Contexts: Dialogue* (Redefinition of the relationships)
Requisite Variety: Removed Relationships: *Counting* (The intention of defining such patterns was dismissed)
Requisite Variety: Removed Relationships: *Coherence* (The intention of defining such patterns was dismissed)
Requisite Variety: Removed Relationships: *Plausability* (The intention of defining such patterns was dismissed)
Requisite Variety: Removed Relationships: *Realism* (The intention of defining such patterns was dismissed)
Say that Again: Introduced Concept: *Say that Again* (New pattern and homonymous card)
Seeking for PC: Introduced Concept: *Seeking for PC* (New pattern and homonymous card)
Shout and Yell: Introduced Concept: *Shout and Yell* (New pattern and homonymous card)
Signature: Introduced Concept: *Signature* (New pattern and homonymous card)
Sing to Act: Introduced Concept: *Sing to Act* (New pattern and homonymous card)
Sonic Weapon: Introduced Concept: *Sonic Weapon* (New pattern and homonymous card)
Sound Decoys: Removed Relationships: *Coherence* (The intention of defining such patterns was dismissed)
Sound Decoys: Added Relationships: *Context: Stealth* (Redefinition of the relationships)
Sound Decoys: Added Relationships: *Context: Consequent Sound* (Redefinition of the relationships)
Sound Decoys: Added Relationships: *Context: Make Sound not War* (Redefinition of the relationships)
Sound Decoys: Added Relationships: *Context: Emotional Script* (Redefinition of the relationships)
Sound Decoys: Added Relationships: *Relates to: Unaware NPC* (Redefinition of the relationships)
Sound Decoys: Added Relationships: *Relates to: Seeking for PC* (Redefinition of the relationships)
Sound Decoys: Added Relationships: *Relates to: Sonic Weapon* (Redefinition of the relationships)
Sound Decoys: Added Relationships: *Often uses: Foley* (Redefinition of the relationships)
Sound Decoys: Added Relationships: *Often uses: Sound Effects* (Redefinition of the relationships)
Sound Design in Games: Introduced Concept: *Sound Design in Games* (New card)
Sound Effects: Introduced Concept: *Sound Effects* (New pattern and homonymous card)
Sound Input: Introduced Concept: *Sound Input* (New pattern and homonymous card)
Sound Layers and Semantics: Removed Relationships: *Coherence* (The intention of defining such patterns was dismissed)
Sound Layers and Semantics: Added Relationships: *Context: Sound Design in Games* (Redefinition of the relationships)
Sound Layers and Semantics: Added Relationships: *Makes use of: Acoustic Ecology* (Redefinition of the relationships)
Sound Places: Introduced Concept: *Sound Places* (New pattern and homonymous card)
Sound Suppressing: Introduced Concept: *Sound Suppressing* (New pattern and homonymous card)
Sound Visualization: Introduced Concept: *Sound Visualization* (New pattern and homonymous card)
Stealth: Introduced Concept: *Stealth* (New pattern and homonymous card)
Subtitles and Captions: Introduced Concept: *Subtitles and Captions* (New pattern and homonymous card)
Title Screens: Introduced Concept: *Title Screens* (New pattern and homonymous card)
Trance: Introduced Concept: *Trance* (New pattern and homonymous card)
Uh-Uh: Introduced Concept: *Uh-Uh* (New pattern and homonymous card)
Uh-Uh: Deprecated Concept: *Uh-Uh* (Quitted during conception: lack of examples; exploration is part of *No Can Do*)
Unaware NPC: Introduced Concept: *Unaware NPC* (New pattern and homonymous card)
Voice Acting: Introduced Concept: *Voice Acting* (New pattern and homonymous card)
Whistling and Humming: Introduced Concept: *Whistling and Humming* (New pattern and homonymous card)
Whistling and Humming: Deprecated Concept: *Whistling and Humming* (Quitted during conception: lack of examples; exploration is part of *Unaware NPC*)
Window of Opportunity: Introduced Concept: *Window of Opportunity* (New pattern and homonymous card)
Yell to Survive: Introduced Concept: *Yell to Survive* (New pattern and homonymous card)
Yell to Survive: Deprecated Concept: *Yell to Survive* (Quitted during conception: lack of examples; exploration is now considered part of *Sonic Weapon* and current *Shout and Yell*)

Introduced in the Seminal Collection

Entrainment: Introduced Concept: *Entrainment* (New pattern)
Foley: Introduced Concept: *Foley* (New pattern)
Horse Hooves: Introduced Concept: *Horse Hooves* (New pattern)
Imminent Death: Introduced Concept: *Imminent Death* (New pattern)
Requisite Variety: Introduced Concept: *Requisite Variety* (New pattern)
Sound Decoys: Introduced Concept: *Sound Decoys* (New pattern)
Sound Layers and Semantics: Introduced Concept: *Sound Layers and Semantics* (New pattern)

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