Aesthetic Heuristics in Ubimus

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In this paper we propose aesthetic heuristics as an area of study within ubiquitous music research. Initially we discuss the motivations for narrowing the focus of the experimental variables involved in creativity-centred design studies. Then we place aesthetic heuristics within the current efforts toward designs for creativity support, highlighting recent studies that target everyday musical creativity. The reviewed experimental results point to a gap between the current theoretical proposals in musical creativity and the factors that impact everyday musical activities. Self-referentiality of the experimental-theoretical construct and early domain restriction are two of the limitations pointed out by previous theoretical work. We provide a working definition of aesthetic heuristics, indicating its object of study and its rationale. We also lay out initial experimental strategies. Potential contributions from interaction aesthetics and ubimus research are discussed, introducing the concept of creative bias and a set of experimental hypotheses. The last section of the paper furnishes examples of creative biases within the context of musical interaction design.

1. INTRODUCTION

Sellen et al. (2009) list five transformations that impacted recent advances in Human-Computer Interaction: 1. the end of interface stability, 2. the growth of techno-dependency, 3. the growth of hyper-connectivity, 4. the end of the ephemeral, 5. the growth of creative engagement. This last transformation implies that computer tools now can be assembled and appropriated in ways that change our worldviews. Whether we like it or not, computational technology pervades our daily activities, opening opportunities both for positive and negative action (Rogers 2014). Becoming our own producers, developers, publishers and critics whether in routine or creative activities has potentially far-reaching consequences. One of these consequences is the ability to reshape our daily experiences introducing aspects that previously were relegated to highly trained practitioners in specialized venues. Hence, technologists have begun explicating the nature of use as a question of experience and how it unfolds over time, highlighting its subjective qualities (Wright et al. 2008).

Although computers have been used within the context of creative musical practices since the early days of computer science, technology-based creative music research still presents serious methodological difficulties. On one hand, creativity research has not yielded computer-based infrastructure to study musical phenomena in real-world settings. On the other hand, computer science research has generally targeted the support of music production (e.g., sound synthesis, real time control, graphic user interface design) rather than the users’ needs within the context of creative activities (Eaglestone et al. 2008). Upton et al.’s (2005) bleak assessments of the state of the art still holds true: “There is currently a lack of a research base for electroacoustic composition systems. Studies have been mainly restricted to ‘traditional’ tonal Western Art Music. The search for objective models of composition is also exacerbated by sparsity of insightful research into creativity, particularly from a software perspective. Appropriate methodology is also problematic because of the difficulty of determining the cognitive processes of composers. Further, derivation and validation of models requires empirical studies, but these have rarely been used to research composition. The experimental studies that exist fail to address interaction with computer systems, or to address complexities of professional composition. Few go beyond trivial composition exercises using crude and simple sound sources (Upton et al. 2005).

One of the current multidisciplinary efforts to investigate the creative potential of converging forms of social interaction, mobile and distributed
technologies with materially grounded artistic practices is ubiquitous music research (Keller et al. 2014a). The term ubiquitous music (ubimus) encompasses practices that empower participants of musical experiences through socially oriented, creativity-enhancing tools (Keller et al. 2011a; Miletto et al. 2011). Ubiquitous music has been defined as a research field that deals with distributed systems of human agents and material resources that afford musical activities through sustainable creativity support tools. One perspective targets the development of computational tools for supporting ubiquitous musical activities by non-musicians (Flores et al. 2014; Miletto 2011), proposing design patterns and metaphors for interaction to boost creativity. Another approach focuses on the educational and philosophical issues raised by ubimus practice, highlighting the applicability of a dialogical proposal grounded on the Brazilian educational movement (Lima et al. 2012) and impacting the area of participatory design (Keller et al. 2014a). A third perspective proposes the fusion of creativity studies with ubiquitous music practices, signalling a path toward the application of experimental ubimus research to increase our understanding of creative phenomena in real-world settings (Keller et al. 2010, 2014a).

Taking as a point of departure recent theoretical advances in Interaction Design and Human-Computer Interaction (Löwgren 2009), Keller et al. (2014a) discuss a body of knowledge relevant to creativity support in the context of ubiquitous musical activities. Among the concepts and methods that have been proposed to describe aspects of the ideation and materialization of experiences with technology, pliability (Löwgren 2009) and anchoring (Keller et al. 2010) have served as triggers for aesthetically aware design initiatives, highlighting the affinity between interaction aesthetics and ubimus (Keller et al. 2014a). Engagement, temporal patterns of behaviour, alternative forms of design with innovative material combinations and user identities inserted in cultural contexts have been identified as common themes. Creative potentials, everyday creativity and distributed creativity constitute emerging phenomena targeted by ubiquitous music experimental research. Despite the several parallels between the interaction aesthetics and the ubimus research agendas, targeting creativity implies dealing with phenomena that have not been considered within the aesthetics-oriented human-computer interaction perspectives. Opportunities for innovative design can be identified by observing creative practices (design patterns), by applying cognitive models (design actions) and by uncovering emergent properties through experimental work (design qualities). These three strategies can be combined to implement creativity support metaphors, targeting both domain-specific and general creativity factors.

This paper introduces a new object of study within ubimus research: aesthetic heuristics. The proposal is closely aligned with recent advances in interaction aesthetics (Keller et al. 2014b; Löwgren 2009), encompassing the knowledge gathered through ubiquitous music experimental work (Keller et al. 2011a; Lima et al. 2012) and taking advantage of the theoretical tools developed in the context of seventeen years of ecologically grounded creative practice (Keller et al. 2014c). Aesthetic heuristics concern creative-activity decision making. In other words, the term aesthetic heuristics focuses on the decision processes involved in creative activities that target aesthetic choices. Despite their narrowly oriented focus – prominently dealing with creative decision making – aesthetic heuristics cannot be detached from the flow of ongoing creative activities and their material, social and cognitive support. As objects of study creative decisions are localized events that take place while creative processes unfold. Hence, most of the theoretical and methodological tools that have been used in creativity-centred design and in information technology creative practice can be employed in the study of aesthetic heuristics. The next section provides a working definition of the proposal, indicating its object of study, its rationale and the initial experimental strategies. The third section discusses creative bias followed by the potential contributions from interaction aesthetics and ubimus research to aesthetic heuristics. The necessity of creative bias is discussed in section five. At sixth and final section brings the potential creative biases and its perspective of applications.

2. AESTHETIC HEURISTICS: CREATIVE DECISION-MAKING AS AN OBJECT OF STUDY

A growing body of experimental evidence has been gathered on outcomes based on irrational or biased assessments of prospects. This is a key issue in utilitarian decision-making because mismatches between assessments and outcomes may lead to miscalculations of the necessary resources ensuing the application of suboptimal policies.

Heuristics are cognitive shortcuts that help to make decisions under uncertain conditions (Kahneman & Tversky 1979). The uncertainties may be informational – when not enough knowledge is available to make an informed decision – material – when the available resources are not sufficient to ground the decision-making process – or temporal – when the decisions have to be made under time pressure. Expanded notions of heuristics have also...
been used in other fields, lifting the requirements of making decisions under pressure and generalizing the concept to “creative decision helpers.” Amabile’s (1996) distinction between formalized thought and heuristic procedures traces a line between computationally oriented perspectives on creativity and decision-making in everyday contexts. But recent research on computational creative methods has incorporated unstructured techniques to target activities that rely on resources that become available during the creative act. While computational intelligence relies on knowledge representation and formalized reasoning, idea processors usually set emphasis on broader (unstructured) thinking. As Lubart (2005: 369) suggested, “the key to designing truly useful systems may be to clarify the nature of the computer’s contribution for each proposed system, how it fits with the nature of the creative thinking task and to what extent the system provides what the user[s] lack in order to be creative rather than being redundant or contradictory with the users’ own ways of functioning.” This expanded notion of creative heuristics tie the cognitive shortcuts used in decision-making with the intent to produce a creative output.

Amabile (1996) compiled a list of the most cited heuristics for decision-making in the context of creative activities. Rather than focusing on well-defined procedures, five of the seven items discussed by Amabile describe strategies to deal with creative activity without predefined goals:

1. Play with ideas (Wickelgren 1979).
2. Try to generate hypotheses by analyzing case studies, using analogies, accounting for exceptions and investigating paradoxical incidents (McGuire 1997).
3. Make the familiar strange and the strange familiar (Gordon 1961).
5. (a) Use concentrated work sessions rather than scattered, distributed work sessions; (b) start by playing with the same idea in a number of different ways before entering the idea-generating sessions; (c) do not rely on over-learning of response algorithms (Mednick 1962).
6. (a) Try to rearrange the elements of a problem; (b) take a break; (c) start to consider a solution involving the most important elements before elaborating the solution in detail; (d) try to consider classes of elements on behalf of particular elements; (e) given that the way to reach a goal from your position seems too far, it may help to look for shorter ways (Anderson 1980).
7. (a) Apply “intermediate impossibles”; (b) determine the value of an idea by its potential to set off further ideas rather than on its validity (de Bono 1971).

Items 2 and 6a, 6c, 6e call for explicit formulations of specific epistemic targets as the first stage of the creative activity. Thus, they can be classified as problem-solving activities that can be tackled through formalized procedures. The other heuristics apply a diversified set of strategies to deal with unknowns. Both exploratory (1, 5c, 6d) – involving increasing the unstructured knowledge of the available resources – and combinatorial-analytical strategies (2, 6a, 6c, 6d) – focused on structured knowledge of the resources – are usually employed. In line with Stein’s (1953) proposal, some strategies target the settings (5a) or the personal disposition (6b) toward the resources and activities. Other strategies strive to expand the potentials (1, 3, 4, 5b, 7b) or to avoid fixation (2, 3, 4, 5c, 6), by increasing the available resources or by inducing a change of paradigm through the use of unfamiliar resources (3, 4, 7a).

So far, we have discussed two approaches to the study of decision-making. One approach deals with estimating prospects in uncertain conditions, focusing on the use of heuristics as cognitive shortcuts for utilitarian decision-making. Another approach proposes heuristics as strategies to deal with creative decisions targeting two types of activities: (a) activities that involve a large number of unknowns; (b) activities in which epistemic targets cannot be established before exploring the epistemic space. Following Amabile (1996), a tight definition of creative heuristics may exclude formalized procedures, or at least it may use explicit formalization as preparation for decisions based on implicit cognitive processes. These two applications of heuristics point to a third avenue of research involving creative decisions with limited resources. Arguably, this is the most demanding case for two reasons: 1. it precludes the adoption of an explicit epistemic target – which would restrict the range of creative outcomes – and, 2. it reduces the availability of support for decision-making. This second caveat is being addressed by recent proposals in interaction design (Herrmann 2009), indicating the need for broad approaches aligned with the current developments in usability research (Hornbaek 2006).

3. CREATIVE BIASES

Creative products can be characterized by their heightened relevance and originality (Weisberg 1993). When placed within the context of group activities, these two factors may engage opposite forces (Ferraz & Keller 2014). Widely distributed resources tend to become more socially relevant than scarce resources. The downside of easily available resources is that their originality magnitude is usually fairly low. Given these constraints, collective creative products demand
creative decisions that lead to intense sharing of unique resources. Psycho-economic models of creativity suggest that the analysis of the flow of resources may unveil the mechanisms that boost and constrain creative outcomes (Rubenson & Runco 1992, 1995; Sternberg & Lubart 1991). If creative processes were to occur in ideal conditions, creative decision-making would be based on objective, rational assessments that would maximize the use of resources leading to improvements in both individual and group creative performance. This is rarely the case. Creative processes are usually resource-intensive and high performance levels are very difficult to maintain. Why is this so?

A possible answer to this question is that creativity-oriented heuristics are riddled with biases and unrealistic assessments of prospects. Even if this weren’t the case, and individual decisions tended to optimize personal creative outcomes, the best scenario would not necessarily imply good results for group creative practices. Thus, the study of creative decision-making – within the field of aesthetic heuristics – involves at least two experimental strategies: (1) the analysis of creative activity to unveil decision biases and; (2) the study of group creative outcomes to observe mismatches between individual prospective assessments and group creative results.

5. WHY DO WE NEED TO STUDY CREATIVE BIASES?

Creative activities involve the consumption and production of resources (Rubenson & Runco 1992, 1995; Sternberg & Lubart 1991). Purely rational decisions would imply an optimal usage of resources, maximizing the creative output and ensuring positive impacts on both the material and social dimensions of the creative outcomes. This is rarely the case. There are several factors that preclude an optimal performance in creative activities. At least three of these factors are related to the decision-making process involved in creative activities.

Firstly, effective creative practice is usually very costly. In teleological activities, the epistemic goal is set in advance (Fantauzzacoffin & Rogers 2013). Creative practice is self-reflective (Donald 2006), meaning that the creative strategies are shaped during the creative activity rather than before the activity takes place. The goals are products of the activity, hence they cannot be fixed a priori. However, despite the epistemological drawbacks of the teleological approach, it has been adopted by several musical creativity theorists (Collins 2005) because of its low consumption of resources. Aesthetic creative practice usually demands long stretches of exploratory activity before any specific goal can be established (Yamamoto & Nakakoji 2005; Keller et al. 2014c). These exploratory activities consume a large amount of resources. The logic of the teleological approach is this: if we restrict exploratory actions to a minimum, the efficiency of the decision processes will increase. What we are dealing with here is a bias favouring low resource consumption at the cost of reduced process quality. The ability to reshape worldviews is one of the key features of creative practices (Donald 2006). This ability may be closely related to the impact of the activity on the creative potentials rather than to the solution of well-defined problems. Large epistemic spaces seem to be a requisite for the expansion of these potentials.

Second, creative practice is based on and impacts social relational properties (Keller et al. 2014b). These properties emerge through ongoing interactions among agents. Thus, they are constantly changing but they do not change abruptly. General creativity frameworks include persuasion as one of the determinants of the creative processes (Kozbelt et al. 2012). A similar proposal has recently been introduced within the context of computational creativity, labelled framing (Bown 2014). Both persuasion and framing demand the active participation of the agents involved in the activity to manipulate the subjective value of the creative products.

Third, enactive activities – i.e., activities that have direct impact on the creative products – are usually used to measure the effectiveness of creative performance (Coughlan & Johnson 2006; Runco 2004). This may be misleading. Despite the fact that enactive activities have an immediate effect on the material relational properties, they may operate at very low efficiency levels. This is the case with novice practitioners. Within the context of group musical activities, non-musicians participating in enactive activities tend to produce lots of irrelevant sonic products – usually defined as creative waste (Ferraz & Keller 2014). As the agents gain expertise, the quantity of garbage decreases and the probability of producing original and relevant products increase. Concomitantly, the level of rejection – determined by the standard participants’ acceptance of creative products – may also increase. Thus, when comparing newbies and highly skilled participants doing enactive activities the ratio between the quantity of garbage and the quantity of products may remain the same, despite the changes in the quality of the overall output. In this case, what changes is the profile of the creative biases. Novices’ decisions tend to favour low resource consumption that lead to low-quality outcomes, while experts’ generally adopt strategies that lead to high-quality products without the need to increase resource usage. One way to untangle
the analysis of performance in enactive activities is to assess both the material output and the creative biases that underlie the decision-making process.

6. POTENTIAL CREATIVE BIASES AND PERSPECTIVE OF APPLICATIONS

This section discusses seven examples of what may constitute distinct creative biases. We provide definitions applicable both to the musical realm and to general creativity studies. Finally, we discuss the implications of aesthetic heuristics for creativity-centred design, pointing to tailored experimental strategies that take into account individual biases and their impact on group creative practices. So far, we have identified seven examples of creative biases in the experimental literature on creativity: instrumentalism, carbon racism, rationalism, autistic bias, persistence bias, display bias and magnitude bias.

Instrumentalism: The tendency to assign creative functions to a device. By focusing exclusively on the device, the adopted technique predetermines the creative potential of the activity, i.e. treating the computational resources as if they were acoustic instruments. One example is the mobile music instrument Ocarina (Wang 2014). The Ocarina partially incorporates the affordances of the acoustic instrument of the same name, letting the user press the touchscreen of the mobile telephone as if she were occluding holes of a ceramic ocarina. This device-oriented approach does not take into account the actual affordances of the relationship performer-instrument which are constructed through the proprioceptive feedback provided by the real material in conjunction with the sonic outcome. Another example of instrumentalism as an unsustainable technique has been documented by Ruviaro (2012). Laptop orchestras adopt a European nineteenth-century hierarchical approach to music making, using portable computers as orchestral components without changing the underlying social assumptions. Given the rapid replacement of computational devices, within the next few years most laptop computers will probably end in a dumpster, burying with them all the music produced for the laptop format. Thus, laptop orchestras have been born to linger as historical curiosities, just like tape music, Wii and Kinect artworks.

Carbon racism: Strong form – only humans can be creative; weak form – organisms are more creative than machines. The critical perspective on this concept has emerged from research on computational creativity (Bown 2014). The manifestations of computational creativity show that algorithmic outcomes can be as creative as non-technological products (McCormack & d'Inverno 2012). When faced with extreme conditions, such as activities demanding very long stretches of time or activities that have to be done in harsh environments, machines are better equipped than humans to deliver creative products. The cultural relevance of the technological expansion of human cognition is well supported by current philosophical trends (see, for example, the various forms of the extended-brain hypothesis – Donald 2006; Hutchins 2010). The extended-brain proposal relies on key cognitive resources available in the environment, including both social and material resources. Within this perspective, computational resources can be categorized as one form of material resources (Keller et al. 2014a). As Donald (2006) suggests, aesthetic activities depend heavily on material resources for cognitive support. Given that creative activity demands both behavioural and material resources, outcomes within technologically oriented creative practices must make use of computational support as a source for creativity. In their strongest manifestations, carbon-biased approaches stand on the premise that human groups without technology achieve equivalent creative magnitudes as the groups that employ technological resources in their creative practices. An empirical prediction of the weak carbon-biased approach is that creative products produced by humans will attain systematically higher creative magnitudes than machine products. This may be empirically analysed but in order to obtain ecologically valid results on creative performance, experiments have to be conducted in everyday environments where creative activities are carried out. Most daily environments feature potential technological support for creative activity in the form of personal portable devices, wireless Internet access and various audiovisual transduction systems. Given these baseline conditions, stripping participants of all computational support will not provide information on up-to-date creative activity. Therefore, advances on the study of the carbon bias will need to take into account everyday usage of computational resources, untangling the cognitive and the computational resource contributions and caveats.

Rationalism: In principle, purely rational decisions imply an optimal usage of resources. Thus, they maximize the creative output, reducing the impact on both the material and social resources. In practice, rational decisions require well-defined problems and constrained epistemic spaces. Aesthetic decisions are usually highly subjective. They deal with volatile resources (Keller 2014), therefore factors and conditions are subject to rapid changes. They are emotionally and socially charged, with immediate impact on cognitive resources. In a nutshell, creative practice deals with individual and group cognitive states that involve tight interactions among cognitive and
material resources. As discussed previously, creative activity implies self-reflection, therefore part of the necessary resources are produced during the activity, changing the epistemic space. Rationality biased decisions ignore the dynamic quality of creative processes and treat resources as static. Sometimes this assumption simplifies the decision-making procedures providing higher levels of abstraction. For example, simplistic serial operations such as inversion, retrograde and transposition can be used effectively to produce consistent pitch material (cf. Anton Webern - Symphony no. 21). In spite of their simplicity, over the course of the twentieth century the mechanistic application of serial procedures has produced more sonic garbage than professional creative products. Another caveat of the rationality bias is ignoring the implicit factors embedded in decision-making. Effective support for musical creativity may involve not only explicit knowledge but also implicit knowledge gained during the creative activity. In musical interaction design, supporting reflective and epistemic activity may prove to be more important than supporting actions directly related to sonic resources (Keller et al. 2014c; Miletto et al. 2011).

Given the space constraints of this paper, the remaining four creative biases will be portrayed within the context of musical interaction design decisions.

Persistence biases: prioritize material products over behavioural products. Thus, design decisions will favour support for enactive actions rather than reflective or epistemic actions, i.e. sound-making tools instead of sketching or planning tools.

High-magnitude biased decisions sacrifice intuitiveness and simplicity to support highly idiosyncratic usage. In musical interaction design, typical examples are: using symbolic notation for generic event sequencing; supporting synchronous activity over networks without accounting for the latency and jitter that degrade synchronous interaction; simulating hardware controllers as widgets without supporting the original affordances of the controllers, e.g. knobs on touchscreens.

Display biases rely on cultural contexts to assess the relevance of resources and products. From a musical interaction design perspective, effectiveness is not measured by the quality of the sonic product but by the subjective value given to the instrumental display. This form of bias may stem from adaptations that emerged from the selection of honest signals (Zahavi 1975). Irrelevant and costly features of artistic manifestations, such as solo instrumental performances with dozens of keyboards and highly complex interfaces of analogue modular synthesizers may be manifestations of the display bias.

Autistic bias stems from the romantic categorization of art objects as the products of an inspired genius. This view has extensively been criticized by recent creativity theorists (Weisberg 1993), pointing to the need of large temporal investments to achieve professional creative performance. Despite the growing evidence of the social grounding of creative manifestations (Amabile 1996), some domain-specific approaches to musical interaction insist on placing self-expression at the centre of the design process. Gurevich and Treviño (2007) provide a critical assessment of these proposals highlighting two trends that have undermined the view of music making as an individual activity for self-expression: collaborative music making by novices and the experimental approaches to composition of the second half of the twentieth century. These two forms of creative practice place self-expression as a secondary by-product of community actions rather than as an objective to be attained. Reducing the autistic bias may lead to support for distributed creativity (Hutchins 2010; Keller et al. 2010), increased engagement (Brian-Kynns 2011) and smoother learning curves for novice music practitioners (Miletto et al. 2011; Pimenta et al. 2014).

Biases may shape the personal investments on creative resources and activities. We have discussed three creative biases and exemplified other four using references taken from the musical creativity and musical interaction literature. Evidence was gathered on the influence of three creative biases on design decisions: (1) instrumentalism has induced a preference for forms of musical interaction that do not rely on technical limitations rather than on aesthetic qualities; (2) carbon racism has placed overdue stress on anthropocentric agency, excluding material and technological support as sources of creativity. An important aspect of this bias is the procedural inability to conduct ecologically valid research in everyday settings; (3) rationalism projects the notion that creative decision-making is a form of problem-solving activity. This bias implies that agents deal with well-defined problems, they base their decisions on explicit knowledge, and they have permanent and complete access to resources.

7. FINAL WORDS
In this paper we have: (a) provided a working definition of the proposal, indicating its object of study, its rationale and the initial experimental strategies; (b) presented the potential contributions from interaction aesthetics and ubimus research to
aesthetic heuristics; (c) explored the concept of creative bias introducing a set of research questions, examples of creative biases and their implications in the context of creativity-centred design.

8. REFERENCES


