CREATING THE CREATOR: DIGITAL SPACES OF VIRTUAL ARTISTRY

By

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This work is dedicated to my parents, Jeff and Shannon Solomon, who on innumerable Sundays during my preteen years let me take the bus by myself to New York City so that I could get rush tickets to see Broadway matinees.
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Convergence in contemporary musical software.
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Digitally assisted creativity often refers to the process of helping creators be creative in the digital domain. Taking this paradigm as a point of departure, the present document entertains the idea of digital assistants that help creators become more creative. After having first explored the etymological patrimonies of the words “digitally,” “assisted,” and “creative” as they relate to music composition and the arts in general, the dissertation will then develop a theory of the processes through which one could possibly become more creative, concluding with the discussion of a digital tool that facilitates several aspects of the aforementioned theoretical framework.
CHAPTER 1
INTRODUCTION

Any body can have ideas—the difficulty is to express them without squandering a quire of paper on an idea that ought to be reduced to one glittering paragraph.

—Mark Twain, Letter to Emeline Beach, 10 February 1868

This dissertation proposes a new paradigm in which the process of digitally assisted composition may be considered and undertaken. Underlying this paradigm is the core assertion that digitally assistive compositional devices must act as virtual spaces that enable the composer to develop musical structures and forms from varying levels of epistemological and ontological certitude. This assertion is first developed via a theoretical inquiry into the nature of digitally assistive devices and subsequently buttressed by a software implementation of said inquiry’s salient findings. Chapters Two through Six explore the three words digitally, assisted, and composition (with Chapters Four through Six focusing specifically on creativity and composition), delving into their separate histories and winding a coherent thread through all three ideas in the dissertation’s capstone, Chapter Seven, via an extended metaphor based on the writings of Piaget and Jankélevitch on childhood and death respectively. Chapter Eight looks at current implementations of digitally assistive compositional devices, measuring the extent to which they fit within the framework advanced in this dissertation. Chapter Nine presents an implementation of a digitally assistive device, named Organdiae, that acts as an exemplar of the goals stated in Chapter Seven, concluding with suggestions for further research.

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The epigraph to this chapter is drawn from Booth (1947, 226–227).
CHAPTER 2
THE DIGITAL IS VIRTUAL

Virtual now defines an absolutely positive mode of existence. Duration is virtual; it is real with respect to a given degree of duration insofar as this degree differentiates itself. . . . Without any doubt, the virtual is in and of itself the modality of that which does not act, because for it, action is only distinguishable via differentiation, which means that something virtual ceases to be what it was while keeping something from its origin. But by the same logic, the virtual is the modality of that which is.¹

The present chapter defines the “digital” from a sociological standpoint, evaluating how it is constructed from a broader notion of the “virtual.” After having established this, I will look at the short history of the “digital” as virtual, noting how constructions of the “self” are made in this space. Lastly, I will look at what it means to create a digital tool for the digital self—a new conceptualization of “self” that must be considered in its own right when advancing any discourse on digital production and exchange, including digitally assisted creativity.

2.1 Before Digital, There Was Virtual

The modern discourse on the virtual narrowly predates the commercialization of digital technology. Deleuze, in his epochal *Différence et Répétition* (first published in 1968), constructs a notion of the virtual that has few intellectual antecedents. Perhaps

¹ This is a translation of the Deleuze quote. All foreign language texts in this document are followed by the author’s English translations.
the only direct link that can be drawn is to Bergson (1906), who discusses the virtual in his *Matière et Memoire*, stating:

Nous partons d’un “état virtuel”, que nous conduisons peu à peu, à travers une série de *plans de conscience* différents, jusqu’au terme où il se matérialise dans une perception actuelle, c’est-à-dire jusqu’au point où il devient un état présent et agissant. (*Bergson, 1906, 268*)

*We begin from a “virtual state” that drives us little by little through a series of different planes of consciousness to the point where the state materializes as a current perception, that is to say a state that becomes present and acting.*

While Deleuze’s discussion of the virtual makes the same virtual/actual distinction as Bergson’s does, Deleuze’s fortification of the virtual is more rigorous and complete. Furthermore, Deleuze is the first scholar to call for precision in defining the term:

> We have ceaselessly invoked the virtual. In doing so, have we not fallen into the vagueness of a notion closer to the undetermined than to the determinations of difference? (*Deleuze, 1994*)

Bergson, on the other hand, often uses “virtual” in passing and only with reference to past events (see *Bergson 1906, 136, 144, 151*).

Deleuze's precision in his definition of “virtual” is a response to a perceived “oscillation in the philosophy of Leibniz” (*Deleuze, 1994*) concerning Ideas. He writes:

> The virtual is opposed not to the real but to the actual. *The virtual is fully real in so far as it is virtual.* Exactly what Proust said of states of resonance must be said of the virtual: ‘Real without being actual, ideal without being abstract’; and symbolic without being functional. Indeed, the virtual must be defined as strictly a part of the real object – as though the object had one part of itself in the virtual into which it plunged as though into an objective dimension. (*Deleuze, 1994, 208–209*)

The other part of this object’s self is the actual, and thus, any transmogrification of the virtual in the domain of the real represents a process of actualization. Conversely, that which becomes real is, according to Deleuze, the possible:

> The possible is opposed to the real; the process undergone by the possible is therefore a ‘realisation’. By contrast, the virtual is not opposed to the real; it possesses a full reality by itself. (*Deleuze, 1994, 211*)
It is here that Deleuze’s critique of Leibniz becomes most apparent. He criticizes the part of Leibniz’s philosophy that posits the “Idea” as a Platonic form, stating:

The possible and the virtual are further distinguished by the fact that one refers to the form of identity in the concept, whereas the other designates a pure multiplicity in the Idea which radically excludes the identical as a prior condition. (Deleuze, 1994, 211–212)

It is for this reason that Deleuze’s scholarship is almost without precedent; he sees Leibniz’s work as an intellectual bottleneck that stifles discourse on the virtual by confusing it with the possible.

This hesitation between the possible and the virtual explains why no one has gone further than Leibniz in the exploration of sufficient reasons, and why, nevertheless, no one has better maintained the illusion of a subordination of that sufficient reason to the identical. (Deleuze, 1994, 213)

Shields (2003) extends Deleuze’s line of reasoning by dividing the possible into the abstract and the probable, stating that “the abstract is a ‘possible ideal’ (expressed as pure abstraction, concepts)” (Shields, 2003, 29) whereas “the probable is an ‘actual possibility’ usually expressed mathematically, such as a percentage” (Shields, 2003, 29). He also changes Deleuze’s terminology from “actual” to “concrete,” allowing him to posit a quadpartite division where “actual” contains both “concrete” and “probable.” In this taxonomy, he draws an exhaustive gradient of potential transformations between concrete, virtual, abstract, and probable, reprinted in Figure 2-1. To support this categorization scheme, Shields provides a comprehensive literature review of scholarship on the virtual in his chapter “The virtual and the real.”

Later in The Virtual, Shields brings the digital into the fold of the Deleuzian discourse on the virtual. He states that “computer-mediated communication reintroduces virtualities as important presences in the form of distant but significant others—friends, clients, teammates—and in the form of digital simulations for play and by which future trends and actualities are anticipated and prepared for” (Shields, 2003, 44). In the same
Figure 2-1. Quadpartite division of the real and the possible proposed by Shields (2003, 34).

vein as Deleuze, Shields does not contrast the digital-as-virtual with the real. Rather, he clumps the two in the same camp:

In the context of digital technologies and their social forms at work and in the telecommunications of advanced capitalist societies, ‘virtual’ comes to equal ‘simulated’. Rather than being something which as an incomplete form of reality—something real in essence, ‘almost,’ ‘as if’ and offered as being ‘as good as’—the virtual comes into its own as an alternative to the real. The virtual is not merely an incomplete imitation of the real but another register or manifestation of the real. (Shields, 2003, 46)

Although Shields never explicitly develops the concept of a digital self, he hints at it in manifold ways. Perhaps most profoundly, he indicates our willingness to be bored in rather than of digital environments—that is, we wait around in digitalia for something to arrive instead of simply jettisoning the computer for baseball. It is clear that, if one concedes that multiple selves can exist for the multiple spaces in which one situates oneself, the digital as an environment can be a container of “selves” in the same manner as rituals and role-playing games. The extent to which said selves resemble that which constitutes one’s “actual” self is the choice of the individual—it is for this reason that my digital avatar can, without irony, be a 15-year-old female from Hong Kong if I so choose. What is important is that, like in any environment, one acknowledges the reciprocal force by which selves shape the environment (both literally and as perceived) and how
the environment shapes selves. This will, in turn, create a space in which tools have meaning, be they responsive or preemptive, deterministic, or expressionistic.

2.2 The Digital Self

There are many monickers for the contemporary digital virtual environment, but sociology, by way of science fiction, has adopted the term “cyberspace” to describe this virtualscape. While the notion of alternative, information-based spaces of exchange has existed as long as humans have created informational networks, the notion of cyberspace in digitalia grows from late 20th-century utopian prose-odes such as Gibson’s Neomancer, where cyberspace is:

A consensual hallucination experienced daily by millions of legitimate operators, in every nation, by children being taught mathematical concepts . . . A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding. . . . (Gibson, 1984, 51)

The newness of cyberspace and the digital self has engendered a host of anthropological writing on the subject, categorizing the emergent modalities of action and interaction that have arisen from this paradigm shift. To date, it seems like scholarship falls into two principal camps—both of which are suggested by Gibson’s prescient quote. The first, “Unthinkable complexity. . . clusters and constellations of data,” represents the interaction between the self, the myriad of data available in cyberspace (information, or being), and the computational speed offered by computers (process, or doing). The incomprehensibility of computers’ operational mechanisms has led humans to anthropomorphize these machines as “agents” in their own right—as technofeminist Wajcman notes:

The conception of the non-human as actant serves as a corrective to a rigid conception of social structure. It involves a view of society as a doing rather than a being. The construction of technologies is also a moving, relational process achieved in daily social interactions: entities achieve their form as a consequence of their relations with other entities. (Wajcman, 2004, 39)
The comingling of information (being) and the processes that carry said information (doing) has brought us to attach new value to the latter. As Hobart and Schiffman attest in the extreme:

Substance has vanished entirely from information. Our information technology stakes out a realm in which meaning or content—what earlier ages had abstracted from experience . . . — is replaced by logical rules. We have drawn the information idiom so far away from the immediacy of experience that no content whatsoever is retained in its digital means of which a piece of experience can be encoded and thus informed. (Hobart and Schiffman, 1998, 203)

This devaluation of information with respect to the means by which it is transmitted is perhaps the most salient manner in which human behavior has changed as a result of interactions with digital agents. This is not, however, to say that the nature behind this behavior has changed—humanity’s penchant for process is as old as conspicuous consumption, and its non-digital form can still be seen in woodsheds filled with unused tools and bookstores’ overstuffed self-help sections. However, the cheapness of software coupled with the ease of digital piracy has created an age where humanity’s zeal for process can run virtually unchecked (note the triple-entendre embedded in this use of “virtual”), amassing throngs of interconnected technologies without any particular concern for the information that will run through them. As I will argue in Section 3 of the present chapter, this underlying obsession with process intersects with market forces in the technology sector to form the fertile crescent of digital creativity.

A second epochal manner by which digital technology represents a break from older forms of virtuality is in its facilitation of inter-human communication—Gibson’s “consensual hallucination experienced daily by millions of legitimate operators.” Like any forum of human exchange, initial anarchistic endeavors have given way to common-law rules that govern our cyberspatial interactions. Benedikt provides a list of key design features by which cyberspace may be defined:

- The Principle of Exclusion – “The case of two, nonidentical objects having the same extrinsic dimensions and dimension values, whether at the same time, or
including time as an extrinsic dimension at the outset, is forbidden, no matter what other comparisons may be made between their intrinsic dimensions and values” (Benedikt, 1991, 136).

- The Principle of Maximal Exclusion – “Given any $N$-dimensional state of a phenomenon, and all the values—actual and possible—on those $N$ dimensions, choose as extrinsic dimensions—as ‘space and time’—that set of (two, or three, or four) dimensions that will minimize the number of violations of the Principle of Exclusion” (Benedikt, 1991, 139).

- The Principle of Indifference – “the felt realness of any world depends on the degree of its indifference to the presence of a particular ‘user’ and on its resistance to his/her desire” (Benedikt, 1991, 160).

- The Principle of Scale – “the amount of (phenomenal) space in cyberspace is thus a function of the amount of information in cyberspace” (Benedikt, 1991, 167).

- The Principle of Transit – “travel between two points in cyberspace should occur phenomenally through all intervening points, no matter how fast (save with infinite speed), and should incur costs to the traveler proportional to some measure of the distance” (Benedikt, 1991, 168).

- The Principle of Personal Visibility – “(1) individual users in/of cyberspace should be visible, in some non-trivial form, and at all times, to all other users in the vicinity, and (2) individual users may choose for their own reasons whether or not, and to what extent, to see/display any or all of the other other users in the vicinity” (Benedikt, 1991, 177).

- The Principle of Commonality – “virtual places [should] be ‘objective’ in a circumscribed way for a defined community of users” (Benedikt, 1991, 180).

It should be clear that none of these rules are perforce stitches in time for cyberspacial interactions—some, such as the principle of transit, actually retard the potential speed with which communication takes place. By force of habit and the waxing of the collective sub-conscience, users of digital technology have acquiesced to them—in other words, they are truly a “consensual hallucination.” From these rules has grown a veritable culture that mixes certain comfortable trappings of concrete, day-to-day life with what Bell calls a new utopianism, reflecting our attention to “the ways in which we assemble particular narratives about how these new technologies have changed, are changing, or will change our lives” (Bell, 2007). This is not unlike other contemporary virtual spaces
such as Brazilian Carnival, Casual Friday, and Fantasy Football—in addition to simply creating a space where difference is acceptable, these spaces afford us a sort of critical *Gedankenspielraum* that is allowed to encroach upon the quotidian. Like the interaction between the self and the machine, the interaction of selves *through* a machine has given rise to two remarkable novelties that will prove to be essential to digital creativity. First, cyberculture provides a sort of self-contained escapism by which its inhabitants, becoming acclimated (if not desensitized) to exploration, are perpetually thinking several moves ahead:

> Sitting at a computer, logged onto the Internet, for example, we are constantly clicking between the embodied sensations of staring at a screen and typing and the disembodied dream of surfing cyberspace as uploaded consciousness, but also connecting to other stories, other images and ideas. *(Bell, 2007, 6)*

The second idea follows from the first; cyberculture is made more, not less, interesting as a function of the extent to which it stops being totalizing *(Lévy, 2001)*. Unlike other virtual constructs whose success is determined by the extent to which they offer a holistic alternative to the corporeal, cyberculture’s intrigue is precisely the elusivity of its own totalizability—perhaps a first in the long history of the virtual.

This novelty of digital technology with respect to the virtual is mitigated by two important arguments. One, succinctly summarized by Lévy, states that:

> It is impossible to separate the human from its material environment, or from the signs and images through which humanity gives meaning to life and the world. Similarly, we cannot separate the material world—even less so its artificial component—from the ideas through which technological objects are conceived and used, or from the humans who invent, produce, and use them. Moreover, images, words, and linguistic constructions reside in the human mind, providing humankind and its institutions with means and reasons for living, and are transported in turn by organized, tool-bearing groups, just as they are by communications circuits and artificial memories. *(Lévy, 2001, 4)*

In this light, the above-enumerated rules of cyberspace are not *a posteriori* digital ornaments but rather integral elements of computational design, without which we could not have made these machines (let alone understand what we have made). The second
argument, more problematic, acknowledges that the human hand guiding technology prevents users from a sort of technological determinism:

Social scientists have increasingly recognized that technological change is itself shaped by the social circumstances within which it takes place. The new sociology of technology set out to demonstrate that technological artifacts are socially shaped, not just in their usage, but especially with respect to their design and technical content. Crucially, it rejected the notion that technology is simply the product of rational technical imperatives; that a particular technology will triumph because it is intrinsically the best. (Wajcman, 2004, 33–34)

While both of these points may be true, they are only valid insofar as they are considered over a long time scale. The naïveté of any call to arms against technological determinism reveals itself when one considers the technical competencies of 2010’s Everyman. As Bell writes:

At the symbolic (and therefore also at the experiential) level, lots of people do feel that they are in a deterministic relationship with these new technologies, that they are relatively powerless, that the makers and sellers of these things are in control, and that sometimes the technology itself is in control, too. So I think it is important to register determinism, to acknowledge its potency as a commonsense way in which lots of us experience and articulate our relationship with the intimate machines we live with. (Bell, 2007, 8)

This is made worse, not better, by the androcentric approaches taken by designers who try to “humanize” computer interactions. Their consolidation of power, regardless of any earnest intentions, creates the scenario described by Lévy (in a sardonic self-critique of sorts):

They promised you utopia, electronic democracy, shared knowledge, and collective intelligence. You ended up being dominated by a new virtual class, made up of media (film, television, video games), software, electronics, and telecommunications magnates, flanked by the designers, scientists, and engineers who oversee the construction of cyberspace. Ultraliberal and anarchist ideologues, high priests of the virtual, serve as their spokesmen and interpreters, justifying their power. (Lévy, 2001, 203)

Recently, a satisfying middle-ground has offered itself as an option whereby users can substantially shape their cyber-environment by using programs that allow for modular development and design (i.e. jEdit), permitting them to exert varying degrees
of control from the cosmetic to the computational. However, one's control over aspects of certain technologies does not imply a sense of control over technological progress and technological creation. It is this determinism that, be it actual or perceived, acts as a principal factor in the convergence of digital tools to be discussed in Chapter Eight.

2.3 How To Make a Digital Tool

The idea that a digital tool may be considered apart from its users is an apocryphal notion: all of the scholarship cited above conflates discussions of digital avatars with discussions of the tools (or “processes”) to which said avatars avail themselves. This section, then, does not aim to separate the concept of a “tool” from the concept of a “self,” nor does it answer the “how” behind a digital tool (meaning best practices, or what a tool should do). Rather, it addresses the “why” behind these tools’ general existence. This will, in turn, frame a subsequent discussion that elaborates the unique “hows” of digital creativity tools.

Like the design of most tools, the driving force behind the creation of most digital technology is money, whether it be the making or deliberate eschewal of it. By deliberate eschewal, I am invoking the idea of one who works on an open source project because she believes that a certain technology should be free or she feels that a given technology cannot fully develop in a capitalist system (or both). In either case, it is rare that a process of creating a digital tool sidesteps the use of commercial software or hardware. In order to understand these tools, therefore, it is important that one understands the economic pressures that give birth to them. First, intellectual property courts in America and Europe have been reticent to uphold patents for new software, leading companies to reconsider the traditionally central role of research and development vis-à-vis the potential success a product will have. As Parker notes:

Under normal circumstances, if a company develops an innovation, commercial success will depend on generating an adequate market for the new product. A high proportion of the non-technical failures are found to be due to lack of interaction between the marketing and the R and D functions. (Parker, 1978, 58)
The marketing divisions of digital firms, far from being disadvantaged by a lack of copyright protection, actually thrive in this environment—a company may market a line of products as being ostensibly unique without worrying about the deeper ingenuity of its code base. It is not surprising, then, that people are wary of a sort of technological determinism; one loses a sense of “worth” and “fairness” in a market where there is no true metric of substitutability. This inculcated regurgitation of self-similar technologies has not only shaped consumer confidence; it is the basic driver behind the morphology of tools in cyberspace. Because market forces have created a culture where “earlier knowledge feeds what follows” (Parker, 1978, 55), users have come to accept this cannibalization of the past as a technological pedigree of sorts. Thus, tools retain a cachet by actively mimicking (if not completely plagiarizing) other tools, independent of their actual efficacy. Even open-source projects buy into this, aiming to provide pieces of software that feel like their fee-based counterparts instead of using their outsider status to be experimental and innovative. It is against this backdrop that design moves in, dictating certain broad precepts that govern how these tools look and feel.

Specifically, Mandel has identified several design constraints that, while they intersect with other technologies, persistently crop up in the digital realm:

- **Quality of Experience**: Taken together, the criteria raise one key question: How does effective interaction design provide people with a successful and satisfying experience?

- **Understanding of Users**: How well was the design team grounded in understanding the needs, tasks, and environments of the people for whom the product was designed? How well was that learning reflected in the product?

- **Effective Design Process**: Is the product a result of a well-thought-out and well-executed design process? What were the major design issues that arose during the process and what was the rationale and method for resolving them? How were budgeting, scheduling and other practical issues, such as interpersonal communications, managed to support the goals of the design process?
• **Needed:** What need does the product satisfy? Does it make a significant social, economic, or environmental contribution?

• **Learnable and Usable:** Is the product easy to learn and use? Does the product communicate a sense of its purpose, how to begin, and how to proceed? Is this learning easy to retain over time? Are the product’s features self-evident and self-revealing? How well does the product support and allow for the different ways people will approach and use it, considering their various levels of experience, skills, and strategies for problem-solving?

• **Appropriate:** Does the design of the product solve the right problem at the right level? Does the product serve users in efficient and practical ways? How did considering social, cultural, economic, and technical aspects of the problem contribute to an appropriate solution?

• **Aesthetic Experience:** Is using the product an aesthetically pleasing and sensually satisfying one? Is the product cohesively designed, exhibiting continuity and excellence across graphic, interaction, information, and industrial design? Is there a consistency of spirit and style? Does the design perform well within technological constraints? Does it accomplish an integration of software and hardware?

• **Mutable:** Have the designers considered whether mutability is appropriate or not? How well can the product be adapted to suit the particular needs and preferences of individuals and groups? Does the design allow the product to change and evolve for new, perhaps unforeseen, uses?

• **Manageable:** Does the design of the product move beyond understanding “use” merely as functionality and support the entire context of use? For example, does the product account for and help users manage needs such as installation, training, maintenance, costs, and supplies? Have these needs and others been considered in an individual as well as an organizational sense? Does the design of the product take into account issues such as negotiating competition for use and the concept of “ownership,” including rights and responsibilities? (Mandel, 1997, 6)

Were one to accept this list uncritically, one would assume that it could apply to any field of design. However, a few core features precipitate directly from the market forces that shape these tools. A product’s ability to communicate its own sense of purpose is, save novelty items at flea markets, an overwhelmingly digital phenomenon that stems from digital technologies being marketed to impulse buyers (one need only think of the openness of a computer store contrasted with the closed and packaged
nature of the goods in a supermarket). This has, in turn, shaped the tastes and needs of consumers who can substitute between many different alternatives in both the software and hardware domain. As a result, aesthetic issues have become increasingly important, spawning an entire literature on best-design practices for user interfaces (Udsen and Jørgensen 2005, Giaccardi and Fischer 2008). Recalling the “digital self” constructed in the previous section, one sees a synergy between the self and tool that parallels man’s early efforts to shape weapons in the image of his own extremities. The obsession with process (doing) over information (being) invariably leads to a permissivity regarding the unflagging newness of software (meaning an acceptance by consumers of rapid technological progress) that is necessary for the well being of an industry whose market forces drive it to constantly create new products in the absence of intellectual property protections. Furthermore, like any social space, the “principle of visibility” and “principle of commonality” described above feed into a culture where the way a product looks (and the way it is marketed) are as important to its tradability as what the product actually does. In spite of the surface-level cynicism one may feel towards the market-oriented undercurrents that potentially shape cyberspace (or, even worse, Western societies’ complacency with, or even desire for, markets that can prey upon and ultimately fabricate its needs), the market’s glorification of process is not inherently negative and, in some domains, may actually be refreshing and beneficial. As I will argue in Chapter Five, creativity is one of these areas—thus, we find ourselves in a unique situation where a seemingly nefarious market practice, inextricably linked to the formation of a virtual self (digital) and a virtual space (cyber), proves to be sympathetic with the advancement of creativity. This key point, however, cannot be fully developed until one sees exactly what affordances are provided by said “creativity” tools in practice and in theory.
2.4 Towards Assistance

In this Chapter, I have defined the digital as a subset of the virtual, examining two important aspects of the digital universe: the digital self and the digital tool. These ideas will be revisited in Chapter Nine, where I propose a new digital tool and argue how the creative self, as defined in Chapters Four through Seven, can be expressed through this tool. A cornerstone of this tool will be the manner that it assists composers to reflect upon and construct these digital selves. However, this idea of “assistance” is non-trivial: what does it mean to assist? Although most digital tools assumedly exist to assist someone in doing something, most scholarship on digital technology (such as Mandel (1997) discussed above) starts with certain unstated a priori about what “assistance” is, developing standards such as “manageable” and “needed” from ideas of what humans feel will be useful as assistance. But when does this assistance become interference, and to what extent is assistance defined by the needs of an individual agent as opposed to a set of experts who understand the way that people need to be assisted? The next chapter will explore these questions through an inquiry into a controversial contemporary form of assistance—assisted suicide. From this, I will develop a general notion of assistance that, when mixed with digital, can be brought to the creative process and the process of becoming creative.
CHAPTER 3
ASSISTANTS

The wise setting of boundaries is based on discerning the excesses to which the power, unrestrained, is prone. Applied to the professions, this principle would establish strict outer limits—indeed, inviolable taboos—against those ‘occupational hazards’ to which each profession is especially prone.

—Leon Kass, “Neither for Love nor Money: Why Doctors Must Not Kill”

Assistance, as a general phenomenon, is virgin academic territory. That is, while there is ample literature on what it means for somebody to assist somebody else with respect to a given task (buying a car, scoring a goal, organizing a calendar), the idea of what it means to assist is rarely problematized in and of itself. The only contemporary debate that has engendered a scholarly discourse on the subject is that of Physician Assisted Suicide (hereafter PAS). Clearly, the “assistance” one would receive during the process of digitally assisted composition has little to do with the assistance that a physician may give someone to help her die. However, there are many salient lessons one can glean from this field that are applicable to the present inquiry. This chapter surveys select literature on assisted suicide, concluding with a discussion about the manner in which issues of intrusion, inadequacy, and miscommunication in the PAS debate are analogous to problems that arise when creators seek assistance from digital devices.

3.1 Physician Assisted Suicide from an Assister’s Perspective

Even in the PAS literature, the debate often veers towards the same set of philosophical questions that one would find in articles about euthanasia—an examination of the moral and theological underpinnings of patients’ right to die as well as physician’s legal responsibilities and liabilities with respect to this issue. However, three central

The epigraph to this chapter is drawn from Kass (1989, 36).
issues emerge concerning the physician's abilities to assist: inappropriate physician behavior, physician inadequacy, and the potentially paratopic role of the physician.

3.1.1 Inappropriate Behavior

One recurrent question that arises in PAS scholarship is the extent to which physicians, if allowed to help patients die, will over-fulfill their roles as assistants. Putting aside the issue of what physician assisted suicide is or should be, I will use the operative definition posed by Baron, who states:

> Ending one’s life in solitude can be a lonely and frightening undertaking, fraught with uncertainty, ambivalence, and opportunities for failure. We hope that the responsible physician will be present at the patient's death in order to reassure the patient and to make certain that the process is carried out effectively. (Baron, 1996, 21)

Against this backdrop, Dworkin writes:

> Actions [such as placing a pillow over the face of a patient], even though they may be viewed as merely helping to finish the act of suicide undertaken by the patient, clearly cross the line to euthanasia. (Dworkin, 1998, 130)

The motivation for such behavior varies, but often stems from the bond that arises between a doctor and a patient:

> The relationship of a physician to a patient with far-advanced disease does not conform to the Cartesian metaphor of a watchmaker's relationship to a broken watch. Physicians practice within a context of mutuality that has emotional as well as clinical components. Attention must be accorded the real possibility that a physician's inability to perceive an alternative means of responding to a dying patient's distress comprises an important factor contributing to the suicidal ideation on the part of the patient. (Byock, 1997, 117)

One interesting aspect of this observation is the reversal of the direction of influence typically identified in PAS. Here, patient’s ideas are inadvertently formed by the preferences of their doctor, and thus, their suicide may not be voluntary at all. Even worse, they may be convinced that this desire to die is of their own volition due to a combination of lack of personal reflection and the implicit esteem in which their doctor is held.
3.1.2 Physician Inadequacy

Independent of a physician’s actions and intent with respect to a particular patient, several factors exist that impinge upon the physician’s general ability to provide assistive care. Byock writes:

There are substantive concerns regarding the impact that a patient’s suffering and feelings of depression and hopelessness can have on the physician, as well as the impact that the physician’s emotional history—including previous experience with the death of a loved one, recent experience of multiple losses, personal values or emotional depression—and current feelings of sadness, grief, frustration, helplessness, fatigue and previous personal experience may have on the patient. (Byock, 1997, 118)

This observation is borne out by statistics regarding common maladies that arise in the physician community:

Anyone raising the question of physician-assisted suicide among a group of doctors comes to recognize their conflicted response. All may recognize the anguish of individual sufferers pleading for release. There are reluctant proponents of physician-assisted suicide in the medical profession, but few outright enthusiasts. When it comes to singling out their own profession to carry out a practice of assisted suicide, both proponents and opponents share a sense of worried unease. The sense of apprehension in the health care community is heightened by a consideration that physicians rarely discuss in public: the levels of impairment within their own profession that could affect patients whose expressions of a desire to die would call for the most scrupulous and skilled examination. Alcoholism and dependency on other drugs afflict approximately 10 percent and 7 percent, respectively, of health professionals with symptoms labeled “stress impairment syndrome”; between 6 and 20 percent of the cases reported to state physician health programs concern impairment due to mental illness. (Dworkin, 1998, 133–134)

Medical problems aside, a lack of proper training can also be a contributing factor to physician inadequacy:

Another potential factor influencing a patient’s disposition regarding suicide is the treating physician’s level of palliative medical expertise; where one physician may see a patient’s pain syndrome as intractable and thus consider the patient helpless, another may recognize the syndrome as an indication for a neurolytic block, spinal anesthesia, urgent radiotherapy, high dose opiod infusion, or other intensive palliative interventions. (Byock, 1997, 117–118)
One of the problems identified in the previous subsection—that patients’ trust of physicians can inadvertently lead to underthought and uncritical conclusions regarding their own death—is only further magnified by problems that plague a physician’s behavior. Assuming that the troubled physician is either unaware of these problems or unconcerned by them, she has the potential to inadvertently create a reputation that, because of her revered status, implicitly validates and even endorses the practice in the eyes of patients.

3.1.3 Medical Paratopia

An esoteric theory on PAS claims that the role of physicians in society make it such that, when PAS is permissible, people can use it as a social lever to express other sentiments besides a literal desire to commit suicide.

Physicians are trained to respond to patient references to suicide as constituting cries for help. By analogy, might the debate about euthanasia and suicide constitute such an appeal on a society-wide scale? Just as revealing one’s intention to commit suicide is often a cry for help on the part of the persons not yet ready to die, desiring of securing humane attention and relief of suffering in any other way, so it may be that the debates about physician-assisted suicide also have overtones of a cry for help. They sound an alarm about the needless pain and suffering at the end of life that is now the lot of so many in our society, meant to call attention to what more adequate treatment would mean. (Dworkin, 1998, 136)

Here, the sphere of PAS is the locus of a displaced debate concerning general issues in patient care that have more to do with living than dying. The potential danger, like that of a “cry for help,” is that patients can inadvertently become recipients of PAS in a culture when they, at some level of their subconscious, were merely seeking more dignified and effective terminal care.

3.2 Assistance in Creativity

An analogy can be readily drawn between several of the problems that arise in PAS and digitally assisted creativity. Assistive devices can become creatively intrusive when they ideate in the creator a feature of their behavior that the creator subsequently confuses for their own creativity. At the worst extreme, a certain piece of software
may guide a group of creators to create similar work without their realizing it, at which point the work becomes a manifestation of the tool's behavior (which itself may be creative, but is only a reflection of the creativity of the person or people who made the tool) rather than the localized created act that the individual artists sought to make. Deficiencies in the tools, either through bugs or lack of knowledge, can have a similar effect; a creator who implicitly trusts a tool and its makers may unknowingly acquiesce to substandard performance for lack of critical distance. Like the medical example, this problem is only exacerbated by a history of “successful users” who themselves have failed to disambiguate bugs from features. Lastly, assistive devices allow creators to express cries for help that would otherwise never have emerged. For example, the use of algorithm is sometimes a purgative through which a creator realizes that her engagement with digital technologies could have created more interesting results than the algorithm by composing in a more intuitive manner. Several composers, including Boulez and Brün, have engaged in this practice in the final stages of making work. The opposite case would be the composer who never realizes that she is “sounding an alarm” about the difficulties in contemporary creation, which robs her of an opportunity to add nuance and multivalence to her work.

None of this is to say that digitally assisted creativity should be avoided for these three reasons, just as PAS’s negative attributes are not so dissuasive that they conclusively serve as an argument against it. Rather, by anticipating the problems that come along with such assistance, makers of the tools that provide assistance can better delimit their tools’ boundaries as assisters and better encourage those who seek assistance to be self-reflective about their actual needs.
CHAPTER 4
COMPOSITION I: THE BRÜNIAN CREATOR

The composer has begun to recognize that technology is not merely the provider of instruments, of devices, of conveniences; in short, the composer is learning that technology is not just techniques and engineering. The composer now defines technology as the science and art of applying knowledge to the desire for problem solving.

—Herbert Brün, “Technology and the Composer”

Were a clairvoyant to inform Voltaire of the yet-to-be-invented field of “digital creativity,” the satirist’s first two questions (in no particular order) might be “what is digital” and “what is creativity”? While the former is to be expected given that the concept of the “digital” (which translates into French as numériqu e) did not exist in 1756 (apart from, of course, things having to do with the number ten), the insouciance with which he would ask the second question, in the same manner as the first, would give the psychic pause. This is because Voltaire, history’s second gadfly after Socrates (who one could imagine having started with the more fundamental question “Why are you talking to me?”), was a rigorous defender of the definition of terms, arguing that a meaningful discussion could not be had without a functional understanding of what words mean. In fact, he felt that the only meaningful discussions were attempts to create functional definitions. This is the motivating impetus behind my attempt to define creativity—a concept that has been in existence far longer than the digital and yet has only been rigorously explored in the late 20th century, most notably by Csikszentmihalyi (1996).

One wonders why creativity has been relatively unexplored before the 1990s in spite of the fact that the term has been used extensively in Western societies when describing its various discipline-specific vicissitudes. After discussing this etymological paucity, I will explore the scant literature that considers creativity in a holistic manner, using this to frame a subsequent discussion about digital creativity.

The epigraph to this chapter is drawn from Brün (1970).
4.1 Creativity Studies

The difficulty one finds in summarizing a scant corpus of scholarship, such as the digital-as-virtual from Chapter Two, is dwarfed by the difficulty one encounters when attempting to describe a body of scholarship that does not exist. It is for this reason that the following paragraph, while presenting some concrete facts, contains a fair bit of speculation to connect the dots. Should the reader not accept my intermediary hypotheses, hopefully the facts provided are substantial enough to validate this central claim: that “creativity studies” as contemporarily defined did not exist before 1990 because of strong discipline-centric notions of what creativity meant. Thus, in a way, scholars were never sidestepping the issue—they simply saw it as irrelevant because it was already being studied, albeit in a more fragmented (and therefore perhaps more relevant) manner.  

Said studies fall into two broad camps: professional creativity (how to be more creative in a specific domain) and creativity pedagogy (how to teach people to be more creative in general). The former can be seen in manifold fields, especially artistic ones—a short centennial bibliography of music composition methods (Amerus 1271, Tinctoris 1477, Zarlino 1571, Charpentier 1693, Bordier 1770) reveals a historical preoccupation with creativity or, at the very least, with how to create. The latter can be seen in pedagogy texts such as Kagan (1967), Gowan et al. (1967), Rothenberg and Hausman (1976), and Sawyer (2003). Discussions about “creativity” as an umbrella concept begin with two developments that are inextricably linked to the digital tools (and therefore market forces) discussed in Chapter Two. First, companies

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1 This discipline-specific approach is still part of the contemporary creativity landscape—see Bohm (1998) (business) and Syrett and Lammiman (2002) (science).

2 These are just texts with which I am familiar. The Patrimoines et Langages Musicaux lab at the University of Paris 4 counts no less than 153 of these composition treatises concerning various instruments, styles, and theoretical persuasions between 900 and 1950.
sought to market tools that facilitated “creativity” for wide sectors of society, which made it necessary to define creativity in the broadest terms possible. Second, it has become increasingly important for professionals to have creative competencies in several fields absent of the hierarchically organized labor market that characterized the period from the beginning of the post-agrarian Industrial Revolution until the Technological Revolution of the late 20th century. It is not surprising, therefore, that the seminal texts on creativity of the past twenty years spend a significant amount of time discussing emerging technologies—far from amalgamating a current fad into an age-old dialogue, these scholars understand that discussions about creativity would be moot without acknowledging, at least in part, the technological progress that has brought about this mode of thinking.

Hewett, one of the first writers to recognize the importance of Csikszentmihalyi and extend his work into the realm of the digital, defines creativity as a dance between the constraints of a problem and the aptitudes of the solver(s), where the most important ingredient is:

the development of a vision—the pattern of relationships among building blocks—that becomes transformed into some sort of reality. The creative process must then consist in part of bringing all these things together at one time and place in an appropriate combination to produce a creative result. (Hewett, 2005, 388)

It is this last aspect that, for Hewett, distinguishes creativity from intelligence—a distinction that he acknowledges as being problematic for certain critics of creativity studies who see creativity as a manifestation of intelligence. Sidestepping this terminological debate (for which Voltare will have to forgive me), for the purposes of this dissertation, the rest of this chapter will adopt Csikszentmihalyi’s operative definition that combines aptitude, constraint, and vision, conceding that if creativity is in fact
just “intelligence,” then it is at least a special form of intelligence.\footnote{Certainly, all tasks to which intelligence must be applied do not require these three characteristics.} Csikszentmihalyi and Sawyer (1995) feel that this type of holistic problem-solving vantage point requires, paradoxically, a hermetic engagement with the problem coupled with intense socialization whereby people attempt to articulate nascent solutions or prove the validity of fully formed ones. Creativity also obliges the effective use of analogy, metaphor, fantasy, play, and innovation, as it is often difficult to encapsulate (let alone solve) an ill-defined problem with standard terms of mediation (Csikszentmihalyi, 1996).

As previously indicated, this scholarship suggests that certain capabilities of emerging technologies are beneficial for, if not necessary to, creativity in the contemporary era. Hewett writes:

Much of the discussion of insight provides clear justification for the importance of providing a creative worker with access to a library of stored analogs of both end products and of component parts and processes. Multiple alternative representations of the domain content and/or structure play a role in allowing the creative worker to explore different visions or ‘what if?’ courses of actions needed to add to existing knowledge. (Hewett, 2005, 397)

Of this library’s layout, he writes, “The importance of tailorability of a working environment for creative work has been stressed in the work of several people reviewed earlier, as has the importance of allowing creative workers to shift work from one problem domain to another related domain with different constraints” (Hewett, 2005, 397). Perhaps most importantly, the creator needs ways to chart her progress through this virtual territory:

[The creative writer] needs some mechanism for being able to capture ideas that occur during the writing process. The most useful solution is one that allows for an effortless, almost reflexive capture of the idea in a way that does not disrupt the work flow but which allows the writer to quickly capture the idea or insight, returning to it later for evaluation, etc. This same type of need exists for a composer developing a new work. The particular instantiation and form of the ‘ideas’ will differ, but the need for easy capture that does not disrupt the workflow is there for both. (Hewett, 2005, 398)
Here, Csikszentmihalyi’s writing becomes less and less holistic and categorical, moving from necessary priors of creative engagement to aspects of contemporary creativity that seem impossible without computer assistance, showing the extent to which modern creators (if not modern academics) conceive of their problem-solving needs with respect to the plethora of new technologies (and technological possibilities) that can service them.

4.2 Digital Tools for Creativity

Already in Csikszentmihalyi, certain aspects of digital tools for creativity are elucidated in a categorical manner that anticipate salient and recurring issues in the field of digital creativity. However, to narrow the scope of digital creativity for the purpose of this dissertation, the rest of this chapter is organized around the following motivating question: *What are the best manners by which the creator may express her creative self?* This requires more explanations of uniquely digital phenomena than Csikszentmihalyi’s work (which is painted in broad strokes absent of a robust digitalscape that could support or contradict his predictions), surveying the vast literature on digital creativity from the 2000s to ascertain the most pervasive theoretical trends in software design. Aside from articles offering lists of what digital creativity tools should offer their users (of which there are many and whose contents overlap a great deal), three main issues emerge: mutability and metadesign, inter-human communication, and human computer interaction.

The need for mutability, perhaps the most salient issue identified in the literature, stems from the desire to “make more people more creative more often, enabling them to successfully cope with a wider variety of challenges and even straddle domains” (Shneiderman, 2002, 116). Echoing the previously described market forces that bring about this multi-functionality, Shneiderman notes that “gatekeepers” in academia (journals, critics, curators, etc.) have begun shaping their standards on certain measures of digital competency and diversity, even requiring certain specific pieces
of software for formatting purposes, which has increased the demand for mutability in software design. This has led to “inter-domain analogies” (Bonnardel and Marmèche, 2005, 423) whereby creators, presented with mutable and multi-functional pieces of software, may engage in lateral creative thought that is potentially more robust than domain-specific software would permit (recall Hewett’s call for analogies and ludic exploration). Recently, the concept of metadesign has extended this interdisciplinarity by enabling users to explore, with increasing measures of certainty, ill-defined problems whose solutions require such thinking. Metadesign also acknowledges that the convergence of several competencies is a temporal process whose ordering is critical to the success of a project:

User-centered and particularly design approaches have focused primarily on activities taking place at design time. These approaches have not given enough emphasis and they have provided few mechanisms to support systems as living entities that can evolve over time. Metadesign is a unique design approach concerned with opening up solution spaces rather than complete solutions, ... and aimed at creating social and technical infrastructures in which new forms of collaborative design can take place. (Giaccardi and Fischer, 2008, 19)

Metadesign calls into question the divide between “design time” and “use time,” creating intermediary layers where users can modify a program’s core functionality and encouraging market mechanisms allowing users to commercially redistribute said functionality. Of course, any process of temporal mutability offers the possibility for constructive errors, which metadesign aims to incorporate into software by privileging solutions that prevent users from unintentionally retracing faux pas (Edmonds, 2000). The ultimate goal, albeit difficult to conceive (let alone realize) is that mutable software should permit the creator to actually transform her own space instead of simply exploring it (Ritchie, 2006). This heightened sense of mutability accentuates the inherently transformative qualities of the creative process—just as the artist must sometimes reconfigure her physical work space to achieve new results, so too must
the digital creator feel this sensation of creative destruction (even if it is, to an extent, a mirage facilitated by a given digital technology).

Inter-human communication, touched upon in the last chapter’s exploration of cyberspace, extends this notion of interdisciplinarity by providing forums whereby human-to-human interactions across disciplines are possible, creating an ideological (and lexicographical) lingua franca. This issue is not unique to creativity software—social computing in general seeks to facilitate communication in which the technological platform is not a negative interferent (or, in other words, where technology is either transparent or a positive interferent). Many of the previously-discussed principles of cyberspace that aim to replicate person-to-person interactions and social institutions have focused on transparency, which seems like a reasonable first step for tools that enable “creative” dialogue. This is not to say that transparency existed before cyberspace—language, sound, drawings, and any other pre-digital intermediaries are imperfect lexical containers of one’s creative vision (and even poorer communicators of one’s creative uncertainties or curiosities). Rather, cyberspace has to confront the dual task of replicating traditional means of interpersonal exchange to mollify people’s inherent mistrust of the new while creating novel, potentially better, ways of facilitating the transparent exchange of ideas. Recalling Hewett (2005), insofar as socialization is necessary for creativity, the simple existence of these forums is already a significant boon—unlike the issue of mutability discussed above, the need for innocuous spaces where chit-chat and banality can occur between creators is as important as (if not more important than) a space where profundity can be articulated and transmitted. However, there exists some literature calling for creativity-specific modifications to forums of digital exchange. Lubart (2005) recognizes the need for computers to act as traffic cops in the creative process, coordinating the multi-step process of creative communication in addition to acting as a transparent conduit of ideas. This, to an extent, falls under the auspices of metadesign; rather than separating inter-human communication from
the problem of design, it can be considered as a design problem in and of itself by requiring that communication networks develop simultaneously with the solution to the problem that necessitates these networks (Giaccardi and Fischer, 2008). In growing said networks, special attention needs to be given to boundary objects—that is, objects that either delimit users’ personal creative space or create the illusion that such a space exists (Fischer et al., 2005). In acknowledging this, one arrives at a middle ground between the computer-as-intermediary and the computer-as-mediary. One example of said boundary exists in aesthetic-based approaches to human-computer interaction. The argument goes as follows: technology favorable to human-computer interaction needs to facilitate creative practices that inspire users to be creative. Going even further, these digital “surroundings” may possess the ability to “appeal to user emotions,” changing the voice with which they create (Udsen and Jørgensen, 2005, 208). Linking this to the previous concept of mutability, there is in aesthetic engagement a temporal dimension whereby creators’ decisions are linked to the order in which information is processed (Taylor, 2002). At an extreme, this requires blurring the boundaries between information (what counts) and containers of information (an interface) (Yamamoto and Nakakoji, 2005).

As a recapitulative of the three digital hot-spots identified in the literature (mutability and metadesign, inter-human communication, and human computer interaction), what follows are the “lists” by which several authors have sought to describe digital tools for digital creativity. Instead of combining several oft-cited lists (i.e. Bowen (2003), Lubart (2005), Shneiderman (2002)), I will use Greene (2002) as a point of reference, whose work is itself an amalgamation of several prior articles on the subject of best-practices in digital creativity software creation. Her seven requirements for creative tools are that they:

- Support pain-free exploration and experimentation;
- Support engagement with content to promote active learning and discovery;
- Support search, retrieval, and classification;
• Support collaboration;
• Support iteration;
• Support and perhaps encourage instructive mistakes;
• Support the domain-specific actions that must be done. (Greene, 2002, 102–104)

This list is particularly appropriate to the chapter at hand because of its operative verb “support.” By contrast, the verb “encourage” will, in the next chapter, be joined with words such as “proliferate,” “contradict,” and “unflaggingly insist” to describe the means by which a digital tool may become a mediary.

4.3 Music-Composition-Specific Issues

By now, the reader should be thoroughly unconvinced that this treatise is principally concerned with the composition of music. It is here that said skeptic receives part of her payoff—having defined terms such as “creativity,” “digital self,” and “digital tool,” one can now meaningfully discuss uniquely musical issues in digital creativity. In doing so, no particular technological innovations are discussed (save one), instead discussing broad technological innovations that have enabled composers to, as Brün (1970) wistfully suggests, “have their dreams materialize, their intentions implemented, and their problems solved.”

The most recurrent debate about the composer and technology is a reformulation of an older question concerning the extent to which composers, as practitioners, should play or even create the instruments for which they write. The body of received knowledge regarding instrumentation and orchestration obviates the composer, to a certain extent, from being intimately familiar with the instruments that appear in her scores. Such familiarity, at the extreme, may have a detrimental effect on composition, both because it significantly impedes the learning process required to complete a work on time (if every composer needed to know every instrument of the orchestra as intimately as a player of that instrument, few orchestral works would ever get written) and, assuming composers have limited cognitive resources, because it effaces heuristics such as orchestration books on which composers must rely to create works.
for large instrumental forces. On the opposite extreme, works by composers such as Lachenmann and Essl are the result of an intimate romance with the capacities and restraints of particular instruments, allowing harmonic, rhythmic, and formal concerns to grow out of the design of the instrument and its player. Insofar as the computer is an “instrument” (both of sound production and sound organization), contemporary theorists typically extend this debate by contrasting a virtuosity with end-user software (surface knowledge) with the ability to code (deeper knowledge). However, these binary distinctions fall apart under closer scrutiny. End-user software does not lock its users into maintaining a form of creative distance between themselves and the “core” of music making. Instead, treating end-user software as a found object allows one to approach it as an instrument in and of itself with a core “sound” and peripheral or extended techniques. To employ an example from the commercial realm, there are several artists who sidestep easier creation processes and choose to bend Reason into doing arbitrarily difficult DSP tasks that push its limits as a sequencer (and even require extending its functionality)\(^4\), effectively replicating the difficulty they would find in pushing an instrumentalist to the limits of its (her) expressive and technical capacities.\(^5\) On the other side of the spectrum, coding does require a familiarity with the “instrument” of the computer, and may even provide the composer with a sort of creative inertia that transfers to decisions in the realm of sound-making (Smith, 2006).

\(^4\) Listen to, for example, Prodigy’s album *Always Outnumbered*. Liam Howlett of Prodigy writes “And that sound we got out of Reason is something that we now and again had to go back to Reason to duplicate; sometimes we’d do a thing in ProTools and it just didn’t rock it like Reason did, so we take it out of ProTools and try to duplicate it in Reason instead” (Hägglund, 2003).

\(^5\) One is reminded of Nancarrow’s work, which did the same to the electro-mechanical control of a player piano—one of the missing links in this set of examples from extended human-played instruments to extended digital simulations of them. See Drott (2004), which argues that Nancarrow “undoubtedly recognized that the instrument imposed a number of constraints even as it removed others” (Drott, 2004, 534).
However, coding can result in the creation of a constrictive end-user interface that robs the composer of the supposed open-endedness of coding languages. Thus, while digital creativity tools perpetuate this instrumental debate, they effectively blur the lines between composer as mechanist, composer as interpreter, and composer as instrument builder. Recently, this debate has been complicated even further by intermediary approaches to digital creativity that mix end-user interfaces with coding or scripting. Far from rejecting the aesthetically minded immersive worlds suggested in the previous section, this environment is actually comfortable for artists who have, for hundreds of years, communicated their ideas through a symbolic language entirely abstracted from the actual mechanisms of sound production (Herrema, 2006). Furthermore, the inherently iterative processes that form the basis of many compositional techniques, new-and-old, find a happy home in environments that provide macros for code “loops” and the ability to instantiate multiple copies of an object at once.

Another compositional debate that has been carried into the age of digital creation is that of the difference between improvisation and composition. Composers’ ability to use computers to cultivate and arrange improvised material is a contemporary extension of the process by which composers, improvising on an instrument, accrue a set of materials and procedures that ultimately form a piece. One manifestation of this trend is a sort of artificial “intelligence” that, based on certain rules, improvises music asynchronously⁶ or in real time. A more recent development brings the improviser into the loop, creating a feedback cycle whereby the improviser responds to digitally-generated material and vice versa. This reveals the inherently fuzzy line between improvisation and composition—like the classical cadenza or the Cagean happening, the composer “composes” a space in which improvisation occurs.

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⁶ The most famous being Cope’s *Experiments in Musical Intelligence*, which analyzes a composer’s oeuvre and attempts to generate stylistically viable replicas of her works.
Furthermore, improvisatory feedback, insofar as it can shape the way an improviser or composer responds, makes the computer alternate between an “intermediary” (log of the composer’s ideas) and a “mediary” (what Sawyer (2003) calls an “agent provocateur”).

A last trend, which touches upon all art forms that existed before the digital age, has to do with the incorporation of sensorality into the process of creating and actualizing digital media. Only Bowen (2003) explores this problem in depth and, while her study is confined to the plastic arts, many of her conclusions extend to the physical process of writing music, whether it be working out ideas on an instrument, touching pen to paper, or burning deficient drafts (or, in the case of Paul Dukas, complete works). Bowen identifies this sentiment as the “tug-of-war between the seductive authority of digital imaging programs and the web, and the artists’ yearning for the physicality of the material art object [in this case, a score or recording] and being immersed in its hand-made realisation” (Bowen, 2003, 224). In the physical world, things are created and deleted, but in the digital, things have the semblance of being created and deleted (Lévy notes this when he speaks of the computer crash as the most painful reminder that computer users must reconsider what the definition of “is” is). Thus, the sense of abandonment with which an artist gives herself over to her work is mitigated, to a certain extent, by the feeling that one is collaborating with (if not handing over control to) an Other. This conscientiousness “of the program as a form of collaborator in that process” (Bowen, 2003, 223) has a psychological impact on the creation of new work, perhaps even extending to one’s aesthetic psyche in general. However, as Bowen notes, this difficulty is only encountered by those who have moved from the concrete into the digital—those who have grown up with the two simultaneously (or those who only know the digital) do not bemoan the lack of tactility in creation. Thus, this sentiment may be transitory and irrelevant to future generations of artists who use digital technology.
However, insofar as this issue is certainly pertinent in 2010 (and insofar as the art created today will have some bearing on the art of tomorrow), it is important to note.

### 4.4 Brün Revisited

The modern digital creativity environment as described in this chapter actualizes many aspects of Brün’s speech “Technology and the Composer,” where he advocates the idea of technology as the intermediating conduit through which composers can make work and bring about social change. When he articulates “our need for the control of acoustical events for a purpose, and our ways of catering to this need through a maze of apparently continuous chains of either observed or stipulated problems, and either found or invented or stipulated solutions” (Brün, 1970), he expresses a desire for technological progress that has been partially realized since his death by the concept of metadesign discussed above. The idea of metadesign also answers his call that “all people have at their disposal a device that will respond to each person’s input according to the language stipulated by that person” (Brün, 1970). Lastly, his final utopian image of a building where the arts “investigate, stipulate, create, and exploit systems” has been realized in the non-physical space of “cyberspace.”

But what if the arrow of technology’s effect in Brün’s principal discourse were reversed? What if, instead of us pouring our ingenuity into machines, we asked machines to pour ingenuity into us? This will be the subject of the next chapter—a subject that is under-examined by the creative community and yet whose importance is inestimable with respect to the continual formation of a creative, let alone digital, self.
CHAPTER 5
COMPOSITION II: THE CREATIVE MEDIARY

In any creative process there will be supporting tangible and conceptual structures that remain static and provide the basis from which malleable constraints are built. . . . By considering the static constraints in any given situation, we can differentiate and analyze the areas in which practitioners consciously explore constraints and the underlying structures used to frame this exploration.

—Tim Coughlan and Peter Johnson, “An Exploration of Constraints and End User Development in Environments for Creative Tasks”

Within a span of 25 years, three movies and a television series about “super” cars emerged in the American popular culture landscape that reflected man’s deepest desires, and fears, with respect to this increasingly universal technology. Only one, Gary Larson’s Knight Rider from the eponymous television series, offered a car (Kit) whose *raison d’être* was to aid its owner in stopping crime. Two cars from Anglo-American cinema, Chitty-Chitty-Bang-Bang by Ian Flemming and The Love Bug (aka Herbie) by Disney, treated the car as a capricious companion with a mind of its own—always willing to help but also demanding a form of attention and respect from its owners. Lastly, Stephen King’s Christine, vengefully wreaked havoc on the sleeper community of Libertyville. A continuum arraying the cars from “intermediary” to “mediary” would read as follows:

Kit (effectively a slave) → Chitty-Chitty-Bang-Bang (occasionally passive aggressive, but generally helpful) → Herbie (confused and misunderstood in spite of his best intentions) → Christine (blood-thirsty psychopath).

Interestingly, this continuum also corresponds to the degree of “humanity” the authors built into these machines: Kit was a mechanical ode to the gods of technology, whereas Christine was the reincarnation of a girl who was brutally murdered. What about technology, then, becomes more human as a function of its ability to get in the way

The epigraph to this chapter is drawn from *Coughlan and Johnson (2008, 447).*
of man’s desires? How does this “humanization” of technology correspond with the endeavors of the “digital creator” as discussed in the previous two chapters? Finally, how are these desires fulfilled or denied by the market forces that control the evolution of technology? This chapter will develop along the same lines as my automotive analogy, starting with minimally intrusive technology (à la Chitty-Chitty-Bang-Bang—the reader should realize by now that Kit was the subject of the last chapter) and moving on to digital Christines that have the potential to negatively affect the pathos of the user.

5.1 The Stimulation of Creative Thought

The most benign way that a computer can act as a “mediary” is in the role of catalyst. Edmonds writes:

Increasingly, however, a different role is being found for the computer. It is the role of a catalyst, or a stimulant, to our own creative thinking. In such cases the computer is not primarily performing a task for us and generating an answer within itself, rather it is helping us to generate answers within ourselves. The computer helps us think creatively. (Edmonds, 2000, 193)

This extends beyond a unimodal notion of creative agency to the multiple creativities touched upon in the previous chapter, enabling lateral analogies and thought processes:

A fundamental requirement of an environment for creative practice is that it supports and enables the development of new forms and the new knowledge that is required to achieve such outcomes. The point is that creativity requires circumstances that enhance development possibilities. The question is how do we ensure that both the creativity and the technology development are fostered in tandem? The technology requirements gathering for creativity must be a highly responsive, iterative process where new insights are fed back quickly into the development process. This co-evolutionary process is a form of practice-based research where the existing technology is used in a new way and from which technology research derives new answers: in turn, the use of new digital technology may lead to transformation of existing forms and traditional practices. (Edmonds et al., 2005, 458)

Furthermore, in both lateral and profound thought, the need emerges for people to maximize their limited cognitive capabilities, which computers can help effectuate by monitoring the working habits and progress of creators. Lubart writes:
In fact, a survey of successful inventors showed that perserverance was the most frequently cited attribute needed for creativity. It is possible that computers can encourage creativity by monitoring the working process and supporting the potentially creative person as he or she proceeds. For example, Burleson proposes . . . that computers can help people to handle time pressure by ‘setting’ deadlines to keep a project on schedule and reminding the user of this contract, or by monitoring the user’s work and pointing out problems of procrastination, or problems of too many interruptions. A lack of breaks can itself lead to fatigue and sub-optimal performance, so computers could improve users’ quality of life and perhaps foster creative incubation by proposing breaks to their users. (Lubart, 2005, 366)

Ultimately, this liberation from the tedium of computing helps artists focus on two important goals: structure and process (Edmonds, 2000). This soft form of mediazation is transferable across projects as well—the computer, remembering the means by which an artist works, can dispense with digital acquaintances and immediately begin to support the way in which an artist creates.

5.2 Self-Imposed Creative Constraints

Very much like the term “creativity,” the idea of “constraint” is often discussed with respect to a specific domain. For example, constraint-based optimization has led to breakthroughs in diverse fields such as physics, economics, and biology. In the arts, stylistic and technical constraints (the fugue, the still life, iambic pentameter) provide a creative challenge that allows the artist to express her ingenuity by exploring (and even extending) the expressive capacities of a constrained space. Perhaps the oldest constraint common to all the arts is that of time and its Doppelgänger money, which forces the artist to make creative decisions that arguably could not have come into being without these limiting factors. Unfortunately, almost no literature exists on the general efficacy of self-imposed constraints in the creative process,¹ and even less on digital

¹ See Stokes (2006) for the only comprehensive book on the subject.
constraints. It is for this reason that the following section will be supplemented with reflections on creative constraints in my own creative work.

At first glance, digital constraints seem like those that one would expect to see in the arts. That is, they resemble devices such as a twelve-tone row or color matrix, but transplanted into the digital realm. Candy writes:

An important characteristic of digital technology is that to use it to its full [potential], you have to be prepared to make explicit the implicit assumptions that are in our mind as you develop the work. It is the very need for explicitness that makes it both challenging and rewarding to many artists. In order to work digitally, the constraints have to be specified in such a way as to make the computer generate an outcome that is satisfying to the artist. But, more importantly, the process of specifying the constraints in digital form can be best understood as an integral part of the creative process. The choice of whether to program or to use a software application can be critical to how much the artist has control over the character of the constraints to be specified. (Candy, 2007, 366)

These constraints are not static but, like the creative process, evolve as the work develops. As Coughlan and Johnson write:

Creative work is defined as a cyclical, iterative process of ideation, the generation and representation of novel thoughts, and evaluation, reflection on the value of generated ideas. These cycles are interspersed periods of constraint development, a subprocess that considers both the fit of existing constraints and how constraints could affect the outcome and then implements changes to the constraint structure. The model has developed to aid general understanding of creativity support needs and to define the role of constraint development. (Coughlan and Johnson, 2008, 446)

The refinement of constraints not only helps in realizing a tangible creative goal, but also begets new constraints that help one achieve a desired outcome.

Candy (2007) and Coughlan and Johnson (2008) discuss local, project-specific and process-specific digital boundaries that the artist can use to shape her work. However, insofar as global workspace-based constraints in the artist's life shape the nature of her production, so too can constraints in a digital environment lead to holistic changes in one's approach towards artistic creation. The psychology of workspace constraints is hitherto unstudied in the literature, but manifold examples of emergent technologies
attest to society’s quizzical desire to constrain how and where we work. As a case study, consider the advent of digital recording. After first transferring audio from analogue tape to disk pack drives that displayed a waveform of the audio on an oscilloscope, one would then send command-line instructions from a Digital Equipment Corporation PDP-11 to a software package entitled Digital Audio Processor (DAP) to perform mixing processes such as splicing and fades (Easton, 1976). This approach is not only indebted to traditional analog tape processes—it never truly escaped from them, so much so that Soundstream, the company at which DAP was created, followed the invention of this Digital Audio Workstation (DAW) with a digital to analog converter that allowed for write operations directly on the tapes themselves. The dispensing of the disk pack, in terms of the evolution of integrated digital technologies, was actually a step backwards. However, users’ comfort with this workspace constraint created the demand for a seemingly antiquated practice—a phenomenon similar to Jared Diamond’s documenting of civilizations who abandoned agriculture to take up the hunting and gathering from which they assumedly evolved. While DAW technology has advanced considerably since then, current DAWs still replicate certain trappings of analog tape technology. This is not to say that all of these practices should be given up—the idea of cutting and splicing, in a way, seems essential to sound editing, irrespective of the technology being used. However, the fact that these terms and functionalities persist into technologies in which they are not native is proof of the extent to which older technologies leave an indelible mark on their user base, even if said users could do better work by adopting a new practice.

Not all self-imposed constraints, however, are initially chosen by the user. An example is the technological restraint to which I am currently subjected—I am writing this dissertation on a computer where the bottom 2/7 of the screen is broken, forcing me to undergo innumerable machinations to see the contents of what I write, let alone what I read. With this digital handicap, the graphic-based composition environments
have become mostly useless (most of these environments put essential information at
the bottom-most part of the screen). Thus, I have opted to compose out of the Terminal,
a meager, easily-resizable program that has introduced me to the world of Unix. This,
in turn, has led me to using Python, SuperCollider, ImageMagick, and Lilypond to
generate scores, which has brought me to new realms of algorithmic composition and
programming. I now cannot remember how it felt to create without a broken screen
and, if tomorrow I woke up and my screen were miraculously fixed, in spite of any
feigned delight, I would secretly try to subject it to the forces necessary to replicate
the bumpy train rides, spilled coffee, and unfortunate experiments with alternating
current that have caused this problem. Thus, workspace-based constraints, be they
intentional or “fortuitous,” have the potential to push the artist’s psyche in the same way
that compositional restraints can shape a work.

5.3 Brün Re-Revisited

It would be intellectually dishonest to suggest that technology-as-constraint as
described above is the conceptual antipode to technology-as-intermediary as discussed
in the previous chapter. However, this conception of technology does provide an
alternative viewpoint to the idealistic and utopian vision of the composer’s relationship
with technology, expressed initially and most famously by Herbert Brün in “Technology
and the Composer.” This speech, delivered at the UNESCO in 1970, calls for a form of
creative technological access and opportunity that is not unlike that which is currently
afforded by the internet and similar technologies. In it, he categorizes with Brechtian
gusto those who he considers the opponents of this technological freedom:

Technology would have a far more beneficial impact on society if its
potentials were controlled by the technologists rather than by industrialists
and politicians. (Brün, 1970)

Here, Brün is not speaking of any localizable group of industrialists and politicians, but
rather the archetype of those that he feels impede technological progress. It is effectively
an aside that acts as a backdrop to his main point about technology’s relationship with
the composer. That said, the singling-out of these groups reveals a profound distrust of money and power that existed in the early days of computer music. Forty years later, irrespective of whether or not industrialists or politicians continue to merit the distrust that underlies Brün’s statement, the actual effect that these groups have had (and continue to have) on the dissemination of technology is not only of paramount importance, but also of absolute necessity. The present section seeks to (re)define the role of these two archetypes—the industrialist and the politician—at the top of the technological mediary totem. The manner in which they bring constraint to technology not only creates an all-encompassing social creative constraint, but also facilitates the creation of intermediating software. Far from posing a problem, they actually forge opportunities for composers to creatively distinguish themselves, leading me to claim that technology has a far more beneficial impact on society when its potentials are controlled by industrialists and politicians than by the technologists.

Global markets, whose supply chain is assumedly furnished by industrialists, are interconnected and impersonal. Classical economics dictates that this supply meets consumer demand at a price above or below which the supplier would not maximize its profit margin. In the most pessimistic scenario, demand is merely the collective assertion of a preference that the industrialist/supplier has subconsciously inculcated in its demanders. Irrespective of the motivating forces behind demand, it is clear that demand for personal digital technologies has risen over the past forty years. Industrialists, who benefit from alimenting this demand and who are in competition with other industrialists,² are thrust into a cycle of continuous research, development, and production. Because the United States and European Union are vigilant in their breaking up of technological monopolies, this trend is only likely to accelerate until digital

² A competition that is higher than other industries due to the previously discussed difficulties in patenting digital technologies.
technology is supplanted by something else. While these pressures on industrialists result in an overproduction of technology with respect to consumers’ actual ability to buy new versions of these technologies, it does fuel innovation and drive down costs. Composers, in Brün’s model, benefit immensely from this. They are precisely those who need technologists to be constantly innovative, and while Brün only mentions money cursorily, I would assume that he would support the greater access that cheaper technology affords to those whose entry into composition is contingent on the cost of their tools. This type of phenomenon would not necessarily arrive were technologists to control technology policy. While the technologist would likely want to develop technologies that she felt were interesting, only an artistically-minded or altruistic technologist would, given the opportunity to “control the potentials” of the technology she creates, dedicate her work to the betterment of composers’ lives. Relating this to the above discussion of mediaries, the “workspace” mediary becomes a lingua franca in the creative community; composers are collectively constrained by the technological frameworks into which they buy unless the composer is willing to write her own software. In this way, industrialists contextualize the composer’s creative response in the same way that the CEO of Fender is ultimately responsible for the mass-dissemination of a collection of norms to which composers wishing to write for electric guitar refer.

Under this analytic lens, “politicians” are no more guilty than “industrialists” in the development of technology. Government spending represents a unique sort of “regulation cost” to preemptively or reactively correct markets in the same way that umpires officiate baseball players to make sure that they keep playing the “game” as defined. In doing this, government spending funds technological research (amongst other things), which winds up benefiting the public directly: in fact, many popular open-source projects were launched (and are sustained) under the auspices of universities that receive significant amounts of government funding, assumedly to correct a market error whereby private industry and society do not adequately fund the
universities from which they benefit. This tendency is only exacerbated, not quelled, by the questionable political practices about which Brün is likely thinking when he diametrically opposes the politician to the technologist. Pork barreling and logrolling for one's state effectively ossify line items for the disparate universities and think tanks that write open-source code.

Looking at the industrial and political realities of 1970, it is clear why Brün would have been wary of industrialists and politicians; the extent to which they “mediated” a creative response was so severe that it effectively disenfranchised all but a privileged few composers who had access to mainframe computers. However, as happens in many industries (tulip circa 1650, rifle circa 1810, automobile circa 1950), competitive forces ate away at this aura of exclusivity until the technologies that Brün dreams about in “Technology and the Composer” became unremarkable for many of us who did not live through the era during which he was creatively active. I do not believe that Brün’s skepticism about industrialists and politicians reflects a lack of foresight about patterns in economic behavior, but rather a desire to use the language of the day to make his point via dialectics that his audience would understand precisely because said audience was, in part, responsible for creating these dialectics.

5.4 Virtuality in Mediation and Intermediation

Interestingly, portions of Brün’s essay anticipate certain concepts in the contemporary digital landscape that I will discuss in subsequent chapters:

What if it were true that composition simply is the generator of relevance, and that composers, no matter of or in what, are people who desire that whatever they create be relevant to whatever they consider important? If this were true (and I stipulate it is), then I could go on and state: The thoughts I consider important, and the medium in which I try to create what otherwise might never happen, are related through my desire for relevance; thus they become representatives of two systems which ought to show a high degree of mutual analogy, once a structure composed by me is applied to both. (Brün, 1970)

To speak of creating relevance is effectively to conjure up two layers of virtuality. On one level, there is the created relevance that forms in time, which humans must identify as
real but not concrete (if it were part of their quotidian lives in the most unadulterated sense, it would not be “created relevance” as Brûn mentions but merely “relevance”) and therefore virtual. On a different plane, there is the thought space from which the artist’s ideas and structures emanate—a space that structures information in lattices of relevance that are not necessarily linked to the musical surface. These two virtual spaces of relevance are vital in the composition process and are the subject of the next chapter.
CHAPTER 6
COMPOSITION III: STRUCTURE / FORM—OUT OF TIME / IN TIME

A structure is like a bridge from nowhere.

—John Cage, 45’ for a speaker

Dès que le discours contient l’avant ou l’après, on est en-temps.

—Iannis Xenakis, Kéleūtha

As soon as the discourse contains “before” or “after”, one is in time.

Moving from general issues about creative intermediaries and mediaries to the more specific domain of music composition, this chapter defines two terms that are *ritornelli* throughout contemporary writing about how composers compose—structure and form. While these ideas are two of many that arise when discussing contemporary composition, they are so central to the compositional lexicon that by defining them, one is able to touch upon many heuristics through which musical creative thought is organized. This chapter looks at the these two ideas through the writings of John Cage and Iannis Xenakis,\(^1\) concluding with a discussion of their conceptual nexus via the keystone of graph theory.

### 6.1 Structure and Out of Time

Perhaps the most difficult part of defining structure in music composition is disambiguating the term from the word as defined in music theory and analysis. When the latter disciplines write of “structure”, there are two principal ideas that are at play.

\(^1\) Many other composers have written about form and structure. I have chosen to focus on the written works of Cage and Xenakis because they provide a succinct and comprehensive overview of the terms as currently used.
The first is what I call “generic metaphoric”—that is, a use of the word structure that gleams its significance from another field. For example, when Lerdahl and Jackendoff (1996) describe generative arboreal structures in Shoenberg’s Op. 11 No. 1, it is clear that they are relying implicitly on a biological metaphor to comment upon the work’s structural characteristics. The same metaphorical word-play can be seen in Forte (1973), who uses mathematical language from set theory to describe the transmutations that various musical “strains” could go. Neo-Schenkerians employ this technique as well, using architectural metaphors to describe how a work is “constructed.”

The second use of the word “structure,” which is uniquely musical, has to do with the structures retained from one’s listening of a work that are independent of the way a work forms. That is, several writers have engaged in speculative theory on the residual network that one uses to represent a work outside of its temporal comportment. Wolff (1998) and Feldman et al. (2004) both talk about process by which a work becomes atemporal upon reflection, allowing one to conceive of what they call “structural” relationships. While this dialog is limited insofar as it only pertains to a specific style of listening (if not music-making in general), it does at least imply that one can create cognitive heuristics to speak structurally of music without necessarily likening music to something else.

Structure as talked about above is primarily concerned with the “trace” of a work. However, as Nattiez (1976) argues, the structural relationships perceived by listeners in a “trace” are not ipso facto related or equivalent to the creative structures that gave birth to the trace. What I am concerned about are the structures that a composer uses in the creation of a work, which undoubtedly result in this trace, but are not wedded to the

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2 Numerous examples, including many articles in the Journal of Schenkerian Studies, show the manner in which this metaphorical language is put into practice. Katz (1935) and Schachter (1976) show early examples in which the word “structure” is used in extended architecture analogies.
anti-communicative discourse (to evoke a Brünian term) that the work inspires. Instead, they come from the idea space in which the composer must operate to create the work.

To further develop a uniquely compositional definition of structure, I turn to the writing of two composers who often made explicit structure/form distinctions: Xenakis and Cage. Xenakis, in speaking of *hors temps* (out of time), writes:

> Ce qui se laisse penser sans changer par lavant ou laprès est hors-temps. Les modes traditionnels sont partiellement hors-temps, les relations ou les opérations logiques infliges à des classes de sons, d'intervalles, de caractères, sont aussi hors-temps. *Xenakis* (1994, 68)

*All that can be reflected upon without being changed by what comes before or after is out of time. The traditional modes are partially out of time, the relations or logical operations used on different classes of sounds, intervals, characters are also out of time.*

While this definition resonates with the previously-defined uses of structure in musical analysis, it is the use of these things “on” different classes of sounds instead of generalizing “about” classes of sounds that is of paramount importance. Also notable is the fact that Xenakis omits any relationship between these structures and the musical surface of the work—one senses that they are principally creative dispositives.

Cage’s writing on structure is more problematic because he proposes different definitions of the term, even going so far as to explicitly nullify certain definitions of structure from his early period in favor of late-period ones. When speaking of his percussion works from the 30s and 40s, Cage says:

> I thought, if I’m not going to have tonality in my music, I’ll need something to make an alternative structure; and that was rhythm. I examined the nature of sound, which has pitch, duration, overtone and amplitude. Then I examined silence; and of those four things, silence had only duration. Therefore, in discovering the need for a rhythmic structure I was finding a correct structure for music—whereas the European structure, based on tonality, would not admit noises or pitches outside the major and minor scale, and was incorrect. *Kostelanetz*, 2002, 64

Here, structure is linked to alternative parameterizations of music that permit him to privilege the organization (and perhaps perception) of these parameters over others.
However, one sees a distancing from the musical surface when Cage writes later of structure:

I understand the word “structure” as the division of the whole into parts. And I would apply the usefulness of the idea of structure to a work of art that sets out to be an object, namely, to have a beginning, middle, and end. And if one is making a work, which I do often, that is not an object, but a process, then that concern doesn’t enter in and the question of whether it is better or not better, is not to the point. I think, perhaps, if you were not involved with process, as I often am, but were involved with object, that the question of what would be a better object than another object is very hard to decide. (Kostelanetz, 2002, 231–232)

Thus, the divisional schemes in his thought are no longer necessarily linked to the process by which a work forms. In perhaps his most poetic yet focused definition of the term, Cage writes in *Silence* that structure is “like a bridge from nowhere,” emphasizing the linking nature of structural phenomena while at the same time expressing that these links are self-contained—that is, not part of a sequence. In spite of Cage’s own recantation of the structure-based processes used in his early works, his shifting definition of structure does not invalidate the structures that gave birth to the *Imaginary Landscape* suite. Rather, what began as a multifruction of European pitch structures became so conceptually supple that it could no longer be considered as being solely useful for the parameterization of a given work. In a way, this broad conception of structure was always latent in Cage’s listening—when he writes of Webern compared to Satie, he says:

I was always devoted to Erik Satie’s music, and I still am. You don’t really have to be interested in it in order to enjoy it. Whereas in the case of Webern, I think you’re obliged to be somewhat interested. [One must be interested in the construction] and all of the ideas and everything. Otherwise, I don’t think it’s that seductive. (Kostelanetz, 2002, 48)

This intrepid listening spirit finds its way into his compositional method as he grew older, imbuing his writing process with the richness of the musical and natural networks that fascinated him from his early days.
6.2 Form and In Time

If defining structure required a *disambiguation* of sorts, defining form calls for a *reambiguation* of a term whose ambiguity (and I use ambiguity in the same way that Messiaen uses “charm” to describe a certain vitality inherent in uncertainty) has been enervated due to the casual way in which *form* and *structure* are often used interchangeably to describe a work’s comportment above a certain durational threshold. To estrange *form* from its erstwhile kissing-cousin structure, then, I look again to the writing of Xenakis on *en temps* (in time) and Cage on form.

Xenakis’s *en temps* is the proper *verso* to the *recto* that is *hors temps*. He writes, “Dès que le discours contient lavant ou laprès, on est en-temps. L’ordre sériel est en-temps, une mélodie traditionnelle aussi” ([Xenakis, 1994], 68). (As soon as the discourse contains “before” or “after”, one is in time. Serial order is in time, as is a traditional melody.) The categorical nature of *en temps*, encompassing all that has a before and/or after, is precisely what makes this distinction remarkable given the era in which it was coined, when integral serialism was often referred to as “structure” without the acknowledgment that the results of serial processes, if not the series themselves, unfold in time just as traditional counterpoint and melody does.

Cage’s definition of form, while again more complicated, effectively makes the same distinction. Early in his career, he defined form as “the morphology of a continuity” and “expressive content” ([Cage, 1966b], 35), stating that “the principle of form will be our only constant connection with the past” ([Cage, 1966c], 5). Later in his career, he denied his use of formal considerations in his work, stating “[My earlier] attitude towards form is sort of in the middle between my present thought and my early thought. Now I don’t bother to use the word *form*, since I am involved in making processes, the nature of which I don’t foresee. How can I speak of *form*?” ([Kostelanetz, 2002], 72). It is precisely this negation of form that fixes its positive definition as that which unfolds in time—Cage thought that it was useless to speak of form because he felt it was out of his control.
6.3 Graph Theory

What structure and form share is their relational nature. Structural relationships exist in a neutral space where relevancy is created by the links forged between said space’s constituent elements. Formal relationships, while different in that they are always temporal in nature and therefore become relevant through metrics in which the passage of time is defined, are relationships nonetheless. Thus, to effectuate a comparison between structure and form, one must employ a theory that facilitates the articulation of relationships. Currently, the most powerful set of tools that can describe relational networks is graph theory, which I will define below before bringing it to bear on the ideas of structure and form.

Graph theory, a field that began with Euler (1741) in his solving of the Königsberg Bridge problem, has since been developed in disparate fields both theoretically\(^3\) and computationally\(^4\) into the contemporary practice of digital graph exploration and manipulation. Graphs comprised of vertices and edges show the user the links (edges) between various states (vertices) in several different layout and coloring configurations. Traditionally, the coloring and shaping of vertices and edges represent information that is specific to the nature of the phenomena being graphed (for example, in voltage diagrams, vertex and edge presentation often changes in function of the capacity and resistance of different parts of a system (Paul, 2001)). Coloring is also used to show emergent communal organizations of vertices as determined by various Gestalt-based parameters (see Girvan and Newman (2002), Reichardt and Bornholdt (2006), Palla et al. (2007) for popular clustering algorithms such as edge-betweenness, network modularity, and \(k\)-clique percolation respectively). Several layout algorithms exist to

\(^3\) See Biggs et al. (1986) for a comprehensive bibliography dating until 1936 and West (2001) for a summary of more contemporary contributions.

\(^4\) See Battista et al. (1998) for a comprehensive bibliography dating until 1998.
spacialize these vertices and edges in multiple dimensions, and certain public domain libraries offer dynamic layouts based on physical models such as Brownian motion and attractive/repulsive forces.

Using “structure” in the sense defined above, *hors temps* links between ideas can be visually represented by graphs with directional edges that connect related nodes. The significance of these edges can also influence the coloring and layout schemes defined above, allowing one to manipulate the grouping of one’s ideas both statically and dynamically. Additionally, graphs can also be used to represent the way that networks “form,” where the paths act as temporal circuits between events. Tracks in a recording session, for example, can be thought of as graphs with the audio representing nodes and silence representing edges. Thus, while it is clear that structure and form have distinct conceptual patrimonies, graph theory provides a common ground where the two can be represented visually. Furthermore, as Chapter Nine will argue, graph theory allows the creator to explore the intersections between the two concepts, morphing representations of structures into forms and vice versa.
CHAPTER 7
CHILDHOOD, DEATH, AND CREATIVE BOOTSTRAPPING

Supposons un être qui ignore tout de la distinction entre la pensée et les corps. Cet être prendra conscience de ses désirs et de ses sentiments, mais assurément il aura de lui une notion beaucoup moins claire que nous de nous-mêmes. Il se sentira, pour ainsi dire, moins intérieur à lui-même que nous, moins indépendant du monde extérieur. La conscience que nous avons de penser nous détache, en effet, des choses. Mais surtout, les connaissances psychologiques d’un tel être seront toutes différentes des nôtres. Les rêves, par exemple, lui paraîtront une irruption du dehors dans le dedans. Les mots seront liés aux choses et parler consistera à agir directement sur les corps. Inversement, les corps extérieurs seront moins matériels: ils seront pénétrés d’intentions et de volonté.

—Jean Piaget, La représentation du monde chez l’enfant

Let us imagine a human who is ignorant of all distinctions between thought and body. This being would be completely conscious of his desires and his sentiments, but certainly less clearly than we would be. In other words, he would feel less inside himself than we do, less independent from the external world, for our awareness of our own thinking processes effectively detaches us from things. Above all, such a being’s psychological knowledge would be completely different than ours. Dreams, for example, would appear to him like an internal eruption of the outside. Words would be linked to things and speaking would be tantamount to acting on the bodies of things. Inversely, exterior bodies would be less material: they would be penetrated by intentions and will.

Pourquoi ce front soucieux? La réponse “Parce qu’il a une maladie de foie” est bien une réponse, une réponse qui assigne la cause déterminée et circonstancielle du souci: le Parce-que neutralise en effet le Pourquoi et comble l’interrogation. Mais la réponse “Parce qu’en général il mourra un jour” n’est pas une réponse, car c’est une réponse qui répond par la question elle-même, car c’est un Parce-que qui ramène circulairement au Pourquoi: la nécessité de mourir n’est-elle pas l’essence même de la vie? Devoir mourir n’est donc pas à proprement parler un motif d’inquiétude: la mort est plutôt la source de toutes les inquiétudes empiriques et naturelles; la mort est l’inquiétant en toute inquiétude et ce qui donne à chaque souci sa dimension de tragédie.

—Vladimir Jankélévitch, La Mort

Why the long face? The response “Because he has a sickness of the liver” is a good response, a response that assigns a determinate and circumstantial cause to a concern: the Because effectively neutralizes the Why and satisfies the interrogation. But the response “Because, in general, he will die one day”
is not a response, for it is a response that responds with the question itself, for it is a Because that circularly brings back the Why: is not the necessity to die the essence of life? The fact that one must die is not strictly speaking a reason to worry: death is rather the source of all empirical and natural worries; death is that which is worrisome in every worry and that which gives every preoccupation its tragical dimension.

Although the previous five chapters defined digitally, assisted, and creativity as constituent parts of digitally assisted creativity, they have failed to define digitally assisted creativity. This is rectified presently. Digitally assisted creativity is the effectuation of the creative process (as defined in Chapters Four through Six) by use of assistive digital tools (where “assistive” corresponds to the role of an assister as described in Chapter Three) used by the digital self in the digital virtual space constructed in Chapter Two. As a foil to this concept, the present chapter entertains a notion of second-order assisted creativity that I call “creative bootstrapping”—the act of ameliorating one’s own creative faculties by virtue of one’s own creativity.¹ That is, this chapter seeks to lay the groundwork for an inquiry into the extent to which assistive technologies help the composer to become more creative. The crux of my argument lies in the claim that creative bootstrapping can move in one of two directions—from an assemblage of ostensibly unrelated data inwards towards the generation of meaning (what I call ontologically poor and epistemologically rich, hereafter abbreviated O-E+), or from a position of great internal certitude outwards towards data that confirms the validity of this intuition (ontologically rich and epistemologically poor, hereafter abbreviated O+E-). As human perception and cognition are at the heart of both of these states, it is imperative that they

¹ The term “bootstrapping” is borrowed from computer science, where since the 1950s computers have executed important tasks like starting up by creating files and processes that then create other files and processes. Or, in other words, they pull themselves up by their own bootstraps.
be defined through explorations of modalities of human thought. To do so, I have chosen two case studies that represent immersive and extreme examples of O-E+ and O+E- respectively: Jean Piaget’s writings on childhood and Vladimir Jankélévitch’s treatise on death entitled *La Mort*. The chapter will conclude by linking these virtual spaces to the concept of creative bootstrapping in the digital realm, framing the subsequent two chapters’ discussions of software design in digitally assisted composition.

### 7.1 Childhood in the Work of Piaget

This section will develop an O-E+ virtual space by exploring the concept of childhood in the work of Piaget, one of the first thinkers to break with Teutonic positivism in child psychology and look at the subject empirically and temporally. Instead of answering the question “what are children thinking?,” he looked instead at the more dynamic issue of how children become thinkers. His fundamental argument is that the child’s development can be seen as a process of cognitive stabilization towards the *équilibre mobile* (mobile equilibrium) of adulthood (Piaget, 1964, 12). This equilibrium permits the adult to confront diverse situations by drawing upon a steady “self” that is influenced by, but ultimately separate from, the outside world. Creativity, as described in Chapters Four through Six, is exclusively a product of this mobile equilibrium, whereas the present chapter seeks to visit the initial ontological impoverishment of the child as well as the successive states of development that lead to its eventual understanding of interrelated phenomena. Then, I will explore the epistemological richness of this space, arguing that the child has a heightened sensitivity to what “knowledge” is in spite of the fact that it lacks ways to structure this knowledge.

To construct this ontologically poor space, I break from the temporal order in which Piaget presents the child’s development, moving instead from internal/individual to external/social so that similar milestones of ontological development may be discussed concurrently. A first ontological “fascination” of the child is that of variation as separated from the perception of an “original” event. Piaget writes:
Les conduites précédentes [de l’enfant] se multiplient et se différencient de plus en plus, jusqu’à acquérir une souplesse suffisante pour enregistrer les résultats de l’expérience. C’est ainsi que dans ses “réactions circulaires,” le bébé ne se contente plus de reproduire simplement les mouvements et les gestes qui ont conduit à un effet intéressant: il les varie intentionnellement pour étudier les résultats de ces variations et se livre ainsi à de vraies explorations ou “expériences pour voir.” (Piaget, 1964, 22)

The child’s actions multiply and diversify until they reach a certain numerical threshold permitting him to commit a given experiment to memory. Here, in what we may call “circular reactions,” the baby is not content with the simple reproduction of the actions that led to an interesting effect: he varies these actions intentionally to study the results and begins a process of exploration, undertaking different “let’s-see-what-happens-when-I . . . ” experiments.

If this process represents one of proliferation, a negative version of it exists in the child’s recognition of absence.

L’on n’observe pas avant le cours de la seconde année de conduite impliquant l’évocation d’un objet absent. Lorsque se constitue vers 9-12 mois le schéme de l’objet permanent, il y a bien recherche d’un objet disparu: mais il vient d’être perçu, il correspond donc à une action déjà en cours et un ensemble d’indices actuels permettent de le retrouver. (Piaget and Inhelder, 2004, 53–54)

One does not see until the second year any indication that the child searches for an absent object. From 9-12 months, while he is constructing the idea of a permanent object, one can see that the child has the ability to search, but these searches are for objects that have just been seen. The search, thus, can be linked to an action that the child has already undertaken and the ensemble of clues present that would permit him to find the identified object.

The child’s interaction with objects and his mental internalization of them eventually leads to the development of a thought process that is increasingly independent from the objects/events that initiate it. Piaget writes:

Avec l’image mentale, ensuite, l’imitation n’est plus seulement différée mais intériorisée et la représentation qu’elle rend possible, dissociée ainsi de toute acte extérieur au profit de ces ébauches ou esquisses internes d’actions qui la supporteront dorénavant, est alors prête à devenir pensée. (Piaget and Inhelder, 2004, 57)

With mental images, then, imitation is no longer just differentiated but also moved to the interior. The representation that this makes possible, disassociated from external actions and coming instead from internal designs
and sketches of actions that hereafter make imitation possible, is ready to become what one would identify as thought.

This internal separation of things and their “forms” is an important step in several theories of ontology, and it is for this reason that I identify a lack of this separation in the young child as being ontologically poor.

Fascinations also exist with respect to the child’s community, both old and young. Concerning the young, Piaget writes:

Lorsque [les enfants] cherchent à se fournir des explications les uns aux autres, ils parviennent avec peine à se placer au point de vue de celui qui ignore ce dont il s’agit, et parlent comme pour eux-mêmes. Et surtout il leur arrive, en travaillant dans une même chambre ou à une même table, de parler chacun pour soi tout en croyant s’écouter et se comprendre les uns les autres, cette sorte de “monologue collectif” consistant à s’exciter mutuellement à l’action plus qu’à échanger des pensées réelles. (Piaget, 1964, 34)

When children look to explain things to each other, they struggle to put themselves in the shoes of someone who does not already know what they are thinking—they speak as if they were speaking to themselves. Above all, while together in the same room or at the same table, they begin a sort of loquacious “every man for himself,” all the while thinking that everyone understands each other. This type of “collective monologue” is more in the domain of the mutual excitement of action than the communication of real thoughts.

Later, once children begin to enter the adult world of interpersonal exchange, they still endeavor to retain this personal vocabulary and perspective, albeit increasingly internalized. Piaget calls this the “jeu symbolique” (symbolic game):

Le jeu symbolique marque sans doute l’apogée du jeu enfantin. . . . Obligé de s’adapter sans cesse à un monde social d’aînés, dont les intérêts et les règles lui restent extérieurs, et à un monde physique qu’il comprend encore mal, l’enfant ne parvient pas comme nous à satisfaire les besoins affectifs et même intellectuels de son moi dans ces adaptations, qui, pour les adultes, sont plus ou moins complètes, mais qui demeurent pour lui d’autant plus inachevées qu’il est plus jeune. Il est donc indispensable à son équilibre

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2 The most famous example being Plato’s discussion of forms in his Republic.
affectif et intellectuel qu’il puisse disposer d’un secteur d’activité dont la motivation ne soit pas l’adaptation ou réel mais au contraire l’assimilation du réel au moi, sans contraintes ni sanctions. (Piaget and Inhelder, 2004, 58–59)

The symbolic game marks, without a doubt, the apogee of children’s games. . . . Obligated to adapt without cease to a world of social elders, whose interests and rules are exterior to the child, compounded by a physical world that he does not completely understand, the child does not succeed like us in fulfilling the emotional and even intellectual needs of his ego in these institutions that, for adults, are more or less complete, but that rest estranged from the child as a function of his inexperience. It is, thus, indispensable to his emotional and intellectual equilibrium that he can retain a sector of activity where the motivating force is not adaptation or reality but rather the assimilation of reality into the ego, without constraints or sanctions.

This symbolic game is, for the child, a fight against the dissolution and assimilation of its world into that of older adults. It recreates many of the phenomena discussed above, but the child recognizes that these recreations are inherently internal. It is data about this symbolic game gleaned from older children that form the basis of Piaget’s speculative theory about early childhood; one way that observers can mentally recreate the ontologically poor state of a child is to imagine this game as a totalizing, holistic paradigm in which the child lives before its integration into the world of older children and adults.

Having established the manner in which a child’s fascinations lead to greater ontological certitude, I now turn to the epistemological basis from which these fascinations occur. Piaget argues that the child’s motion towards equilibrium is in fact a motion away from the equilibrium of tautologistic affective unity. That is, in the beginning, everything is internal for the child, including the external world.

Au point de départ de l’évolution mentale il n’existe à coup sûr aucune différenciation entre le moi et le monde extérieur, c’est-à-dire que les impressions vécues et perçues ne sont rattachées ni à une conscience personnelle sentie comme un “moi,” ni à des objets conçus comme extérieurs: elles sont simplement données en un bloc indissocié, ou comme étalées sur un même plan, qui n’est ni interne, ni externe, mais à mi-chemin entre ces deux pôles. (Piaget, 1964, 23)
At the beginning of a child's mental evolution, there exists no differentiation between the self and the outside world, meaning that his lived and perceived impressions are neither linked to a personal, conscious “self” nor to objects conceived of as being exterior: they are simply data in an undistinguished bloc, or spread out on the same blueprint, that is neither internal nor external but rather midway between these two poles.

This confusion of worlds manifests itself in three different ways:

First, children confuse the signifier and the signified or the mental object and the thing that it represents. With respect to thoughts in general, the idea of and the name of the sun, for example, are thought of as being part of the sun, as if they emanated from it. Touching the name of the sun, then, is touching the sun itself. With respect to dreams, we see a similar phenomenon: the dreamed image is supposed to emanate from the thing or the person who represents this image. The dream of somebody being run over comes from that person himself, etc. Or, for example, while one dreams of school the dream is “at school,” just as one thinks of the word or name sun as being “in the sun.” There is a confusion between dreams and the things that are dreamed.

A second confusion is that of the internal and external. Words are primitively situated in things, then everywhere in the ambient surroundings, then in the mouth and finally in the head. Dreams obey the exact same process: first
situated in things . . . , they are then localized in a room, even if they come from the head (as words are localized in the ambient surroundings, even if they come from the mouth); dreams are finally localized in the eyes and then, definitively, in the thoughts of the child and in the child's head itself.

Enfin une troisième variété de réalisme donne lieu à une confusion entre la pensée et la matière. La pensée est, pour ceux des enfants qui se sont posé la question, un souffle, étant donné qu'on pense avec la voix. Elle est aussi une fumée, pour autant que l'haleine est confondue avec la voix. La rêve, pour ceux des enfants qui se sont posé la question, est également en air ou en fumée. Chez les petits qui n’ont pas encore compris l’origine subjective des rêves . . . , il est simplement “en nuit” ou “en lumière.” (Piaget, 2003, 104)

Finally, a third variety of realism takes place via a confusion between thoughts and material objects. Thoughts are, for children that have posed this question to themselves, a breath, as if it were what one thinks with the voice. Thoughts are also smoke insofar as the breath is confused with the voice. Dreams, for children that have asked themselves this question, are also in air or in smoke. For children who do not yet understand the subjective origin of dreams . . . , they are simply “in the night” or “in the light.”

This unity of inside/outside perception, according to Piaget, leads adults to the conclusion that children are selfish. In reality, this selfishness represents the yet-unbroken self-centric subsumption of the outside world into the child's internal thought processes.

Selfishness is, then, a virtue. In fact, it is the virtue—it is tantamount to altruism and, paradoxically, is a synonym for selflessness. Piaget writes:

Il y a donc deux égocentrismes, l’égocentrisme logique et l’égocentrisme ontologique. De même que l’enfant fait sa vérité, il fait sa réalité: il n’a pas plus le sentiment de la résistance des choses qu’il n’a celui de la difficulté des démonstrations. Il affirme sans preuve et il commande sans limitation. La magie sur le plan ontologique et la croyance immédiate sur le plan logique, la participation sur le plan de l’être et la transduction sur le plan du raisonnement, sont donc les deux produits convergents du même phénomène. A la racine de la magie et de la croyance immédiate se trouve la même illusion égocentrique: la confusion de la pensée propre et de celle des autres et la confusion du moi avec le monde extérieur. (Piaget, 2003, 142)

There exists, therefore, two forms of selfishness—logical and ontological. In the same manner that the child constructs his truth, he constructs his reality: he resists things no more than he has difficulty making himself understood. He affirms without proof and gives orders without limits. Ontological magic and his immediate belief in logic, his participation in human affairs and his transduction with respect to reason, are both convergent products of the
same phenomenon. At the root of this magic and these beliefs lies the same egocentric illusion: the confusion of one's own thoughts and those of others as well as the confusion of the self and the external world.

Thus, far from lacking knowledge about things, children seem to live in the same epistemologically-rich state as adults. It is a lack of ontological loci, then, for which the process described above serves as a corrective. Furthermore, it is for this reason that I call this O-E+ space virtual—it is real insofar as it is filled with perceptual knowledge, but not actual knowledge according to the terms by which adults, the vanguard of the actual/virtual divide discussed in Chapter Two, construct the actual. One may even go so far as to say that the child's world is neither virtual nor actual but simply real because it cannot make the distinction.

Of course, there is a difference between identifying that an O-E+ state exists in children and arguing that adults can somehow internally recreate this state for the purpose of creative bootstrapping. To understand how this may be possible, I turn to Piaget's writing on adult psychology:

Il semble que l'on puisse tirer deux conclusions des analyses qui précèdent. La première est que l'enfant n'est guère moins conscient du contenu de sa pensée que nous ne le sommes du nôtre. . . . Juste perception des données de la conscience, mais inconscience de la voie par laquelle ces données ont été acquises, tel est le paradoxe de cette "intuition." (Piaget, 2003, 107–108)

It seems that one may draw two conclusions from the previous analyses. The first is that the child is hardly less conscious of the content of his thoughts than we are of ours. . . . The paradox of this "intuition" is that it is predicated on the accurate perception of his conscience's data while he remains unaware of the path by which these data were acquired.

This is not to say that adults are necessarily conscious of how they acquire certain data, but rather that adults have the ability to sort through this data once acquired. Piaget follows this analysis with a definition of the "spacial" element of the O-E+ virtual space:

Ce paradoxe est lié étroitement à la particularité que voici (ce sera notre deuxième conclusion). Si l’enfant a conscience des mêmes contenus de pensée que nous, il les localise tout autrement. Il situe dans l’univers, ou chez les autres, ce que nous situons en nous, et il situe en lui ce que nous localisons en autrui. C’est ce problème de la localisation des contenus qui
est tout le problème de la conscience de soi chez l’enfant, et c’est faute de le poser clairement que l’on simplifie ce qui, en fait, est très complexe. On peut, en effet, supposer un esprit très sensible aux moindres remous de la vie affective, très observateur en ce qui concerne les particularités du langage, des coutumes et de la conduite en général, mais très peu conscient de son propre moi, parce qu’il prend systématiquement comme objective chacune de ses pensées, et comme commun à tous chacun de ses sentiments. La conscience du moi naît, en effet, de la dissociation de la réalité telle que la conçoit la conscience primitive et non de l’association de contenus déterminés. Noter chez l’enfant un vif intérêt pour lui-même, un égocentrisme logique et sans doute moral, ce n’est pas prouver que l’enfant soit conscient de son moi, c’est au contraire indiquer qu’il confond son moi avec l’univers, c’est-à-dire qu’il est inconscient de lui-même. (Piaget, 2003, 108)

This paradox is strongly linked to the following particularity (which will be our second conclusion). If the child’s consciousness of his thoughts is similar to ours, he localizes them completely differently. He puts in the universe, or in others, that which we situate in ourselves, and situates in himself that which we localize in others. It is this problem of the localization of thought content that is the fundamental problem of the child’s consciousness of himself, and it is our fault for not having clearly asked this question that we simplify a very complex process. It is entirely appropriate to suppose that the child is sensitive to the smallest eddies of his emotional life, perceptive with respect to the particularities of language, customs, and general behavior, but unconscious of his own ego, because he systematically confirms the objectivity of all of his thoughts, and thus he feels that these thoughts are common to everyone. The eventual consciousness of his ego is effectively born from the dissociation of reality as perceived by a primitive consciousness and not the linking together of definitive thoughts. One must note that the child has a lively self-interest, a logical and undoubtedly moral selfishness. This does not prove that the child is conscious of his ego, but rather it indicates that he confuses his ego with the universe—he is unconscious of himself.

Piaget’s use of the term “the dissociation of reality” is of paramount importance—insofar as the concrete and virtual create the real, it is a syllogism that, to perceive concreteness and virtuality as conceptually distinct, reality must be disassociated. In the child’s mind, this cognitive unraveling is born from an already active and affective identity rather than from a developmental quantum leap. Thus, in an O-E+ space, the adult can retain all of the emotions and observations that one has in non-ambiguous, concrete, or virtual spaces. It is the arrangement of this space’s terrain, and not its contents, that creates an ontological disparity. Contrast this with perhaps the most poorly-named
virtual exercise in recent history: virtual reality. Virtual reality is nothing more than an immersive virtual space that, technology permitting, can cause the user to temporarily confuse virtuality for concreteness and even for irreality depending on the way that the program is designed. There is nothing about virtual reality that confounds virtuality and concreteness into a uniform reality because the user is never encouraged to undercut their conception of virtuality and concreteness, but rather to effortlessly sojourn between the two. The aspect of Piaget’s writing that would be pertinent to any adult attempting to mentally recreate a childlike O-E+ virtual space is that children not only confuse the concrete and the virtual, but they are also indifferent to how the two are distinct. This cannot be born of some type of apathy, but rather of a conflation\(^3\) and confounding\(^4\) of an agent’s mindscape that renders the import of traditional concrete/virtual distinctions immaterial. Why this is important will be discussed at the end of this chapter after a discussion regarding Jankélévitch, and how this can be done is the business of Chapter Nine. For now, we can conclude that Piaget’s childhood is a manifestation of an O-E+ virtual space that, because of a lack of distinctions between the virtual and the concrete, is governed by a benevolent selfishness.

### 7.2 Death in the Work of Jankélévitch

If childhood is a state, death is a nothing—not a state, not even a moment, but a pure non-thing. As Plato writes in his Apology, death is the only thing about which we can know nothing because there is nothing to know (Jankélévitch, 1993, 39). Vladimir Jankélévitch, a French musicologist and philosopher, wrote *La Mort* as a reaction against society’s bizarre treatment of this natural event.

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\(^3\) Conflation meaning assimilation of parts into an improbable whole.

\(^4\) Confounding meaning the confusion and substitution of elements that would not be substitutable in the adult world.
Pourquoi la mort de quelqu’un est-elle toujours une sorte de scandale? Pourquoi cet événement si normal éveille-t-il chez ceux qui en sont les témoins autant de curiosité et d’horreur? Depuis qu’il y a des hommes, et qui meurent, comment le mortel n’est-il pas encore habitué à cet événement naturel et pourtant toujours accidentel? Pourquoi est-il étonné chaque fois qu’un vivant disparaît, étonné comme si pareil événement arrivait pour la première fois? (Jankélévitch, 1993, 8)

Why when someone dies is it always a sort of scandal? Why does this ever-so-normal event awaken so much curiosity and horror in those who witness it? Since the dawn of mankind (which is also the dawn of death), why have mortals not yet become accustomed to this natural and yet always accidental event? Why is it surprising every time someone passes away, surprising as if a similar thing had never happened before?

This section summarizes Jankélévitch’s answers to these questions, pinpointing what death “is” and, more importantly, looking at the way that living humans confront death (both consciously and subconsciously) and how this confrontation lends itself to the construction of an O+E- virtual space.

According to Jankélévitch, it is important to first establish the nature of death before elaborating the myriad of human thoughts and emotions that surround death. He writes: “La mort est à la fois la négation pure et simple de l’essence et la négation pure et simple de l’être, et elle est doublément antidivine en cela; elle n’est ni le Rien fondateur ni le Néant créateur, mais elle est le plat non-sens du sens et le pur et simple non-être de l’être” (Jankélévitch, 1993, 69). Death is both the pure and simple negation of reality and the pure and simple negation of being, and it is doubly anti-divine in doing this; death is neither the partitive Nothing nor the creative Oblivion, but it is the plain non-sense of sense and the pure and simple non-being of being. Jankélévitch, always exact in his terminology, draws a distinction between the concept of “nothing” as some sort of inversion of life or counterbalance to life (a concept that he concedes may exist, but is beyond the scope of the question) and instead categorizes death as the meaningless end. Literally meaningless, because everything to which a human attaches meaning (both objects and actions) ceases to have meaning. Furthermore, death does
not have a locus of “happening" as a temporal event would. We can only understand it in terms of what comes before it (life) and what comes after it (biological decomposition and, depending on one’s religious persuasion, some sort of transmigration). Death is not dying, which is actually a way of living. More precisely, dying is an institution whereby the statistical likeliness of death becomes a preoccupation. “Dans et par le vieillissement, l’impalpable je-ne-sais-quoi de la temporalité se rend visible comme processus concret et caractérisé” (Jankélévitch, 1993, 189). In and through old age, the impalpable je-ne-sais-quoi of temporality makes itself visible as a concrete and characterized process. It is in this way that Jankélévitch constructs a continuum between life and death—far from treating it like a binary, he actually likens death to sleep the same way that Plato does. Just as we abandon the sense of our concrete lives for the non-sense of sleep, we can conscientiously abandon the sense and meaning of being to various degrees, even to the point of denial of self-awareness. Or conversely, as he cites from Bichat, life is “l’ensemble de fonctions qui résistent à la mort” (Jankélévitch, 1993, 93) (the group of functions that resist death). It is for this reason that we cannot truly talk or think of death because talking and thinking usually carries a modicum of sense, and death is the ultimate non-sense. Jankélévitch writes:

Incapable of thinking death, we are left with, it seems, only two solutions: either think on death, around death, about death, or think of something else like, for example, life. The first solution drowns the problem in an ocean of inoffensive generalities. . . . As for the second, is it just a “solution?” We do not ever think death, because it is properly unthinkable; however, we can think of mortal beings, and these beings, at the moment during which we are thinking about them, are living beings.
These two ways of deflecting death represent our engagement with the subject when it comes into what Jankélévitch identifies as the central-most frame of consciousness—the frame that he links with the absurd scandalization and sentimentalization that accompanies death. However, this does not characterize our daily relationship with death—a relationship that Jankélévitch describes as omnipresent and omnipotent.

Jankélévitch’s characterization of this relationship goes as follows. First, he associates death with the elevated form of consciousness through which humans define themselves.

L’homme charnel pense seulement à ce qu’il voit. Mais l’homme profond, voyant les présents, pense aux absents, pense à ce qu’il ne voit pas, et qui n’est pas là, et qui peut-être n’existe absolument pas, voit donc, à sa manière, ce qu’il ne voit pas, voit l’invisible par une vue de l’esprit: cette vue surnaturelle ou suprasensible pénètre selon Platon au delà des apparences pelliculaires et s’oppose à la perception de ces apparences comme l’intuition intelligible de l’essence à l’intuition sensible. (Jankélévitch, 1993, 48)

The man of the flesh thinks only of what he sees. But the deep man, seeing what is present, thinks of what is absent, thinks of what he does not see, and what is not there, and what may not even exist. He sees, in his own way, what he does not see, sees the invisible by way of his mind: this supernatural or supersensitive view penetrates, according to Plato, beyond earthen appearances and opposes itself against the perception of these appearances like one’s intuition, knowing the essence of things, opposes itself to the sensory.

This foresight manifests itself as a preoccupation (he uses the term “souci,” which roughly translates to “worry”) about things to come. This even exists for future and present happiness: “Le bonheur est le souci du plaisir. A condition de ne pas survoler le présent, l’homme se plaît à son plaisir, par une complaisance sans mélange; mais il se soucie du lendemain et des conséquences de ce plaisir” (Jankélévitch, 1993, 49).

Happiness is a preoccupation with pleasure. In order that the present moment is not overlooked, man’s pleasure with his pleasure is a sort of unbridled complacency; but he is still preoccupied with the consequences this pleasure will have come tomorrow. If man cannot help but worry about what will happen (for this is the human condition),
and if death is the ultimate “happening,” then by definition, death is the ultimate worry. This does not mean that death is a preoccupation, nor that it is particularly distracting, but rather that it is a worry of a different order—death is a deeply buried, dull, inextinguishable, and diffuse anguish. Because of this:

La réflexion sur la mort n’a-t-elle rien de commun avec une concentration d’attention: l’attention, et surtout l’attention sensorielle, désigne le lieu dans l’espace; c’est-à dire qu’elle repère, localise, détermine le plus précisément possible, en abscisse et ordonnée, la présence de l’objet ou la source du bruit; et elle est analytique en cela; à l’affût des détails elle épie, guette, scrute ou ausculte; sa surveillance s’exerce sur certains objets spéciaux ou sur certains indices suspects et significatifs qu’il s’agit de dépister. (Jankélévitch, 1993, 52)

One’s reflections on death have nothing in common with a concentration of one’s attention: attention, and especially sensory attention, designates a place in space, meaning that it pinpoints, localizes, determines as precisely as possible, in Cartesian coordinates, the presence of the object or the source of the noise; and it is analytic in doing so; alert to details, it spies, looks out, scrutinizes or palpitates; its surveillance exerts itself on certain special objects or certain significant and suspect clues that it seeks to track down.

It is for this reason that, by definition, death must be buried and must be omnipresent: if it were localizable like other events in life, it would not be death, and if it were simply absent, it would belong to a man who ignored his own mortality—this special case is, oddly, something that Jankélévitch never entertains, although we can assume that this man would lead a lifestyle so alien to our own that it would be a stretch to call him human.

Of course, worries about our quotidian life and the diffuse anguish of death mean nothing without a conceptualization of time. Jankélévitch makes this clear when he cites our ability to live beyond a form of present-oriented hedonism: “En d’autres termes, la prévoyance est la forme temporelle de la clairvoyance: la seconde vue de notre double vue est une vision non point “à travers” ou “par dessous,” mais “en avant”; c’est une vision prospective des conséquences, plutôt qu’une vision perçant de l’essence” (Jankélévitch, 1993, 48). In other words, foresight is the temporal form of
clairvoyance: the second of our two views [meaning our uniquely human perspective] is not only a vision “through” or “on top of” but “before”; it is a prospective vision of consequences rather than a piercing vision of the essence of things. He sees time and “becoming” (what humans do in time) as a conceptual intermediary between life and death—insofar as we “become” in time, time is a container of life. However, “la succession des moments condamne l’être en devenir à n’avoir qu’un seul présent, un seul Maintenant à la fois. . . . Le temps empêcherait l’homme d’être en acte à chaque instant tout ce qu’il peut être” (Jankélévitch, 1993, 103). The succession of moments condemns the becoming human to only ever having one singular Now at any given time. . . . Time would prevent the man from being at every instant everything that he can be.

Underlining this paradox more succinctly, Jankélévitch writes:

The future that not only shortens all of the delays preventing one’s vital realization, but makes the impending oblivion retreat, brings us, in sum, towards the oblivion. . . . Ceaselessly charging forward with the human’s self-realization, the march towards non-being affixes to realization the inverse process like a secondary contrapuntal line is attached to the first. . . . Destructor and constructor, time is a death that is a life, but this life is a life that is a death.

It is this dual nature of time that puts man in a constant sense of oscillation between confidence in and fear of his future.
Becoming, which makes one become something else via continual alteration, is thus both marker and detour, good driver and the cause of lateness; the fluid succession of moments, that perhaps no one would call a dialectic, represents rather well this itinerary of fettered unification. Possibility unrealized makes us painfully aware of the negativity of opaque time that bars us from the real and denies us enjoyment; but at the same time it makes the hope of tempting realization flicker in man’s eyes.

This ambivalence is, according to Jankélévitch, the manner by which humans indirectly confront death in their day-to-day life. In making this argument, he borrows significantly from his teacher, Bergson, who wrote extensively on the anxiety of choice in the face of death. Firstly, man is able to occupy himself with a host of trivial problems, some psychosomatic, whose existence allows for the localization of solutions that temporarily fight against the insolubility and non-sense of death. “Les rhumatismes et les impôts sont une véritable aubaine pour l’homme anxieux : comme de simples euphémismes, ils servent à détourner la conversation, entretiennent le babillage qui nous empêche de penser à notre misère” (Jankélévitch, 1993, 55) Rheumatism and taxes are a veritable godsend for the anxious man: like simple euphemisms, they serve to reroute our conversations, facilitating the chatter that prevents us from thinking about our misery. Second, and this is directly from Bergsonian thought, man avoids making choices that confirm the passage of time towards death—that is, choices that reveal their own futility and, by extension, man’s own finality. Jankélévitch writes:

La matière vide, la matière sans matière de notre sourde et générale inquiétude, c’est donc la négativité qui, à la limite et en définitive, bouche les chemins de l’avenir, barre le lointain horizon, empêche les hommes de faire sérieusement de trop vastes projets, ou d’envisager des échéances trop tardives, d’entreprendre à fond et sans aucune arrière-pensée, c’est-à-dire nous décourage d’aller jusqu’au bout et de toucher les extrêmes (car la mort, événement ultime, est elle-même cet extrême). (Jankélévitch, 1993, 56)

The empty subject, the subjectless subject of our deaf and general inquiétude, is thus the negativity that, at the limit, definitively blocks the paths towards the future, bars the distant horizon, prevents men from seriously undertaking vast projects, or from envisioning far off days of reckoning, or from living with reckless abandon and without afterthought. In other words, this
negativity discourages us from taking our pursuit of extremes to the highest order (for death, the ultimate event, is itself this extreme).

Jankélévitch notes that certain people, most notably artists, are able to escape both the reification of the trivial and the banalization of the important:

In the same manner that the man of action would never finish anything without the guillotine of a terminal day of reckoning, the creator would never finish his work were he not limited by time and the living man in general would never reach the end of anything were he not spurred on by death, pressed by the fatal term and intuitive prognostic of his short career: consecrated to the temporary and yet bridled by certain delays, the man whose sentence is commuted for an indeterminate duration becomes capable of undertaking ambitious things. . . . Who knows if furtive glances of death give brief lives their precipitous tempo, their hastening and nervous rhythm, and their pathetic intensity? Such would be the dazzling life of a Chopin, or perhaps a Pushkin.

Unlike Piaget, and rather unlike the Platonic philosophical tradition in which Jankélévitch situates himself, Jankélévitch privileges a certain affective comportment over the commonplace avoidance mechanisms that men use to avoid death and general melancholy that death imposes on life. Frivolity and pessimism occupy a sort of ideological middleground between purblind passivity and sublime serenity: he notes that Pascal advocated a life where one was constantly distracted by artificial and superficial agitations, while Schopenhauer macabrely felt that “la surnaturalité mortelle . . . est comme un relief intérieur de la positivité vitale” (Jankélévitch, 1993, 46) (mortal supernaturality . . . is like an interior relief of vital positivity). However, he argues that these
sentiments require a sort of escapism and even negligence that drastically alters the quality of one’s life. To retain a modicum of normalcy, he advocates a solution that combines seriousness with inner-calm. With respect to the latter, he writes:

Nous avions d’abord envisagé la découverte, dans la positivité vitale, d’une réalité négative qui en serait l’inversion; nous soupçonnions ensuite, d’accord avec le phénoménisme, que cette inversion pourrait bien être le fruit d’une sorte de perversion manichéenne; et maintenant la réalité citériéure de la mort nous apparaitrait plutôt dans une certaine conversion morale de la vie à sa propre et secrète intérieurité. Paradoxalement, c’est cette conversion qui nous donne la sérénité; comme c’étaient la superstition de la plénitude vitale et le refus de reconnaître “l’ombre portée,” joints à la brusque découverte de l’ennemi caché en nous, qui engendraient l’affolement et le désarroi. Le vivant converti à la mort de sa propre vie ne passe pas son temps autrement que le profane; ses affaires ne sont pas différentes, ni ses occupations: c’est l’accentuation et c’est l’éclairage de son devenir qui sont transfigurés. (Jankélévitch, 1993, 59)

First we had envisioned the discovery, in vital positivity, of a negative reality that would be its inversion; we then had the suspicion, in accordance with Phenomenalism, that this inversion could in fact be the fruit of a sort of Manichean perversion; and now the proximal reality of death appears to us rather like a certain moral conversion of one’s life to its own, secret interiority. Paradoxically, it is this conversion that gives us serenity; as if it were a superstitious belief in vital plenitude and the refusal of recognizing the “now-brought shadow” coupled with the brusque discovery of the enemy hidden in us, an enemy that engenders confusion and disarray. The living converted to his own life’s death does not pass his time differently than the profane; his affairs are not different, nor are his occupations: it is the accentuation and the illumination of his own becoming that are transfigured.

This heightened awareness of one’s becoming reduces death to something that is treated seriously—that is, earnestly and honestly instead of laterally.

Sans cesse sur le point de sombrer dans le non-être, sans cesse repêché à la dernière minute et sauvé in extremis de la mort qui le guette, l’être trouve dans le devenir une solution orageuse à son insoluble problème. Grâce au devenir, le tragique du désespoir sera tout simplement sérieux. (Jankélévitch, 1993, 115)

Ceaselessly on the point of foundering in non-being, ceaselessly fished out of water at the last minute and saved in extremis from the death that watches him, man finds in his becoming a stormy solution to his insolvable problem.
Thanks to his becoming, that which is tragic about his despair becomes simply serious.

Or, conversely, a lateral awareness of death (if one can even call this an awareness) abets death’s profundity and pervasiveness, which inculcates the mundane sentiments that one uses to find temporary, but ultimate untenable, relief from the dull pain of one’s own mortality.

The manifold artifices defined above by which we avoid and/or bury death are all ways that humans confront the ultimate epistemological impoverishment (E-) from which they will never be able to escape. With death, the inability and absurdity of constructing a death-space prevents us from even beginning the process of knowledge acquirement, for such an approach requires a destination, and as death is no-where and no-thing, moving towards it loses any type of orientation or meaning. As a virtual space then, death (and more generally O+E-) is the virtual space that humans must construct for an idea without knowledge to be entertainable. Jankélévitch himself hints at the inherent virtuality of this death “space” when he says: “tant que l’être est en vie, la négativité létale reste virtuelle et latente” (Jankélévitch, 1993) (so long as man is alive, lethal negativity rests virtual and latent). Because it is pointless to talk of man being inside this space, Jankélévitch instead talks about the human sentiments that surround this space—be they absurd, defeatist, hedonistic, pessimist, or serene.

7.3 From Piaget and Jankélévitch to Creative Bootstrapping

Having constructed O-E+ and O+E- virtual spaces, this section seeks to determine the extent to which said spaces can influence the development of one’s creative faculties via the process of creative bootstrapping. To begin this argument, I first call the reader’s attention to the assertions by Piaget and Jankélévitch that a child’s development and a man’s rationalizations about death both require a significant degree of intellectual and affective momentum. In the former case, the child is constantly creating its own ontological tools to organize a perceived epistemological fecundity. In the latter, man’s
want of epistemological data surrounding death is precisely that which stimulates
the omnipresent and unflagging inquietude that lurks behind his quotidian problems.
However, this intellectual mobility does not necessarily lead one to the betterment of
one’s creative faculties. To arrive at that end, two issues must be addressed. The first
is a rather pragmatic one—in order for this link between ontology, epistemology, and
creative bootstrapping to have practical relevance, adults must somehow be able to
recreate the sense of mental inertia between O-E+ and O+E- defined in Piaget’s and
Jankélevitch’s work. The second issue is one of similitude; shifting between varying
degrees of ontological and epistemological certitude must be likened to the type of
thought-play that is excited when one is being creative. It should be evident that the
first problem is trivial with respect to Jankélevitch—a recurring theme throughout La
Mort is that adults cannot help but think of death all the time at some level of their
consciousness. However, to say that adults can think like children is more problematic.
While adults can certainly speculate about how children think, this speculation does
not necessarily mean that adults can engage in said thought processes. However,
certain elements of Piaget’s work suggest that such a shift of one’s cognitive frame
of reference is in fact possible. For example, Piaget claims that young children are as
perceptive as adults but cannot yet categorize their perceptions in the way that an adult
would. Furthermore, he claims that older children, via the symbolic game, can craft a
ludic space in which they can freely categorize the world as they see fit. While Piaget
does not offer any suggestions as to when children stop playing the symbolic game, its
fantastical and escapist nature is akin to that which older children and adults attain when
they dream. This suggests that adults, if placed in an environment where their traditional
modes of mental organization were irrelevant, would have nothing to fall back on but
sensorial data. In order to make sense of the world, they would be forced to reason
like a child, forging new cognitive connections between observed phenomena. While
I cannot prove that adults have the capacity to do this, there is no reason to think that
they would have ever lost it—it is simply dulled by years of having tried to assimilate into adult life coupled with their adoption of heuristics that permit them to triage and compartmentalize the otherwise overwhelming diversity of daily external stimuli.

What I must show, then, is that movement along a gradient of ontological and epistemological richness and poorness has the potential to strengthen one’s creative self. Going back to Chapter Four, creativity is (according to Csikszentmihalyi (1996)) “the development of a vision—the pattern of relationships among building blocks.” Bringing this definition into the fold of the present chapter, one can clearly see the ontological (“development of a vision”) and epistemological (“relationships among building blocks”) factors at play in one’s creative work. What is less clear, but vitally important, is Csikszentmihalyi’s use of the em-dash: a punctuation mark that, when used without a trailing em-dash, effectuates a non-sequential, non-conjunctive relationship between two ideas that nonetheless belong together. Csikszentmihalyi is not saying that creativity is either of these things, nor is he implying anything about their sequence in time. Instead, he is suggesting that creativity can be made manifest through quests for ontological and epistemological certitude.

If one accepts that adults’ engagement in the type of reasoning defined above is a manner by which one can become a better creator independent of that which one is creating, one may ask: to what extent can an individual separate the act of being creative from the process of making creations? Insofar as training is meant to isolate and perfect the gestures that comprise a given activity, it is my belief that considerations of ontological and epistemological richness represent a form of training in which one may pantomime the mental process of being creative. This does not mean that one becomes ipso facto more creative by putting oneself in O-E+ or O+E- states for the same reason that stretching is not necessarily helpful for the athlete who does not know how to stretch properly. In drawing this analogy with training, my argument is that
fluid motion through various states of ontological and epistemological certitude has the potential to actuate both the positive and negative eventualities that “training” implies.

As training in a sport centers around a different set of tools and places than the sport proper, so too can one conceive of creative training “tools” that are not necessarily used to make work. The question then arises: How can shifting states of ontological and epistemological certitude be systematized and revisited by one wishing to bootstrap their creativity outside of a work-making context, and how can this virtual space be set apart from other spaces in which creative work is usually made? Chapter Nine suggests a specific “exercise” in the digital space that, I will claim, allows for one form of interactive creative bootstrapping. In order to discuss this exercise, however, it is first necessary to understand the myriad of digital creation tools in which any new assistant of digital creativity invariably situates itself. The categorization of these tools is the business of the next chapter.
In extremis, *all that typewriting can write is the record of its own destruction.*


An authoritative history of the typewriter by Wershler-Henry (2007) shows us the peculiarities of an epoch where an ancient form of cultural production (writing) comes into contact with a new means of actualizing said production (typing). Like many emergent technologies, the typewriter went through a myriad of unmarketable evolutions until the arrival of the first mass-produceable typewriters in the late 19th century. On the tails of the typewriter's popularization came the vilification of its plumitive precursor—the term “slavery” was often used to describe humanity’s enchainment to antiquated hand-writing devices. A host of cultural institutions, from accredited typewriting institutions to the sport of speed-typing, made manifest an interesting collective assumption (dare-say “hallucination”) shared by the Western world; that there existed no benefit of hand-writing that could possibly offset (or at least call into question) the advantages of the typewriter. As is the case for many technologies after an initial fecundity and popularity, market forces encroached upon the conceptual largess of “typewriterness,” and the device became synonymous with the exemplars generated by a handful of industry moguls (Remington being the most powerful). While Wershler-Henry makes no contention that this consolidation spurred a backlash from the typewriter's users, it is interesting that this historical moment also signaled the literati's progressive disillusionment with the typewriter. Its descent into mundanity is encapsulated by Guinsberg’s lament “What can I do to Heaven by pounding on a Typewriter”—besides the text's obvious air of resignation, the capitalization of Typewriter reads as an attestation to its deified status and ubiquitous imprint. Perhaps nothing

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The epigraph to this chapter is drawn from Wershler-Henry (2007, 1).
chronicles this descent from novel to novelty better than the use of the typewriter in high art—Wershler Henry notes the use of the typewriter in Italian Futurism to represent the sound of mechanical progress whereas, by the 1960s and 1970s, it was the object of Fluxus satire and absurdity.

The above summary acts dually as a prelude to the chapter to follow; we will see, in the subsequent sections, a music-composition landscape in digitalia that is not unlike Wershler-Henry’s depiction of the typewriter. I will argue that we are currently seeing a process of convergence that parallels the invention of the electric typewriter in the early 20th century. It is with respect to this landscape that I couch my tool as a sort of left-turn from standard practice—a left turn that affords a critical component of creative bootstrapping as defined in Chapter Seven.

8.1 Composition Tools and Convergence

Several histories,\(^1\) technological/lexicographical primers,\(^2\) and composite-texts\(^3\) exist on the development of electronic and digital composition. To summarize this literature, I will take a different approach than the authors cited above, looking instead at the development of digital technologies from the perspective of technological “convergence.” By convergence, I mean the tendency both for technologies to resemble each other (Yoffie, 1997) and for the needs of disparate user-constituencies (and therefore cultural groups) to also resemble each other.\(^4\) This requires first the establishment of traditional classification schemes used to describe music composition

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\(^1\) See Shapiro (2000), Katz (2004), Evens (2005), Théberge (1997). This latter is particularly excellent, as it focuses not only on the social forces that gave rise to these technologies, but also on the commercial and production forces that aliment said social tendencies. This integrated approach is closest to the one that I will take.


\(^3\) See Leider (2004).

\(^4\) See Paz (2009), Barbero (2009), and Kleinberg (2008).
software, looking then at epochal moments in the developments of these technologies and the markets in which they are exchanged to understand why convergence occurred and what effect this phenomenon has had on musical creators.

As a first step towards explaining convergence, it is important to define key terms in digital technology that will form the bulwark of the hybrid technologies to be discussed in this chapter. These terms represent a taxonomical consolidation derived from (and often advocated by) the survey texts cited above. The first is synthesis/analysis, or the generation and decomposition of signals using digital signal processing. Leider (2004) notes that this tradition stems from non-digital unit generators (UGens) that effectuated basic analog signal processing operations. The majority of contemporary digital unit-generators share names with their non-digital ancestors (Boulanger, 2000), including the mixing mechanisms to make composite processes. The second term is the Digital Audio Workstation (DAW), initially an extension of analog recording technology that has, to a large extent, come to replace its predecessor. Leider (2004) notes that composers use this technology to arrange sounds in time. A third type of compositional technology is the sequencer, discussed at length by Emmerson (2000) and Darter and Armbruster (1984). This is the most popular form of digital compositional technology, mostly due to the ease of use of sequencing devices coupled with the emergent collage-based popular electronica art forms (Butler (2006), Gaillot (1998)). A last form of digital composition technology takes root in a much older tradition of music engraving. No scholarship looks closely at the manner in which composers use digital

5 Note that already here there is a form of convergence at play—the sequencer must trigger something, be it recorded or synthesized sounds. However, in saying sequencer, I am referring to software and hardware whose principal function is the triggering of events.
typesetting to make work, and very little situates this technology in a historical dialogue on writing and engraving practices.⁶

As in the typewriter industry, a single enterprise is responsible for the majority of convergences in the above-mentioned technologies. This industry, Digidesign, created the first commercially marketable Digital Audio Workstation (Sound Designer) whose entry into the market portended an affordable alternative to prohibitively expensive high-end digital recording suites. During the late 1980s and early 1990s, Pro Tools succeeded Sound Designer as Digidesign’s premiere suite, and with the evolution of Pro Tools came two of the most important steps towards industry convergence—the incorporator of a MIDI sequencer into Pro Tools and the creation of a third-party Plug-In API, permitting the incorporation of post-processing (and eventually real-time) unit-generators into Pro Tools (Payne, 2006). These two features of Pro Tools have since been incorporated into and extended by several other DAWs. In 2006, the parent company of Pro Tools (Avid) bought the popular typesetting program Sibelius, which portends the potential incorporation of fully-functional digital typesetting in the realm of the DAW.⁷

This tendency towards the convergence of functionality has been approached from other directions besides the DAW. Leider (2004) notes that CSound has, since its inception, used a sequencer-like syntax to trigger the interaction of various DSP processes. Other contemporary digital music composition software, such as Chuck and SuperCollider, allow for interaction with MIDI sequencing devices and provide several

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⁶ See Powell (2007) for the only extant study on the subject, and it is limited mostly to a study of two dominant technologies.

⁷ To substantiate this claim, the author can only offer a paltry reference to a chat thread in which a Sibelius employee announces “you can be sure that we are working closely together with our parent company on a whole bunch of things” in relation to this question. While this is hardly convincing or substantial, it does suggest the possibility that such a merger of functionality may happen (Spreadbury, 2008).
Table 8-1. Convergence in contemporary musical software. Check marks indicate the domain in which each piece of software began, while dashes indicate the domains into which a piece of software has subsequently spread.

<table>
<thead>
<tr>
<th>Software</th>
<th>Synthesis</th>
<th>DAW</th>
<th>Sequencing</th>
<th>Typesetting</th>
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<td>Ableton Live</td>
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<td>✓</td>
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<tr>
<td>Reason</td>
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<tr>
<td>Reason</td>
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<td>✓</td>
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<tr>
<td>SuperCollider</td>
<td>✓</td>
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<tr>
<td>Finale</td>
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<tr>
<td>Rosegarden</td>
<td>-</td>
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</tr>
</tbody>
</table>

means to script the order of events. From another vantage point, typesetting programs such as Finale and Rosegarden have for nearly two-decades offered MIDI-sequencing abilities and are now beginning to allow multi-track recording to accompany a typeset part, converging towards the Pro Tools model. Table 8-1 shows this tendency through a sampling of popular composition software. While as of 2010 there is only one piece of software that comprehensively provides the functionality of all four above-defined domains, this trend in convergence suggests that the industry will eventually propose suites, if not single pieces of software, that integrate functionalities whose provenance resides in the above-discussed traditions.

Two notable exception to the above-described trend are Max/MSP and OpenMusic. Both projects, developed at the Institut de Recherche et Coordination Acoustique/Musique (IRCAM), were designed for the organization and generation of compositional materials. Their graphical interfaces make the structure of one’s ideas more readily available by virtue of their proximity on the computer screen: visual clumping of media, text, and music allows for thought play in the structural domain independent of an eventual formal result. While other text-based programs such as SuperCollider also allow for the visual organization of ideas through syntax that permits interrelated bits of code to exist in disparate parts of the same document and in different documents altogether, this markup language oriented approach to the generation and organization
of material does not allow for the richness and instantaneity of visual and audio media that can be achieved in graphical programs. However, while ideas can be organized in both OpenMusic and Max/MSP, this is not their express purpose—they both exist for the creation and ordering of material in acoustic and electroacoustic music respectively. The next section will explore this digital lacuna in organization technology, looking at contemporary modes of organizing creative thought.

### 8.2 Tools for Sketching and Organizing Ideas

If the previous section endeavors to weave a coherent narrative through a fecund and interrelated software-scape, this section takes as its point of departure a paucity—the lack of tools whose express purpose is to help the user “organize” ideas. After having reviewed the scant literature that exists on the subject, I will conclude by entertaining ideas as to why the creative community has avoided discussing this issue and what this avoidance means for digitally assisted creativity, especially with respect to the composition of music.

First, one must dispense with a rather trivial but obvious notion of what the representation of an idea is in digitalia. A myriad of programs can be invoked to represent ideas, sketches, drafts, mock-ups, and generally fuzzy conceptions of a thing simply by virtue of the fact that these programs are a priori meant to represent fully formed versions of said thing. For example, should I wish to make an outline of a poem, a collection of musical motifs that will constitute a ricercare, or a set of shapes that will form a piece of web-art, I can make all of these things in pieces of software in which poetry, music, and websites can be composed. Rather than entertaining the idea of how sketches can be made in any one of these systems, I instead endeavor to discuss systems whose express purpose is the containment of ideas that are not, and may never be, fully formed. There are very few articles in the literature that deal
with the issue of *how* digitally-based composers and artists sketch,\(^8\) and those that do are bound to fields whose terminal products *are* sketches. That is, scholarship by Johnson (*2005*) (design) and Elliott and Hearst (*2002*) (architecture) pertain to fields that render a sketch of a thing to someone whose job it is to create a final realization. This is not an indemnification of their efforts—interestingly, the peculiar nature of these fields forces them to take a more sketch-attuned approach in the evaluation of software. It is rather a testament to the fact that sketching, as an activity separate from creating, has yet to come into full fruition in the digital age. This is especially true for music, whose structures and forms are digitally unsketchable unless one chooses to use a piece of software in a way that it was not meant to be used.

Even accepting the fact that sensitivity to the representation of quasimodal ideas has been ill-provided and under-researched in digital scholarship, even when ideas *are* fully formed, the manner in which their relationship is presented is often beholden to a carry-over from non-digital technology. Word processors delimit text by paragraphs and pages because this is how they will be shown in print form. The same holds true for musical scores in part order. Heuristics do exist for the analysis of both documents (ie word counts, key detectors, etc.), but these are considered ancillary to the main functionality of the system at hand. Perhaps the only technology that has begun to break from this model is the Personal Information Manager (PIM), which trades on the ease with which it represents data in multiple ways. But even in this rare example, the poverty of scholarship is astounding—aside from Jones (*2008*), there is no literature that treats the organization of personal data in the digital domain. Even Jones does not fully treat this problem—although his book is intimately inter-wound with digitalia, it is not his goal

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\(^8\) Take Hall and Sallis (*2004*) as an example—while superlatively written, its title is misleading. “A handbook to twentieth-century musical sketches” stops in the 1950s and confines itself mostly to written sketches.
to explore the efficacy of digital containers of information but rather the psychology about why one attaches meaning to information in the digital age.

Thus, absent of any debate on the subject, but not wanting to initiate one for fear of sprawl outside the scope of this dissertation, I will endeavor to explain why such little attention has been given to the digital organization of creative ideas, especially in the arts. The first possibility, which is to-date unstudied, is that creators simply use non-digital sketching and idea-organizing mechanisms, entering digitalia only to fashion full works. Were this to be the case, the question arises—what can digital means offer that traditional idea-hashing ideas cannot? Another possibility, also untested, is that creators make their sketches with whatever tools they use to make a final work, often times leaving backups of intermediary drafts as the only traces of one’s sketchwork. Here, another question arises—are there any aspects of sketching in the same sandbox in which one composes that compromises the conceptual breadth of one’s ideas? A third possibility, linked to the second, is that making sketches has become outmoded with the arrival of digital technology. The interactivity and versatility of a given program may give the creator the ability to test out certain ideas in a manner that she feels is sufficient to have prototyped a work, meaning that she will not resort to other avenues of testing before the final product is created. More research must be done to ascertain which one of these three possibilities holds true in music composition. However, faced with this present lack of information, I make the relatively safe claim with respect to this dissertation that music composition in particular has a wealth of software in which work can be made but no software in which work can be sketched in a manner divorced from that in which it is finally realized.

8.3 "Organizing" Digital Creativity: A First-Order Implementation of Chapter Seven

If digital composition software is going the way of the typewriter, its standardization is reinforced as much by the convergence of features as by the extent to which almost
all programs omit means to effectuate certain crucial aspects of the composition process—namely sketching and idea organizing. But what does this have to do with the business of Part I and digital creativity? Ostensibly, the lack of sketching software poses no problem for the creator of Chapter 3, as she is using digital creators as a means of expression of some pre-existing concept that merely needs to be realized in digital form. For the seeker of creative mediaries from Chapter 4, the majority of composition tools provide no overt mechanism for the internalization of compositional challenges and roadblocks aside from potential design flaws and/or limitations within the program. However, there is a growing tendency for programs to allow for scripting—this is especially true in open source languages based on extant programming languages such as Lilypond (which is based on Scheme) and SuperCollider (which is based on SmallTalk). Scripting is a way to incorporate user-defined constraints into the composition process, especially using some form of controlled randomness. Thus, the composer does have at her disposal a means by which the construction of creative barriers may be internalized in the digital context.

The creator described in Chapter 5, however, has no express means by which she may engage in a form of creative bootstrapping using the tool with which she is working. This problem exists both for the O+E- creator who has an irrefutable internal understanding of that which she wants to create but no intuition as to how this should (or even could) be made manifest and for the O-E+ creator who is attracted to a myriad of data that they feel to be affectively significant without knowing how or why these things belong together and what the best container is for these things. I say “express means” because it is undeniable that composers undergo such searches in countless ways using extant technology—every addition, deletion, and modification in a MaxMSP patch, Finale score, or Reason jam can be seen as a step in this search towards something. However, there is no software that is made expressly to engage composers in this search, which I will argue in the subsequent chapter is facilitated by the initial decoupling
of said process from the creation of a fully-formed composition. While sketching and idea-organization is not the sole domain in which this search can be effectuated, I argue that spaces where one can sketch, organize, and explore one’s own creative ideas are necessary for the process of creative bootstrapping. That is, regardless of the direction one travels along the O/E gradient, the continual re-presentation and re-organization of one’s ideas must be part of this process. Or, in other terms, insofar as creative aggrandizement is predicated on some form of internal “search,” the means by which one traverses this landscape and the supports on which and through which said landscape is made manifest are crucial aspects of any creative journey. At a minimum, one can simply be uncritical about this process. But even the most shallow inquiries into the self require some abrogation of ontological and epistemological disparities, and it is this abrogation from which idea re-presenters and re-organizers as defined above take flight. So, in taking the above-promised left-turn from the convergence of composition software, I endeavor to implement a space where the necessary, though often ignored, business of Chapter 5 can become of paramount importance.

Enter Organdiæ, a tool for sketching musical compositions. And perhaps even a tool for sketching in general. In Part II, which treats the theoretical and practical considerations on which Organdiæ is based, I make no claim that this is the model by which idea sketching and organizing, as defined in this chapter, can be effectuated. Rather, Organdiæ is an implementation of said tool. By implementation, I mean that it provides a sufficient, but not necessary, digital space for idea organization and, by logical extension, represents one means of attacking a necessary aspect of creative bootstrapping—the classification of one’s own creative digital self.
CHAPTER 9
ORGANDIÆ: A PYTHON TOOLKIT FOR CREATIVE BOOTSTRAPPING

Into this, structure and all, anything goes. The structure was not the point. But it was practical: you could actually see that everything was happening without anything's being done. Before such emptiness, you just wait to see what you will see.


Organdiæ is a Python toolkit that aids with the process of creative bootstrapping as defined over the course of this dissertation. Specifically, it allows for assisted composition insofar as it provides composers with a way to organize both structures and forms that vary in their degree of ontological and epistemological certitude. More simply, one may think of it as a space where “precomposition” occurs if one accepts the definition of precomposition, advanced by Mark Applebaum, as a set of processes that lead to the creation of a musical work but would not be considered composition.

This chapter will start with two simple examples that portray a composer who, through Organdiæ, creates structural and formal lattices that act as bases for creative work. The subsequent section will show how Organdiæ can be used to explore two extreme cases that represent the philosophical milieus of Piaget and Jankélévitch respectively.

9.1 A Structure in Organdiæ

Organdiæ’s facilitation of the creation of structure takes its impetus from the graph theoretical concepts discussed in Chapter Six: relationships between nodes are indicated by labeled edges.¹ The nodes may represent anything, including collections of other nodes, allowing for a form of structural nesting. As each node is a Python object, nodes may themselves have rich functionality that is outside the purview of Organdiæ. Certain functionalities are, however, built-in for certain node types: by generating

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¹ These edge labels are only visible in a svg-enabled browser, where they appear as tooltips when hovered over by the mouse.
```python
>>> from organdiae import *
>>> soundlib = ng('sound library')
>>> mysoundlib = soundlib('birdsong sound library')
>>> g = DiGraph()
>>> g.av(mysoundlib)
>>> birdsongs = []
>>> for x in range(10):
...   birdsongs.append(ng('birdsong'+str(x)+'.au'))
...
>>> visoundlib = soundlib('violin sound library')
>>> g.av(visoundlib)
>>> vibirds = []
>>> for x in range(4):
...   vibirds.append(ng('vibird'+str(x)+'.au'))
...
>>> mimick = ng('mimickry')
>>> bs('birdsong')
>>> g.ae(visoundlib,mysoundlib,sb(mimick))
>>> angelou = ng('angelou_caged_bird.txt')
>>> g.av(angelou)
>>> whip = ng('whip−poor−will.jpg')
>>> g.av(whip)
>>> emilie = ng('Emilie Lesbros')
>>> imitator = ng('imitator')
>>> g.av(emilie)
>>> g.ae(emilie,whip,sb(imitator))
>>> loc = ng('summer location')
>>> macon = ng('Macon, GA')
>>> g.av(macon)
>>> g.ae(macon,whip,sb(loc))
>>> me = ng('Mike Solomon')
>>> ub = ng('ubiquitous, recurring thought')
>>> g.av(me)
>>> whip
>>> g.ae(whip,me,sb(ub))
>>> summer = ng('summer vacation 2009')
>>> g.ae(g.g(0,5),me,sb(summer))
>>> gv(g)
>>> pick()
```

Figure 9-1. Coding structure in Organdiae: a rhapsody in birdsong.
Scalable Vector Graphics (svgs) via its GraphViz backend, Organdiæ is able to draw upon web browser technology to allow the displaying of many media. Figure 9-1 shows a simple example of said structuring mechanism’s Organdiæ code, and Figure 9-2 displays this using the Organdiæ GraphViz backend.

It is important to note that this example does not represent a musical work *per se*. Rather, it represents an idiosyncratic structuring of ideas, not unlike Cage’s comment about Rauschenberg’s use of structure. The connecting of ideas in tangential and oblique ways is part of the thought play that goes into any creative process as defined in Chapter Four, and furthermore, making these connections from differing vantage points of epistemological and ontological certitude allows for creative bootstrapping as defined in Chapter Seven. To buttress this claim, Appendix B gives a more elaborated version of an Organdiæ session that led to the creation of a musical work, and Appendix A provides a link to Organdiæ’s documentation for those wishing to learn about and use it. However, for the reader desiring to see the utility of such an endeavor before diving into these more involved and categorical sources, below, I will expound upon elements of Figure 9-1, showing the manner in which this graph acts as a structural container for my own creative thought.

To represent a library of ten birdsongs sounds, I effectuate the commands on lines 7–8 of Figure 9-1. This sequence of commands creates representations of these bird
sounds in Organdiae. Now, they are ready to become part of a structure. One may say that this engagement with the computer starts from a position of O-E+—that is, a fecundity of data whose ontological comportment is weakly defined. This is similar to the *magie ontologique* (ontological magic) described in Piaget (2003); data are non-heirarchically entered into a system in which they do not yet have meaning save the overarching category into which they are entered, called `mysoundlib` in the code. After creating a similar pool of violin sounds, I then connect the bird to violin sounds via the command on line 22 of Figure 9-1. This use of edges in building my graph (`ae` is short for “add edge”)² is similar to that which one would find in mind-mapping, where one links ideas in an arboreal and hierarchical manner. What is unique about Organdiae is that it does not privilege tree structures over other forms of graphs that one uses to represent structure (see Figure 9-17 for an example of a circular structure). By providing a digital forum where creators can grow their structures in manifold directions, Organdiae facilitates the type of lateral mental connectivity described in Chapters Four and Seven.

Equally permissible are the discontinuities that Organdiae affords. Nodes in the graph about Macon, GA and Maya Angelou are, for me, ways to structure thought about birds without being forced to forge connections between things whose relationship remains mystical and opaque. That is, I perceive these ideas as being connected to the extent that I have chosen to include them in the same graph, but at the same time, I have chosen not to define any explicit connection between Angelou and Macon within the context of this graph. This harkens back to the point, made in Chapter Two (Shields, 2003), about the virtual within the virtual; on one hand, all elements in Organdiae are related insofar as they are within Organdiae, but within Organdiae, they can be entirely unrelated. That these thoughts become part of a musical work is incidental to my having represented them in Figure 9-2. Any relation that they have with an eventual piece

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² For more about the functionality of Organdiae, you may visit [http://www.organdiae.com](http://www.organdiae.com).
of music would be made *a posteriori*, if at all. Rather, by virtue of the fact that I am a musically creative person, these thoughts will invariably effect the way that I make work. Their presence in Organdïæ, then, is a manifestation of my desire to attend to them dialectically through technology in hopes that having done so will make me a better creator of music.

Those who are familiar with interactive programming may question the utility of Organdïæ when compared to the native data-organization collection mechanisms, such as lists, sets, and dictionaries, that are offered by most programming languages. Rather than supplanting these methods of organization, Organdïæ seeks to complement them with a set of graph theoretical tools through which users can define idea-containing structures that fall outside the auspices of these languages’ default behavior. In Figure 9-2, for example, clicking on *violin sound library* takes the user to a collection of four pieces of audio. One may liken this means of organization to a set—a group of unordered elements. However, the same data could have been represented by the drawing in Figure 9-3. This radial structure no longer resembles “setness” in the same way that Figure 9-2 does despite the fact that it represents the same idea. By alternating between different structural representations of one idea, the line between the medium and message becomes blurred—rather than assuming that structure is a neutral container of charged elements, Organdïæ’s existence is predicated on the idea that structures themselves convey meaning and that the elaboration of structures has an effect on one’s perception of the information that structures contain. This creates a circuit where the user, in modifying her structural containers, is forced to reconsider the elements held within her structure, which then necessitates new approaches to structure for these revamped ideas. One may say that networks in Organdïæ are partially cybernetic; Organdïæ enables the user to govern multiple structures as they evolve over the process of making creative work. However, a network like this is clearly not as complex as the cybernetic mind that Bateson (1967) describes insofar as it does not
endogenously admit the possibility of randomness (meaning that any randomness within it must be created by the user). Rather, it acts as a sort of sandbox into which elements of a creator’s internal structuring mechanisms can be made manifest through digital technology.

As small as Figure 9-1 and Figure 9-2 are, they show the breadth of possibilities and the limitations of Organdiæ. One can imagine a network containing many more zones of ideas coalescing around certain themes, some of which give way to sub-graphs that have entirely different internal organizations. In doing so, one engages in a process of lateral connection making that engages and ameliorates the creative faculties that are used in composition. Or, in other words, one creatively bootstraps. Organdiæ can even be used for the outright structuring of a composition by representing transformations of musical material. However, “the map is not the territory” (Korzybski, 2000, 750); the vital necessity for Organdiæ to remain a map comes precisely from the existence of other software and media through which the territory (music) is made manifest. At the extreme, Organdiæ provides the composer with a spectrum along which she can define the mapness and territoryness of any given endeavor, shifting between the two as a network becomes more or less related to the actualization of a musical work.

Conversely, the limitations of Organdiæ’s ability to allow for creative bootstrapping in musical structure are similar to those that one finds when suspending one’s disbelief in the entering of any digital (and thus virtual) space. As is true for Second Life, those
who are not willing to become conversant through Organdiæ will simply not use it. Rather than arguing that Organdiæ portends any type of universal utility in what it affords creators, I argue that for the creator who is facile with interactive programming (or is willing to become facile), Organdiæ provides a space through which many of the aforementioned ideas about creativity can be explored.

One last point to note regarding structure in Organdiæ is a hidden level of structural play present via the use of the class inheritance mechanisms discussed above. All of Organdiæ’s objects are classes that, via Python’s metaclass capabilities, can inherit from any Python class and be the parent of any Python class to be created. For example, in the Python terminal, the lines of code shown in Figure 9-4 open an Organdiæ session and create an orchestral inheritance scheme. This scheme can be represented graphically via Organdiæ’s GraphViz backend should one so choose. However, the real power of this structural interplay lies not in its ability to be visualized but rather in its use of object-oriented programming to allow for the sharing of data and the automatic inheritance of properties. For example, Figure 9-6 shows how Organdiæ can encode geographical belonging via class inheritance mechanisms.

While visualizations of structure are invaluable to work-making composers, a visual representation of data is only one way in which relationships may be observed. Object-oriented structuring of Organdiæ classes allows for creators to fully integrate Organdiæ into the manifold creation suites that currently exist in the Python programming language, so that Organdiæ itself can be nested in a larger compositional structure. In Figure 9-7, Organdiæ classes inherit from SuperCollider SynthDefs and can subsequently be used in the creation of audio. The reason that I pay particular attention to this in the present chapter is because this is one of the few, if not only, ways in which
Figure 9-4. Creating orchestral classes, and using Python’s `issubclass` method to verify class inheritance.
Figure 9-5. A representation of the class inheritances created in Figure 9-4.
>>> from organdiae import *
>>> bs('geography')
>>> earth = ng('earth', neighboring_planets=['mars', 'venus'])
>>> north_america = ng('north america', dg=earth, neighboring_continents=['south america', 'asia'])
>>> usa = ng('united states',
    dg=north_america,
    neighboring_countries=['cuba', 'mexico', 'canada', 'russia'])
>>> nj = ng('new jersey', dg=usa, neighboring_states =
    ['pennsylvania', 'delaware', 'new york'])
>>> nj.neighboring_states
['pennsylvania', 'delaware', 'new york']
>>> nj.neighboring_countries
['cuba', 'mexico', 'canada', 'russia']
>>> nj.neighboring_continents
['south america', 'asia']
>>> nj.neighboring_planets
['mars', 'venus']

Figure 9-6. Geographic regions inherit information from their parent classes.

>>> from sc import *
>>> from organdiae import *
>>> sc.start()
>>> osynth = ng('organdiae sc synth', dg=(DiGraph, sc.Synth))
>>> issubclass(osynth, DiGraph)
True
>>> issubclass(osynth, sc.Synth)
True

Figure 9-7. Creation of an Organdiæ object that inherits behavior from SuperCollider classes as well.

structures can be elaborated outside of Organdiæ that have an intimate bearing on its functionality.\(^3\)

\(^3\) Excepting, of course, absurd examples such as structures that cut computers’ power, etc.
9.2 A Form in Organdiae

Any form is a path through instantiated exemplars of elements of a pre-existant structure.\footnote{By “instantiated exemplars,” I mean the ephemeral instance in time that represents a structural idea. A form forms via successions of single sonic realizations of canonical, structural supports such as scores and CD.} Forms are only glimpses of the structures from which they were created and certainly do not suggest the multiplicity of forms to which that structure may give birth. Furthermore, if structures hold pointers to certain objects (texts, sounds, ideas, etc.), a form can only hold single references of these things at one time. With respect to sound, any two playings of a material will be different, and even in the most similar of cases (i.e. fixed media with unchanging atmospheric pressure and no ambient noise), any two hearings of said material will invariably be different. Organdiae is able to represent these transient aspects of form in its ability to focus on certain paths through a structure and to create single instances of structural items by using the class/instance distinction available in Python and most object-oriented languages.

Take, for example, the following collection of ten birdsong materials. Figure 9-8 is a group of proposed forms through those materials. Because the images of these forms are superimposed on top of each other, it is impossible to distinguish which edges signify which formal relationships. To make different successions of events clearer, Organdiae allows for the “compression” of certain formal choices and the “expansion” of others. Figures 9-9, 9-10, and 9-11 highlight three different forms in the network, with the other forms rendered using dotted lines. The extent to which nodes and edges in Organdiae act as containers for smaller events is defined by the user—for example, the “macaw” above could theoretically be comprised of several successive parts of a macaw call, in which case exchanging “single macaw” with “series of notes subdividing macaw” in Organdiae is a straightforward operation as it would be in many sequencing programs.
Figure 9-8. Several temporal paths between different birdsongs superimposed on the same graph.

Form can also be manifest through object-oriented programming by using instances of structural “classes” to show the uniqueness of a particular event. For example, if one were to create three classes representing three audio files, one could then create several instances of each audio file and use edges in the network to represent the sequencing of these instances in time, as in Figures 9-12, 9-13, and 9-14. This conceptualization of classes and their instances is as old as object-oriented programming itself and draws its inspiration from Platonic thought about the form and its terrestrial exemplars: the class is a template for a thing that will exist, and an instance
Figure 9-9. One of three different temporal paths highlighted showing trajectories between bird songs.

draws its meaning from the fact that it exemplifies organization and behavior built into its class.

Thus, in addition to providing a way to represent structures, Organdæ allows for the creation of paths through time, or forms, that can subsequently be made into compositions. Alternatively, these forms can simply be part of structures, meaning that formal connections between temporal events can be a subject upon which one reflects in structuring one’s creative self, thus blurring the line between these two concepts.
9.3 Grey Zones of Form and Structure

Perhaps the most powerful aspect of Organdiae is its ability to allow the user to move between formal and structural signification in quests of creative bootstrapping not unlike those described in Chapter Seven. Because anything can be called anything and subsequently connected to anything, all notions of form and structure are user defined. This allows users to engage in processes of creation that vacillate between the two over the course of a creative process.

Take the Piaget example of a creator who is abundantly stimulated but lacks the ability to forge meaningful relationships between stimuli in the network. Such a network
Figure 9-11. One of three different temporal paths highlighted showing trajectories between birdsongs.

may resemble that of Figure 9-15. To call this a form or structure would be a stretch, but it is certainly something that could become either of those things. Furthermore, just as the child goes through a period of definitional entanglement, so too can a network like this be subjected to definitional impossibilities that resist interpretation and act as their own sort of anti-communicative statement against which the composer is supposed to make meaning. An absurdist approach to structure, complemented by the more “normal” structures discussed above, allows the composer to experiment with what Vaggione (2001) would call alternative ontologies whose prosody could result in the creation of work. Furthermore, the fact that such a conundrum can be succinctly
articulated in Organdiæ triggers a process of creative bootstrapping that transcends the individual work level: forced to make meaning out of absurdity, the composer improvises a response that gives birth to a more stable creative network that acts as basis for several works.

The same is true of the Jankélevitchian model, whereby a developed network of shared meaning points to a region of the creative conscience about which the creator is ignorant. Here, the incompleteness of the graph at its center is hermeneutically problematic: in any part of the structure one can understand the significance of local relationships, but globally the lack of clearly defined loci is the same lack that pushes Jankélevitch to question why, in society, there are so many rituals surrounding a phenomenon about which none of us are ultimately aware. Bringing this idea to the
structure/form paradigm, the lack of a convincing omphalus in the rock→paper→scissor graph acts as a tacit challenge to its creator: rather than grafting meaning onto a network of disparate stimuli, here the creator is faced with pockets of concentrated meaning that ultimately leave some seminal question unanswered. Thought processes such as this do not lend themselves to ‘works’ per se, but they engage a creator in the type of self-criticism that ultimately pushes her to make work from a state that is, to borrow a term from Jankélévitch, serious. That is, the composer searches for an ineffable inner tranquility that comes to terms with a lack of concrete centrality that is subsequently filled with a virtual response.
9.4 Organdiæ as a Revisitation of the Virtual in the 'Pataphysic Hyperreal

If Chapter Two posits the virtual as a subset of the real, then Organdiæ is a virtual tool that allows one to celebrate the genesis of 'pataphysical spaces as an affirmation of the hyperreal. Jarry (1972) defines 'pataphysics as follows:

La pataphysique est la science des solutions imaginaires, qui accorde symboliquement aux linéaments les propriétés des objets décrits par leur virtualité. (Jarry, 1972, 669)

*Pataphysics is the science of imaginary solutions that symbolically accords the properties of objects described by their virtuality to said objects’ lineaments.*

This quote is of paramount importance to one’s understanding of Organdiæ’s purpose: the tool invites users into a consensual hallucination where they may readily confuse real objects (both concrete and virtual) with lineaments of these objects. It is only
Figure 9-15. All the events referred to in Billy Joel’s “We didn’t start the fire” without their historical ordering.
Figure 9-16. All the events referred to in Billy Joel’s “We Didn’t Start the Fire” with a revisionist historical ordering.
by doing this that the space becomes immersive enough to meaningfully attain the ontological magic that Piaget's child feels when discovering meaning between things. Furthermore, it is only by doing this that the centrality, omnipresence, and latency of an idea’s ubiquity can penetrate the consciousness of an Organdiæ user in the same way that death is the fundament of all affective thought in the work of Jankéliévitch. This type of dialectical engagement leads to a hyperreal state as defined by Baudrillard (1981):

La simulation n’est plus celle d’un territoire, d’un être référentiel, d’une substance. Elle est la génération par les modèles d’un réel sans origine ni réalité: hyperréal. Le territoire ne précède plus la carte, ni ne lui survit. C’est désormais la carte qui précède le territoire. (Baudrillard, 1981, 10)

Simulation is no longer that of a territory, of a referential being, of a substance. It is the generation by models of a real without origin or reality: hyperreal. The territory does not come before the map anymore, nor does it survive it. From now on, it is the map that comes before the territory.
The process of simulation that Organdiæ facilitates is pataphorically without origin\(^5\) because we must forget where ideas come from to remember (literally re-member, meaning give them membership again, albeit in a virtual mind) why they have meaning.\(^6\) This process is also without reality because neither O-E+ nor O+E- are real; the former is unreal because it is tautological in its inclusiveness and thus resists comparison, whereas the latter evades reality as a singularity without a supporting lattice of knowledge through which its real vicissitudes can be constructed in anything other than circumambulatory ways. Creative bootstrapping in Organdiæ is thus a \textit{prima facie} after which the territory of a creative work follows. This is a much more optimistic view of hyperreality than the emptiness one feels when reading Baudrillard. It echoes a cornerstone of Deleuzian thought: “to think is to create” (\textit{Deleuze}, 1994, 147).

Through the computer’s assistance, the digital virtual allows creators to fashion their own imaginary hyperreality from which creative work springs forth.

\textbf{9.5 Conclusion}

To claim that this software is in any sense a holistic answer to the epistemological and ontological quandaries raised over the course of this dissertation would be reductionist and unfair to the philosophical breadth of those concepts. As such, this last section of the dissertation is in no way meant to close the debate on these ideas, but rather to offer one way in which they may be considered. Mostly, this dissertation stands in opposition to the idea that computer-assisted composition should exist in a single piece of software that helps move the composer from conceptualization to creation.

\(^5\) Pataphor being a term used by Paul Avion throughout his website, defined in the essay “Closet ’Pataphysics” as follows: “The moment of pataphor occurs when the metaphor has become so embellished it no longer relates to that which it was meant to embellish” (Avion, 2006).

\(^6\) As Davenport (1997) states: “The imagination is like the drunk man who lost his watch and must get drunk again to find it” (Davenport, 1997, 5).
Any such program is ultimately assisting said composer to compose along the terms of engagement that are built into that assisting device, even if said terms are relatively benign and open-ended. Rather, this dissertation seeks to define in broad terms how creativity may be assisted (digitally or not), subsequently offering one virtual space in which certain approaches of assisted composition can be usefully conceptualized. Harkening back to Lévy (2001), digital-virtual phenomena resist totalization by virtue of their expansiveness, and given the expansive nature of the issue at hand, the universe of tools that can treat it is inherently ill-defined and ever expanding. It is the hopes of the author that Organdiae be seen as not the but a tool that aids composers in the continual pursuit of this quest. By doing so, the creator, beyond receiving assistance in the making of a creation, is walking through a process that contributes to the continual creation of her creative self.
APPENDIX A
ORGANDIÆ DOCUMENTATION AND SOURCE CODE

Organdiae’s documentation and source code is available online at:

APPENDIX B
INTERACTIVE ORGANDIÆ SESSIONS LEADING TO THE CREATION OF NORMAN (AGE 7) DREAMS OF BEING A VIOLIN

As explained in Chapter Nine, Organdiæ is a clearinghouse for the creation of structures and forms from varying vantage points of ontological and epistemological certitude. In doing so, issues that seem tangentially (if not entirely un)related to the composition of music are, in fact, pointers to zones of affective meaning that helped me creatively bootstrap my mind so that it could ultimately compose norman (age 7) dreams of being a violin. Other examples of networks in Organdiæ can be found on http://www.organdiae.com.

B.1 July 6th, 2010

```
>>> from organdiae import *
>>> bs('dissertation')
>>> dif = ng('difficult french words')
>>> mydif = dif()
>>> translation = ng('translation')
>>> ng('barbouiller',name=True)
<class 'organdiae.core.core.barbouiller'>
>>> barbouiller
<class 'organdiae.core.core.barbouiller'>
>>> ng('to daub, like shaving cream',name=True)
<class 'organdiae.core.core.to daub, like shaving cream'>
>>> ng('badigeonner',name=True)
<class 'organdiae.core.core.badigeonner'>
>>> daub = ng('to daub, like shaving cream')
>>> daub
<class 'organdiae.core.core.OMrvDEjSMzVh9cIX4BSpQzYaDNM1PXQpnJsUkyx'>
>>> ng('maculer',name=True)
<class 'organdiae.core.core.maculer'>
>>> whitewash = ng('to whitewash')
>>> ng('to get stains on',name=True)
<class 'organdiae.core.core.to get stains on'>
>>> stains = ng('to get stains on')
>>> to
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'to' is not defined
>>> mydif.ae(stains,maculer,sb(translation))
>>> mydif.ae(whitewash,badigeonner,sb(translation))
>>> mydif.ae(daub,barbouiller,sb(translation))
>>> transpairs = [
... ('trapu','heady, strong'),
... ('refluer','flow in the other direction')
... ('chiner','be cheap, be annoying')
```
34 ... ('terne', 'kinda meh')
35 ... ('maroquinier', 'leather maker')
36 ... ('juron', 'swear word')]
37 Traceback (most recent call last):
38 File "<stdin>", line 4, in <module>
39 TypeError: 'tuple' object is not callable
40 >>> transpairs = [
41 ... ('trapu', 'heady, strong'),
42 ... ('refluer', 'flow in the other direction'),
43 ... ('chiner', 'be cheap, be annoying'),
44 ... ('terne', 'kinda meh'),
45 ... ('maroquinier', 'leather maker'),
46 ... ('juron', 'swear word'),
47 ... ('coasser', 'croak like a frog'),
48 ... ('decocher', 'shoot off (an arrow, remark)'),
49 ... ('avoir la trouille', 'be really scared'),
50 ... ('se formaliser de', 'be surprised about'),
51 ... ('fripouille', 'scoundrel')]
52 >>> frng = [ng(x[0]) for x in transpairs]
53 >>> enng = [ng(x[1]) for x in transpairs]
54 >>> len(frng) == len(enng)
55 True
56 >>> for x in range(len(frng)):
57 ... mydif.ae(enng[x], frng[x], sb(translation))
58 ...
59 >>> mydif.p()
60 VERTICES
61 0. maculer
62 1. kinda meh
63 2. juron
64 3. be really scared
65 4. coasser
66 5. heady, strong
67 6. to get stains on
68 7. maroquinier
69 8. swear word
70 9. avoir la trouille
71 10. croak like a frog
72 11. scoundrel
73 12. be cheap, be annoying
74 13. badigeonner
75 14. to daub, like shaving cream
76 15. shoot off (an arrow, remark)
77 16. fripouille
78 17. terne
79 18. trapu
80 19. leather maker
81 20. decocher
82 21. to whitewash
83 22. refluer
84 23. be surprised about
85 24. flow in the other direction
86 25. chiner
87 26. barbuiller
B.2 August 31st, 2010

```python
>>> from dissertation import *
>>> bikeride = ng('bike ride')
>>> mybikeride = bikeride('bike ride home')
>>> ribbit = ng('ribbit')
>>> chirp = ng('chirp')
>>> croak = ng('croak')
>>> powerlines = ng('buzz of the power lines')
>>> mosquito = ng('mosquito')
>>> mybikeride.av(ribbit)
>>> mybikeride.av(chirp)
>>> mybikeride.av(croak)
>>> mybikeride.av(powerlines)
>>> mybikeride.av(mosquito)
>>> mybikeride.p()
```

VERTESES

EDGES

```python
>>> beauty = ng('the most beautiful sound ever')
>>> descriptor = ng('descriptor')
>>> descriptors = ['m_harm37.au', 'haunting', 'harmonics', 'calm', 'contemplative', 'eternal']
>>> life = ng('life')
>>> mylife = life('my life')
>>> for x in descriptors: mylife.ae(ng(x), beauty, sb(descriptor))
```
>>> mylife.p()

VERTICES
0. eternal
1. the most beautiful sound ever
2. harmonics
3. contemplative
4. bike ride home
5. m_harm37.au
6. haunting
7. difficult french words (hash 17128464)
8. calm

EDGES
0. haunting -- the most beautiful sound ever
1. eternal -- the most beautiful sound ever
2. calm -- the most beautiful sound ever
3. harmonics -- the most beautiful sound ever
4. m_harm37.au -- the most beautiful sound ever
5. contemplative -- the most beautiful sound ever

>>> mylife.g(0,7).ilsagitde
'difficult french words (hash 17128464)'

>>> mylife.g(0,7).ilsagitde = 'difficult french words'

>>> mylife.p()

VERTICES
0. eternal
1. the most beautiful sound ever
2. harmonics
3. contemplative
4. bike ride home
5. m_harm37.au
6. haunting
7. difficult french words
8. calm

EDGES
0. haunting -- the most beautiful sound ever
1. eternal -- the most beautiful sound ever
2. calm -- the most beautiful sound ever
3. harmonics -- the most beautiful sound ever
4. m_harm37.au -- the most beautiful sound ever
5. contemplative -- the most beautiful sound ever

>>> pick()

WRITING mybikeride TO dissertation.oie
WRITING mydif TO dissertation.oie
WRITING mylife TO dissertation.oie

B.3 September 10th, 2010
4. buzz of the power lines

EDGES

>>> help(ng)

>>> bosscroak = ng('boss croak', dg=mybikeride.g(0,2))
>>> mybikeride.p()

VERTICES

0. ribbit
1. chirp
2. croak
3. mosquito
4. buzz of the power lines

EDGES

>>> wimpycroak = ng('wimpy croak', dg=mybikeride.g(0,2))
>>> mybikeride.av(wimpycroak)

>>> sequences = ng('sequences')
>>> croaksequences = ng('croak sequences', dg=sequences)
>>> mycroaksequences = croaksequences('possible croak sequences')

>>> follows = ng('follows')
>>> followsshort = ng('follows with a short gap', dg=follows)
>>> followslong = ng('follows with a long gap', dg=follows)

>>> newseq = [bosscroak(), bosscroak(), wimpycroak(),
            ribbit(), ribbit(), ribbit(), ribbit(), ribbit(), ribbit(),
            ribbit()]

>>> newseq = [followslong, followsshort, followsshort,
            followslong, followslong, followslong,
            followslong, followslong, followslong]

>>> len(newgaps)

9
```python
>>> len(newseq)
10
>>> for x in range(len(newgaps)):
    mycroaksequences.ae(newseq[x], newseq[x+1], sb(newgaps[x]))
...
>>> mycroaksequences.p()

VERTICES
0. ribbit (hash 19315536)
1. boss croak (hash 17245008)
2. ribbit (hash 19315600)
3. boss croak (hash 17246256)
4. boss croak (hash 17246320)
5. wimpy croak (hash 17247536)
6. boss croak (hash 17244816)
7. ribbit (hash 19315568)
8. boss croak (hash 19315280)
9. boss croak (hash 19315344)
10. wimpy croak (hash 19315376)
11. ribbit (hash 19315408)
12. ribbit (hash 19315440)
13. ribbit (hash 19315472)
14. ribbit (hash 19315504)

EDGES
0. ribbit (hash 19315472) --> ribbit (hash 19315504)
1. boss croak (hash 17246256) --> boss croak (hash 17246320)
2. boss croak (hash 19315280) --> boss croak (hash 19315344)
3. ribbit (hash 19315504) --> ribbit (hash 19315536)
4. ribbit (hash 19315536) --> ribbit (hash 19315568)
5. boss croak (hash 19315344) --> wimpy croak (hash 19315376)
6. boss croak (hash 17244816) --> boss croak (hash 17245008)
7. wimpy croak (hash 19315376) --> ribbit (hash 19315408)
8. ribbit (hash 19315408) --> ribbit (hash 19315440)
9. ribbit (hash 19315440) --> ribbit (hash 19315472)
10. boss croak (hash 17246320) --> wimpy croak (hash 17247536)
11. ribbit (hash 19315568) --> ribbit (hash 19315600)
```

```
2. contemplative → the most beautiful sound ever
3. haunting → the most beautiful sound ever
4. calm → the most beautiful sound ever
5. harmonics → the most beautiful sound ever

>>> pick()

121 WRITING mycroaksequences TO dissertation.oie
122 WRITING mybikeride TO dissertation.oie
123 WRITING mydif TO dissertation.oie
124 WRITING mylife TO dissertation.oie

>>> gv(mylife)

B.4 September 10th, 2010

1 >>> from dissertation import *
2 >>> mylife.p()
3 VERTICES
4   0. eternal
5   1. the most beautiful sound ever
6   2. contemplative
7   3. harmonics
8   4. m_harm37.au
9   5. bike ride home
10  6. calm
11  7. haunting
12  8. difficult french words
13  9. possible croak sequences
14 EDGES
15   0. m_harm37.au → the most beautiful sound ever
16   1. harmonics → the most beautiful sound ever
17   2. haunting → the most beautiful sound ever
18   3. eternal → the most beautiful sound ever
19   4. contemplative → the most beautiful sound ever
20   5. calm → the most beautiful sound ever
21 >>> dsys = ng('dynamical systems')
22 >>> kees = dsys('dynamical systems with keesling')
23 >>> model = ng('use to model')
24 >>> chirping = ng('chirping choir')
25 >>> mychirping = chirping('my chirping choir')
26 >>> mylife.ae(kees, mychirping, sb(model))
27 >>> mylife.p()
28 VERTICES
29   0. eternal
30   1. the most beautiful sound ever
31   2. my chirping choir
32   3. contemplative
33   4. harmonics
34   5. m_harm37.au
35   6. dynamical systems with keesling
36   7. bike ride home
37   8. calm
38   9. haunting
39  10. difficult french words
40  11. possible croak sequences
41 EDGES
42 0. m_harm37.au --> the most beautiful sound ever
43 1. harmonics --> the most beautiful sound ever
44 2. dynamical systems with keesling --> my chirping choir
45 3. haunting --> the most beautiful sound ever
46 4. eternal --> the most beautiful sound ever
47 5. contemplative --> the most beautiful sound ever
48 6. calm --> the most beautiful sound ever
49 >>> pick()
50 WRITING mycroaksequences TO dissertation.oie
51 WRITING mybikeride TO dissertation.oie
52 WRITING mydif TO dissertation.oie
53 WRITING mychirping TO dissertation.oie
54 WRITING mylife TO dissertation.oie
55 WRITING kees TO dissertation.oie

B.5 September 10th, 2010

1 >>> from dissertation import *
2 >>> ng('gig', name=True)
3 <class 'organdiae.core.core.gig'>
4 >>> ICP = gig('International Composers Pyramid gig')
5 >>> mylife.av(ICP)
6 >>> mylife.p()
7 VERTICES
8 0. eternal
9 1. the most beautiful sound ever
10 2. dynamical systems with keesling
11 3. calm
12 4. haunting
13 5. International Composers Pyramid gig
14 6. my chirping choir
15 7. difficult french words
16 8. contemplative
17 9. harmonics
18 10. possible croak sequences
19 11. m_harm37.au
20 12. bike ride home
21 EDGES
22 0. contemplative --> the most beautiful sound ever
23 1. harmonics --> the most beautiful sound ever
24 2. calm --> the most beautiful sound ever
25 3. m_harm37.au --> the most beautiful sound ever
26 4. dynamical systems with keesling --> my chirping choir
27 5. eternal --> the most beautiful sound ever
28 6. haunting --> the most beautiful sound ever
29 >>> pick()
30 WRITING mycroaksequences TO dissertation.oie
31 WRITING ICP TO dissertation.oie
32 WRITING mybikeride TO dissertation.oie
33 WRITING mydif TO dissertation.oie
34 WRITING mychirping TO dissertation.oie
35 WRITING mylife TO dissertation.oie
B.6 October 2nd, 2010

>>> from dissertation import *
>>> ng('documentation', name=True)
<class 'organdiae.core.core.documentation'>
>>> vgs = ng('Lilypond vector graphic package')
>>> vgsonline = ng('http://www.apollinemike.com/lilypond/vgs/')
>>> mylifeae(vgsonline, vgs, sb(documentation))
>>> pick()

>>> proof = ng('proofs of concept')
>>> sketches = ng('sketches')
>>> vgssketches = sketches('sketches for my vector graphic spanner')
>>> vgssketches.av(ng('gliss.ly'))
>>> vgssketches.av(ng('pick3.3.ly'))
>>> vgssketches.av(ng('down.ly'))
>>> announcement = ng('announcement')
>>> lyannounce = announcement('announcement of vgs to the lilypond list')
>>> mylifeae(vgssketches, vgs, sb(proof))
>>> mylifeae(ng('lymail.eml'), vgs, sb(lyannounce))
>>> pick()

VERTICES
0. eternal
1. the most beautiful sound ever
3. lymail.eml
4. contemplative
5. dynamical systems with keesling
6. m_harm37.au
7. harmonics
8. International Composers Pyramid gig
9. sketches for my vector graphic spanner
10. Lilypond vector graphic package
11. difficult french words
12. calm
<table>
<thead>
<tr>
<th></th>
<th>13. haunting</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.</td>
<td>possible croak sequences</td>
</tr>
<tr>
<td>15.</td>
<td>bike ride home</td>
</tr>
<tr>
<td>16.</td>
<td>my chirping choir</td>
</tr>
</tbody>
</table>

**EDGES**

<table>
<thead>
<tr>
<th></th>
<th>harmonics --&gt; the most beautiful sound ever</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>lymail.eml --&gt; Lilypond vector graphic package</td>
</tr>
<tr>
<td>2.</td>
<td>sketches for my vector graphic spanner --&gt;</td>
</tr>
</tbody>
</table>

Lilypond vector graphic package

<table>
<thead>
<tr>
<th></th>
<th>calm --&gt; the most beautiful sound ever</th>
</tr>
</thead>
</table>

Lilypond vector graphic package

<table>
<thead>
<tr>
<th></th>
<th>dynamical systems with keesling --&gt; my chirping choir</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>contemplative --&gt; the most beautiful sound ever</td>
</tr>
<tr>
<td>7.</td>
<td>eternal --&gt; the most beautiful sound ever</td>
</tr>
<tr>
<td>8.</td>
<td>m_harm37.au --&gt; the most beautiful sound ever</td>
</tr>
<tr>
<td>9.</td>
<td>haunting --&gt; the most beautiful sound ever</td>
</tr>
</tbody>
</table>

**B.7 October 20th, 2010**

```python
>>> from dissertation import *
>>> norman = ng('norman (age 7) dreams of being a violin')
>>> mylife.av(norman)
>>> mylife.p()

**VERTICES**

<table>
<thead>
<tr>
<th></th>
<th>eternal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>the most beautiful sound ever</td>
</tr>
<tr>
<td>2.</td>
<td>norman (age 7) dreams of being a violin</td>
</tr>
<tr>
<td>3.</td>
<td>contemplative</td>
</tr>
<tr>
<td>4.</td>
<td>Lilypond vector graphic package</td>
</tr>
<tr>
<td>5.</td>
<td>harmonics</td>
</tr>
<tr>
<td>6.</td>
<td>m_harm37.au</td>
</tr>
<tr>
<td>7.</td>
<td>sketches for my vector graphic spanner</td>
</tr>
<tr>
<td>8.</td>
<td>dynamical systems with keesling</td>
</tr>
<tr>
<td>9.</td>
<td>possible croak sequences</td>
</tr>
<tr>
<td>10.</td>
<td>International Composers Pyramid gig</td>
</tr>
<tr>
<td>12.</td>
<td>calm</td>
</tr>
<tr>
<td>13.</td>
<td>haunting</td>
</tr>
<tr>
<td>14.</td>
<td>my chirping choir</td>
</tr>
<tr>
<td>15.</td>
<td>bike ride home</td>
</tr>
<tr>
<td>16.</td>
<td>difficult french words</td>
</tr>
<tr>
<td>17.</td>
<td>lymail.eml</td>
</tr>
</tbody>
</table>

**EDGES**

<table>
<thead>
<tr>
<th></th>
<th>lymail.eml --&gt; Lilypond vector graphic package</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>m_harm37.au --&gt; the most beautiful sound ever</td>
</tr>
<tr>
<td>2.</td>
<td>haunting --&gt; the most beautiful sound ever</td>
</tr>
<tr>
<td>3.</td>
<td>contemplative --&gt; the most beautiful sound ever</td>
</tr>
<tr>
<td>4.</td>
<td>harmonics --&gt; the most beautiful sound ever</td>
</tr>
<tr>
<td>5.</td>
<td>eternal --&gt; the most beautiful sound ever</td>
</tr>
<tr>
<td>6.</td>
<td>calm --&gt; the most beautiful sound ever</td>
</tr>
<tr>
<td>7.</td>
<td>dynamical systems with keesling --&gt; my chirping choir</td>
</tr>
</tbody>
</table>
```
Lilypond vector graphic package
9. sketches for my vector graphic spanner -->
Lilypond vector graphic package

>>> ng('material'
... .name=True)
<class 'organdiae.core.core.material'>
>>> mylife.ae(mylife.g(0,14),norman,sb(material))
>>> mylife.p()

VERTICES
0. eternal
1. the most beautiful sound ever
2. norman (age 7) dreams of being a violin
3. contemplative
4. Lilypond vector graphic package
5. harmonics
6. m_harm37.au
7. sketches for my vector graphic spanner
8. dynamical systems with keesling
9. possible croak sequences
10. International Composers Pyramid gig
12. calm
13. haunting
14. my chirping choir
15. bike ride home
16. difficult french words
17. lymail.eml

EDGES
0. lymail.eml --> Lilypond vector graphic package
1. m_harm37.au --> the most beautiful sound ever
2. haunting --> the most beautiful sound ever
3. contemplative --> the most beautiful sound ever
4. harmonics --> the most beautiful sound ever
5. eternal --> the most beautiful sound ever
6. calm --> the most beautiful sound ever
7. my chirping choir --> norman (age 7) dreams of being a violin
8. dynamical systems with keesling --> my chirping choir

Lilypond vector graphic package
10. sketches for my vector graphic spanner -->
Lilypond vector graphic package

>>> mylife.ae(mylife.g(0,9),norman,sb(material))
>>> pick()

WRITING mycroaksequences TO dissertation.oie
WRITING ICP TO dissertation.oie
WRITING mybikeride TO dissertation.oie
WRITING vgssketches TO dissertation.oie
WRITING mydif TO dissertation.oie
WRITING lymannounce TO dissertation.oie
WRITING mychirping TO dissertation.oie
WRITING mylife TO dissertation.oie
WRITING kees TO dissertation.oie

>>> gv(mylife)
Figure B-1. Image of the graph mylife.

B.8 Graphical Results
Figure B-2. Image of the graph mydif.

Figure B-3. Image of the graph mybikeride.
Figure B-4. Image of the graph mycroaksequences.
APPENDIX C
NORMAN (AGE 7) DREAMS OF BEING A VIOLIN

The score for *norman (age 7) dreams of being a violin* can be found on the following website:

http://www.apollinemike.com/norman7

This score was the result of a series of Organdiae sessions, all of which are documented in Appendix B.
REFERENCES


Spreadbury, D. (2008). Re: Sib. 5.2: Integration of sibelius and pro tools?


BIOGRAPHICAL SKETCH

Mike Solomon has earned degrees in music composition from The University of Florida (Ph.D.), Queen’s University Belfast (Masters), and Stanford University (Bachelors). His music explores the manners in which technology can dialogically engage a composer’s creativity by means of analytic and stochastic algorithms.

Mike’s works have been performed at events such as the Sounds New Festival’s International Composer Pyramid (ICP), the International Computer Music Conference (ICMC), and the Society of Composers, Inc. (SCI) Annual Conference as well as numerous events at the University of Florida. He has received commissions from Stanford University and the Township of East Brunswick, and he was a finalist in the American Society of Composers, Authors and Publishers (ASCAP) Foundation Morton Gould Young Composer Awards and the Music At The Anthology (MATA) Festival. He has presented papers at the Society of Music Analysis’s Theory and Analysis Graduate Students’ (TAGS) Day, Music Theory Southeast (MTSE), and ICMC. He recently completed a year-long research residency at the Université Pierre et Marie Curie (UPMC), where he examined symbolic representations of internalized acoustic representations.