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TIME AND INTERACTION: RESEARCH THROUGH NON-VISUAL ARTS AND MEDIA

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Introduction

This chapter discusses the challenges related to arts based research in and through time-based artistic expressions. Even though many of the examples referenced in this chapter belong to the field of musical practice, the issues and challenges they intend to highlight are obviously common to several other real-time scenic and performing art forms. Even art expressions that are not easily associated with the real-time processes of music (e.g. painting, directing, design, etc. as well as hybrid forms converging artistic and technological thinking such as computer-game design and the design of multi-user interactive environments), may in fact prove to have much in common with the time-based art forms.

Although few art forms are unanimously non-real time or real-time, a distinction used below is that between artistic practices that are *embedded in time* (in-time processes) and those that are *contained in time* (over-time processes).[1] For an action to be embedded in time means that the time it takes to perform it matters; that time is a factor whose value is decisive. For example, the difference between reading or writing a book in one day or to do it in one year is not necessarily a difference that changes the meaning or expression of the book, whereas the time it takes to play or listen to a piece of music has everything to do with its expressive qualities: playing the same piece of music in ten minutes or in two hours is likely to make it a very different experience. For this reason it is argued here that there is a difference between a reflection upon the research object as a whole (outside time) and a reflection on the research object as it unfolds in time, and the researcher engaged in arts based research in the real-time arts should embrace and investigate the in-time properties of the research object. Questions relating to the documentation and dissemination of in-time insights are further discussed and a point is made that the outcome of an arts based research that

investigates the complex feedback loops in the time-based arts may be of interest also outside the art world.

The fact that in music *action* takes place *in* and *through* real time rather than primarily *over* time makes it an interesting, and equally difficult, candidate for artistic research. To gain access to whatever information may be hidden in its in-time properties the researcher needs to resist the temptation of falling back on the investigation of the over-time and out-of-time representations of the art work, such as musical scores, manuscripts, transcriptions, etc. Although most musical expressions offer the same temporal complexity, in the practice of Interactive Music, which is briefly discussed in the first section, the man-machine interactions surface the in-time aspects of music in a particularly useful way. As an hint at the compound nature of time a brief overview of temporal multiplicities is given and further on the artistic practice of the author is used to exemplify the research process from within the musical flow, and the feedback between the different aspects of the practice. Finally, turning to Bergson's important writing on memory, it is suggested that even the in-memory (virtual) representation of in-time processes contain and depend on time.

Virtuality and interaction

Both of the two main concepts here, virtuality and interaction, are nested with difficult and sometimes contradictory meanings and connotations. Although they do have significance also outside the field of human-computer interaction this chapter is not the place for an in depth discussion of all of their readings. In the following I will primarily use them as they are understood and used in the context of human-computer interaction in artistic practice.

Virtual reality

When the technology became usable in the early 1990s, Virtual Reality was seen as a great potential for art production (Moser *et al.* 1996; Wood 1998; Dixon 2007). Virtual Reality is a game of deception where there is no extension in space (although there appears to be one) and where existence depends entirely on the interactions between the subject and the Virtual Reality technology. The virtual is disembodied and lacks a general visual component: the fact that users are able to mould their own (virtual) visuality is, after all, one of its great qualities.[2] This visuality may be different each time, or it may be identical to any other visuality, since making duplicates is no problem in the digital realm of the virtual. As technology has advanced its positions in Western culture, the virtual is nearly ubiquitous. To define a Virtual Reality that is distinct from *reality* is almost impossible, because there is a virtual aspect to nearly all activities in the occidental world (Baudrillard 2002: 176–81). Central to the concept of Virtual Reality is the interface through which the user is able to *interact* with the technology and the virtual worlds contained in it, but the aspect of interaction in the field of interactive art and media is problematic as the term *interactive* has to some extent been hijacked by computer interface designers. Though one of its lexicographic meanings is 'reciprocally active', its meaning in the context of computer interface design is more geared towards a methodology of control, than sharing or mutual exchange; aspects

that are central to any human-human interaction. In the reduced meaning of computer interaction the actions of one part, the user, are controlling re-actions in the virtual world, often in a one-to-one relation: one action, one re-action. The ethnologist and cultural analyst Robert Willim (2006: 69–86) looks at the simplified user interfaces of much technology as a means to bring lucidity to sometimes extremely complex systems such as the internet or networked computer games. Habit formation and predictability brings order to an incomprehensible virtual world where a mouse click on a given icon on a computer desktop is expected to result in the same machine response, regardless of the user's preceding activities. Interaction in the context of the real-time arts, however, itself a highly complex system in which actions and responses flow back and forth in constantly shifting feedback loops, is rarely about one-to-one mappings, habit formation or predictability, and artistic interaction is not easily transformed to fit the reduced idea of interaction that technology typically offers. Hence, artistic practice is in need of novel approaches to interface design that allow for an extended view on interaction, and this need may fuel both the practice itself as well as the development of computer interface design.

⟨ one   The virtual world offered to us by modern technology is interesting both in the ways that it connects art and art practice to other research disciplines such as computer science and artificial intelligence in the ways described above, but also in the way that it deviates from the real world. Due to their ignorance of conventions and lack of long term memory, machines are phenomenal individual forgetting devices (Miller 2004) and the absence of an embodied relation between the machine and its operator is consolidating the breach between human cultural heritage and the agnostic nature of the machine. In the virtual world, beneath the predictability of the interface, nothing is hard wired, hence, muscular memory is useless: any one physical movement can have a different meaning each time. Envision the four members of the German pop-group Kraftwerk, standing still and expressionless in front of their keyboards (obviously exploiting their dissociated relation to the machine-instrument). Compare this vision to the physicality of almost any acoustic instrument performer playing live in front of an audience. In an attempt to avoid the temporal and corporeal split between the technology and performer (between body and machine) so particular and well exploited by Kraftwerk, many artists working with computer technology have found ways to circumvent the missing physicality in their virtual tools, either by designing interfaces that allows for more dynamic modes of interaction, or by designing software that models or emulates a sense of embodiment. These efforts derive from the interactive needs of the real-time arts and lead to initiatives and inventions that may inform both the artistic practice as well as our thinking about human-computer interaction; that changes the object of research as well as its context but which also impacts a much wider scope. The lack of context particular to the virtuality of electronic art – digital tools may be infinitely updated and revised after which integral aspects of their original version have been altered and any knowledge related to their earlier edition may have become obsolete – is in this sense an asset in the ways that it forces the researcher to constantly rethink his or her practice.[3] At best it enables novel approaches to artistic problems or issues but, it may equally well participate in creating expressions void of inter-musical (or inter-artistic) references. Approaching this field as a researching musician is a difficult

task and the scientific as well as the social and cultural aspects of the virtual should be taken into consideration.

Interactive music

Interactive music may be seen as the musical representation of Virtual Reality technology. It is music that involves technology and where the responses from this technology are depicted by real-time stimuli from human and/or virtual performers. The intricacy of the dynamics in the relationship between the man and the machine is of particular interest while working with interactive music, and as a sub-genre of computer music it is interdisciplinary by nature (Moore 1990: 24). In the context of arts based research it is obviously important to draw upon knowledge that emanates from related fields of inquiry but it is equally important to re-evaluate those same sources. Historically there may have been a tendency for computer music to lean towards the natural sciences in a way that has hindered the development of the artistic and humanistic aspects of this genre, and for the researcher engaged in arts based research it is important to remember that the primary purpose of the research should not be to manifest theories external to the field but to also critically examine and question the related sciences. Though there may be modes of thinking that correspond to and overlap with the practice, owing to the nature of artistic practice, there will surely be aspects that deviate from it. The concept of time, and the idea of music and other time-based art forms as being embedded in time, is one mode of thinking that leads away from the more traditional scientific methods because the interactions between the artist(s) and the object of research are subject to constant change.

Much (but not all) art production, as well as most other abstract operations at least in their early stages, are over-time activities. Painting a picture, conceptualizing an art installation or writing a musical score are (roughly speaking) over-time operations even if the result, or the instantiation of these art works, may be in-time operations. The American art critic Harold Rosenberg, in a discussion of the aesthetics of impermanence, discusses the art work as an 'interval in the life of both artist and spectator' and continues: 'compositions into which found objects are glued or affixed of from which they protrude or are suspended make art subject to time on equal terms with nature and commodities for daily use' (Rosenberg 1966: 92). Further on Rosenberg turns to action painting where the art object is 'abandoned altogether', replaced by a single act of creation: 'composition turns literally to an event' (Rosenberg 1966: 93). In this latter example we could truly speak of visual arts as an in-time process, although this process is nullified as soon as the result of the event, the canvas, is exhibited as an art work independent of its mode of creation.

It is possible in the example above to link together the action to the object and look at the canvas as a carrier of the (in-time) action that gave rise to it, and to argue that research carried out with reference to this canvas may also include the action and temporalities that were part of its creation. However, when dealing with real-time art forms with or without technology, it is much more difficult to unanimously distinguish the object. The music that is a result of real-time processes such as improvisation, live coding, interpretation, etc., is made up of a volatile substance that is not easily transformed to a researchable entity. While investigating how the virtual sound worlds

of computer instruments, created and edited in real-time, may interact with (or fail to interact with) the real world, the questions pertaining to access and documentation will become important. Although the Western tradition has developed powerful musicological methods to represent and document music visually (Bregman 1994), are there methods independent of time that retain the temporal identity of the object rather than do away with it? Video recordings of performances are a practical method commonly used but it is important to remember that, as opposed to the canvas above, a recording is a representation of the object and not the object itself.

Time and multi temporality

As was stated above, performing music, as well as performance in other time based art forms, takes place *in* time, and I believe it is fair to assume that in these cases there is a difference between investigating 'the object' in-time,[4] while it is unfolding, as opposed to doing it over-time. Hence, the researching artist in these disciplines needs to be able to explore the object in a multifaceted way as a stratum of analytical modes in simultaneous operation, some of which are performed in real-time and some that are performed in non-real-time, accessing the object through documentations of the performance. The question of time is significant as many of these simultaneous processes take place in different time scales or temporal modes. Orchestra conductors are making judgments on the music in the present, based on their knowledge and expectation of what will happen in the future of the music: in the next bar, the next section, the next movement, the end of the concert, the next concert, etc. They are able to simultaneously keep a fish eye view on the piece without losing the details in the process. As is pointed out by Dixon 'theory and criticism in digital arts and performance, as well as artist's own self-reflections, are replete with explanations and analyses of how works "explore," "challenge," "reconfigure," or "disrupt" notions of time' (2007: 522) but the temporalities referred to here are not simply disrupting another temporality (although they do that too), nor do they easily fit into one single 'extra-temporal' category as is suggested by Dixon. They co-exist and operate in parallel with other present temporalities. The ability to simultaneously act in multiple temporalities is not unique to performing artists. It is something we constantly do to various degrees in every day life, but because of the ways in which different temporal and interactive modes unfold in the real-time arts, arts based research may provide unique insights into this complex area.

To the Greek composer and architect Iannis Xenakis, the question of time was of great importance. His views, most likely influenced by his work as an architect, are used here as a backdrop for the ideas of time, memory and temporality discussed later in this chapter. According to Xenakis (1971), non-synchronicity and discontinuity of events in time is what makes the flux of time perceptible: without it, time would remain hidden, illegible and inapproachable. Xenakis also argued, however, that the same music may exist outside time, as a snapshot, as an abstract representation. This representation, when encoded in our memories, or when described as a musical structure (e.g. a fugue), becomes accessible to us as a whole; a whole which we can navigate, jump back and forth in, and sustain at random access. The whole becomes not a succession, but something non-temporal that 'can be viewed as one *time spectrum*

of a fundamental duration' (Roads 2001: 73, my emphasis).[5] This is comparable to the transformation from event to object that was discussed above with regard to action painting and according to this line of thought, even though the activities that lead to the creation of an art work are embedded in time, and entirely dependent on time, another transformation, perhaps an ontological one, forces the art work into its out-of-time representation. That the 'chief attribute of a work of art in our [twentieth] century is not stillness but circulation' (Rosenberg 1966: 93), does not make a decisive difference in this context, as that circulation (in most cases) is an over-time process rather than an in-time process.

That in-time processes such as music are transformed to 'image-representations', or get transformed to their out-of-time representations in the consciousness of performers or audiences, is a common thought that rests on the idea that also a performance work may be seen as an object. In essence, this is also an ontological construct. Xenakis's idea of musical memory as a spatial translation of the musical events contained in it could be traced to his background as an architect, and may have been influenced by his aptitude and sensibility for spatial rendering. If ~~we limit ourselves~~ to the realm of the time based arts; is it really possible that ~~our~~ one's in memory representation of something such as music, that exists and evolves in time, can be represented *independent* of time? And if it is, what is the coupling between time and space that makes the transformations from one to the other transparent; how is the space/time spectrum calculated? These are examples of questions that may be tackled from within an artistic practice in the context of arts based research. Only from within the flow of time is it possible to fully grasp the time-space transformations and their significance, specifically as well as generally. Xenakis's book is an interesting example of an early practice based research project and a document of a composer's view on questions such as time and temporality in music and they are interesting precisely because of his strong relation to the spatial dimensions.
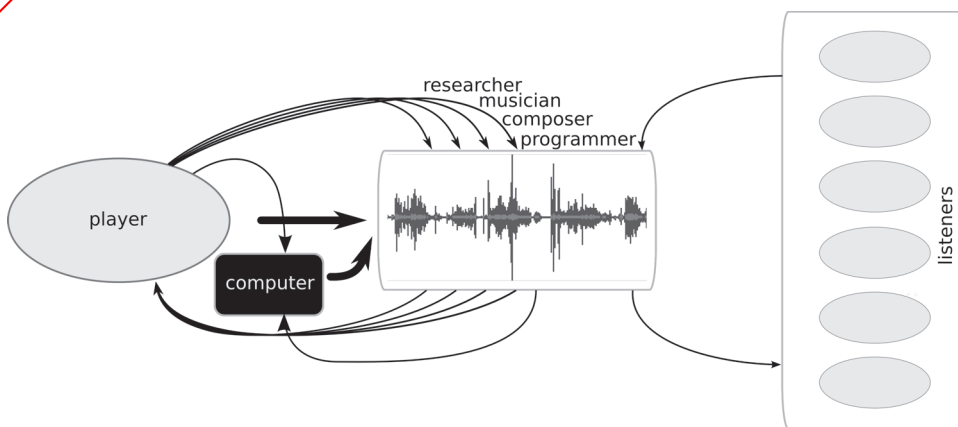
[A] one limits oneself

Figure 16.1 A simplified graphic representation of an instant of an improvised performance with an interactive computer. The performer is reflecting upon the output in several different modes of thinking (represented by the arrows leading from the performer to the sound). The feedback of the reflection is represented by the arrows leading from the sound back to the performer.

Performing in practice

Something that is embedded in time will always be difficult – but not impossible – to conceive of as an object (though object is a misleading term here), independent of its temporal context. Despite Xenakis's argument to the contrary, I will argue that this ~~I~~ we 'object' will not easily transform itself to a spatial representation, mainly because in the real-time arts it is not just the order of the events and the speed at which they are deployed that matters and that gives this object its character. Just as important are the many interactions between the many different agents that play a part in the construction of the in-time event. The performer/researcher working in the field of arts based research should resist the temptation of objectifying the in-time performance and instead embrace the possibilities and the great challenges that lies in investigating the in-the-moment, unfolding, real-time, processes of creative and interactive activities. Their in-time aspects, such as their physicality, and inter-subjectivity, are primarily accessible from the inside, from within the creative activity and they risk losing their identity if they are instead looked upon as over-time processes, resolved of their 'in-timeness'.

Performing research in-time is a difficult task, but for arts based research in time based arts to be different from e.g. standard musicological research, the practitioner and researcher has to face these difficulties and attempt to access the object from the inside. The means both doing it, and the methods by which it can be done, will inevitably have to differ depending on the nature of the practice. Investigating and acknowledging the differences between divergent temporal domains and temporalities is a prerequisite, regardless of the discipline. In other words, to engage in arts based research, accessing the object of research as an in-time process constitutes an activity that may offer an interesting alternative to the otherwise dominant visual modes of research expression. To visualize a flow of time, i.e. to perform the kind of time/space transformation as was suggested by Xenakis, is admittedly a powerful and pedagogical trick, but it is a transformation of an
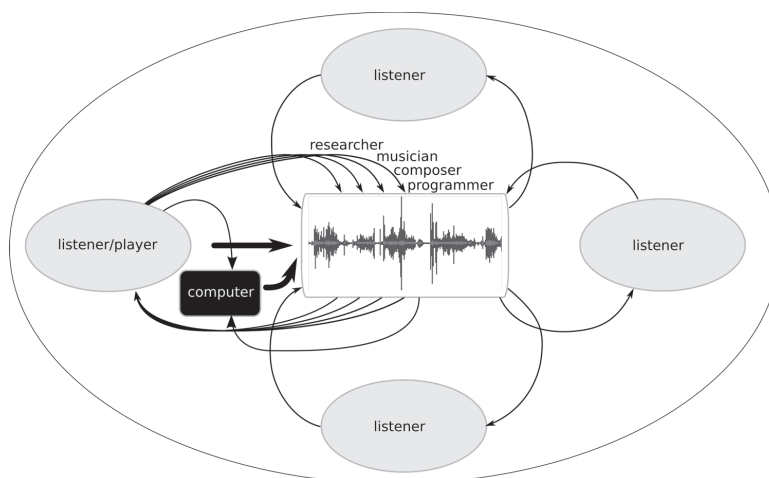

Figure 16.2 A modified version of Figure 16.1, in which the linear conception of a producer and a group of consumers is replaced with a distributed 'sphere' of listening.

in-time process to an over-time process, and in the shift, temporal, interactive, as well as other kinds of information is bound to get lost.

Performing reflections : Henrik Frisk

As a performer, engaged in an actual performance with an interactive computer system, and simultaneously a researcher, I combine several different roles and disseminating processes at once. As can be seen from Figure 16.1, I at once access and evaluate the object in different modes of thinking relating to the different tasks I carry out, or have carried out in preparation for the performance (as a programmer, a musician, a composer, etc.). The object in this case is simplified to constitute the bare audible trace left by what I and the computer produce together. In the same way as the conductor, the evaluation is simultaneously done at different rates and against different inner 'templates', expectations or value judgments (of which some may be downright banal). Is this note in tune, is this good music? Does this work against the pre-conceived form? Is this computer programme functioning the way it should. Will this work in the next concert?

In addition to the performance specific reflections, in arts based research there is also the research activity. In my own experience the point of intersection, the convergence, between the in-time music and the research upon that process, is an area that is laborious to navigate wisely and honestly. It is easy to get lost and it is easy to get drawn outside the temporal flux so particular to musical practice. It is always tempting to detach the research from the in-time process and let it operate in its own temporal mode, more closely related to how musicological activities are carried out. Intimidating questions relating to the validity of research performed from within *bad* art (i.e. bad art but good research) makes the task even more difficult for the researcher (if at all possible, no artist researcher will ever be proud to have performed excellent research but bad art). However, many of these distracting questions relate to the (false) idea that the researcher could somehow be distinct from the performer, as if a Cartesian split between the rational investigator and the unpredictable creator was possible and desirable.

In Figure 16.2, representing a slice of time of a performance, the trajectories of reflection create a feedback loop between the object of research and the musician. A corresponding loop may also be found in between the listeners and the music, representing the listener's reflections upon that same music as it takes place in real time. Although it is unlikely to be entirely synchronous with those of the performer, provided the performer and the listeners share some musical references or have a common cultural ground it is conceivable that some of the reflections made by the listeners will overlap with some of the performer's. It is as a listener I (as a performer) am able to reflect on that which I play and in that sense the audible trace, although produced by me, is a shared object of reflection for both myself and the listeners.

In this view of our interactions, the producer-consumer conception of performer-listener is resolved in favour of a relation more geared towards an inter-subjectivity. Marcel Cobussen, in his book *Thresholds: Rethinking Spirituality in Music*, discusses listening and suggests an understanding of 'listening to music' that really means 'listening *to and fro* music' (Cobussen 2008: 135, emphasis in the original). When

experienced, this oscillating movement of coming and going moves beyond the idea of the listening subject and the sounding object. According to Cobussen, 'to listen to and fro de-centres them, wipes them out'. Through the shared act of listening the subject-object divide between the listener and the sounding object is erased, and the producer-consumer distinction between the performer and the listener is blurred. If the performer is a listener among other listeners, the traditional view on a flow of communication from a creator to a listening subject indeed becomes difficult to maintain. Instead we may consider the image of a group of listeners in which some members are *also* performers and creators (Figure 16.2).

Interaction and feedback

According to improviser Vijay Iyer, the sense of 'shared time' is an important property of music listening and is a crucial aspect of musical improvisation. Listening to a performance of improvised music is to experience the improviser's real-time struggles, their in-time processes. Also to non-dance oriented music, listening to music is a co-performance, a 'participatory act of marking musical time with rhythmic bodily activity [which] physicalizes the sense of shared time, and could be viewed as embodied listening' (Iyer 2008: 276). According to both Cobussen and Iyer, the interactions between the agents at play (listeners, performers, creators, etc.) are central, not only at each end of the flights of communication between the agents involved, but also in the continuum *between* them. Applied to the context of arts based research this would mean to complement introspective reflections and reflections on the object with an investigation of what goes on in the interactions with the listeners/viewers, the technology in use, the other performers, or with any other zones that influence the artistic practice.[6] Before looking at the aspect of multi-temporality within these interactions, however, I will briefly return to the nature of the in-time reflections in the imagined performance sketched in Figure 16.1.

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In the interactions and feedback loops between the performer and the audible trace in Figures 16.1 and 16.2, it is difficult to separate artistic evaluations and reflections from those that are research oriented. Or, perhaps more accurately described, also a research oriented reflection may very well result in an alteration of the object, an alteration that changes the output. The in-time research oriented reflection resists the theory versus practice divide in that it operates in parallel to the practice, and as such it undoubtedly also has an impact on that upon which it reflects.[7] Not all art practice is arts based research but all arts based research performed in-time in the ways described here will alter the artistic expression in some respect. Furthermore, the research activity may constitute meta-reflection, reflections upon purely musical reflections (e.g. why is it important that this note is in tune?) forming compound reflections of both an artistic and research oriented nature, further influencing the present and future expressive qualities of the creative work. In other words, although the trajectories of reflection may be distinct from one another, their responses are not.

The different temporalities of the elements involved in an interactive performance are important to understand and acknowledge for the arts based researcher. A computer, as a concept and before engaged in an interactive performance, may be seen as the ultimate representation of an over-time process: its operations are almost entirely

independent of time. The need to understand and evaluate the reasons for the changes in the computer output as well as the changes themselves in an interactive computer performance, is without a doubt one of the more challenging aspects of being an artist engaged in real time digital art forms. It involves having to evaluate the abstract and largely outside-time functionality of a computer programme in performance, while simultaneously engaging in the temporal flux of the in-time progress of the output. Using and writing computer programmes to be used in interactive performances are difficult tasks. To hold different temporal representations active at the same time may be second nature for a musician, but the added aspect of the interactive computer makes it both more complex to understand and more difficult to perform. However it may also help the performer-researcher to understand and acknowledge these different temporalities, not least through the range of documentation possibilities it offers and which may be explored by the researching performer.

Interacting with the virtual

The almost mystical sensation of simultaneously being able to be in time, 'now' and in memory – in the recollection of a previous now – is an important and powerful aspect of time-based arts in general and music in particular. Imagine listening to a well known melody being played. As the melody is unfolding there is a perpetual interaction between its in-memory representation and its real-time representation. Sometimes, if the memory of a particular piece of music is really strong, it may overshadow the real life version of it and conversely, if the performance is powerful and expressive it may overwhelm the original memory, overwriting it with the new version. As was discussed above, it is tempting, and practical, to gather musical events into larger structures (e.g. notes into melodies, movements into symphonies, songs into song-cycles, etc.) and regard them as singularities, as image representations of what they represent. As such they would have no reference to time. Their temporality would get transformed into a kind of spatiality, and conceptually they would approach a representation of infinite time (Roads 2001), or as Xenakis put it, time is abolished in such structures: 'one could say that every temporal schema, pre-conceived or post-conceived, is a representation outside time of the temporal flux in which the phenomena, the entities, are inscribed' (Xenakis 1971: 264). They become virtual translations of the original in-time representations, similar to how the resultant canvas of action painting may be seen as an outside-of-time representation of an in-time action. But if time really is abolished, how is it that we can keep track of such time specific data as duration, and silence, in our memory of representations of music, plays, movies, etc.? This question is not merely of theoretical or philosophical import; it has great impact on the way we understand and execute practice based research in the real-time arts. To examine an artistic practice from within – as opposed to examining it from the outside – we need one needs to be able to access the object in real-time. And to gain access to it in real-time it is necessary to understand what real-time is relative to non real-time, i.e. in-memory representations.

In the survey of memory and imagination in Paul Ricœur's seminal book *Memory, History, Forgetting* (2004), in the first chapter he critically discusses Husserl's concept of memory in general and the ideas of retention in particular.[8] The duration of a musical
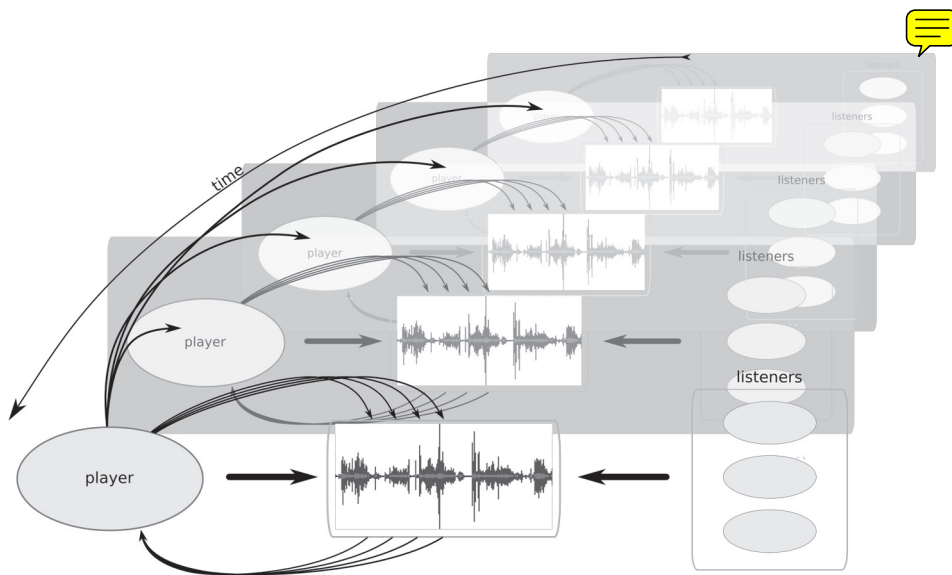
Figure 16.3 The imaginary performance as sketched in Figure 16.1 with the addition of time. Past events are fading out but held on to by the in-time perfo[...] as is represented by the arrows pointing back into previous nows. It should be noted that this is a extremely simplified graphic representation of phenomena that are infinitely more complex.

note is used to address the question of what means for something that endures to remain (but any other event unfolding in time may equally well symbolize the phenomenon). And this is indeed at the heart of the matter for the present discussion: when in music, or any other real-time art form, ~~we perform~~, there is a complex interplay *[one performs]* between creation and duration and the elements that make up the art work has both a virtual, in memory, and a real representation. These entities endure and as they develop in time they create duration.

How is this possible? How can the present 'now' and the memory of the past 'nows' coexist? How can the memory of the preceding now co-exist with the memory of a 'now' six months ago? Husserl, using ~~with~~ the sounding note as an example, states that the note, as it is played, makes the now perceptible, and, as it continues to sound it 'has an ever new now, and the now that immediately precedes it changes into a past'. The 'ever new now' is what constitutes the modification in the perception that constructs the duration. The 'now' that is pushed back by the 'new' now however is not disappearing but is held on to, and it is this 'holding on to' that Husserl labels *retention* (Ricœur 2004: 32). Hence retention is, in a manner of speaking, a way to hold on to the note while it is sounding; as a modified perception of it. The new now, that can never become the 'real' but one which can trail the present, and can be experienced almost as if it took place in the real domain as a virtual (re-)presentation moving alongside of, or being pulled by, the real in a continuous flow in time. The real and the virtual as sketched above may further be seen as modes of perception: outwards, listening to one's own or others' sounds as they disclose in time, and inwards, listening

to past experiences and memory representations. Both of these modes continuously co-exist and interact with one another.[9]

The double reflection; reflection upon that which is present in a 'now' and a reflection upon past experiences and memories, is by no means particular to the field of musical practice and it should be of interest to the a[...]ased researcher to explore the difference between these two modes of reflection although it may raise some methodological concerns. As mentioned above, video documentation has proven to be useful, but even with a video and audio recording of a performance, unwrapping the different processes and their influence on the events may be difficult.[10]

Memory

According to Henri Bergson, we can look at the present-past axis as an inverted cone (like an ice-cream cone) where the tip is the present and the other end represents the oldest unconscious memories. Each segment of this cone represents a virtual plane, a region in the past (Bergson 1991: 170–232). In Gilles Deleuze's reading of Bergson each such region contains the totality of the past in different levels of contraction or relaxation, and at any time one can make a leap to any segment of the cone, to any past memory, bringing it back into consciousness (Deleuze 1988: 60). The cone is not to be understood as a storage device in which memories are put, slice by slice in succession, but rather it is an abstract visualization of the human capacity to place oneself in the past, while still having access to everything prior to that particular point in time, as well as everything past it. 'It is in this sense that one can speak of the regions of Being itself, the ontological regions of the past "in general", all coexisting, all repeating one another' (Deleuze 1988: 61). The cone symbolizes a dynamic process, more dynamic than the image can represent, because there are several motions in simultaneous operation. While the base of the cone remains still, the tip of the cone, which at all times represents the present, moves perpetually along the plane of existence 'of my actual representation of the universe' (Bergson 1991: 152). If this is the horizontal movement there are corresponding vertical movements where pure memories are descending down to the tip, to where action takes place, and images from the present are ascending up into memory (Lawlor 2003: 47–8). In other words, one has (at least) two contrasting movements, one of the cone moving on the plane of existence and one inside the cone affecting the level of contraction at any virtual plane within the cone. Hence the virtual plane of memory is not a static *image* of a time in the past, but a constantly changing one. Following this conceptualization of the relation between the present and the past, the idea of a temporal schema outside time that Xenakis brought forth should perhaps be questioned. Does not the memory of a musical event vividly hold on to the temporal aspect of its origin? Is it not so that the temporal relations between the events contained in a memory matters to its representation?

The virtual planes of memory discussed above are likely to be linked to the virtuality present in all artistic creation. Common to both the virtual planes of memory and to the virtuality of art practice, with or without technology is that, although they generate visual elements and images, they do not depend on them. While the mental leaps back and forth between the present and the past is a natural component to all performing art practices the jump to a virtual plane of the past in the spur of the moment of the

performance may also create an unsurpassable breach: an ontological difference that, in the best case, fuels the performance and takes it to new heights, but at its worst, detaches it from the logic of the present. Under such circumstances the virtual plane fails to actualize itself and remains trapped in the memory of the performer(s).

In Figure 16.3 the slice of time discussed earlier is now put into the context of a *flow* of time. Past events are slowly sinking into retention while the reflective listener-performer is able to make leaps back in time. Although only the activities of the performer are plotted, similar leaps back in time are obviously also performed by any given listener. Furthermore, it should be pointed out that the figure is a very rough image of *some* of the processes going on. That time is of great importance to the real-time arts is perhaps self-evident, but the argument that has been pursued throughout this chapter is that the ways in which time operates in performance is of importance to the way arts based research may be carried out in these art forms, and that research in this field may further our understanding of time and temporalities in more general terms. Many of the central issues that, for example, improvising performers (in any art form) learn and conquer, such as sensitivity to the other, synchronicity, timing, dialogue, interaction, embodiment, entrainment, etc., are concepts that are of great interest to both the natural and social sciences.[11] If arts based research is able to unlock and communicate some of the aspects concerning the in-time properties of their practice, many other research disciplines may benefit from and seek to further explore this knowledge.

Summary

The distinction is obviously not clear cut between in-time and over-time processes in art. Most art practices, as has already been pointed out, begin with some kind of over-time process in its preparation stage. Even improvisatory practices, which depend extensively on in-time activities, commonly involve stages of preparation in which constraints and limitations are set up. By introducing the interactive computer in this context the over-time articulations (artistic structures, constraints, form, etc.) may be brought into real-time performance, hence a layer of complexity is added for both the performer and the researcher. In the words of Susanne Kozel (Chapter 12) the computer may provide a structure that, in the interactions with a performer, constructs 'a topology of meaning'; in itself a valid metaphor for the holistic nature of the interactions between in-time and over-time processes that have been discussed in this chapter.

Over the last three or four decades a number of successful interactive art works have been produced, surpassing the limitations and quirks of digital systems. The 'ideal' interactive performance system may hide its abstract functionality or may display its full power; it may be the invisible, virtual performer or it may be the dominating force in the interplay with human performers. Considering the great range of expressions that have emanated from interactive technology over the last decades, from a purely artistic point of view there is no need to worry about the computer as a tool or vehicle for artistic production. Although there are a number of ways in which digital technology may be useful in artistic work of all kinds, of particular interest to the present discussion are the ways in which real-time art practices may have needs and place expectations on

the technology that will impact on its development. That the corporate world and the applied sciences have looked towards the arts for many years is no news. In 1970 the photocopying and computer company Rank Xerox started Xerox PARC, an entire laboratory dedicated to experimental and artistic work based on the products they developed. The telephone company AT&T's research department Bell Labs, where the foundation for present day information technology was set out, similarly let composers and early sound artists such as James Tenney and Jean-Claude Risset work in their laboratories. And still today it is not difficult to find calls from the applied, natural and social sciences to the world of artistic practice for expertise on various matters. In particular the field of human-computer interaction seems to ask for input from artists. In a study on perception and performance in both human-technology interaction and music, authors Kirlik and Maruyama (2004) comment on the fact that 'design and training in many socio-technical systems proceed all to often as if "doing it by the book" or working "like a machine" were admirable qualities'. Their hypothesis is that by turning to musical practice, in particular musical improvisation, the design and understanding of the social aspects of human-computer interaction systems can be greatly improved. Designer and scholar Aukje Thomassen similarly mentions music as a means 'to fully research the applicability' of the flow heuristic explored in her thesis and concludes that interdisciplinary work is needed and 'the major disciplines are the field of social sciences such as psychology and cultural studies, but also the field of the arts in particular music and fine arts' (Thomassen 2003: 239). Furthermore, according to authors Engeström and Escalante, there is a tendency to limit the thinking about human-computer interaction to 'microlevel interactions between programmers or users and computers. The broader social forces and structures that constrain such interactions and are themselves reproduced and moulded by microlevel events are often left unexamined.' Arts based research in the real-time arts has much to contribute here and may provide a useful alternative to the 'naive image of human-computer interaction as narrowly technical and as a problem of cognitive optimization' (Engeström *et al.* 1996: 325).

These are examples of areas in which arts based research in the real-time arts may interface with other research communities, and although there has been a general tendency on the part of the natural sciences to employ an overly romantic view of artistic practice, requests like the ones cited here should not be neglected. That the results of arts based research may not harmonize with (scientific) expectations is beside the point: there is an expectation that knowledge specific to the field of artistic practice may be useful in other, related fields of research. More specifically, because of the high demands they impose on technology and due to their largely non-traditional methods, the real-time arts involving computers have great potential to inform the more general field of human-computer interaction research in ways that other research disciplines may not be able to do; not least, in the ways that time and memory is dealt with, and in the ways that the abstract, non-temporality of the computer has to be tackled.

It will always be tempting to approach the object of research as a whole rather than as a distributed agglomeration of interactions but throughout this chapter I have argued that understanding the mutual influence of the in-time and over-time aspects of artistic practice is of great significance for the researcher engaged in arts based research. Furthermore, I have stressed that the use of interactive computer technology is of interest to the topic of arts based research in that it foregrounds issues pertaining

to time and temporality in the context of real time arts, but also in the ways that it offers connections to cognate research disciplines.

Coda

Considering the important role perception, reflection, and sensibility to visual and auditory stimuli plays for artists in general and for the researching practitioner in particular, it should be of interest and value for the researching artists to further the study of phenomena relating to time and interaction. Regardless of whether the practice involves technology or not, both the constructive and receptive phases of artistic processes are of interest here, particularly if the research is performed in an interdisciplinary environment in interaction with, for example, the behavioural or computer sciences or, for that matter, in collaboration with other artistic disciplines. The scholarly study of computer games, an emerging field of inquiry that Dixon called 'game performance theory' (2007: 621), may be a discipline of interest to the artistic researcher ~~but also the computer game designers themselves~~. Both the programming, and the practice of playing them, are interesting arenas for exploring ideas relating to time. The way that computer games create the illusion of immersion, and the way that they often participate in disrupting the time-space relations, makes them appear as contemporary and virtual incarnations of the *Gesamtkunstwerk*, and for Richard Wagner questions connected to time and space were foregrounded, at least towards the end of his vast production. In one of the central scenes in his opera *Parsifal*, the protagonist's mentor Gurnemanz mystically explains to him: 'Du siehst, mein Sohn, zum Raum wird hier ~~Zeit.'~~ (You see, my son, time here becomes space). In a commentary to this scene, German composer Wolfgang Rihm points out the brilliance in the way Wagner stages the time to space transformation. It is not made by a sudden move but rather as a seamless transition, like a walk through a long series of infinitesimal transformations. (In a common staging, along with the music in this passage, Gurnemanz and Parsifal are slowly walking towards a changing landscape, backs turned to the audience.) When portraying the time to space transition, Wagner resists the non-temporal aspect of space to which Xenakis alludes, and focuses on the movement for, as Rihm states, the perception of space requires movement (Rihm 2001).

To Rihm, time is movement. In a constant motion, events are sinking into time (similar to the way the concept of retention was described above), and, according to Rihm, in the process that which ~~we label~~ musical material is constructed. If musicological research has been focused on describing that material, arts based research should, among other things, be focused on the motion that precedes it. Furthermore, that knowledge will not only be of interest to the practice itself and to the general field of art practice, but is also likely to be of interest to related fields of inquiry such as human-computer interaction and social practices. In an interesting commentary on Heidegger's essay *The Question Concerning Technology,* Aden Evens concludes that 'art provides the best forum in which to pose and re-pose the question concerning the digital. […] Art pursues invention and so explores the limits of its media to forge new possibilities and discover unexpected directions' (Evens 2005: 82). It is the responsibility of arts based research to make these possibilities, discoveries, and directions available to the researching community.

Notes

1   I am indebted for the in-time versus over-time terminology to Vijay Iyer (2008) who refers to it in a discussion on embodiment in improvisation. For the original source along with a few additional on the topic of robotics and cognitive science, see Smithers (1996; 1998), Gelder (1998).

2   Compare William Gibson's famous definition of Cyberspace as a 'consensual hallucination' (Gibson 1984).

3   That this may equally be a frustration is described in Ostertag (2002).

4   Let the object, for the moment, encompass all and any aspects of the artistic practice.

5   See also Stockhausen (1957).

6   Cf. Chapter 10, in which the project Bodies in Flight describes the contemporary human as interstices in-between various discursive fields and their related technologies.

7   Also compare to how Susanne Kozel (Chapter 12) writes that 'innate to performance is the ability to reflect on what we are doing while we are doing it. I practice, and I reflect upon practice in infinitesimal loops.'

8   The full meaning of this concept, and the significance of Ricœur's thinking upon it, is far beyond the scope of this chapter. I use these sources as inspiration and I do not intend to unpack a full philosophical discussion on time.

9   Henk Borgdorff similarly speaks of a reality of the art work that 'precedes any re-presentation in the space of the conceptual' (Chapter 3).

10   Evidence of this may be found in a study performed by the author in collaboration with Stefan Östersjö and described in Frisk and Östersjö (2006a; 2006b). Despite numerous analyses of the video material it took us over six months working on the study to realize we had continually misinterpreted what had really been going on in the documented session.

11   For an example in which research in organization theory turns to improvisation as a method, see Lindahl (2003).