On Composing a Medium

The art of a dreamer requires more than
the adaptability for survival.
One might have to refuse to survive under certain
condition in order to construct an alternative.
"Survive!", advised he, who has survived. He could be
the dreamer's nightmare.

Introduction and Background

When we speak of technology we often focus on tools and techniques. They are easier to refer to, due to the conventional ways of making references by turning to the namable objects and well-defined methodologies. However the primary inquiry of technology is in forming questions, generating cases, and creating problems that may not fit in existing paradigms. It is this aspect of technology that makes it an open discourse in a broader context in which scientific and engineering practices can be revisited. Technology includes "illiterate" practitioner's inventions as well as theories. For example, as Harding pointed out, the people who invented the compass were illiterate, meaning in the practice domain of compass as a tool, they were not scientists [Harding]. The word "illiterate" is applied to people here. Let's note the term also applies to the practice for which descriptive language is not yet available. When the practice is indescribable we are illiterate to the need for the solutions to the problems. When we are illiterate to such problems, we call them ill-defined problems. Bringing ill-defined problems to well-defined problems is a beginning of an involvement with technology, necessarily involving our linguistic practices.

In this paper I focus the discussions on composing a medium in the context of a computation environment. In part, we will be able to address the issue with a relatively well-defined language of computability. There is a wealth of problems to be addressed in mutual performance configuration between human and machine including the tasks for bringing human-centered performability into a computable domain. For the last few years I have been involved in a group project working on the problems of such performance technology. The goal was not in diving into newly established research areas such as HCI, computer graphics, and cognitive science. Rather we were creating the problems that did not exist and along the way solving the problems of interface, representation, and synchronization in parallel processing for time critical computations. Such computations include real-time dynamical simulations, sound synthesis, and graphical display [Choi 1997]. My intention was no more than for substantiating the concept of *performing a listener* in contemporary society with contemporary technology [Choi 1996]. To state it clearly, the project goal was to extend technology to nourish the human listening capacity of the observers.

The concept of *performing a listener* implies a performing listener develops an awareness of her or his actions by auditory feedback, as well as sensitivity towards the systems he or she is interacting with. An intelligent performance depends on a performer's ability for making decisions as to when to continue, change, and rest one's actions. For this the performer is to be empowered with a proper medium within which the performance takes place. Mainly the desirability of time-critical observation was to be fully supported by real-time sound synthesis and musical experiences that explicitly invoke listeners' cognitive processes. In this emphasis the concept of a performing listener differs from that of a virtuoso. The virtuoso practice is accompanied by traditional notation, by the aesthetics associated with the development of western instruments, and by consonance and dissonance theory as in Zarlino [Zarlino 1550] and Rameau [Rameau 1772] which bases its rationale on the natural harmonic series. The dominant practice carries the assumption that the role of a virtuoso performer is to figure out how to drive a system such as a musical instrument given goal state descriptions. The notational system is provided often as a general description of the sounds as a content goal while instruction for tone production is left implicit. Thus the tone production is heavily depended on oral tradition and the cultural *a priori* played a large part in virtuosic performance acquisition. One does not have to assume such traditions and the rationale behind as *a priori* when composing a medium in a computation environment for facilitating an alternative capacity of a listener. The profound common feature of the two performers, however, lies on their mutual role as listening agents in motion. Their motion reflects the change of their internal states governed by an interactivity with their instruments. Through motion their inner sense is externalized, thus observable.

medium and content

For resisting the description of an artist as "content provider":
when we wish certain content to be present
we must prepare the condition
from which the content could be accounted for.

With the aspect of technology stated in the introduction, we wish to examine the issue of the composability of a medium in works of art. The term, medium, has specific implications associated with the technology such as mass media, where the term presupposes a quality of being transparent and a premise to simply mediate with no interference. Through the observations of mass media practices we have learned the implication of such premises is no longer feasible for supporting any medium as an objective representation tool for the world. Similarly, we wish to revisit whether any medium can be an objective tool for artistic expressions. Can a compositional idea be independent from the medium it predicts? One might say it doesn't matter what an artist uses to create a work of art as long as he or she gets the result. This premise may be compatible with the description of an artist as a content provider often for an industrial demand. The role of an artist is reduced to the role of demonstrator for proving the utility of certain tools and software for commercial promotions. The conceptual ground for such

premises, however, is irrelevant for practitioners and artists in a computation environment particularly when one faces the machines that take nothing for granted other than the specifications in terms of their internal states, inputs, and product set. The specifications of the machines are unique to the compositional problems. With the prevalence of multimedia there is a similar concern in presenting a work of art using certain tools as objective tools for achieving certain effects. We wonder how much tools shape the final results when we note how certain packaged products keep our students of art busy collecting data and sampling. Not to eliminate the possibility of many tools, what has to be examined and included in our discourse is the composability of, and with, the tools and conditions that surround us.

Tools leave a trace in works of art and this is not necessarily undesirable. It simply means the composability of the tools has to be taken into compositional criteria, and this is desirable. Thus we attribute the distinctions between "a composition for a medium" and "the composition of a medium". For the former the composition assumes a well-defined medium for its presentation, for the latter the composition explicitly addresses the construction of its medium of presentation. The word, medium, is applicable in a wide range from the substances appealing to our basic senses, to instruments, genre, and tonality. I do not intend to categorize different uses of the term. The discussion starts from the following two statements:

1. A medium requires perturbation for its presence to be witnessed.
2. Let the act of the perturbation be a performance.

The composition will involve the construction of a medium as a dome circumscribing subsystems and structures of perturbation by which the systems will behave. With this task definition of composition, what do we mean by content? When we input content such as soundfiles or images and retrieve them it will be nothing more than utilizing technology of data storage and sampling. When we speak of dynamical models as subsystems and complex interaction we do not think of content in terms of what to be input or provided. Content is not what we put into the composition, rather we prepare the system and structure in ways the content will be brought up by ways of representing systems behaviors. The systems behavior again is not the content-oriented goal itself. It is the product of complex interactions involving internal structures of the complex system in which the interaction takes place.

Systems, structures, and performance

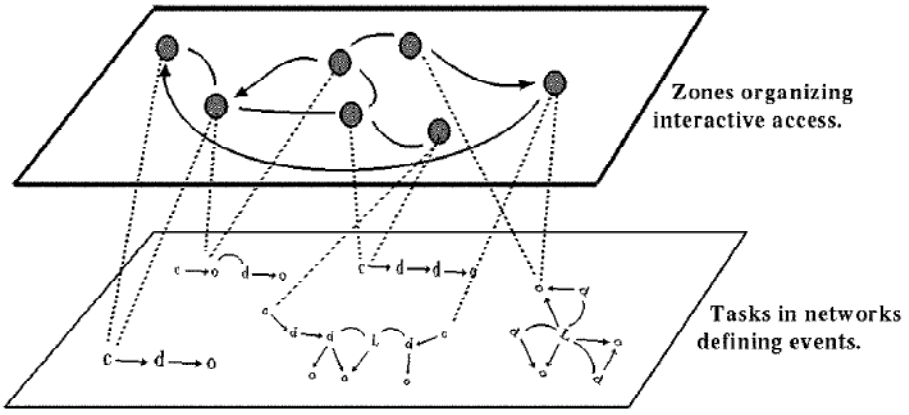
For the composition of a medium, we define the task in three redundant ways applying three alternative terms. The tasks for the composition of a medium are to construct 1) a stipulated universe of elements and their relations in terms of formal theory, 2) a well defined complex system comprised of subsystems and structures in terms of systems engineering, and 3) an environment in which the observer who describes and perceives

the configuration as an environment is an active part of the environment in terms of ecology.

Systems have elements and states upon which performers interact. The degree of complexity of the system varies depending on the computational models. When generating sounds and graphics together a system of dynamics can be applied to the two systems of sound synthesis and graphics through structural coupling. The structures of the systems are configured through a topology of connectivity which characterizes the interactivity of the performance (see figure 1). The topological configuration is dictated by the criteria to enable performability. The behaviors of the systems can be displayed in a way that is perceivable by the performers through the coupled systems of representation to enhance performability. What kind of system the composer employs is one set of compositional problem and what kind of structural configuration is another. These two sets of problems are tightly connected in terms of the parameterization since one has to decide which parameters are to be interactive parameters through which performance dynamics can be applied. In addition to the level of complexity inherent to the systems under interaction, a careful selection of interactive parameters determines the degree of complexity in interactive performance. Too much variations of arbitrarily coupled parameters often generate the situations in which the process of interactivity is unintelligible for observers.

All these problems are open to a wide range of solutions such that what kind of compositional criteria one would consult becomes a non-trivial issue. For summarizing I state two criteria:

> 1. *Selection of interactive parameters* is to be made as to enhance the learning experience of an observer during the exploration of complex dynamics in a performance medium.
> 2. *The method for structural coupling* among systems parameters is to be applied as to maximize an intelligibility of interactive processes.



At this point, since it is relevant to say we are concerned with a medium as a complex system, I would like to bring two references to address this recurring theme in socio-academic discourse.

We live in a society with the generally accepted definition of adaptation [Lorenz 1965]:

> "Adaptation" is the process which molds the organism so that it fits its environment in a way achieving survival.

As computer technology is advanced enough to update various simulations based upon complex phenomena, the logical processes based on biological explanations or "real-world" understandings come to the front line of discussions. Subsequently the metaphors such as "environmental fitness", "mutations", "memes", "adaptation", and "survival" cross over many disciplines. Let's not forget metaphors are often used for explanatory designations. The uses of metaphors that are heavily dependent on explanatory powers tend to be often mistaken as prescriptions for the subsequent thoughts. The production of art differs from the production of explanations and I can not elaborate this in this paper. However, as a composer I stand closely by the following reference. Not necessarily contradicting the preceding reference, as an alternative, in the early 1960's Ross Ashby stated

> ... there is not a single mental faculty ascribed to Man that is good in the absolute sense. If any particular faculty is *usually* good, this is solely because our terrestrial environment is so lacking in variety that its usual form makes that faculty usually good. [Ashby 1962]

How absurd it appears to be, at least at first sight, this statement seems to contradict our common acceptance of nature as unpredictable in detail and uncontrollable by its nature. Note that the assertion adaptability is "good" often shadows the examination of the condition under which certain adaptability is "good". Further the value association obscures the fact that a generative process starts from the stipulation of constraints for conditionality. By stipulations of constraints one gains freedom and generative power. Performance may generate metaphor but is not constructed on explanation-based metaphor. In composing a medium, generating performance cases is preferred to explanations for examining the explainer's conditions under which the performance is generated. The criterion for composing a medium is to create the conditions such that, certain human capacities are to be facilitated otherwise the particular observatory capacities might not be attainable. In creating the conditionality, performability is more of our concern than survivability.

Enabling Performability

The presence of a human performer in a computing environment can not be assumed but to be addressed in terms of computability. Performers orientation could be provided with sensibility descriptions of "here and there", "this and that", and "now and then". For

enabling performability I address the following three orientations for human performer, 1) spatial orientation, 2) object orientation, and 3) temporal orientation. It is noteworthy that Kant considered space and time as *a priori* for transcendental logic [Kant]. This suggests the logical world such as computational processes will be more accessible to us with the perception of space and time. Numbers or bundles of numerical descriptions assume differences and intervals such that their abstract forms suggest certain spatial configuration. One of difficulties often encountered in a computation environment is the lack of an intuitive access to the environment appealing to our senses in terms of space and time. This difficulty became more approachable to address with an apparatus such as CAVE[1] that enables 3D viewing. At the same time we want to make sure the notion of space can be extended with plasticity by deactivating the assumption that space is exclusively 3D. VR space can be considered as a listening space where sound can be positioned with directionality, distance and movement attributes. It also can be configured as a control space where any conceptual framework can be differentiated, abstracted, and configured with visual references. In VR, space can be considered as an immersive *manifold interface* to parallel computational processes. We conceive of 3D space as a manifold for interacting with *n* number of control parameters of the systems of interaction. The details for structuring manifold space in conjunction with an interface concept can be found in previous studies [Choi 1995, 1997].

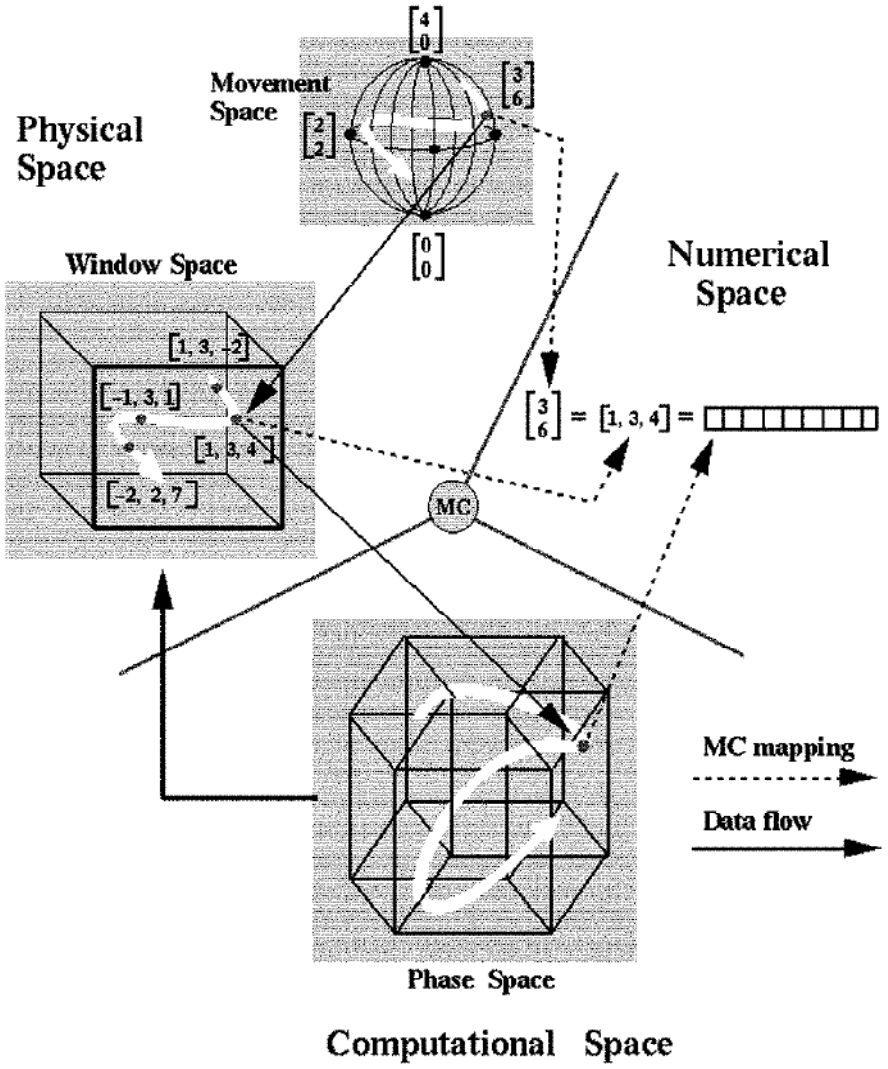
To realize this conception of a space observers have to be empowered with the capacity to develop an ecological competence in an abstract space. The ecological competence has to be founded on coherent rehearsals of an observer as well as on the computation environment. The consistent calibration of the spaces in a performance system is a crucial part in achieving the coherent rehearsals. Since control, display, and simulated dynamics appear to be occurring in the same space in VR, it is important to maintain distinct definitions of three spaces, physical space, numerical space, and computational space. *Physical space* is a pre-quantized space that is continuous within boundaries. The boundaries are determined by the space affordance that is inherent to the stage or display apparatus such as the CAVE. *Numerical space* is a quantization of physical space. The space translates position information to computable descriptions. While position and control information is bound to the space affordance in physical space the perception of this space can be scaled according to the desired degree of geometric detail with respect to the simulated dimensions of the scene, the viewing distance and the angle of view. *Computational space* is where the states of dynamical models are updated. A number *n* of parameters determines the variety of controls the model affords an observer.

A medium is acknowledged by an observer according to perturbations generated by an apparatus. The calibration of space is the calibration of the dimensionality of an apparatus

[1] The CAVE™ is a display apparatus constructed of image projection screens measuring 10 wide x 10 deep x 9 high in units of feet. Thus physical space is bound to a 10' x 10' x 9' cube within which a performer's actions take place. Spatial coordinates are represented from the point [0, 0, 0] (in x, y, z) at the center of the 10' cube, measuring the floor at [0, -5, 0] and the left wall at [-5, 0, 0] as you face into the closed cube (the front screen). Geometry is represented in CAVE™ applications at the same scale as the physical space, suggesting that the virtual space is a direct encoding of the physical dimensions.

to the dimensions of a field where perturbations occur. Observers apply an action to such an apparatus to make observations. An observer's capability to adjust a perturbation by adjusting his or her actions creates a condition I refer to as a *performance system*. A composer composes a medium when the composer optimizes a performance system by knowing and imagining an observer's range of actions and the concomitant system responses.

Figure 3. Performance space calibration applying a Manifold Control method for mapping physical space to high-dimensional control space, with ecological organization of movement. The white arrow represents a Path event created by a hand gesture. The MC governs numerical projections.



closing statements

A performer acts in time. When "time is nothing but the form of inner sense", as Kant stated, a performance carried by a human being in time cannot be replaced by an automaton. When "time is the formal a priori condition of all appearances whatsoever ... immediate condition of inner appearances, and thereby the mediate condition of outer appearances", the particular performance instances are not merely possible states of systems and structures due to the indiscernible presence of the performer. Generating the particulars otherwise would not be possible.

Composition of a medium is to situate the organization of boundary conditions among interacting components, as well as to enable performability. Performance of a medium is to generate the indiscernable presence of the performer.

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