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Aspects of digital affordances: Openness, skill and exploration

In this paper I will present some thoughts I have been making the last few days working with interactive music and movement technology as a part of the workshop during the days, and trying to orient my self in different perspectives on the notion of affordance at night. I have ended up with a discussion of two kinds of affordance – what I have called *instrumental* and *open* affordances. But before I go into more details about these two, I would like to briefly contextualize the concept of *affordance*.

The term was originally defined by James Gibson as a part of his *ecological psychology*, proposing among other things that organisms through being evolved in a certain environment develop a sensory system that is attuned to perceiving the aspects of the environment that are crucial for its survival. His perhaps most radical idea was the one of *direct perception*, i.e. that the environment is always already structured and that organisms are directly sensitive to *that* structure through having evolved in it. The concept of affordance was then defined as the objectively measurable action opportunities provided to an organism by its environment based on the qualities of the object or environment and of the capabilities of the subject. Hence, the organism and the environment were seen as a system of interdependent entities, because of certain more or less invariant physical conditions and of the evolutionary co-adaptation to these, and then with *affordances* describing the relationship between the entities.

Later, the term became adopted by the field of human-computer-interaction and interaction design thanks to the American Donald Norman, who used it as a part of his psychology of everyday things. After experiencing a great many appliances and devices

that he didn't know how to operate during a stay in Great Britain he understood how the affordances of these devices were one crucial dimension of learning how to operate them. Clearly then, these affordances were not a result of the co-evolution of organisms in a certain environment, but rather they were a product of deliberate decisions of designers. Thus, one could not postulate the same reciprocity in the relationships between the individual and the environment as for Gibson. Most likely as a consequence of this, Norman added one important distinction to the concept, in separating between what he called "real" affordances, which were comparable to Gibson's original notion, and *s* affordances, which were those affordances that were actually perceivable by the subject. For Norman this was an important difference, since the existence of affordances weren't always perceived, in other words, there could be action possibilities that were hidden from a user and the user could sometimes envision actions that weren't possible in reality. Anyway, Norman's appropriation of the affordance concept caught on in the HCI communities and has later been increasingly used in literature about interactive art and music.

Now, back to the two aspects of affordances that I have come to see as relevant for my own work, both as a designer of interactive sound environments for the MotionComposer, and through research on live-electronic performance practice.

The first of these are what I call *instrumental affordances*, and they refer to affordances that are dependent on skills in the application of some kind of technology. To see affordances as related to skill is indeed close to Gibson's original conception, since he saw the capabilities of the organism as one component of affordances. During human history and pre-history, the use of increasingly sophisticated tools have radically altered human capabilities and thereby naturally affected what the environment has afforded to us.

Tools, or more broadly, technology, have their own affordances, however. A bow and arrow, for instance, has certain action possibilities which can be highly dependent on the users' capabilities. Once mastered, it will increase one's chances of survival. For certain types of digital interaction, skill can in the same manner be of crucial importance for affordances. Within computer gaming, for instance, most games have an element of skill that you need to acquire to be successful, especially in the form of eye-to-hand-coordination, quick and appropriate response to presented challenges and learning of complex action sequences. Another example is open source software, which really affords opening only by people with quite advanced computer skills. In the NIME community, where the focus is on developing new interfaces of musical expression, (NIME) one often strives to build devices with potential for *virtuosity*, that is, devices with which it is possible over longer periods of time and applying considerable effort to develop expert skills, basically following the model of acoustic instrument performance practice. A possible path towards virtuosity is often seen as converging with the expressive capacities of a NIME. According to this logic, the less skilled the interaction, the less expressive it will tend to be. A third aspect of instrumental affordances that also often seen as entangled with the other two, is the issue of *control intimacy*, a notion introduced by F. Richard Moore, and defined as "the match between the variety of musically desirable sounds produced, and the psychophysiological capabilities of a practiced performer". In other words, when a skilled performer is able to play exactly what she intends musically, the result is an intimate and expressive interaction where the performer can feel the device as a direct extension of her body.

However, I would like to disentangle these three aspects of instrumental affordances and claim that they are not necessarily converging neither when it comes to

interaction with Digital Musical Instruments nor when it come to interaction with digital environments more generally.

Firstly, I believe that if there is a sufficiently high degree of similarity and simultaneousness between the spatiotemporal shape of the executed action and the spatiotemporality inherent in the output, one can indeed experience both a sense of expressivity and intimacy with the device or interactive environment. This is something we have experienced with relatively basic mappings with the Motion Composer. Here, we are dominantly relying on an overall correspondence between the size of movement and the intensity of the sounds, and our experience is that this is something that invites the users to move and that it can dissolve the boundaries between subject and environment. As a consequence, the environments we are working with afford a wide dynamic range of movements, from the tiniest blink of an eye, to the most energetic leaps off the ground. Moreover, the high sensitivity of the motion tracking hardware has enabled us to explore the active use of *stillness* as a parameter in the interaction. What we call *sensitives*, which are single sounds triggered by small movements following stillness, suddenly makes stillness much more interesting than what is common in interactive environments, precisely because it is only by being completely still, and then move a little, that one can produce these single sounds.

Now back to the issue of control, if one carefully relegates some features of the interactive output to machine control, this doesn't necessarily reduce the feeling of expressivity neither by performer nor audience. It all depends on the existing musical skills and habits of the individual. While a professional jazz pianist would probably have great problems with letting a machine choose the notes for her, non-musician users of the Tonality environment of the MotionComposer can let the machine choose what

harmonies one plays, while still being able to dynamically and expressively shape phrases with his movements. I think this video of Frank from the CARE centre in Montréal illustrates this. Anyway, the point is that when designing digital devices or environments for interaction, being able to adapt the affordances according to the skills of the user can be a good thing.

I also want to mention that relying on the development of skill and instrumental affordances in interaction also have psychological and social aspects. These can have positive or negative effects depending on the success or failure in executing an intended action. This is, however, a relatively big discussion that I don't have the time to get into at this point.

Instead I want to address what I have called *open affordances*, which are the features of digital devices or environments that afford a more open form of exploration, where searching, discovering and playing are basic afforded actions. These actions are still dependent on the users capabilities, of course, but much less in the form of skills; Rather it relies on sensory and attentive focusing, and might be amplified by mental traits or states like openness and creativity. It can, in fact, be linked to instrumental affordances, in the sense that exploration and mapping out action possibilities and feedback patterns can be a necessary prerequisite for starting to develop skills. While it can be critical for the survival of an organism – just think about the task of locating what is edible in an environment – it also has a central place in digital interactive environments, both in many genres of gaming and in art practices. Here, it is impossible not to mention the work of John Cage, naturally, for whose art openness and exploration were central, both in the process of making it, but also for the people experiencing it. In pieces like 4'33" or in the Black Mountain happening, it was really up to each individual member of the audience to explore, search and discover with open senses and open

minds. And since such experiences are a lot less imbued with a homogenizing intentionality, they can open up for the audience members as co-creators, relying both on earlier experiences and current sensory input, potentially resulting in individual experiences that vary a lot.

As Cage's two very different pieces exemplify, open *affordances* can be the result of very different strategies. In the silent piece, it was a result of the absence of a dominating and centralizing affordance, while in the happening it was due to the multiplicity, complexity and richness of the experience. Similar strategies to achieve open affordances can also be frequently found in digital interactive art, and it is something that we have also applied in the MotionComposer. Here, we are applying the environment metaphor where we are mapping spatial position to a particular sound or groups of sounds, with or without narrative association. By using several hundreds of sound files together with randomization of sound parameters, we have tried to attain a level of complexity, variation and richness that can invite exploration and play for longer periods of time that can be interesting both for user-performers and listening spectators. Thus, we have aimed at open affordances that can invite exploration, curiosity and close listening.

A good thing about basing interactive design on open affordances is the low dependency on users' skills and the high dependency on subjective experience. This means that such environments can evoke interest for users of different abilities, bodily as well as mentally. The high dependency on subjective experience also means, however, that what is discovered might trigger both positive and negative reactions for the user. The consequences for design answering this openness in subjective reaction could be to include a form of adaptive affordances, where the system would try to figure out what kind of sounds the user spent the most time with. Or, a much simpler approach, and one

that the MotionComposer is currently using extensively, is just to have rich enough possibilities for exploration with a variety of exchangeable environments, and then hope that every user can find something of value.

Another type of *open* affordances that I also would like to briefly mention here is the ones that occur from malfunctions, misuse, defects or accidents. These might be unwanted from the perspective of the makers and designers, at least initially, but they can still be highly interesting for users, especially if they are devoted to exploration. For some people, this has even become a strategy, a way of dealing with technology and media. Hardware hacking and turntablism are two examples of this. And, in the MotionComposer we have also found that interesting things can happen if one disregards the ground rules of the tracking. For instance, we have found that sometimes when leaving the tracked image, the activity value has been stuck at a small value above zero, something which has produced rhythmical pulsations of sounds. And this has encouraged further development of the combination of sound particles and rhythmic structures.

So to close off, the concept of affordance can be useful when designing interactive environments, because it invites thinking about users, technology and audience as an ecosystem where reciprocal interchange of information and sensation take place. It highlights the fact that both thinking and sensing are distributed and embodied processes, where environment, technology and users constantly feed back on each other. The two types of affordance I have just discussed can, in my view, both be useful when designing for interactivity, and I think that a good balance between these aspects can lead to meaningful and enjoyable interaction.

