Use Qualities: An Organic Luxury We Can Afford.

A Primer and Implementation of how Organic Interfaces can Improve the Use Quality Affordance.

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Abstract

Use qualities are sought after in interaction design and increasingly reachable given the new developments in tangible, ubiquitous and embodied interactions. But are they really obtainable regardless of what approach one chooses. This thesis explores how use qualities can be reached by Organic Interaction Design and in doing so it also provides a primer for what this concept entails: A concept which demands a high level of intuitivity in the designs of new media and new interaction trajectories. It is implemented here in a case of an interactive table complete with tangible interactions. This thesis provides examples of how use qualities such as immersion, playability and even vulnerability are reached not via e.g. system transparency but rather via a mimicry of the tacit cues of biological systems occurring in the natural world. The interaction design need be thoughtful and holistic for such endeavors.

1. INTRODUCTION

How can interactive experience afford use qualities such as engagement, seduction, anticipation, surprise, parafunctionality, pliability and even vulnerability?

At the root of this lies the hierarchal nature of use qualities and to afford the above stated ones immersion and fluency must, in some form, be reached. They do not operate on a level playing field and are probably subject to an all or none bifurcation meaning that you are probably able to have for example the use quality of parafunctionality or you are not. There are discrete states in which the qualities are present and respectively states when they are not.

Figure 1. Use Quality Field of Interest Adapted from Löwgren & Stolterman 2004
In explaining how, let us ponder a non-digital use case vis-à-vis a digital one.

- If you, when walking in a forest stumble upon a stick, this might lead to a series of thoughts regarding the stick's potential use. You might imagine it being an artifact with a purpose; a tool of some sort. You might even find yourself letting your mind wander into the fictitious setting in which it might be a tool; you might act out its function. These are one of the uniquely human capacities: the imagination of things not yet manufactured, the ability to think, envision and discuss future projects; are all crucial to human evolution, symbolic communication and certainly to civilized/industrialized society (Gärdenfors 2005). The interaction with the tree branch is quite intuitive and the possibilities invite themselves. Maybe it lends itself to be broken into two parts; maybe it has intriguing material qualities such as pliability: these qualities are immediately at hand and subject to true direct manipulation.

- If on the other hand: the walking in the forest, the finding of the stick, the picking it up, the ocular inspection, need be mediated through textual code, drop down menus or the clicking of icons - the imaginative qualities falls short. The mind would focus on the way in which to perform the tasks at hand instead of just experiencing it. The human experience is an embodied one. If instead of fluent interaction with our milieu we are forced to figure it out the use qualities above will be much harder to achieve. If computer administrative debris (Tufte 1998, p.89) stands in the way of the user experience than that is the user experience.

2. AIM

The purpose of this thesis is twofolded; on the one hand it aims to retain the concept of organic interaction on firm theoretical ground, juxtaposed with neighboring theories. On the other hand it strives to ascertain the consequences of Organic Interaction implemented and the Use Qualities it affords. This brings about the question: What is the best way to design for said use qualities? Clearly some interactive obstructions have to be surpassed in order to come even close to an embodied experience. But once those barriers are breached how would you create the affordances of use qualities? These are the two primary questions of this thesis. It seems evident however that some use qualities supersede others.

3. METHOD

Largely the method will consist of the evaluative design process with some computer modeling, A design case will serve as the externalization of theoretical headway which will then be analyzed and discussed in an exploratory study of a design process implementing an Organic User Interface.

4. THEORETICAL GROUND

The aims of this thesis align with finding the basis and affordance for the existence of certain use qualities. In doing so, some sort of operating level must be identified where they conjure. The underlying theoretical assumptions are those of experimental psychology. The finding that people have the intuitive ability to adapt to rules or patterns before knowingly being able to articulate what
the pattern is, has been a long-withstanding fact within this field. Shown in Simon & Ericsson (1980) where a betting game without preëxplained rules was presented to subjects. In the beginning of the game the subjects were losing money but after a while they seemed to adapt to the game and consequently started winning. At this point however they where not able to articulate what the rule or strategy they where following was: it had not yet reached consciousness yet they applied it. It is plausible that it is in this cognitive purgatorio: an instance of non-declarative knowledge that you would find the breeding ground for high level use qualities. In order to achieve this level of cognitive effortless (system related) knowledge, however, certain demands on the interaction fluency, ambiguity and organicness must be met.

Figure 2. The optimal Interface?

4.1 Theoretical reiteration

A holistic theoretical ground of works from psychology, human computer interaction and design research must be synthesized in order to specify what yields fluency and organicness. On one level of course it is a technological challenge although the working of certain technological advances will not be the focus. Instead the preëxisting theory of new technological implications such as gestural interaction, embodied interaction, tangible interaction, ubiquitous computing, and digital design will converge to optimally locate the theoretical ground and practical implications that new opportunities and design trajectories make possible, will be dealt with on this level. Also the relative benefits of tangible vis-à-vis intangible computing will be dealt with as will the increasing computer administrative debris exasperation.
4.1.1 Organicness, the lack of natural forces and how to address it.
The aforementioned problem of artificial environments not affording the qualities of tangibility such as resistance, friction and gravity, poses a problem in the sense of the user's sense of causation. The embodied brain relies on cues to register if intentions are met and goals fulfilled, most of those are tacit. In the interactive environment the tacit cues of the real world are absent. Instead when designing the interaction one must replace them with "mission accomplished" banners of sight and sound. These are however not always not as inherently intuitive as were they natural. To exemplify with the throw of a stone: the weight of the stone being lifted and the sound it makes in the air and on touchdown are ways by which we perceive the causality and teleology of the natural world. One might argue we are constructed to respond, tacitly, to just those kind of cues and make calculations, unconsciously (Wiberg 2008), to just those events. For further geological evidence of this, remember Kant's example of casual inference: If we see the sun shining on a rock and the rock gets hot we put one and one together and see causal relations (Kant 1781). These qualities are absent in the artificial world of interactive space hitherto in use and might be fading further away.

One strange incident of resistanceless motion is the circular thumb motion used on the iPod. It lacks resistance and has an actual mapping in any feasible metaphorical way to how you would move over a surface. The jog however previously existent on Sony brand phones (before the Ericsson merger) did have dynamic resistance wherein a sense of physical experience of both acceleration, deceleration, pausation and a one-to-one mapping of direction, DOWN-IS-DOWN, led to a total sense of control and also playability; who doesn't enjoy the spin of salad tosser? (http://vimeo.com/3105027). This as opposed to the often befuddled user experience of the iPod interactivity. Since the merger with Ericsson the sony jog is no longer in production. A development in the surface touch interactivity however is the momentum scrolling (Saffer 2009, p.60) wherein the metaphorical cylinder you spin has acceleration and deceleration. However it is still the metaphor for interaction rather than it being the medium for interaction (Dourish 2004, p.101). It doesn't contain actual physical qualities but metaphorical ones. The actual mediated interaction in this case would be in the form of the salad tosser's physics and its direct manipulatory correspondence to what it controls. It would have to be mediated and actual rather than metaphorical and virtual.

Often the cues of the artificial worlds are scripted via several layers of metaphor and cluttered with barriers of administrative debris (Tuft 1999, p.89) in turn leading to more metaphors needed to convey the maneuvering in said debris. Lacking is the organic experience of the natural embodied circumstance.
4.2 Computer modeling experiment

In an experiment performed via computer modeling a program was told to draw an infinitely complex line. Then halfway to infinity it was supposed to export its results. The purpose of course is to illustrate one of the many differences between the Natural and the Artificial.

4.2.1 Result
The program of course cannot construct a model of half of infinity because to do so it has to figure out where infinity lies to be able to divide it. And even if it did, half of infinity is still infinity. The inevitable infinite loops brought the 4 core computer modeling the recursion to crash.

4.2.2 Analysis
This illustrates the impossibility of the computer supported world to mimic the real world. Because that is what it does in this case. In nature all organisms are programmed to grow infinitely. Given enough time and energy they will. The only thing regulating them is the depletion of resources caused by organisms' strives toward infinity. Since everything is programmed to grow infinitely an equilibrium is reached. As is true of every two or more player game that a Nash Equilibrium is always reached (Nash 1950). This regulatory equilibrium, which might be perceived as harmony, really isn't. Rather a constant struggle. The driving force behind evolution and the origin of (new) species. (Darwin 1859)

Figure 3. Computer modeling output
5. ORGANIC INTERFACES

This then poses the question: What is organic interaction? And moreover how does it differ from Pervasive (McCollough), Embodied (Dourish), Tangible (Ishii 2008). And how does its interface relate to those of Textual, Graphical, Embodied, Tangible, Ubiquitous, or even Physical interfaces?

Well it is in a way operating on all the levels of the aforementioned ones, but only in aspects wherein these could be labeled as organic and in line with the interaction pattern described in the opening narrative. For example it has a lot of similarities with the school of embodied interaction.

Figure 4. A More Organic Pixelation
however it could not be said to have to be transparent in its representation of actual bits, as is embodied interaction. Actual bits are in fact of little or no interest to organic interaction, unless they affect the experience itself, which of course they might, but necessarily don’t.

Firstly it has similarities with the aforementioned views insofar as it is concern with the re-coupling of representation and control, i.e. the merger of input and output. This breaks from the classic separation of the two of Graphical User Interfaces; where representation (pixels) was detached from control (input devices) (Ishii 2008). By making the input devices the representation the separation is broken. The main Difference however concerns the physical output of the interface. As far as possible, in order to ascertain organic interaction one must be adhering to the laws of physics. This has a number of consequences. one of which is the avoidance of pure touch interfaces since they lack haptic feedback.

Of course feedback still can be visual however the future holds a more variable portfolio of interface feedbacks such as illumination air, temperature, humidity, and energy (Reikimoto 2008).

What are then the benefits of organic user interfaces? Apart from the obvious benefit of a simultaneous number of input points that approaches infinity instead of merely one. We have become Servants of our machines (Norman 2007, p.91) instead of them serving us. How did this happen? A counterintuitive turn of history and a much alluded one in theoretical scrutiny. Perhaps the offset of natural organic qualities in computing machinery has relieved us of the problems of the physical world in some aspects, but it has also nullified our proprioception (Laurendeau et al. 2003) of it.

5.1 Metaphorical strengthening of the intangible

The concept of illocutionary force is strong in the metaphorical build up by which we construct or if you will perceive our world. If an action has consequences it encounters illocutionary force. The touch-screen interfaces lack such an encounter. The quality of friction is borderline inexistential. The ramifications of which have gone unchecked in the quest in line with laws of least resistance. The tangibility of technology is fast evaporating in a cloud of storage, a flow of interaction and an abundance of wirelessness. Ever so slightly is the notion of the importance of these tangible aspects dawning on the discourse concerned with the interactions of humanity and technology. One attempt to viscerate the inexperiential qualities of technology, specifically its wirelessness was an art performance by Gordan Savicic. In his piece "Constraint City - The Pain of Everyday Life" which he strapped himself into a straight jacket programmed to tighten when in the vicinity of closed wireless local area networks. He explores cities via the pain inflicted upon him by peoples reluctance to let others access their wifi. This modern day Golgotha does not only contain artistic performative qualities but also theoretical ones. It is in a way the experiencing of the inexperiential he not only externalizes the tacitly mundane but embodies technology in a quite mind opening way. The elicited dimension contains the force dynamical resistance otherwise absent in interactive space. It affords proprioception or kinesthetic sense and as such amplifies the illocutionarity (Johnson 1987) of the act as would be the case in the real world is not the metaphorical one as speech act theory would describe the interaction.
6. CASE

For grounding theoretical headway this thesis' design implementations will be scrutinized in the lights of them. Herein the Organic interface will be put to the test and the achievement in Use Qualities will be traced.

6.1 Skrímslasafn

In the museum of Skrímslasafn, the museum of sea monsters of the West Fjords in Northern Iceland, a Tangible interactive surface is proposed wherein the user control a table top map interface with fiduciary marker pucks. The map represents a bay wherein, according to myth, sea monsters roamed. Located on the map are hot spots containing further information on individual monsters. The map is zoomed via presence sensoring (Saffer 2009, p.71) and panned via Arduino-connected rotary encoded wheels, this to create an all tangible experience and organic interaction design.

![Figure 5. Location of the museum and the fjord which is depicted in the interactive table](image)

6.1.1 Experience

The milieu is inevitably part of the experience and must hence be taken into consideration when contemplating design, design language and interaction modes and trajectories. For instance a futuristic science fiction style intangible interaction would be deemed asynchronous in an environment and surrounding as inartificial as the Icelandic West Fjords.

6.1.2 Process

In the interface design process discussions on look and feel, the feel was considered to be an equally important aesthetic quality as were the look. They would so to speak have to draw from the same aesthetic source. For this early in the process use experiential associations were brought forward to guide the development and to externalize different ideas within the design team. Words containing the look and feel where isolated as markers of aesthetic direction for the project á priori design implementation to create obtainable goals rather than the, ever so often immeasurable measurable goals. These serve as foci and common ground in further design discussions of both the interaction pattern and graphical design. The pico-qualities are shown grouped below.
Embedded Qualities of Use - Tangible Interaction Skrimaslasafn

As for Macro use qualities the ambiguity, uncertainty and even possibly vulnerability were identified as sought after and obtainable goals. These design decisions were reached in order to generate a lurking feeling aligned with the tone of the whole exhibition. With the table top interface as its centerpiece. It ought to be an experience not confined to merely "efficient and error-free performance" (Löwgren 2002) but rather one of immersion where interactive patterns follows the holistic experience. Of course playability is the epitomization of all these qualities. One of the propositions as how to achieve this was to give the fiduciary marker a certain degree of liveliness/agency. It was proposed to have some graphic occurrences appear even without user interactions. The hot spots were proposed to be more suggestive than explicit to add on to the vulnerable feel of the exhibition. Further design trajectories, at this point suggested, were to create patterns for multi-user interaction by having emergent effect added to the pucks. Already the multi-user aspect was afforded in the maneuvering of the map (tuning the steering wheels) and the exploration of hot spots (moving the fiduciary marked tangible objects).

Figure 6. The interactive Table and the wheels used to maneuver its map

Figure 7. Skel the interaction point of the interface
6.1.3 Navigation interactivity

When discussing the aforementioned liveliness, a design decision was reached to turn obstacles into events. For example, instead of turning navigation into something you have to read about in a tutorial or learn, it would be a trait of the pucks, from here on labeled skel, that you were to explore and figure out. This would turn something which used to be a barrier into an experience; a playable experience wherein the only instruction to the user was: The skel will guide you to the monster; without explaining exactly how. Exactly how was suggested to be in the form of bacteria living around the skel, moving with it, which by design are attracted to the sea monsters and become worried end hence erratically moving when in the vicinity of them. Also, by the physics of their movement they would accumulate into a trajectory: pointing to the nearest monsters. Once a monster is located they would be dissolved into the location to be replaced by the content navigation of which will be discussed further. This design decision was later improved so that the germs were only a kind of a force-field instead of actual particle behavior to improve performance and keep within existing design ecosystem. However, the instance of the idea remained a crucial part of the process insofar as the latter idea generation might not have occurred had it not been for it.

6.2 In Search of Use Qualities

The purpose of this organicness, in terms of Use Qualities is the achievement of what Bill Gaver has referred to as interpretative ambiguity. (Gaver et. al. 2007) Wherein he describes the notion of information being presented in an ambiguous way as to not be invasive or obtuse and not posing as unequivocal knowledge. These qualities all come very close to describing the aforementioned cognitive purgatorio wherein non-declarative knowledge is acquired via a non-conscious
thought process, a far superior retriever of information than the conscious one (Wiberg 2008). The information is interpreted but not consciously perceived as information acquisition; an important feature of maintaining the immersion. The script is conveyed but not taught.

A similar stance towards turning necessary thresholds or barriers into experiences was up for debate in another domain. The zoom from the overview of the map going into the subset of the map, which is at a glance in interactive mode was decided to be triggered by a sensor determining whether a person was present at the table or not via presence sensing (Saffer 2009, p.71). This was also discussed in terms of turning it into an experience for the user wherein an overview is given of what the subset is a subset of, but it was also stressed it be a part of the narrative, creating a journey into an alluring world rather than merely transitioning to it. (for video Guðbergsson et al.)

6.2.1 Rationale
The reason for the sensor triggering of this transition in itself is to get the interactive experience started not by the visitor taking the first step but rather inviting her to participation. Whereas information resolution is concerned, the common use metaphor is the scaling, which is attributed intuitiveness. However whenever you are working with a HUD (head-up display) or any system where you are not manipulating content directly on the display the metaphor no longer makes perfect sense. The metaphor is content-is-object, a fairly intuitive metaphor (Johnson 1999) and this object has elasticity, i.e. scalability. If however the content isn't an object and it doesn't contain elasticity another metaphor needs to take its place. Let's take a look at another one: proximity-is-curiousness. The closer a person is to something could reveal a higher level of interest possessed. If then we increase information resolution with proximity the metaphor holds and the interaction pattern is still physical and tangible if discrete steps of resolution are implemented. Comparative to this stance is the Bifocal Display described in Buxton (2007) wherein textual content is shown at a glance but a larger portion than the immediately visible text is shown out of focus.

6.3 Display of Content
When the user stumbles upon content, which is sequences of an image and three lines of text attached to the skel, the navigation of content is done by means of bifocal display as to give intuitive information pertaining to the current state in relation to the content as a whole. The display produces a denotation as to where one is in relation to the rest of the content and an indexation of how much more content there is left to explore. Toggling is done by a 25 degree rotation of the skel to the left or right.

The special case of one skel remaining on the table during idle mode with a story being displayed is being resolved by yet another metaphorical allusion to organicness. It, meaning the story, is flagged as dead inside the program and as such not being displayed when one returns from idle mode. Consequently the surrounding graphics are neither
being displayed with the result of the skel seeming dead. The way the program is constructed one now has to SHAKE-TO-ENLIVEN to regain graphic feedback from the skel, much as one would do in the non-artificial world, were one to revive an organism.

### 6.3.1 Multi-user application
A second multi-user application was amended, as stated in earlier discussions on pico-qualities, this was thought of as an integral part of the whole experience. Firstly instantiated in the panning of the map. The second one would be a feature occurring upon two users skeljar colliding. Then the area between them would reveal more of the monster content and the the cooperation would render more vision than the sum of the parts. This was later improved to become a shockwave running through the ocean from the point of the tangibles' impact. The speed and traveling of the shockwave was stated to correspond to the impact velocity of the tangibles colliding. This to keep the inertia of the movement and in that make the interface organic by keeping it within the laws of physics, specifically Newton's third law of motion: Every action has an equal and opposite reaction. However the implementation of this might interfere with the limits of speed on the fiducial tracking and moreover violate the use qualities of superficial pliability and functional minimalism. Also an emergent effect was established to be in existence due to the fact that if two or more people are using their skeljar near a hotspot, they will in fact have triangulated it with their indicators. A fine line seems to be in existence between the usability and immersion of the system insofar as the ambiguity and suggestiveness of the indicators, making them not so out-figurable so that they are pure indexical but suggestive enough to be playable.

### 6.3.2 Sound
For the ambient sound of the Skrimslaborð it was obvious to use the sound of stormy weather as in wind and waves. For the allusion of liveliness in the monsters an extremely pitched down bird sound, in actuality transposed with formant intact, was used to create an ominous sound yet with qualities of liveliness, the same quality latency was meant to induce. The sound for content appearance was foam samples for similar reasons. (For sounds see http://hringur.gagarin.is/nils/audio/)

The initial sound of entering the experience by presence detection or participating by putting your tangible on the table however has more things required of it. Not only does it have to be inviting and an equivalent counter force to the monster sound, it also need be overt enough to embody the experience itself, it is to the other sounds what Richard Wagner is to Arvo Pärt. The sound was a pitched down and transposed Arctic Loon (Gavia arctica) that was used to work as an antithesis to the monster sounds.

*Figure 11. Sampling foam*
7. CONCLUSIONS

A conclusion established early in the design processes leading up to this thesis was that language need be created to be able to intersubjectively discuss the qualities of the design. However this poses an inherent problem of intersubjectivity; the problem of Private Language (Wittgenstein 1953), an issue that revealed itself late in the design process.

7.1 The Dilemma of Private Language

In discussing for example use qualities of a design or creating new use qualities, the meaning of those are ascribed in situ. Much in the way that Dourish explains how people create intersubjective meaning through an artifact; the artifact in this case being language. But as the discussion ascertains certain meanings in certain words they are also accompanied with an inevitability of intersubjectivity, namely its lack of generalizability. As Wittgenstein would put it: The meaning contains a certain ineffability to those who were not part of denoting them. There is not the same presupposition that everybody else will be able to come to the same understandings based on the Use Qualities alone, therefore bringing new people in to the design process is in fact more of a task then one might think. Based on this explorative study this trait seem to be cross-cultural and regardless of language since the languages used in the design discussion were English, Scandinavian and Icelandic dependent on which suited the topic at hand, the language with the clearest relation between significant and signifié (Barthes 1957) if you will. This special linguistic situation might also contribute to the fact that the language is a private one. This also says something about Use Qualities' plausibility as used outwardly, in say marketing or as measurable usability goals.

In more cognitive terms these issues would correspond to those of shared cognition, a high degree of which need be created in order to establish common ground (Clark 1999) on which to base and carry out a rational design process. Establishing unified mental models of design and its process and creating an anticipation ratio (MacMillan et al., 2004) approaching 1:1, meaning that information is delivered without having had to been asked for. This might however pose the problem of one encountering precisely the lack of in-the-loopness of people outside said shared mental models since it in fact does create, if not a private language, then local language wherefore constant dispersal of design discussions need be widened to more than the inner design team at sporadic times.

7.2 Schemata in Tangible Interactions

One the one hand this type of designing is easier than others since no or few existing schemata are already in place for what the interaction pattern might look like; meanwhile it also make designing more interesting since to create such schemata one must adhere to the untethered natural human response to the design there is no preëxisting mental model of the system. This window of opportunity is however closing and conventions will soon be appearing which is why research is due.

7.3 Use Quality Consequences

The design process benefited heavily from an à priori externalization of use qualities. Even the ideation itself was helped since the language created made it very easy to speak relevantly about very narrow subjects in the design. At the same time it helped stress the importance of the overall
design language and it being contingent on both visual, audial, tactile and haptic stimuli all being in tune. The idea generation itself was probably due to the early discussions on what qualities the design ought to afford and as such high level discussions could be held about how to achieve them through organic interaction design.

Use tests revealed a low satisfaction amongst the elderly. It is evident that use qualities such as vulnerability do not attract this demographic. The pursuit of figuring out the indications themselves neither seemed to appeal to them. They might not want their fears, sense of vulnerability and need for visual information exploited, to paraphrase cognitive media theorist Torben Grodal (2003). This however begs a question about whether designs like these should have such a general appeal or whether identifications of target groups, personae of potential users need be developed in similar designs. Were one to compromise the suggestiveness and disregard the aforementioned informative leeway in the indications under the skel; one would also be removing a vital part of the design and the immersive and playable qualities of the design, making it more indexical since the two are communicating vessels: less ambiguity means an increased level of intelligibility but also means a significantly reduced playability at the price of almost all other immersive use qualities.

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