ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE ENGINEERING AND TECHNOLOGY

HACKING THE GESTURES OF PAST FOR FUTURE INTERACTIONS

M.Sc. THESIS

Atılım ŞAHİN

Department of Industrial Product Design

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ FEN BİLİMLERİ ENSTİTÜSÜ

GÜNDELİK JESTLERİ
YENİ NESİL ETKİLEŞİM TASARIMLARI İÇİN "HACK"LEME

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FOREWORD

Inspirational incident

In Turkey, due to the lack of railway lines between the cities, the bus companies are abundant and many competitors serve transportation in the same routes. When this is the case, bus companies equip their buses with cutting edge technologic outfits in order to compete. People tend to prefer buses with TV screens embedded on their front seats. When I was travelling with one of those intercity buses last year, I encountered a man sitting just besides me. Apparently, there was a problem with the screen in front of him that the digital screen display was strangely upside-down. His first reaction was to make that famous spinning gesture gently with his two fingers on the screen which we all very familiar with our touch screens. Clearly, it didn't work since it was not a touch screen. He tried to do the same gesture again but with a bit more force this time by compressing the screen impolitely. The third try immediately was followed by the same failure as the second attempt. At that moment, something happened that amazed me very much. Suddenly, our observee transformed his gesture into a "real" spinning gesture as he grasped the screen from its edges and tried to spin it literally assuming that the problem was actually about the physical position of the screen (Of course, because it didn't work digitally!). And despite not meaning to at all, he accidently broke the screen by separating it from the upper two screws where it was fixed. Eventually, the problem of the screen position had been fixed, but there was another problem now as there was no display on the broken screen anymore.

This personal experience gave me a strong trigger to make this research. Because it has these provoking aspects about the blurry intersection points of physical and digital world and the way we try to fill this gap with our bodies, with our behaviours, with our gestures. Continuing from this point, the research will basically focus on this distinction between our real motional gestures and the gestures that we use to control our digital technological devices, in the specific manner of our mobile device interactions. You can review this study as an attempt to approximate the edges of everyday gestures and gestures that control technologies to each other with the goal of designing gestural interfaces that permit this distinction to be dissolved.

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December 2013 Atılım ŞAHİN

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SUMMARY

This study proposes a new "vocabulary" of gestural commands for mobile devices, based on established bodily practices and daily rituals. The research goal is defined as making the motional gesture control inputs more intuitive and learnable by dissolving them into people's daily behaviours.

The research approach is grounded on a theoretical framework of phenomenology, which is to say emphasizing the use of gestures in lived experience. This notion is examined through humans' existing relations with the objects in broad terms, involving the historical and spatial aspects of those relations. Reflections from Maurice Merleau-Ponty, Theodor Adorno and Martin Heidegger are blended with a designery perspective in order to create the phenomenological grounding in terms of this research. The way we envison the future of technologies are fairly discussed and the role of our bodies in that envision are examined thoroughly with the intention of putting the focus onto our bodies rather than technology driven developments.

In order to pursue the defined research goals, theoretical research has been followed by practical research involving broad exploration process. The exploration process entails close observations upon users and collaborative improvisation workshops akin to bodystorming. The combination of these methods is named as "hacking the physical actions" and the significance of this approach is highlighted, especially as a constituting source for the similar researches in this field.

The main goal for executing this translation was finding novel movement sets which are relatively dissolving in our physical behaviours through our body memories. This kind of exploration of the new movement sets also incorporates a derivative goal referring to exploration of the dead spaces of our interactions that are not involved in our bodily space formed by our current relations to existing devices. Hereby, the main scaffolding of the workshops was paraphrased as exploring these core values of the movement qualities and finding the fundamental correlations through them. In order to catch these correlations strikingly, the participants of the workshops are exposed to a state of mind which makes them physically and mentally distinguished from the restrictive circumstances of the existing physicality. And depending on the correlations that they find in their movements, the core metaphoric values for each task are extracted and new gesture sets are elicited through the associations occured in the workshops.

The resulting ideas for gestural commands are then synthesized and applied to fundamental tasks of handling mobile phones and explained with a supplementary video.

GÜNDELİK JESTLERİ
YENİ NESİL ETKİLEŞİM TASARIMLARI İÇİN "HACK"LEME

ÖZET

Bu çalışma mobil cihazların jest temelli komutlarla kontrolüne yönelik yeni bir "dil" geliştirmeyi hedeflemektedir. Yapılan araştırma, jest temelli komutların tasarım süreçleriyle ilgili belli başlı yöntemler önerirken, bu yöntemleri insanların gündelik hayattaki bedensel ritüellerine ve nesnelerle kurdukları ilişkilerin bedensel hafızada bıraktığı izlerin temellerine dayandırmaktadır. Bu yaklaşımla tasarlanan jestsel komutların insanların gündelik davranışları içinde çözünen hareket setleri olması itibariyle kullanıcılar tarafından sezgisel olarak daha kolay anlaşılması ve daha kolay öğrenilebilmesi amaçlanmaktadır.

Jest tasarımına yönelik bu yaklaşımı temellendirmek için tasarım bağlamı olarak önerilen teorik çatı, *fenomenoloji*ye dayandırılmıştır. Burada fenomenolojiden kasıt, jestlerin ve hareketlerin yaşanmış/yaşanan deneyimlere dayandırılarak incelenmesidir. Bu fenomenolojik yaklaşım ile insanların nesnelerle olan ilişkileri ayrıntılı olarak değerlendirilerek, bu ilişkideki hareketsel, uzamsal ve hafızaya dayalı kilit noktalar derinlemesine irdelenmiştir. Bu noktada Maurice Merleau-Ponty ve Theodor Adorno gibi düşünürlerin önerdiği kavramlar, tasarımcı perspektifi ile harmanlanarak bahsedilen fenomenolojik temelin oluşturulması için kullanılmıştır. Bu yaklaşım, fenomenojinin tasarım kontekstinde nasıl değerlendirilebileceğinin bir tartışması olarak da görülebilir. Bu çalışmada, fenomenolojik yaklaşımın, özellikle kullanıcı odaklı tasarım araştırmalarında bir rehber olarak kullanılmasının yolları araştırılmıştır.

Teorik araştırmanın ikinci ayağını, geleceğin teknolojileri üzerine sahip olduğumuz vizyonun, bahsi geçen fenomenolojik yaklaşımla nasıl geliştirilip değiştirilebileceğinin tartışması oluşturmaktadır. Bedenlerimizin geleceğin teknolojik ortamında nasıl bir rolünün olacağının yanı sıra, öngörülen vizyonların gelecek teknolojilerinin yaratımında ne kadar önemli bir role sahip olduğunun altı çizilmiştir. Theodor Adorno ve Martin Heidegger'den alıntılanan pasajlarla desteklenen bu nosyon yine çeşitli tasarımcıların önerdiği kavramlarla birleştirilerek ve tasarımcı süzgecinden geçirilerek değerlendirilmiştir. Yeni teknolojileri hayal ederken veya yaratırken kullanılan yaklaşımın teknolojik gelişmelerin sürüklediği ve yönlendirdiği bir iterasyondan ziyade insan bedeninin merkeze konduğu bir yaratıma dönüştürülmesinin olasılığı, referanslarla tartışılmaktadır.

Sözü geçen bu kavramların, etkileşim tasarımı alanında ne gibi karşılıkları olduğunu daha iyi kavrayabilmek adına, araştırmayla bağlantılı olan etkileşim tasarımı dalları, tanımları ve faaliyet alanlarıyla birlikte sınıflandırılmış; özellikle jeste dayalı tasarımların etkileşim tasarımı disiplini içindeki konumu tespit edilmeye çalışılmıştır. Jest tasarımımınn teknolojinin gelişmesi ve sensor sistemlerinin yaygınlaşmasıyla

günümüde nasıl bir boyut kazandığı ve "Jest tasarlamak" mefhumunun günümüz tasarım disiplinindeki karşılığı bu bağlamda incelenmiştir.

Oluşturulan bu teorik temeli desteklemek üzere geniş çaplı bir pratik araştırma süreci yürütülmüştür. Teorik araştırmanın pratiğe dönüştürülmesi aşamasında, bu alanda daha önce yapılan kullanıcı merkezli çalışmalarla ilgili derinlemesine bir literatür taraması icra edilmiştir. Yapılan literatür taraması, tasarım üzerine yapılmış kullanıcı araştırmalarını içerdiği gibi, tiyatro gibi farklı disiplinlerin bazı belli başlı beden araştırması yöntemlerini de konu edinmektedir. Daha önce uygulanmış bazı yöntemlerin sentezlenmesi ve bu sentezin, yapılan teorik araştırmanın eksenine oturtulmasıyla, yapılacak uygulamalı araştırma süreci için yeni bir yöntem önerilmiştir. "Fiziksel eylemleri "hackleme" (Hacking the physcial actions)" olarak adlandırılan bu yöntem teorik temele sıkı sıkıya bağlı bir uygulamalı araştırmalar bütününü kapsamaktadır.

Uygulanan yaklaşımın "Hackleme" olarak tanımlanmasının altında yatan en önemli nedenlerden bir tanesi, "Hack" kavramının, 'bir "şey"in özelliklerini, esas kullanım amacından başka bir amaç doğrultusunda modifiye etme' anlamına tekabül etmesidir. Günümüz teknoloji dünyasında sıkça mevzu bahis edilen bir kavram olması da göz önünde bulundurularak, kullanılan yaklaşımın kısa ve öz tanımı olarak bu tabirin kullanılması uygun görülmüştür. Bu çalışma özelinde değerlendirildiğinde, hedeflenen uygulamalı araştırma, gündelik aksiyonlarımızı "hack"leme temeline oturtulmaya çalışılmıştır. Diğer bir deyişle, gündelik davranışlarımızı *başka* şekilllerde yorumlayarak mobil cihazlarımızın temel fonksiyonlarını kontrol edebileceğimiz jestsel komutlara dönüştürmenin yolları aranmıştır.

Bu tarz bir yorumlama, "anlam"ın ön plana çıkarılmadığı bir pratik araştırma sürecini de zorunlu olarak beraberinde getirmektedir. Çünkü bir şeyin barındırdığı temel anlamları yakalayamadan o kavram üzerinde "hack" yapmak mümkün olamazdı. Böylelikle, jestlerin gündelik hayattaki kullanımlarında gömülü olan "anlam"ları yakalayabilmek, uygulamalı araştımanın temel eksenini oluşturmuştur.

Uygulamalı araştırma, mobil cihaz kullanıcılarının cihazlarıyla olan ilişkilerindeki hareketsel ve uzamsal ögelerin yakinen gözlemlenmesiyle başlamıştır. Bu gözlemler ile günümüz teknolojisinin "beden dili" anlaşılmaya çalışılmış ve elde edilen datalar bir sınıflandırmaya tabi tutularak araştırmanın ileriki adımlarında faydalanmak üzere kaydedilmiştir.

Uygulamalı araştırma safhasının daha kapsamlı icra edilen ikinci aşamasını ise kullanıcılar ile birlikte yürütülen atölye çalışmaları oluşturmaktadır. Ortak çalışmaya dayalı bu atölyelerin içeriği ve kullanılan metotlar, bu tez çalışmasının literatüre olan temel katkısını oluşturmaktadır. "Fiziksel eylemleri "hackleme" (Hacking the physcial actions)" olarak adlandırılan bu alıştırmalar bütünü ile, literatürde "bodystorming" olarak tabir edilen yöntemlere yakınsayan uygulamalar yapılmıştır. Yapılan alıştırmalar diğer bir deyişle tasarım odaklı bedensel doğaçlar olarak tanımlanabilir. Kullanılan yöntemlerin jest tasarımı alanında sağlayabileceği faydaların altı çizilirken, özellikle benzer çalışmalar için nasıl kaynak teşkil edebileceğinin de vurgusu yapılmıştır.

Yapılan uygulamalı araştırma sürecinin nihai çıktısını, akıllı telefonların temel fonksiyonlarını kontrol etmek için tasarlanan yeni hareketsel jest komutu setleri oluşturmaktadır. Bu jest setleri atölye çalışmaları esnasında kullanıcılar ile birlikte tartışılmış, fakat jest tasarımlarının son hallerine, yine kullanıcılardan gelen geri bildirimler doğrultusunda, tasarımcı (tez yazarı) karar vermiştir. Tasarlanan bu yeni

jest setlerinin, ortaya çıkarılma yöntemleri itibariyle metaforik olarak gündelik davranışlarımız içinde çözünen hareket setleri olduğuna vurgu yapılmıştır. Bu mefhum, kullanıcıların gündelik hayatta diğer nesneler ile "etkileşirken" kullandıkları hareketler ile cep telefonu temel fonksiyonları arasında kurulan korelasyonlar sayesinde açığa çıkarılmıştır. Bu tarz bir yaklaşım, katılımcıların varolan fizikselliğin kısıtlayıcı koşullarından sıyrılmasını ve onların fiziksel ve mental olarak yaratıcılığı kışkırtıcı ögelere maruz bırakılmasını gerektirmektedir ki düzenlenen atölyelerin araştırmaya en büyük katkısı bu noktada görülmektedir.

Tasarlanan yeni jest setleri, yapılan atölye çalışmalarının istatistiksel veya kantitatif olarak yorumlanmasıyla ortaya çıkarılmamışlardır. Atölyelerde üzerine çalışılan jestlerin nihai hallerine karar verilirken uygulanan kriter, kullanıcılar tarafından önerilen jestin diğer jestlere oranla sayıca üstünlük sağlamasından ziyade, kullanılan jestlerin ihtiva ettiği metaforik değerleri tespit etmeye yönelik olmuştur. Yapılan atölye çalışmalarının bu şekilde, kalitatif olarak analiz edilmesi, teorik araştırmada ön plana çıkarılan "anlam" mefhumuna paralellik arz etmesi açısından da önem taşımaktadır.

Yeni hareket setlerinin bu yöntem ile ortaya çıkarılması, bedensel uzamımızda tanımlı olmayan "ölü" etkileşim alanlarının keşfedilmesi bakımından ikincil bir araştırma sorusunu da beraberinde getirmektedir. Bu çalışmada uygulanan yöntem bütünü ile, insanlar ve kullandıkları cihazlar arasındaki etkileşim farklı bir boyutta yorumlanarak, teknoloji odaklı bir gelişmeye maruz kalan etkileşimlerimizdeki arka planda kalmış veya tamamen unutulmuş "ölü" noktaların ortaya çıkarılması ve kullanılması da amaçlanmıştır.

Sonuç olarak, atölye çalışmaları esnasında kullanıcılar tarafından icra edilen hareketlerin temel metaforik değerlerinin ayrıntılı gözlemi ve aralarındaki bağlantıların tespiti sonrasında yeni jest setleri ortaya çıkarılmıştır. Tasarlanan jest setleri destekleyici bir video çalışmasıyla birlikte açıklanmıştır. Yaratılan bu jest setleri, bu alanda çalışma yapan tasarımcılar için ilham kaynağı olabileceği gibi, jest setlerinin ortaya çıkarılışı itibariyle benzer araştırmalar için emsal teşkil etmektedir.

Yapılan tez çalışmasının literature temel katkısını, tasarlanan jest setlerinin son halinden ziyade, bu jestlerin tasarım sürecinde izlenen yollar, kullanılan yöntemler oluşturmaktadır. Dolayısıyla son tasarlanan jest setleri, izole edilerek sunulan önerilmiş tasarım fikirlerinden ziyade, bağlamıyla ve anlam bütünlüğüyle birlikte irdelenerek okuyucuya sunulmuştur. Kullanıcı araştırmasında fenomenolojinin merkeze alınarak, icra edilen eylemlerin metaforik yansımalarının ve "anlam"ın ön plana çıkarılması, yapılan teorik araştırma ve uygulamalı araştımanın birbiriyle geçişken bir şekilde örtüştürülmesinin doğal bir sonucudur. Çalışmanın okuyucularına sunmak istediği bir diğer önemli husus da, "sezgi"nin veya "sezgiselliği yakalayabilme"nin bizlerden çok uzakta konumlanmış kavramlar olmadığı; aksine, bedenlerimize gömülü anlamlar üzerine yoğunlaştığımız müddetçe yakalanması oldukça mümkün mefhumlar olduğunun vurgusudur. Sezgiselliğin kullanıcılara nasıl sunulduğu da en az sezgiselliğin kolayca yakalanabilmesi kadar elzemdir. Tasarlanan jestlerin son hallerinin tanıtımı için hazırlanan videoda da bu konu üzerinde durulmuş ve sezgiselliğin böyle bir araç ile nasıl kışkırtılabileceğinin yolları aranmıştır.

1. INTRODUCTION

In every step of the technological developments, the definitions of the interactions between our artefacts and us are changing inarguably. Technological developments are driven by people but it can also be said that people are driven by technological developments. One can easily say it was like that since the beginning: while people were shaping their objects; the objects have also shaped the people in many manners.

In the particular case of our bodies, the way we move is being designated by the artefacts that we are interacting with. And the artefacts entail specific types of movements for their usage which were basically proposed by its "creator". The interaction between our artefacts and our bodies has become inarguably different with the developments in ubiquitous technologies. The movement sets are again, designed/decided by their creator, but this time there might be multiple layers defining our interactions with the artifacts. Because there is embedded information in the motional command sets which makes the movement itself more than an actual physicality. The field of gestural interaction has now been overgrowing with the aid of enabling technologies. We have now uploaded more meanings into the layers of our interactions with the artefacts.

At first sight, gestural interaction could always be understood as a way to interpret our interactions in a more intuitive way while the term "gesture" partly refers to our daily life knowledge and habits. However, if we look close to the existing gestures we use to control today's mobile devices, we would probably recognize that many of these "designed" gestures are, in a way, imposing themselves to us. This is comprehensible, as these gestures are obviously technology driven; because, they are the outcomes of our touch-screen interactions as they are based on two dimensional surface movements. So, in a sense, these gestures are coming from what technology enables us to do or imposes upon us rather than what our bodies actually do.

Developments in today's sensor technologies is a milestone in going from surface based interaction towards to "no interface"[1] interactions. If we are assuming that our future interactions with the devices will be much more than *the fingers dancing on the screens*, the question of the next generation of interactions becomes reasonable to ask. As Bret Victor[2] reasonably states, considering our entire bodies at our commands, the future of interaction cannot be limited to a single finger. So, what is the next generation of our interfaces? And more importantly, how do we create this next generation? Are our gestures going to be imposed by what technology could do or can we make the next generation of these interfaces driven by our actual gestures? With the upcoming technologies, it is now more possible to switch the focus to our bodies again. Let's talk about our bodies and the dead interaction spaces which are now more appropriate to use with the aid of technology. The question is whether we could make our gestures to impose the next generation of our devices or not.

This study will be questioning the above mentioned issues. I believe that questioning these issues is quite important step to define our future interactions with our devices in a sense we, as designers, will create that future. Our visions about the future define our path to create it. Heidegger touches upon it as a beginning sentence to his essay, The Question concerning Technology**: "**Questioning builds a way. We would be advised, therefore, above all to pay heed to the way, and not to fix our attention on isolated sentences and topics" (Heidegger, 1950, p.3). In line with this quote, rather than offering isolated design suggestions and making the reader to fix her attention on them, this study will intend to question our interactions in a broader context to envision our way to create new technologies.

To unfold above mentioned issues, I will first give a brief background about our relations with the artefacts that we have been creating for ages. Together with this background, I will try to secure a better understanding about our relations with the artefacts surrounding us and evaluate them in the manners of interaction design field. I am going to present the assumptions for the future of our interactions through some examples and quotations.

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[1] Golden Krishna propounds his motto "The best interface is no interface" for the new generation of our interfaces. See his talk and essay at http://nointerface.tumblr.com/

[2] *A Brief Rant on the Future of Interaction Design (Victor, 2011).* Available at: http://worrydream.com/ABriefRantOnTheFutureOfInteractionDesign/

On this basis, I will introduce the applied research that I have executed in order to pursue my research questions. These practices are consisting of close observations, connotation exercises and bodystorming sessions which were all made together with users. I will define the combination of these methods as "hacking the physical actions" and will try to reveal the significance of this method, especially constituting a source for the similar researches in this field.

The intention of the followed approach could also be paraphrased as putting the phenomenological point of view into the design context and trying to redefine what we understand from "gesture" and the "intuition"; and examine the relations between those notions in broad terms.

As outcomes of this study, I will present novel motional interaction ways to control our mobile devices claiming that these new gestures have been correlated from our daily physical rituals. By emphasising this, I will point out the significant issues on the intersection points of the gestural interaction and embodied interaction fields with an attempt to better understand how we could design new gestures to make them more embodied with more intuitiveness and guessability coming through our body memories. An accompanying video[1] explaining these new ways of interaction and expressing this translation has also come out with this research.

Documentation of these new ways of interactions and the way that I elicited them with my workshops might provide designers new openings about the adaptation of the current interfaces or creating new artefacts. Moreover, by doing these, this research has been intended to offer a knowledge contribution to the field of gestural interaction within the subfield of embodied interaction which both will also be examined in detail to formulate their positions to each other in the scope of this research.

[1] Available on https://vimeo.com/67966553

2. DESIGN CONTEXT

2.1. Objectified Bodies

In his cult movie, *2001: A Space Odyssey*, Stanley Kubrick demonstrates the invention of the first tool, which has been represented by that famous scene that an ape-man realizing how he could use one of the bone pieces he had found from an animal fossil as a "tool".

This part of the movie was displayed with the section name of "The dawn of man" which symbolizes the first emergence of the humankind, according to Kubrick. Kubrick demonstrates this shift from ape-man to human through the usage of first "tool" by an ape-man.

Figure 2.1: Captures from Stanley Kubrick's movie: *2001: A Space Odyssey.*

The scene coming afterwards where the ape-man kills another ape by using this tool as a weapon, begs a discussion about how every invention has changed our character, our emotions, our violence control etc. through those tools. Despite being a very valuable discussion, this research does not unfold all these issues. Instead, the main focus of the research will be based on merely one aspect of this alteration: the changes occurred in our body rituals; how we are adapting our bodies to our artefacts through our gestures, postures and behaviours. [1]

[1] At this juncture, it is also fair to declare that people's physical activities, postures and gestures discussed in this study are not meant to refer to all people and the terms argued

Ever since that ape (metaphorically), we created tools to fill the gap between our capabilities and our needs. We amplified our capabilities through our tools to execute our needs by converting what we can do into what we need to do.[1] New problems occurred with the usage of those tools and we defined new design openings to make our tools more functionalized and more easy to use evermore. Regarding the capability that we have, we've designed our tools to fit our body moves, appropriate for our body shapes to use them in a more efficient way.

Figure 2.2: Tool as a complementary between capability and need.

If we draw a one way arrow going from our capability towards our needs with the aid of our tools; we would definitely miss something that occurs with the interaction between our tools and us. It is not only us shaping our tools, but also the tools shaping the people in many manners. So, that arrow should be drawn in both directions (Figure 2.2). Continuing from the "ape" metaphor, ape man created the first tool and that tool created the new human type in the evolutionary process. And human created a second tool which changed the humanity in a different way again and so on. This strange *co-creation* between human and artefacts continued through ages in an iterative way with different offsets.

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here are not dedicated to people all over the world. Cultural differences definitely affect our relation with the objects and our body expressions are obviously changing from culture to culture. Although it is reasonably clear that our cultural backgrounds change the way we interact with our artefacts; this realm has not been examined in the scope of this research. That could be a topic for further long period researches as a continuation of this research.

[1] Extracted from the tool definition made by Bret Victor, from his essay, *A Brief Rant on the Future of Interaction Design.* Available at: http://worrydream.com/ABriefRantOnTheFutureOfInteractionDesign/

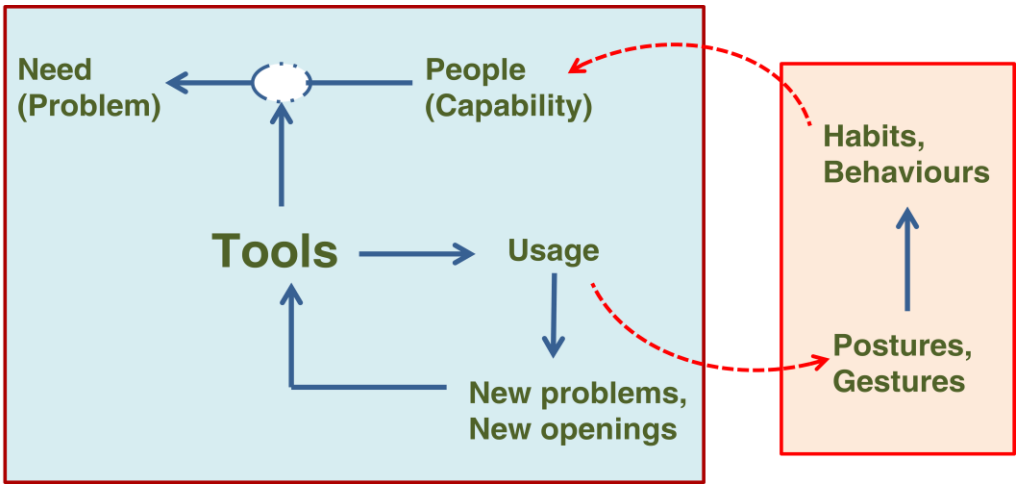

Figure 2.3: Model showing the relations with our tools.

There is this inevitable cycle here as new artefacts reveals new openings and new problems through their usage (Figure 2.3). We recreate our tools according to these new problems. On the other hand, usages of our artefacts create a secondary loop while it is affecting our lives and change our way of living, our movements, behaviours and habits in wide terms. While we are shaping the artefacts for our body, our bodies shape themselves through these artefacts when we are using them and we adapt our bodies to the usages of the artefacts surrounding us. Eventually, this adaptation gets involved in the primary loop as it changes the way we use our capabilities through our habits and behaviours. Many postures, gestures and body rituals we use are coming from our relation with an artefact, from the use of it or from the imitation of its function. I am sitting on my chair now which is defining my posture, speaking to my mobile phone with a little spasm in my folded arm posture and waggling my mouse to wake my computer up.

Figure 2.4: Charlie Chaplin expressing the manipulation of his body influenced by assembly line systems in his movie, *Modern Times.*

In his movie *Modern Times* (1936), Charlie Chaplin illustrates how the new mechanization systems manipulate our body rituals with an ironic interpretation coming into existence in the body of a factory worker. Chaplin successfully performs the tool usage gestures in an exaggerated way and expresses the manipulation of his body.

As an extreme example to postural habits coming through objects, some researchers have shown that even having different toilet use habits like using squat toilette or water closet is affecting people's postures and leg flexibility in all their lives as squat toilet users have more capabilities of moving with their flexible legs and less knee joint problems. (Tekin, Ünver, & Karatosun, 2012) Therefore, when two people coming from different toilet habits get tired, the one who got used to it before can squat to relax for a while whereas the other one should definitely sit on something to relax. Continuing from this extreme "toilet" standpoint concerning gestural habits, we could also discuss modern toilets of today filled with sensory equipments. When we are sitting in toilets, it gets darker in the room if motion sensors do not capture any movement in that period. So, we do this odd gesture that we wave our hand carelessly in the dark to activate the sensor again. We were not using this gesture at all sitting on the toilet before those sensors were introduced to us.

We can see two different effects of the artifacts on our body from these two different examples on the specific case of "toilets". The first one shows how it could affect our physicality whereas the latter one is referring to the gestural behaviours.

To have a better understanding of the essence of this relationship between humans and objects let's take a brief ideational journey to give a voice to some important thinkers on this issue.

Looking to Maurice Merleau-Ponty's writing on tool use, our body has an ability to adapt and extend itself through external tools. When we learn to use a tool, it becomes an extension of our body both in manners of becoming a potential for action or medium for perception (as cited in Svanæs, 1999). Merleau-Ponty uses the term of "Bodily space" when he defines our physical world interactions through our perceptions. He points out the intersection points between the spatiality of the body and the spatiality of the objects and he fairly explains that we are aware of our bodies both as an object among the other objects in the physical world and more directly as

experiencing/living with our bodies (Le corpse propre)(Merleau-Ponty, 1945). When he explains spatial distinctions between external space and the bodily space he emphasizes that the external space is consisting of geometrical navigators like up-down, left-right axes whereas our bodily space constituted by our potentials for actions in this physical space. Therefore, every new movement acquired with the new usages of our new tools changes our bodily space, because they change our actions in the external space and our way of being in the world changes as well. He points out the strong relations with our objects as he exemplifies our bodies extend to include the tools or objects we use: blind man's body includes his white stick and his body ends at the tip of that white stick. And similarly, a woman wearing a hat with feathers on it knows just how to bend her head to fit through the door. (Merleau-Ponty, 1945) For Merleau-Ponty, the perception is embodied and we perceive the world with and through our active bodies. He puts it very briefly when he says: "The body is our general medium for having a world" (Merleau-Ponty, 1945. p.146). Ultimately, if I am using my hammer to drive a nail into wall, it is fair to say that, the action of hammering is much more than merely a body activity. That action, itself, changes my perception of the world through my bodily space like all the actions occurred with the usage of my tools do when I interact with them.

Continuing to the same discussion from the perspective of Theodor Adorno, let's take a quick look at what he says in one of his brief excerpts, *"Do not knock"*, in his book, *Minima Moralia*. He points out how technology drives our desires and alters our impulses through our gestures.

> Technology is making gestures precise and brutal, and with them men. It expels from movements all hesitation, deliberation, civility. It subjects them to the implacable, as it were ahistorical demands of objects. Thus the ability is lost, for example, to close a door quietly and discreetly, yet firmly. Those of cars and refrigerators have to be slammed, others have the tendency to snap shut by themselves, imposing on those entering the bad manners of not looking behind them, not shielding the interior of the house, which receives them. The new human type cannot be properly understood without awareness of what he is continuously exposed to from the world of things about him, even in his most secret innervations... (Adorno, 1951, p.40)

Here we come to an analogue point concerning human-object interactions while Adorno indicates how the "world of things" surrounding us affect our lives.

However, Adorno's voice here sounds a bit pessimistic about these impositions occurring with the usage of new technologies.

> ... And which driver is not tempted, merely by the power of his engine, to wipe out the vermin of the street, pedestrians, children and cyclists? The movements which machines demand of their users already have the violent, hard-hitting, resting jerkiness of Fascist movement. (Adorno, 1951, p.40)

He might have a point there and it seems reasonable that the technology is dehumanizing us and making our gestures ill-mannered in many ways. To make what he says clearer, I would like to correlate Adorno's thoughts to his insights on human-object relations. In *On Subject and Object*, he questions the relationship between subject and object. And he asserts that "the separation of subject and object is both real and illusory." (Adorno, 1969. p. 246). To him, the primacy of the object includes recognizing the epistemic importance of the embodied experience of human subjects to reach the knowledge of the object. As cited in Deborah Cook's book, *Theodor Adorno: Key Concepts*, Adorno puts emphasis on the experience: "a conception of experience … that is embedded in a linguistic form of life and practice" (Cook, 2008. p. 78). He claims that our knowing and being are inseparable from the history of the objects. That could be one of the reasons that he accuses technology when he says "It subjects them to the implacable, as it were ahistorical demands of objects" in the cited excerpt above. To define these relations, Adorno proposes "non-identity" between subject and object, combined with the "affinity" among objects, also between the object and the experience. That affinity is revived by mimetic execution, whereby "the subject immerses itself in the things it attempts to present" (Cook, 2008, p. 91). So, when we are given an object, our natural reaction is intuition that creates an immediate relation to the object through the knowledge coming through embodied experience.

We can correlate Adorno's remarks to Merleau-Ponty's *experiencing/living bodies* notion. However, in Adorno's perspective, he defines the experience through the priority of the objects where Ponty defines it from a more anthropocentric point of view. Despite accepting the priority of the objects, Adorno is a bit gloomy when it comes to the discussion of technology. It seems like he sees the technology making the separation between the subject world and object world sharper because of the lack of "affinity".

Adorno's excerpt is indeed striking in many ways. And we will turn back to some of his valuable insights about the historical experience aspects of our relations later on. However, instead of continuing with the discussion of our "damaged lives" suffered from new developments, I would like to carry this dichotomy to a point where we question how we create new technologies.

Here I give the microphone to Martin Heidegger to hear some insights from his essay, *The Question concerning Technology:*

> **...**Everything depends on our manipulating technology in the proper manner as a means. We will, as we say, "get" technology "spiritually in hand." We will master it. The will to mastery becomes all the more urgent the more technology threatens to slip from human control. (Heidegger, 1950, p.5)
>
> …The relationship will be free if it opens our human existence to the essence of technology. When we can respond to this essence, we shall be able to experience the technological within its own bounds. (Heidegger, 1950, p.3)

To Heidegger, technology is nothing more than a reflection of the people. Technology is not a thing in itself independent and separated from human society; on the contrary, it just mirrors the values of the people who have created it.

> "If we inquire, step by step, into what technology, represented as means, actually is, then we shall arrive at revealing. The possibility of all productive manufacturing lies in revealing. Technology is therefore no mere means. Technology is a way of revealing. If we give heed to this, then another whole realm for the essence of technology will open itself up to us. It is the realm of revealing, i.e., of truth" (Heidegger, 1950, p.12)

Then, it is us deciding on how we interpret the essence of the technology as its creators. The more we inquire about the technology the more we reveal ourselves.

> The essence of modern technology lies in Enframing. Enframing belongs within the destining of revealing. These sentences express something different from the talk that we hear more frequently, to the effect that technology is the fate of our age, where "fate" means the inevitableness of an unalterable course. (Heidegger, 1950, p.23)

Heidegger's approach about understanding the technology can be expounded as more of a role for people in relation to technology while Adorno seems to think technologies consume and determine us. And since he puts the technology as a way of *revealing* for people, his passage has some prospects about the future of technology which could also make Adorno happy if the *revealing* of ourselves was executed well. Yes, it is in our hands to see it as *inevitableness* or not.

In summary, we have been introduced to the notion of living/ experiencing through our bodies by Merleau Ponty and traced the line carried by Adorno on emphasising the importance of the experience and the historical aspects in subject-object relations and eventually we heard Heidegger's considerations on questioning the technology by acknowledging that the technology and the *techne*[1] of those who use technologies are ways of revealing. I would like to give a pause to our ideational journey here and switch our focus to look through to the existing situation in the field of technology concerning the interactions between people and the devices. My purpose doing that is to examine the next generation of our interactions by referring to those notions we gathered from Merleau-Ponty, Adorno and Heidegger.

2.2 Interactions on the Track of Technology

Along the line traced by the technological developments, our relations with artefacts have dramatically changed and the interactions have become more than their shapes and functionalities. This interaction becomes even more significant as we incorporate the computing into our daily experiences intimately by carrying them with us to everywhere woven into clothing, or worn directly on the skin (Hansen & Kozel, 2007, p. 208).

Where the physical ergonomics was the main discussion for our interaction with the non-digital artefacts, the appearance of Human-Computer Interaction field introduced different terms like cognitive ergonomics[2], tactile interaction[3], haptic interaction[4]; tangible interaction[5], gestural interaction[6] and embodied interaction[7] which have became subjects of a discussion of defining the interactions with our digital artefacts. These fields and their relation to each other will be examined explicitly later on in this research.

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[1] *Techne* (Art or craftsmanship): The knowledge of how to do things and make things. (Extracted from Oxford Reference)
[2] *Cognitive Ergonomics and Human-Computer Interaction* (Long & Whitefield, 1989)
[3] *Tactile Interaction* (Challis, 2013).
[4] *Haptic interaction becomes reality* (Raisamo, Surakka, Raisamo, Rantala, Lylykangas, & Salminen, 2009).
[5] *Tangible Interaction* (Hornecker, 2009)
[6] *Gesture Based Interaction* (Buxton, 2007)
[7] *Where the Action Is: The Foundations of Embodied Interaction* (Dourish, 2001)

Regardless of the significant differences in the interactions with our new artefacts in comparison to the old ones, it is fair to mention that the loop emphasizing how we become materials for our tools still remains. Our technological tools are also affecting our bodies in many ways. Some could claim that the digital artefacts are not very engaging from the physical standpoint as we are losing some of our tiresome moves where our new tools are doing many things instead of us. However, on the contrary, we are obviously creating new movement sets, new body language, influenced by this technological environment. The existing body language of our digital devices will be examined in detail later on in this study (see Figure 8). In her article, *Social choreographies,* Susan Kozel touches upon the same issue, while she examines the role of our devices in social context through their manipulation of our body movements.

> ... all of our devices invite a set of physical gestures either determined by the data they convey (voice, text, visuals), by ergonomic or awkward design, or by the set of codes communicated across distinct social groups indicating how to use and wear devices in different social settings (the club, the subway, the library, the studio). (Kozel, 2007, p. 104)

Talking in Merleau-Pontian terms, our *bodily space* is defined by all the things surrounding us. All of the artefacts that we use in our daily lives determine our movement sets and we perform our moves within this restricted space. Getting used to this space around us may affect our bodies in two manners. Firstly, in physical manners: having the same postures or making the same gestures for a long time can cause some physical habits which might sometimes end up some physical consequences of postural disorders or habit spasms. And secondly, it can possibly affect us in mental manners too. With the notion of living/experiencing through our bodies (Merleau-Ponty, 1962), we experience the space surrounding us with our bodies and we create some sort of "body memory" in visceral bearing. Our bodies remember the movements they get used to doing. It is something like when you hang your towel to a different hanger one day; you cannot help your body to not gravitate to the old position of that towel. Or you straighten the position of your glasses with your hand many times even they are not on put on. Our bodies think before us when the "action" is the case. In the same article Kozel points out the notion of thinking through our bodies: "Sometimes we are better able to understand seemingly abstract concepts by filtering them through the minute but concrete moment of encountering the world through our bodies" (Kozel, 2007, p. 106).

Here, I would like to put more emphasis on the use rituals of our artefacts in relation to our body memories. Our body memory easily remembers the way that we are interacting with our artefacts and after a while, these gestural traces of our use-rituals become a kind of symbol expressing that action. When I use my fingers next to my cheek connecting my ear and my mouth, you'll understand that I'll call someone. I can easily imitate the action of playing guitar without a physical guitar or point a finger gun to your face by imitating the posture of holding a gun. There is no need to be a pantomime artist to express yourself with these body moves. Because, it is coming through our own bodies, it is the knowledge embedded in these gestures of our daily performances occurred with the relation with our tools.

Thus, we have this knowledge embedded in our bodies through our lived experiences. When people are introduced to the new devices, they are starting a new relationship with their body memory of gestures coming through the usage of their previous devices. This reflects notions from Adorno on subject-object relations, how our knowing and being are inseparable from the history of the objects. So the intuitive qualities of my interaction with a new technology are strongly dependent on my past experiences and the *affinities* which occurred in this previous interaction. As soon as I find some correlations through the shape or the function of the artefact, or some nuances in the way that I move my joints; my body memory will be evoked by these reminders to find the needed physical action for my interaction. It can be claimed that there is a correlation between our previous habits of our body moves and the new interaction ways we try to achieve.

Figure 2.5: Captures from a conference: An old man trying to use a microphone like if it was a cell phone until someone else shows him how to use[1].

[1] Video available at: http://www.youtube.com/watch?v=9c-oSj5_Scw

Japanese product designer Naoto Fukasawa has proposed that the best designs are those that "dissolve in behaviour," which can be interpreted as the products themselves disappear into whatever the user is doing. In one of his interviews he indicates:

> Designers often want to make something special, something that really grabs people's attention. But I realized that when we actually use these products, whether or not they are special is not that important. So I decided it would be a good idea to look at people's subconscious behavior instead—or, as I call this principle, "design dissolving in behavior." I realized then that design has to achieve an object "without thought."[1]

Highly relevant to Adorno's notion about historical aspects and affinities, but with a perspective of a designer, Fukasawa brings the experience of the lived bodies forward and interpret the notion of thinking through bodies in his key approach: objects "without thought". Therefore, it becomes really important to him that the new use of our new devices should interlace with our behaviours.

As cited in *Designing Gestural Interfaces* (Saffer, 2008), Adam Greenfield, author of *Everyware*, talked about this type of natural interaction in an interview:

> We see this, for example, in Hong Kong where women leave their RFID based Octopus cards in their handbags and simply swing their bags across the readers as they move through the turnstiles. There's a very sophisticated transaction between card and reader there, but it takes 0.2 seconds, and it's been subsumed entirely into this very casual, natural, even jaunty gesture.
>
> But that wasn't designed. It just emerged; people figured out how to do that by themselves, without some designer having to instruct them in the nuances…The more we can accommodate and not impose, the more successful our designs will be. (Saffer, 2008)

The best, most natural designs, then, are those that match the behaviour of the system to the gesture humans might already do to enable that behaviour (Saffer, 2008). We can easily correlate this notion with Heidegger's thoughts where he propounds the technology as if it is no more than revealing the people who are creating it. So, could we say that when our design ideas dissolve in our gestural behaviours we make it more embodied in a way? Let's turn back to this question after examining the gestures and their place within the interaction design field deeper.

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[1] See interview available at: http://www.designsojourn.com/naoto-fukasawa-without-a-thought/

2.3 Shift of the gestures

Today, we have come to a point where we are not complaining about the technological limitations of our devices. Instead, our basic concern is defining the interactions between these devices and people. In his paper, *Appropriated Interaction Surfaces*, Chris Harrison brings up the discussion about the basic limitations of the interaction surfaces in our devices. He reasonably points out that the primary limitations for our modern mobile devices are not the electronics, but the surface area for our input and output (Harrison, 2010). Truly, if we separate the big screen and a keyboard from our Macbook, we will only have some tiny electronic devices that could fit anywhere. We did made processors faster, LCD screens thinner, and hard drives smaller. However, we can't magically create surface area without increasing the size of the device. Therefore, the only way to have input larger than the device is seemed like to separate the two to get rid of from the device's small physical constraints.

In *A Brief Rant on the Future of Interaction Design* (Victor, 2011), Bret Victor, one of the ex-Apple designers for gestural interfaces, *questions* the future of interaction design starting from a provocative point as he criticizes the *Productivity Future Vision*[1] video showing our interactions with our devices in the future.

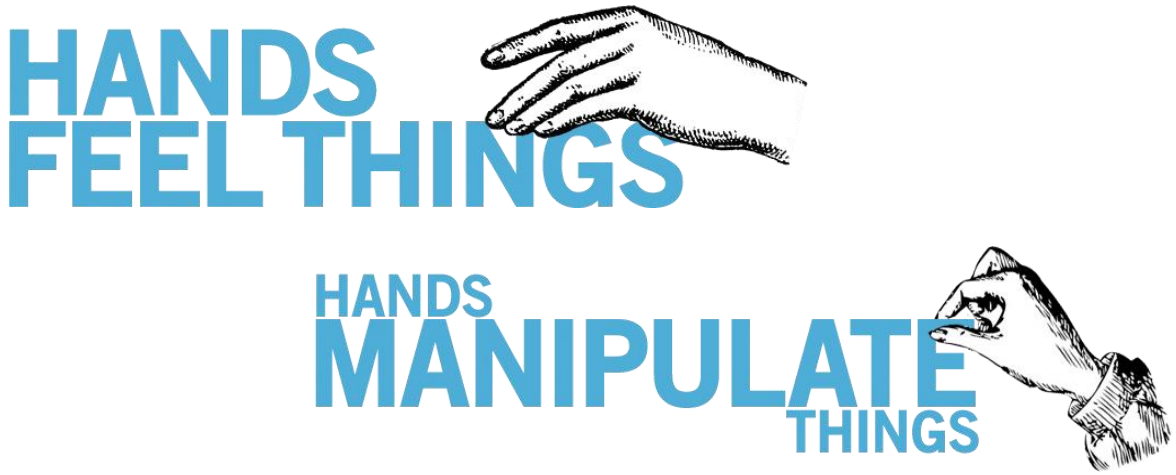


Figure 2.6: Bret Victor's "Hands" (Victor, 2011).

He puts emphasis on the importance of creating the vision of the future but meanwhile he claims the things shown in the video are not appropriate for our future

[1] Available at: http://www.youtube.com/watch?feature=player_embedded&v=a6cNdhOKwi0

interactions at all. He reminds us the two basics that we do with our hands: Our hands feel things and manipulate things.

However, he argues that with today's technology, our hands are stuck onto 2D surfaces to interact with the devices and he claims that it is reasonably hard to question or challenge these basics when we are using our existing devices today. He complains about the fact that our hands are losing their expressivity while interacting with our devices and he proposes that the future of our interactions cannot be limited merely to our fingers moving on the *Pictures Under Glass* and he ironically asks: "Are we really going to accept an Interface Of The Future that is less expressive than a sandwich?"

At this point, we can obviously mention a technological shift came with the developments in the sensory technologies. As stated by Hansen and Kozel, "Acknowledging the sensory, affective, poetic and corporeal qualities of the moment of lived experience is key to designing and understanding the next generation of technologies and— this is not always afforded by existing design methodologies." (Hansen,&Kozel, 2007. p. 208). With a variety of sensory technologies, we have come to a point where we use our gestures to control our devices with a kind of interpretation layer between the gestures and the actual function. I will call this as a shift of gestures since they find totally different meanings in today's technological environment. We are now able to put our experienced bodies forward to transfer the embedded knowledge of our bodies through the ages. Instead of doing the actual physical activity we are using our gestures as if we are imitating that body movement to give an input to our system. In a way, we are using our gestures as symbols out of some pragmatic movements. Talking in the Saussureian semiotic terminology, a sign in this manner can have different definitions. If we briefly say that a *sign* consists of *a signifier* (the form that the sign takes) and *the signified* (the concept it represents)(De Saussure, 1916, p.67), the physical actions we use to control our devices act as the *signifier* which resembles the actual function of the moves that are *signified*. The success of these gestures strongly depends on the interpretation that we make in our minds to match that *signifier* and *signified* items. It becomes really important to interpret our gestures as signs, whereas they have other potential meanings embedded in our gestures.

Although interacting with gestural interfaces may be deemed more natural than using such devices like a mouse and keyboard, it doesn't mean those interfaces are necessarily intuitive to use. The value of the embedded meanings is considerably significant as they reveal the intuitive qualities of our gestural *signs*. The distance between our gestures and the functions that we execute in our devices is sometimes too far from each other while it can be really hard for people to interpret it. On the other hand, it can be indeed very valuable if the designers could catch good interpretation layers of those gestures. The value here is coming through how the interactions dissolve in our behaviour with a referring to the previous discussion I introduced in the end of previous section. It is obvious that we were not using sliding or panning gestures in our daily lives before we had been introduced to touch screens. Therefore, there is a thin line between making the translation of old gestures and creating a completely new gesture as a rule of usage. I am not offering a value judgement to evaluate old and new gestures in comparison. Rather, it is more like offering to talk about our bodies referring to the previous discussions on bodily experience. With the new sensory technologies, we are now more able to put more emphasis on the body and the dissolution of our design in the behaviours.

Considering all of these issues listed above, I would like to pay attention to the role of our daily physical activities and behaviours in order to make gestural interaction more embodied. To do this, we will first have a look to the intersection points of those terms in the interaction design field.

2.4 Gestural Interaction

It is fair to say that gesture based technologies will have strong emphasis in our future through gesture related interfaces and devices. Exploration of potential gestures and postures of tomorrow has become an issue of today's digital technology practitioners. It isn't too hard to have an assumption about some of the technological developments in the near future and to create some use scenarios for them. That's what many of the practitioners in this field are up to today. Let's see its position within interaction design field, together with the other existing fields in the same manner.

One of Nokia's research leaders, Vuokko Lantz, defines Gesture-based interaction as enabled by two broad types of technologies: tangible and deviceless (Lantz, 2012).

The more common tangible technology involves the use of hand-held or wearable devices, or touchable surfaces, requiring physical contact to a gestural input device or sensor system. By contrast, the deviceless technologies do not require direct manipulation of an input device or a surface, but instead recognize gestures via various remote sensors. Though, some technologies are somewhere in between, e.g. capacitive touch panel can be utilized as a proximity sensor as well. To have a better understanding about tangible interaction and embodied interaction let's pay attention to Paul Dourish as he defines the embodied interaction as a combination of Tangible computing and Social computing:

> The idea of Embodied Interaction reflects a number of recent trends that have emerged in the area of Human-Computer Interaction. For instance, "tangible computing" (as conducted, for example, by Hiroshi Ishii and colleagues at the MIT Media Lab[1]), is an area of HCI research where people are exploring how we can move the interface "off the screen" and into the real world. In this model, we can interact with physical objects which have become augmented with computational abilities. This lets designers offer new sorts of metaphors, or take advantage of our physical skills (like being able to use two hands, or to rearrange space to suit our needs), or even to directly observe and respond to our physical activities in the world (perhaps by knowing where we are and who we're with, and responding appropriately). A second trend is what I call "social computing," which is the attempt to incorporate sociological understandings into interface design. This approach to HCI design recognises that the systems we use are embedded in systems of social meaning, fluid and negotiated between us and the other people around us. By incorporating understandings of how social practice emerges, we can build systems that fit more easily into the ways in which we work...
>
> ...These two areas of research -- tangible and social computing -- have been conducted largely as independent research programs. However, I believe that they have a common foundation, and that foundation is the notion of "embodiment." By embodiment, I don't mean simply physical reality, but rather, the way that physical and social phenomena unfold in real time and real space as a part of the world in which we are situated, right alongside and around us. (Dourish, n.d.)

Within tangible interaction, it is fair to mention two more fields: Tactile interaction and Haptic interaction. Ben Challis explains tactile interaction as a way of experiencing our interactions through the touch sense (Challis, 2013). Unlike tangible interaction's wide territory about physicality and the action of "doing", we can acknowledge tactile interaction as a way of "receiving", in the manners of touch

[1] See at: http://tangible.media.mit.edu/

sense. That could also mean that tactile feedback is an additional option to consider in our interactions in addition to the visual and auditory feedbacks.

Where tactile feedback supervenes with the feedback which is merely cutaneous[1] information, the haptic perception includes afferent[2] kinesthesis together with cutaneous information (Challis, 2013). Therefore, the field of Haptic interaction involves the force-feedback which we feel afferently rather than the mere tactile feedback that we feel on the skin just by touching.

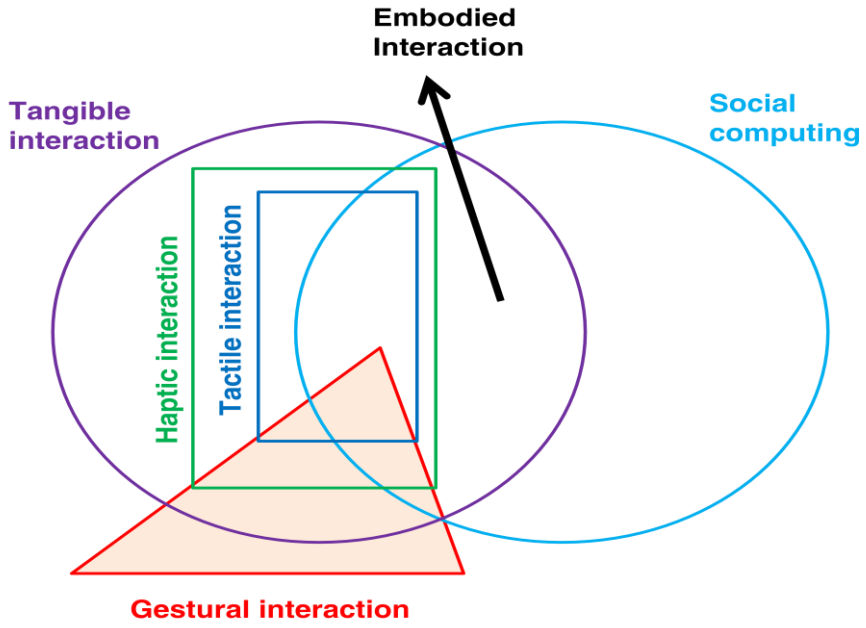


Figure 2.7: Position of Gestural interaction in the interaction design field.

Together with all these definitions, I would like to define the relations of the gestural interaction to other fields as you could see in the Figure 2.7. While creating this scheme, I considered the basic essences of these fields to define their positions to each other. Otherwise, knowing those fields are indeed transitional to each other, I could end up with only one circle representing all of them. I would locate Gestural interaction in a place where it encloses areas from deviceless interaction (which stands out of the tangible interaction), tangible interaction, haptic&tactile interaction and embodied interaction. Although receiving tactile feedback is not a core value for

[1] Relating to the skin (Definition retrieved from Oxford Reference)
[2] Carrying from the outer regions of a body or organ towards its centre. (Definition retrieved from Oxford Reference)

gestural interaction in the first place and the essence of the gestural interaction is more likely revealing *physical doing* rather than *receiving* tactile feedbacks, I believe that discussing the feedbacks that we receive from the systems will be more and more important to discuss in every development step of our interfaces as our interactions getting off from the mere screens.

2.5 Designing gestures

In her article, *10 physical gestures that have been patented,* Annalee Newitz points out that a whole lot of gestures are already copyrighted, and not just by Apple. That company seems to be the biggest gesture hoarder, even applying for copyrights on crazy three-fingered, twirling gesticulations that probably won't ever be used, but which it doesn't want anyone else getting their grubby three fingers on (Newitz, 2011). I wanted to give this intentional introduction to reveal the existing situation in gestural field. In a column titled "Gesture Wars", published on the design Web site Core77[1], Donald Norman argues that because the major technology companies who are creating new gesture-based devices and platforms (Apple, Microsoft, Google, etc.) are "patent happy," they are increasingly designing gesture-based controls that are inconsistent and will cause confusion.

Figure 2.8: Possible patented moves of the future.[2]

[1] Available on http://www.core77.com/blog/columns/gesture_wars_20272.asp
[2] Image taken from http://io9.com/5808604/10-physical-gestures-that-have-been-patented

The reason for that is there is a huge lack of standardization about gesture-based controls. While we are presuming gesture-based controls as intuitive and easy to learn interactions, it might not be that easy to figure out the proper gestures we should use in a few years time as every major tech company put their own rules to define their own interactions. Nobody wants to check manuals every time as they were introduced these gestures as if they are a more intuitive way of interacting, right? Although this recently started gesture wars on copyrights seem to be a weighty obstacle standing on the way of standardization; there needs to be standardization for interactive gestures sooner or later, as stated both by Saffer and Norman (Saffer, 2008) (Norman, 2011).

We can look into this issue in two manners: to be able to create new gesture sets for the same functions in this gestural war environment, designers should understand the core values of the interactions in order to interpret them in a different ways. On the other hand, if we are mentioning about a standardization process concerning the gestures, this should definitely come through our bodies instead of technological imposition.

3. EXPLORATION

After reviewing the background on people-artefact relationship and the gestural interaction with its position in interaction design field, in this part, I will introduce my explorative design process to create new gesture sets for our mobile devices with the notion of making design dissolved in our daily behaviours. I will try to reveal my process step by step with several references to the theoretical background section.

-Why mobile devices?

There are a lot of fields that we could encounter to gesture-based interactions. From public restrooms and shopping mall entrances to the check-in kiosks in the airports; from the game consoles to our personal computers and of course to our mobile phones. Within these areas, I chose to focus on mobile phones to discuss new interaction ways. One of the biggest excuses for this choice was the fact that our mobile phones are the ones that we always keep with us in daily life. And since they are stuck to our hands accompanying us everywhere, it makes sense to discuss our daily gestures through them. When Susan Kozel reclaims the role of our mobile devices in our daily life, she indicates:

> ...We integrate these little devices into our clothing, our pockets, or our bags, and our daily gestures include the arm, head, and spine movements associated with using them. We even walk and see differently when we use them. Our senses are re-patterned, our intuition of space and time folds inward or leaps outward. We access another person by means of our mobile devices: we then carry the other with us, in our hearts, in our memories ... in the devices themselves? (Kozel, 2007, pp. 101-102)

It is fair to acknowledge them as the extensions of our bodies as they are accompanying us nearly in every moment of our lives, affecting our perceptual and gestural lives.

Before introducing the way I executed my applied research, I will touch upon some related researches examining the similar issues concerning gestural interaction. I will

explain them as a motivation to my research both as revealing the technological availabilities and the methods that have been used for the elicitation of the gestures.

3.1 Related Research

Although there is a lot of gesture related research on interactive surfaces, I would like to point out one of the recent and important studies from Wobbrock et al. (2009) as it propounds a user-centred approach to define the gestural commands for some tasks based on surface gestures. It presents a set of user-specified gestures derived from observing how users would perform gestures for varied tasks (Wobbrock et al., 2009). Wobbrock et al.'s study in surface based gestures is a strong justification for elicitation studies in the research of gesture sets. Pointing out to the important issues about the gestural shift from surface base interaction towards motional interaction, Lumsden and Brewster (2003) discuss why it is necessary to comprehend a paradigm shift in terms of interaction techniques for mobile technology and present two multimodal interaction techniques as alternatives to traditional, visual-centric interface designs on mobile devices (Lumsden and Brewster, 2003). Addressing the same issues but from a different perspective, Schwarten et al. (2008) offers a classification for the forms of mobile interaction and presents a comparison of tilt-based interaction with the established keypad interface and develop a new metaphor for tilt-based control which they call as *MarbleControl* (Schwarten, 2008). There is also other related research grounded in computer science which is discovering and proofing the utilities of the sensory systems to substantiate motional interaction.[1]

Discussing and designing motional gestures for mobile interaction with a user-centred perspective have been fairly discussed in several papers. Ruiz et al. (2011) offers elicitation of user-defined gestures for mobile interaction. They use a method in which they give an application loaded smart phone (Google Nexus One smartphone running Android 2.1) to the users to execute some tasks and gather information from the sensors to be able to make classification of the gestures that users have done. They also reinforce their user tests with video recordings to make it easier to understand people's gestures (Ruiz et al., 2011). Their research is quite significant for the literature as an elicitation study for the gestures. Liang et al.

[1] See (Ruiz & Li, 2011) and (Negulescu, Ruiz,& Lank, 2012).

(2012) present a guessability study to elicit a set of user-defined surface and motion gestures for mobile devices to support 3D manipulations of objects at a distance. They use similar type of user-testing method as they execute the tasks through tablets running Android OS (Liang et al., 2012). In their article, *Mobile Interaction does not exist*, Marshall and Tennent (2013) claim that most of the mobile systems are not truly "mobile" as it is not possible to perform any meaningful two way interaction if we are actually moving around with less visual and mental attention to the device. They try to reveal the ways for interaction in motion as they choose to illustrate it in a particular case of interaction design: the design of interactive devices for use while cold water swimming.

Although it might seem like many of the studies listed above locate users in the centre of the researches to elicit gestures, I believe that the studies made to elicit gesture sets through users' bodies could learn more from phenomenology and our relations with the objects. I will introduce my methods as a way to execute applied research with a focus on human-object relations through phenomenological stand point, which is to say emphasising the use of gestures in lived experience.

3.2 Research Method: "Hacking the Physical Actions"

In this section, the applied research approaches that I followed will be introduced in order to pursue my research questions. These practices are executed through close observations, connotation exercises and bodystorming sessions which have all made together with the users. I will define the combination of these approaches as "hacking the physical actions" and will try to reveal the significance of this method, especially constituting a source for the similar researches in this field.

I am using the term "hacking" here as it refers to the practice of modifying the features of something, in order to accomplish a goal outside of its original purpose. So, in my applied research, the main focus was to "hack" our daily actions in order to translate them to control inputs for the fundamental functions of our mobile devices.

At this juncture, it is fair to emphasize that the idea of "hacking" was basically attributed from the theoretical framework of phenomenology which was established as a grounding for this research in the design context section (Section 2: Design Context). To be clearer, the method used in this research is to put the

phenomenological point of view into the design context and then to designate the applied research process in line with that framework. Therefore, the values acquired from theoretical research process were the key elements to define my approach for the applied research. When this is the case, phenomenological standpoint required me to have better understanding of the gestures in lived experience and my applied research was based on this notion. It wouldn't be possible to "hack" something without understanding the core "meaning" of it.

In the specific case of this research, understanding the gestures in lived experience entails grasping our current relations with the mobile devices. This requires understanding how individuals apprehend the artefacts surrounding them and make sense of it, both in physical and visceral bearings. This crucial requirement shaped the way that I executed my applied research. My approach was to understand these manners thoroughly by performing close observations and organizing workshops based on design improvisations.

Next sections will demonstrate the content of my applied research broadly.

3.2.1. Close observations

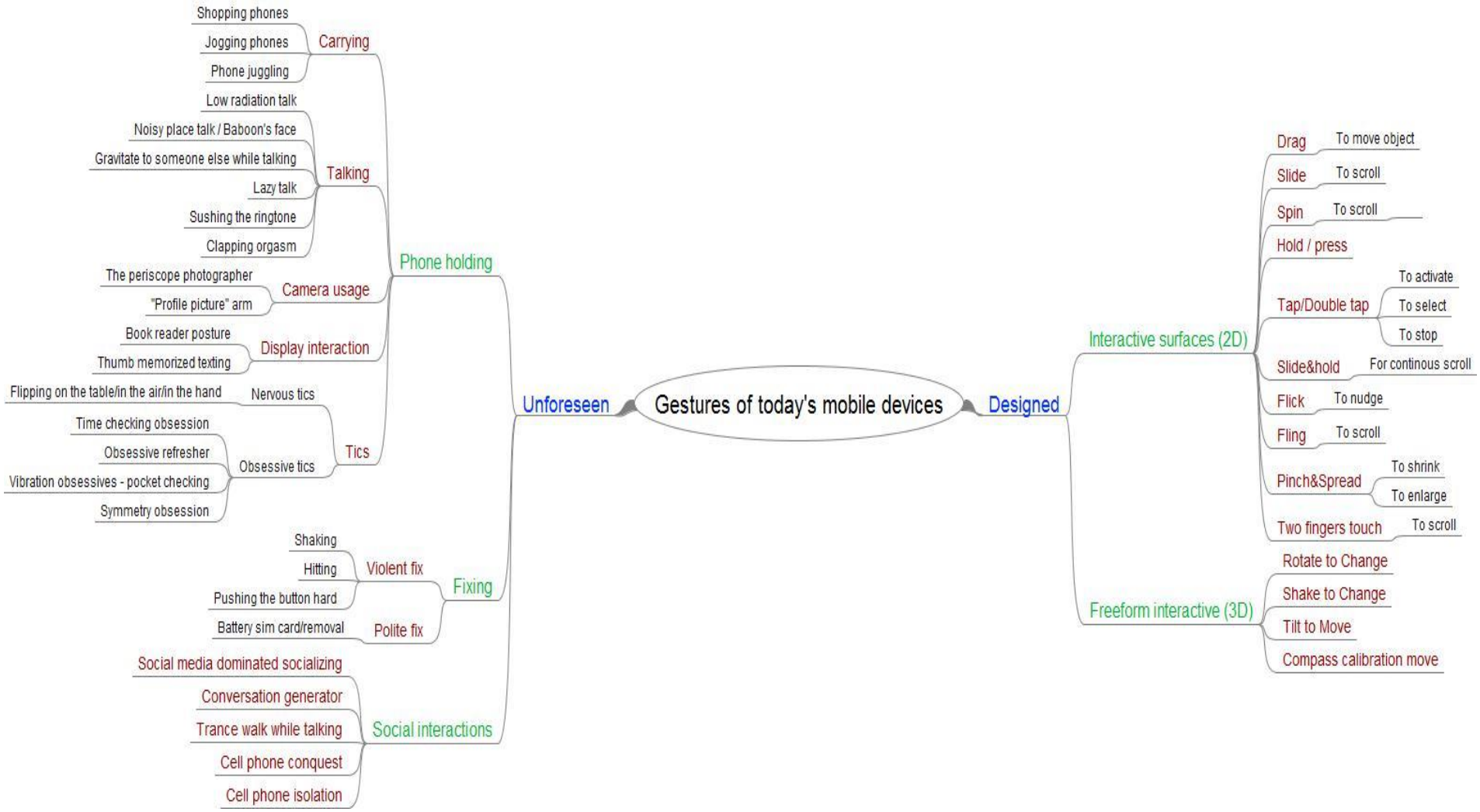
In this phase of the process, the existing body language of the mobile devices was examined by close observations on users in order to have a better understanding about our interactions in gestural manners. Without going into lab environment, or being exposed to any questions, users have been observed in their life interacting with their devices. This research provided some raw data on how people act while using their devices. And the data gathered through observations were then blended with my own experiences as well as involving the aid of the related researches[1] done on the similar subjects. In conclusion, the data sets were classified and narrowed down into several categories.

3.2.2. Classification

This classification has basically built on two main categories which I call as *designed* and *unforeseen* gestures of today's digital devices (Table 3.1). By *designed* gestures, I refer to the common gestures which were created by designers or other related

[1] See (Saffer, 2008), (Hill, 2012), (Nova, Miyake, Chiu, & Kwon, 2012)

Table 3.1: Body language of today's mobile devices.



practitioners to use those gestures as a control input to our devices. These gestures are basically existing control input of the current devices. The gestures could be grouped into two as Interactive Surface gestures (Gestures we perform on 2D screens in order to control our devices) and Freeform Interactive surface gestures (Gestures we perform in 3D space in order to execute the tasks of the devices).

On the other hand, *unforeseen* gestures are referring to the gestures occurred with the usages of our devices which were not intended or unforeseen by the people who created these devices in first place. I have grouped this topic into three sections as Phone holding (Habits occurred while the users hold the phones in different situations, Fixing (Our reactions to the breakdowns in our devices), Social Interactions (Phone usage in social setting).

Having this chart in my hands helped me a lot in the later stages of the process, especially by being a source to better understand the people's activities in my following workhops. The unexpected relations occuring with the usages of our devices played a key role to explore the dead spaces of our interactions with our devices.

3.2.3. Workshops

If we are talking about translating our daily actions to the control inputs for our devices, it is really crucial to understand the correlation between the physical moves and the tasks that we want to achieve through these movements. Hereby, the main scaffolding of the workshops can be paraphrased as exploring these core values of our movement qualities and finding the fundamental correlations through them in a metaphorical way.

This kind of exploration of the new movement sets also incorporates a derivative goal referring to the exploration of the dead spaces of our interactions that are not involved in our bodily space formed by our curent relations to existing devices.

In order to catch these correlations strikingly, I believed that the users should be exposed to a state of mind that makes them physically and mentally distinguished from the restrictive circumstances of the existing physicality. Therefore, instead of giving mobile phones and making users to try them out to find novel interactions, I put them into a situation which demands them to perceive all the objects in a

different way, and make them to use a lot of different props to perform relatively similar tasks to the functions of our mobile devices. Because my question is not to simply ask what we could do with the existing devices, but more like carrying the aspects from our bodily actions and behaviours to the devices.

Content of the workshops

I have made three different workshops with ten people in total. The participants were coming from an age group varying between 25 and 33. And 9 of them were aspiring designers coming from different design related backgrounds. Besides that, all of them had an origin from different countries but all from Western culture. The main framework of the workshops was kept almost the same in each workshop with some tiny modifications. But within this framework, the participants were pushed to create the content of the workshop in their own. Therefore, I should say that each workshop had its own essence depending on the involvement of the participants and their relations to each other.

My initial idea was making the workshops individually with only one person in each workshop. However, regarding the strong aspect of creative encouragement coming from being in the same environment with different people, I changed the format to execute the sessions with at least three people. At least in this type of workshop structure, I thought making it in group setting would push participants' creativity and make them to find some novel things.

Workshop Environment

The workshops have been held in a room which is normally used as a studio by interaction design master students in Malmö University. I really believe that the space perception is really important for the participants when we are making those kinds of workshops. I have rearranged the room as I created a huge empty space in the middle of the room to make participants to move around freely and I surrounded this space with different props. Where there was a separated table filled with some props on it, I also scattered some eye-catching objects in different parts of the room which seemed like they were already there. This was in purpose to make the participants move around and they have eventually "discovered" those objects which seemed like not included in the workshop context. They easily brought these "hidden" things into the context of the workshop with a "creative" feeling arisen for

finding them. And this helped those participants to get into the atmosphere of the workshop eagerly.

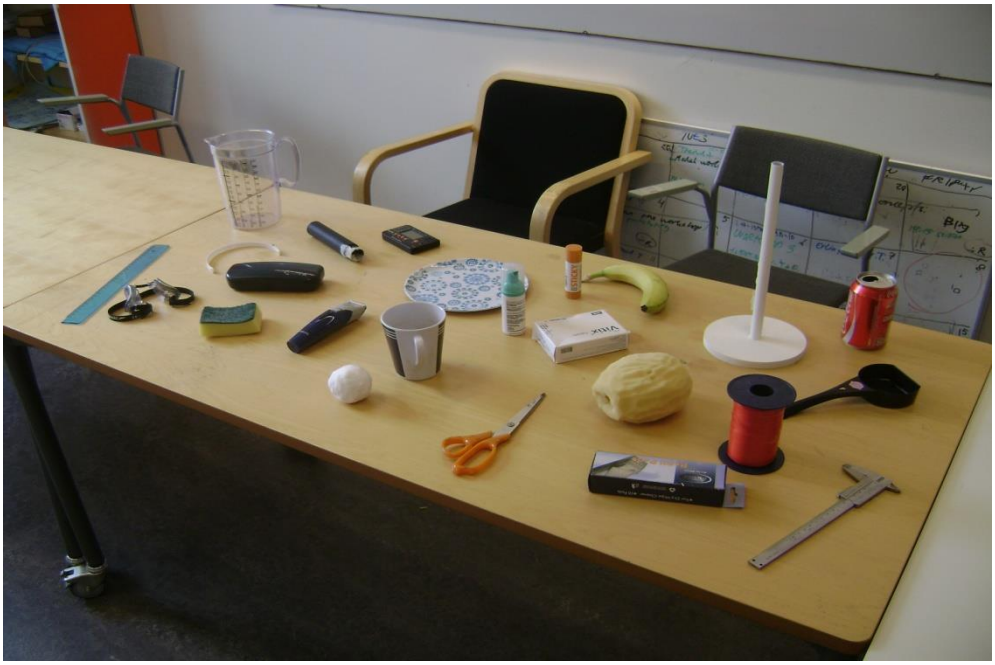


Figure 3.1: Some props from the workshop.

The props were consisting of a lot of different objects of various abstraction levels. Some of them were really abstract like a blank paper and a piece of sponge whereas some of them were some electronic devices like a razor. And there were also some stuff making them interact them through their inward aspects like water filled bottle and sand loaded jar. The scope of these props has been narrowed down during the process. I will touch upon these issues in the upcoming sections as well.

3.2.3.1 Part 1: Mental warming up

This warming up exercise was excerpted from theatre improvisations[1] which I had experienced in many years of my theatre practices. Similar kinds of exercises have also been used in several design research practices as a warming up for creative brainstorming sessions. (Gerber, 2009) The main purpose of this exercise is putting the users in a different mindset to push their way of thinking to an eccentric point.

Hereby, they were asked to walk around the room and by touching or pointing out an object, they were supposed to say what that object is "not". As we expect from every

[1] See (Boal, 1982) and (Spolin, 1983).

kind of improvisations, the important point here was to execute this task in a spontaneous way, without thinking. So, it is basically like pointing a chair and saying "this is a horse!" or pointing out the cupboard and saying "this is my father!". Although it wasn't asked from the participants to find some correlations in their brain to relate that object to something else; it was obvious that with the effect of being together with other people in a workshop environment they tried to find some surprising correlations to make other people laugh. So, instead of caring about the spontaneity of the task they prompted themselves to think about the connotations. Almost every participant approved the same thing, when they were explaining their experiences at the end of the session.

I was expecting this since it is really hard to make people not to think and be spontaneous. But this was not an issue as I used this exercise as a literal warming up for the upcoming exercise.

3.2.3.2 Part 2: Connotation exercise

Very similar to warming up session, participants were asked to execute the same task (saying what the object is "not") in this session. But this time, they needed to say an excuse that express the reason made them to give that name to that specific object. It was more like pointing a chair and saying: "this is a horse, because it has four legs!" or pointing the cupboard and saying: "this is my father, because it is so strict!". Depending on the involvement levels of the participants, we sometimes continued this exercise as a debate on one object trying to come to an agreement on what it is:

> -(Pointing out an eraser) This is a car because it has this rectangular shape!
>
> -No, that is a bomb, coz you can erase the world with that!
>
> -Am I the only one seeing that frog in your hand? Because it is green...-Come on guys, that is obviously a small stone to skip it on the sea like this [movement]!

Figure 3.2: Connotation Exercises.

My purpose in this session was to open participants' minds to interpret the objects in the room in a different way by finding some correlations. I created this exercise when I was thinking about the weak points of the first improvisation exercise. The weak point of the first exercise (thinking correlations) was turned into a strong element within the context of my research as I was looking for some correlations on objects' shapes and the movements occurred with the usages of these objects. This was relatively effective way to put participants' minds in a different setting.

3.2.3.3 Part 3: Body storming[1]

The aim in this session was trying to get into the physical actions occurred with the usage of the objects and understand the way how objects evoke our body movements with their shapes or with their other characteristics. We created a circle in the middle of the room all together and by starting with one object, we literally used that object and expressed an action with our bodies. Depending on their interpretation on each object, everyone made different moves expressing what they were doing with their bodies, without talking and handed it on to the next person in the circle. There was

[1] See the further information on using the bodystorming in Interaction design practices in (Gerber, 2009)

no limitation about the moves as some people have done several actions revealing the things that we actually do with that object whereas some of them were correlating that object with something else and expressing the usage of that associated object/tool. I would like to clarify the different actions from the participants in the following. I exemplified it with one specific object (a mug) to better understand the actions.

Figure 3.3: Body Storming.

-Using it as an actual mug expressing the physical actions of drinking, pouring, smelling the flavour of the drink, licking the drop on the edge.

-Using it as an associated object as a megaphone, hat, stool, telescope and earring and express the physical actions of their usages.

- Expressing the physical activity coming into mind with the shape of the object but without thinking what the object is: hook it to the pointing finger and spinning.

All of these different approaches were significant as they are giving clues about exploring our bodily spaces occurred with the usage of those objects. There are a lot dead spaces in our interactions waiting for to be explored.

3.2.3.4 Part 4: Embedding the actions

In this session, we focussed on the actions and tried to interpret them through different reflections on our bodies. So, in a way, this exercise is executed in an opposite way to the previous one.

To be clearer, I gave a set of actions to them as in the following.

-Splitting	-Shaking	-Pressing
-Hitting	-Knocking	-Emptying
-Throwing	-Pouring	-Washing
-Kicking	-Blowing	-Folding
-Squeezing	-Petting	-Cleaning

Figure 3.4: Embedding the Actions.

I chose these actions due to their potential to be interpreted in many ways and establishing a ground for the next exercise. I read some of these actions loudly and they found an object in their imagination to execute that action with their body by miming it without object. For example, when I gave the action of “shaking” they responded verbally like: “I am shaking my matchbox”, “I am shaking my hip”, “I am shaking the orange juice before drinking”, “I am shaking my head for approving” while they were also miming those actions with their body.

In each workshop I used different variations of these actions. And interestingly, the objects used in the third exercise and the actions used in the fourth exercise strongly influenced the way that they find novel interactions in the fifth exercise.

3.2.3.5 Part 5: Finding novel interactions through props

This is the last section of the workshop and in this session, participants were given a list of functions which we are familiar to us from our mobile phones. The attendants

were asked to find some ways to execute these tasks by using the props lying on the table as if they were our mobile phones.

The task list has included the following items:

- Calling someone
- Muting the incoming call
- Answering the incoming call
- Rejecting the incoming call
- Going to the next/previous page / photo
- Navigating on the map (right, left, up, down)
- Pan the screen view (right, left, up, down)
- Zooming in/out
- Snoozing the alarm
- Deleting the selected item
- Refreshing the page/ status / connections
- Send the message
- Unlock the keyboard
- Go to silent profile
- Turn on the camera
- Turn on the music player
- Turn back to Home screen
- Turn on the phone

Figure 3.5: Finding novel interactions through props.

The participants were given time to find some interaction ways to execute each task in the list as they could use different props for each item. At the end, after trying out the objects and interacting with them physically, they came up with several interaction suggestions for their novel mobile phones explaining why they chose that specific object with that specific gesture. See Appendix A.1 for detailed explanations of these results. Before explaining their "designs", participants were also asked if they had other suggestions of other tasks and they were then asked to design a gesture for each task they suggested. The aim here was to assess if the proposed tasks had enough coverage of possible uses of the phone. Last three items on the list above added to the list with the suggestions of the participants.

3.2.4. Evaluation of the Workshops

3.2.4.1. Using props

As a continuation to the theoretical background which was anchored on interpreting the human-object interplays through phenomenological point of view, I chose the way of using abstract props to execute my workshops. Rather than giving a mobile phone from the beginning, encouraging props were used as medium in the workshops so that they dissolved into the experience, gestures and feelings without restrictions of the actual shape of a mobile phone. In that way, the perception of the users naturally shifts towards the potential explorations of their experiences and everyday situations rather than discussing the technical availabilities of our devices. The props worked efficiently in terms of catching the core values of the interactions between people and objects, through their unconscious, immediate and cultural aspects and revealing what makes objects feel familiar or strange when people interact with them in a certain way. They were used to reveal materials for inspiration from participants' everyday life and they involve people through a playful and ambiguous approach.

3.2.4.2. Abstraction levels

The workshops have started with a wide variety of the props provided to the users. However, I have made few changes in the props during the process due to my observations in each workshop. I have figured out that the abstraction levels for the objects are quite important as they are inspiring people to execute their tasks. When the objects have some obvious functions like scissors, razor, digital metronome

(these were some of the props from the first workshop) it is really hard to interpret them as something else. The abstraction of the objects is also something like playing with materiality. If the object is not obviously something (like scissors) then it becomes abstract but also a sort of material so that the workshop explores the materiality of objects and their link with gestures. Therefore, I have eliminated these items and continued to workshops with more abstract objects makes people able to associate with other objects.

Regarding the workshops, we can talk about a core metaphor which has occurred in many of the actions as a common ground. That core value was to interprete the digital data as a physical *mass* loaded in our devices. So, when participants correlate digital data as a physical load (as if something physical that you can fill into an object), it became easier for them to anchor their metaphors to this grounding.

For instance, let's take the specific case of "sending a message" in the mobile phones. It is easy for people to interpret the action of "sending" just by throwing something away. And while participants were trying to find some correlations for this task by using the props in the workshop, they usually came up up with the idea of throwing the prop that they are using. However, when they could think that there is something else in that prop and they are sending that "something" away rather than the prop itself, the metaphoric value was defined in a different way. In this metaphorical interpretation, mobile phone was correlated to the props (for instance, a mug) and the digital content (in this case, a text message) was correlated to what they have in their props filled (water in the mug, sand in the can).

To push this metaphorical interpretation further, I decided to bring some elements into workshop environment which make participants more eager to use the "digital load" metaphor. The items that I have added afterwards were sand, water, shingles and coins to be able to put them into boxes, mugs, jars or plates.

4. DESIGNING NEW GESTURE SETS

The core metaphoric values of the each task given to the participants of the workshops will be farily discussed in this section. The gestures that I assigned to them depending upon the reflections coming from participants will then be introduced. The term "Core Metaphoric Values" mentioned under the headlines here is referring to the metaphors that I pulled out from users' bodily moves as well as their explanations for the actions that they have done. Defining the core values of the movements allowed me to degrade some functions in the same gestures as they were interpreted in same metaphoric associations. Some of the gestures are coming from our relations with the existing devices whereas some of them have deeper metaphoric roots. Despite these elicited gestures created through a process without focussing on the technological limitations, many of these gestures are possible to implement with the aid of sensor technologies. Figures used in this section were taken from the prepared video[1] revealing the use metaphors alongside the presentation of the designated gestures.

4.1 Calling Someone+ Ending a Call:

Core Metaphoric Values: *Old school telephone associations*

For this task, many of the participants chose a way to execute it by brining the objects to their mouths. The interpretation of "calling" is so strong with its relation to the phone that many of the participants brought the objects to their ears or mouths to mime the action of actual calling. As mentioned in the previous sections, the action of calling has actually transformed into a sign in a sense that we use the gesture of calling (bringing our hand to ear and mouth imitating the actual phone) in a communicative way.

[1] Available at https://vimeo.com/67966553

"I think old school phones are really innovative in terms of revealing our actions embedded in the functions. I physically pick up the receiver to call someone and I am ending the call as soon as I put the receiver back. " (P.10)[1]

Table 4.1: Participants' ideas for the task "Calling Someone".

Calling someone	
P.1	Bringing "mic" shaped object to mouth
P.2	Opening a box and put your voice in
P.3	
P.4	Blowing to can / directly speaking to the sponge
P.5	
P.6	1. Shaking the water filled bottle (sounds like calling somehow) 2. Selecting a match (person) from box and firing it
P.7	Bringing black object to my ear
P.8	Spinning the maracas in the air like a magic stick
P.9	Bringing soft fabric on your ear and rub with cheek to call (you don't really call much people in busy life. You call the specials in this way)
P.10	Turning the sprey bottle's lit off and bringing it into your ear (coming from really old school phones)

Although I didn't think of putting a task for *Ending a call* into my list, it was interesting to see that while the participants were showing their gestures for calling they felt like to continue with showing how would they end the call with the opposite move. Therefore, I brought up these tasks together here as they complete each other.

I translated this gesture as a control input for the mobile phones to execute the same action. So, to call someone, user brings the phone to his/her ear evidently and the phone automatically performs the calling. The opposite of this move will mean to end the call just like putting the receiver back. The user can put his/her phone on the table screen facing downwards or do the same gesture in the freeform.

[1] Participant number 10.

Figure 4.1: Calling someone + Ending a call (1).

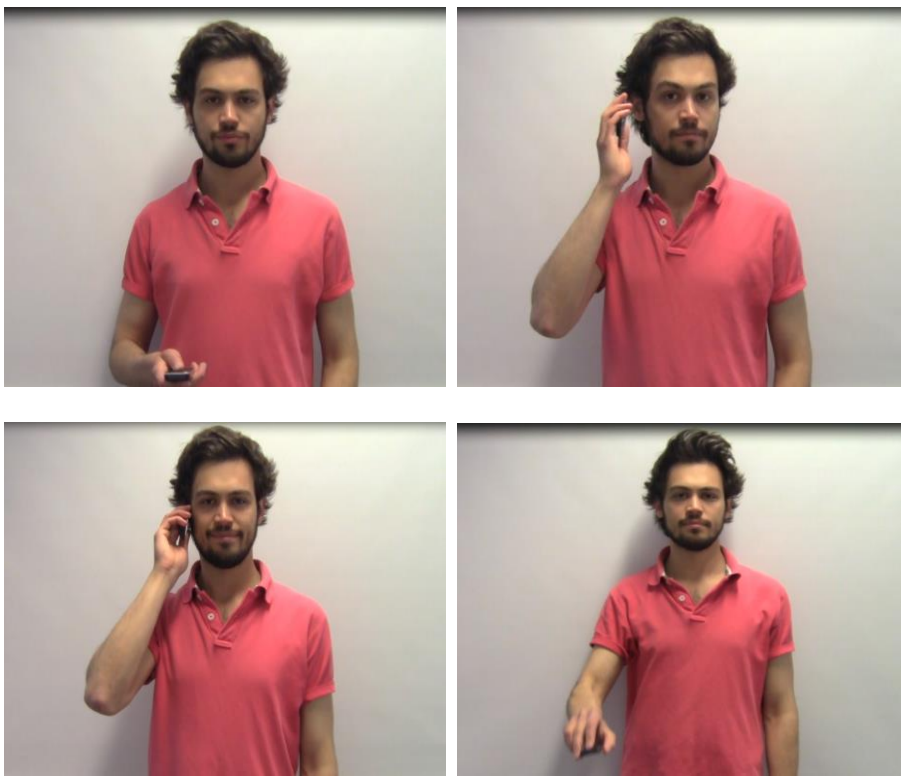


Figure 4.2: Calling someone + Ending a call (2).

Considering some reflections from the participants about the confusion of choosing someone from the list and then giving a call with a motion gesture, we implemented a secondary gesture together with calling gesture as user rub the telephone with his/her cheek to call his/her special one.

> *"I think we don't really call so much people in daily life anymore: only the special ones. So we could assign one gesture for calling that special one." (P.9)*

Figure 4.3: Calling "the special" one.

4.2 Muting the Incoming Call + Going to the Silent Profile:

Core Metaphoric Values: *Shushing, hiding, closing, ignoring something*

Table 4.2: Participants' ideas for the task "Muting the incoming call".

Muting the incoming call	
P.1	Flipping "telephone likely shaped" object over
P.2	Blowing to the open jar (extinguishing the candle)
P.3	Turn the cap of the bottle off
P.4	1. Holding the breath and touching the nose to sponge 2.Suck the air from can
P.5	Put your hand on it like putting your hand onto someone's mouth to shush him
P.6	Pouring the alcohol gel on to incoming call
P.7	Closing the box to not hear
P.8	Squeezing the sponge
P.9	Closing the device's mouth with a tape (shush!)
P.10	

Table 4.3: Participants' ideas for the task "Going to the silent profile".

	Going to the silent profile
P.1	Closing my own ears with my hands
P.2	Putting it into my pocket (Hiding aspect)
P.3	
P.4	Holding the breath and touching it to the nose
P.5	1. Putting your hand on it to make it silent 2.Using the moveable ruler to change the position of its mouth to adjust the volume
P.6	Squeezing the sponge
P.7	Blowing or shuhshing towards to bottle
P.8	
P.9	Putting someting into box and close it. Or only closing or folding the box
P.10	Putting your hand on it to shush

In the workshops, many of the associations made by participants were related to the actions of hiding and shushing. Examining this data and carrying the knowledge coming through the classification that I made for unforeseen gestures (See in Table 3.1, Unforeseen/ Phone Holding Habits/ Talking/ Shushing the ringtone), I carried the gesture of shushing that we do when we try to shush our phones in the silent places by closing our hands onto its speaker to not to make other people get disturbed from our ringtone.

Figure 4.4: Muting the incoming call + Going to the silent profile.

I promoted the same gesture for the function to go to silent profile as it was associated with the same metaphoric values. In practical manners, it could be used for both of these actions where it could mean "Going to the silent mode" if the input comes in standby mode, or "muting the call" if there is applied to incoming call.

4.3 Answering the Incoming Call:

Core Metaphoric Values: *Releasing something out, waking something up, listening carefully*

Table 4.4: Participants' ideas for the task "Answering the incoming call".

Answering the incoming call	
P.1	Bringing "mic" shaped object to mouth (microphone/megaphone move)
P.2	Squeezing the sponge (Releasing smthng out of it)
P.3	
P.4	Bring to mouth and start talking
P.5	Bringing it directly to your ear
P.6	Shaking the maracas. (Shaking means action and it is something like you are waking it up)
P.7	Shaking the maracas. (Shaking means action and it is something like you are waking it up)
P.8	(We should make some actions to see who's calling!) Using tape measure and sliding its tape out to see & push the button
P.9	(It takes so much concentratiton with the actual phones) Squeezing the foam to answer it instead of doing a lot of stuff
P.10	Moving the adjustable ruler into your ear and pushing the button on it.

For answering the call, participants came out with the suggestions revealing the actions of letting something out from an object or activate something in some way. In trace of releasing something out and the key suggestions from the users, I have translated the "squeezing" gesture into a command for the mobile phone where we answer the incoming call by squeezing it. The key aspect of the squeezing is letting something out just like we do while squeezing a sponge to let the water, squeezing the ketchup bottle to squirt ketchup or possibly squeezing a phone to let the incoming call out.

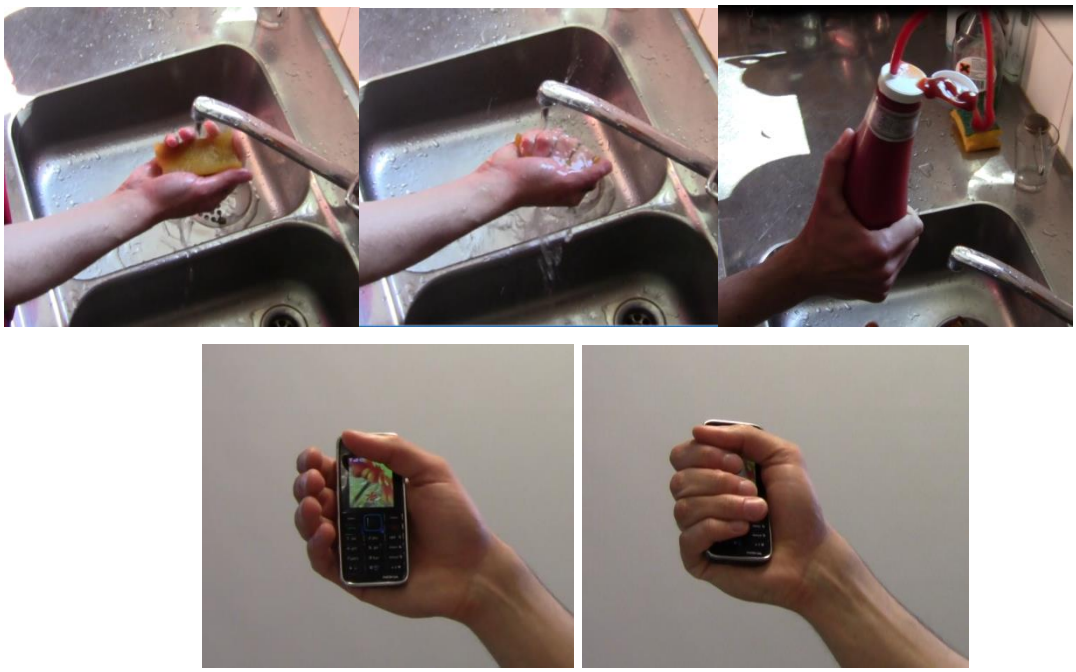


Figure 4.5: Answering the incoming call.

There were also some users suggesting to bring the objects directly to their ears to answer the incoming call just like some of them have done for the calling function. However, when I was evaluating the core values and the practicality of the functions, the problem of bringing a ringing phone close to ear made me to pay my attention to the releasing metaphor.

4.4 Sending the Message:

Core Metaphoric Values: *Throwing away, letter metaphors*

Nearly all of the participants correlated the sending action with the action of throwing something away; either acting like scattering something coming through the object or physically throwing a prop away or even kicking it. I minimized the gesture of throwing and exemplified it with a mug (one of the props from workshops) usage while we are sending (throwing) our message (liquid). Therefore I interpreted it as a flicking move to forward.

Table 4.5: Participants' ideas for the task "Sending the message".

Sending the message	
P.1	Pushing something away to give it to someone (+ flying it away) (like a dove maybe)
P.2	Hand in the plate with a spinning like frisby
P.3	Throwing the ball away
P.4	Pressing on the sponge with the fingers. İf i am sending more than one person i am pushing it several times
P.5	Closing the bottle's tap and throwing it away
P.6	Folding the fabric as if an envelope or letter to end the message
P.7	Stamping it with a hammer like a finished letter. Stamping gesture
P.8	Closing the case (the sound coming out is associating the sending action)
P.9	Kick/ throw the bottle (to literally send something to somewhere)
P.10	

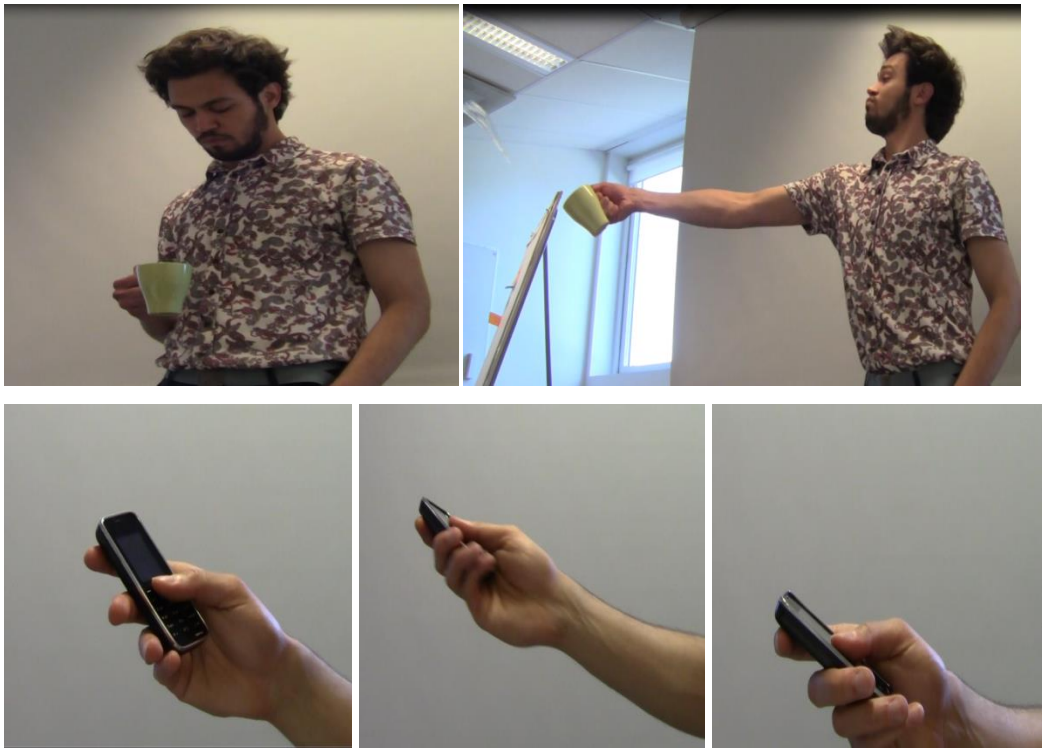


Figure 4.6: Sending the message.

4.5 Deleting the Selected Item+ Rejecting the Incoming Call:

Core Metaphoric Values: *Don't want, trashing, cleaning, scrubbing, and getting rid of something*

Table 4.6: Participants' ideas for the task "Deleting the selected item".

	Deleting the selected item
P.1	Scrubbing the sponge on the table (like cleaning and getting rid of that)
P.2	Putting something inside and close the box (stay there! I dont need you for a while!)
P.3	Cut with the scissors
P.4	Throwing it away gesture
P.5	
P.6	Using eraser and scrubbing with it to erase
P.7	Leaving the tape measure's tape inside (it sounds like when you put something into the garbage
P.8	Emptying the can/ bottle / plate
P.9	Spraying the screen and it will clean it out
P.10	Hammer action. Hitting on it to kill it.

Table 4.7: Participants' ideas for the task "Rejecting the incoming call".

	Rejecting the incoming call
P.1	Scrubbing the sponge on the table (like cleaning and getting rid of that)
P.2	Squeezing and crashing the bottle / hiding the bottle under your arm
P.3	Turning something's actual surface down
P.4	Take it away shake
P.5	Flipping the plate's surface which you interact down
P.6	Drawing a cross with a red pen
P.7	Pushing the inner part of the match box towards inside to hide it
P.8	Allow tape measurement to roll inside and its sounds associates to rejecting
P.9	Smashing with a hammer
P.10	Moving the adjustable ruler and close it to reject

I combined these functions into one as they refer to the same metaphoric values in point of user reflections. Especially for deleting, users' suggestions were mainly related with trashing action. From that trace, I used the gesture of emptying, which we perform to empty the filled object out through something, possibly to trash can or to the ground.

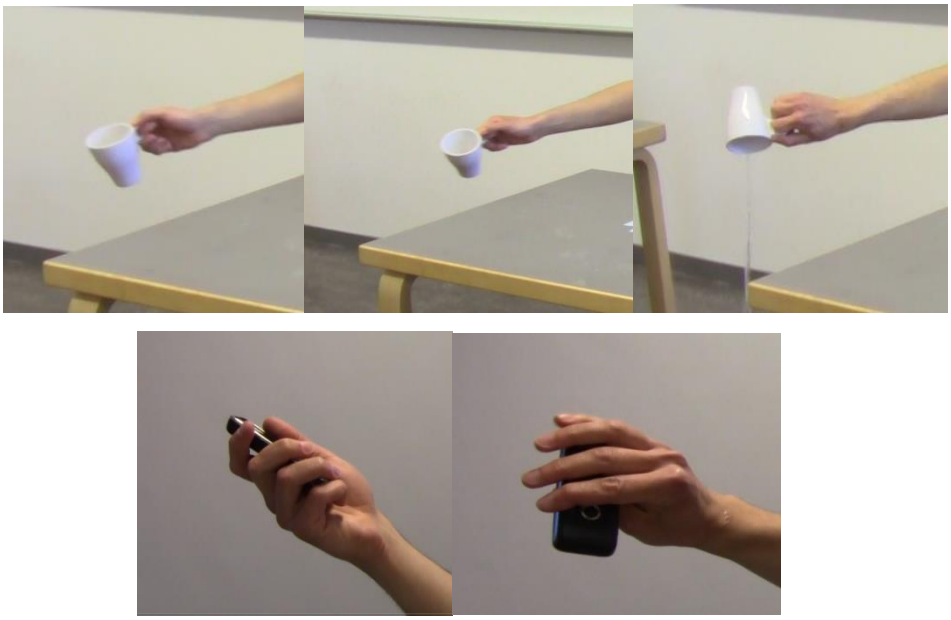


Figure 4.7: Deleting the selected item + Rejecting the incoming call.

With the aid of visual reinforcements like pouring some visuals downwards on the screen, this feature could be more attractive and more encouraging to use.

4.6 Going to the Next/Previous (Page / Photo etc.):

Core Metaphoric Values: *Seeing the hidden*

One of the remarkable points about this task was people's navigation approach to the terms of "next" and "previous". Since the users were coming from Western cultural background, there was no disaccord on the understanding of "next" as right direction, and the "previous" as the left direction as they read in that way.

Another important point about this task in comparison to the other tasks was the eagerness of the people to create imaginary "buttons" on our abstract props. Somehow, the task of going next/previous born into mind in the shape of buttons, arrows and directions as we see the next and previous "buttons" in arrow shapes in the same function with the navigation buttons (which is fairly well-advised).

Table 4.8: Participants' ideas for the task "Going to the next/previous page/photo".

	Going to the next/previous page/photo
P.1	Unrolling the ribbon back and forth (seeing what is inside)
P.2	Turn the banana right and left like turning the pages
P.3	
P.4	Sqeezing the sponge with right hand to go next and vs. (object give him that possibility)
P.5	Spinning the plate clockwise or opposite like a steering wheel
P.6	
P.7	Twisting pill box to the right and left and tapping it with a finger (like taking the pill out) (Tap to stop moving, tap to move)
P.8	Folding the page out/in to go nex/previous
P.9	Using ruler like a music maestro and by swinging it in the air to the right and left
P.10	Tilt the tape to right or left gently to go previous/next

With the metaphoric value of "seeing the hidden" on the "right" and "left", we transformed the gesture of hand-tilting when we do while trying to discover objects in our hands. I have transferred the tilting move as a flicking gesture for rotation as it connotates the "arrowed direction" aspect of the going right and left with its sharp kinaesthetic quality.

Figure 4.8: Going to the next/previous.

4.7 Zooming In/Out:

Core Metaphoric Values: *Distance perception, seeing well, height, magnifying glass*

Table 4.9: Participants' ideas for the task "Zooming in/out".

Zooming in/out	
P.1	Take the object close to your sight with your hands and vice versa
P.2	Twisiting the screw up and down (height associations)
P.3	Using the sensitive ruler's frame move
P.4	1. Take the object close to your body with your hand and vice versa 2. Swimming example: 3D move to get something closer
P.5	Turning the plate clockwise when it is seated on the table
P.6	Using the ruler's moving part. To zoom in close it. Because it is closer to beginning (distance)
P.7	Moving the google closer and away
P.8	Look through into the big tape and moving it back and forth
P.9	Squeezing it in to zoom in (because of the physical size)
P.10	Look through into the small tape and moving it back and forth

Unlike the "previous/next" task, this function has broadly confused many participants as they had some difficulties with its direction aspect. While they were relating their findings to the distance perception, length differences betweeen two points and the metaphor of seeing the closer things well; it was not that easy for them to assign a direction to zoom in or out.

This discussion is very parallel to alterations in the ways that we scroll the pages in different interfaces. Either we control the actual interface directly or there could be a widget in the interface that we control to manipulate actual interface indirectly; which is to say, it is the question of putting a scroll bar as a widget to interact with the page or interacting with the page by directly manipulating the page.

In this line, I would say I chose the way for direct manipulation in this task as I combined the distance aspect with the association of "seeing well" as a way to interpret the notion of distance as something making our vision blurry. Many of the participants correlate the notion of distance by bringing the objects closer to their body or sight.

Figure 4.9: Zooming in/out.

By bringing the mobile phone away from our body with a flick gesture, we are executing the function of zooming out whereas we are zooming in by doing the vice versa.

4.8 Snoozing the Alarm:

Core Metaphoric Values: S*hushing, slamming/violence*

Nearly all of the participants revealed several violent actions to execute this task. Many of them used the slamming gesture where there were some people used even hammer to execute this task. I combined the violent aspect of slamming with gently tapping the old school alarm snooze in one gesture. When user slams his hand on the desk which the mobile phone is seated, the device will receive it as an input to snooze the alarm.

Table 4.10: Participants' ideas for the task "Snoozing the alarm".

Snoozing the alarm	
P.1	1. Push everything on the table away (pushing gesture) 2. Closing the top of the jar with the hand
P.2	Putting the glass jar sidelong to allow the sound pour away
P.3	Rotating the wheel shaped thing on the table (to snooze it until it stops perhaps)
P.4	Slamming on the sponge harshly
P.5	Strangling the plastic bottle
P.6	Hitting on my phone with a hammer. Or if i dont have a hamer slamming it with my hand
P.7	Punching on the phone (politely)
P.8	Slamming on the sponge
P.9	Smashing it with a hammer
P.10	Tapping on the object like we do with the old school alarm clocks. 2. more brutal like hitting with hammer 3. getting rid of gesture

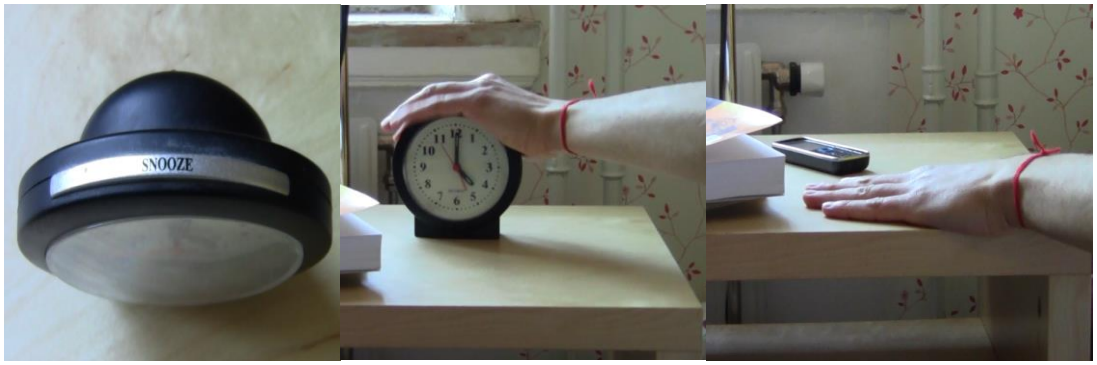


Figure 4.10: Snoozing the alarm.

4.9 Refreshing the Page/ Status / Connections:

Core Metaphoric Values: *Freshness, looking different, something new*

> *" Refresh buttons are really cool with their icon but they are boring. We should feel like we are actually refreshing something" (P.8)*

I pulled out the notion of "freshness" from the explanations of the users when they explained why they have chosen "blowing" action as a command for refreshing. Blowing has such a strong "refresher" as it refers to a new breath and cleaning the dust of the old aged "pages". Hereby, I used blowing as a control input for refreshing.

Table 4.11: Participants' ideas for the task "Refreshing the page/status/connections".

	Refreshing the page/ status / connections
P.1	Squeezing the sponge (coz it is turning back to its is previous shape and refreshing itself)
P.2	Shaking the head! (When you are absent minded you shake your head to refresh your perception)
P.3	
P.4	Turning the sponge (or plate is better) to see something new
P.5	Shaking the water filled bottle (it looks diffrent for a while and then turn back to the previous situation)
P.6	Blowing your breath on the surface (like cleaning the dust)
P.7	Swiping the eraser on the surface (waves coming to the beach and erase your drawings on the sand)
P.8	Blowing air inside.. (Fresh air connotation, freshness of the wind)
P.9	(Refresh button is cool but boring) swing a cloth piece like a child game
P.10	Shaking the tape

Figure 4.11: Refreshing the page/ status / connections.

4.10 Unlock the Keyboard:

Core Metaphoric Values: *Waking up, activate*

Table 4.12: Participants' ideas for the task "Unlock the keyboard".

Unlock the keyboard	
P.1	Open the box and make it work (revealing the action)
P.2	Moving the ruler's frame and open its mouth
P.3	Turning on the razor (because of its sound, it gives the message that i am active now)
P.4	Starting to talk to it to unlock
P.5	Open the bottle to release something
P.6	Blowing towards to the object to activate it
P.7	Swiping the surface of the ruler with the fingers (coming from Iphone)
P.8	
P.9	(It is really hard to swipe with only one finger) Wiping the surface with a bigger sponge
P.10	Spinning my finger on the chamber of the ribbon (Ipod asssociations)

Participants performed the actions of activating something or making something awake as metaphorical values for this task. Shaking something to activate is not only a metaphorical motion as we apply this gesture when we face with a broken device to "resurrect" it immediately like we do to our remote controllers or mobile phones[1] in the times that they don't function well. I transferred this gesture as an input to unlock the keyboard.

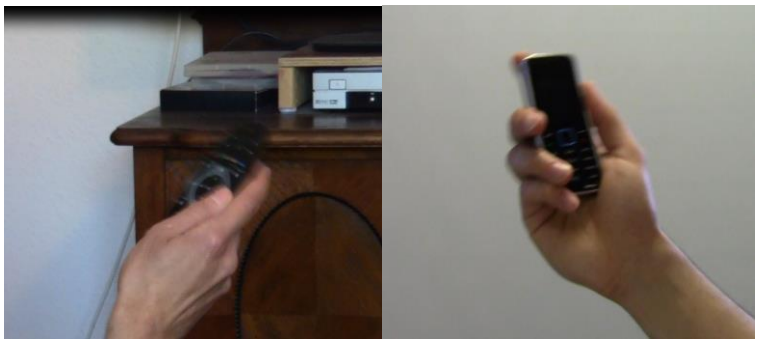


Figure 4.12: Unlock the keyboard.

[1] See Table 3.1 to review the fixing gestures in the subsection of Unforeseen/Fixing/Violent fix

4.11 Turn on the Camera:

Core Metaphoric Values: *looking through something, telescope, glasses*

Table 4.13: Participants' ideas for the task "Turn on the camera".

	Turn on the camera
P.1	1. Looking into pipe like a telescope or periscope 2. Creating a square in the air with the fingers (Sixth sense)
P.2	Turning the black object up to the eye level to activate it. Looking it from hand perspective like painters do.
P.3	
P.4	Looking into glass jar like a telescope or periscope.
P.5	
P.6	Put the googles on
P.7	Looking through the pipe like a telescope
P.8	(Shooting a picture is kind of weird metaphor. It shoots us with the light!) Spraying the view and capturing the picture
P.9	(I think it is looking through something) Putting the googles on to my eyes.
P.10	Spinning my finger on the play (Coming from Ipod)

Nearly all of the participants associated this function to the action of looking through something. Some of them related it to telescopes whereas some of them imagine their props as if something offering a "different world". The key point in all of those examples was the action of bringing the prop to the eye level to see the background through that object. As we actually do while taking photos with our cameras, I used the same move in order to turn on the camera as soon as we lift our hand to take a picture to simplify our interaction by dissolving the design in the gesture.

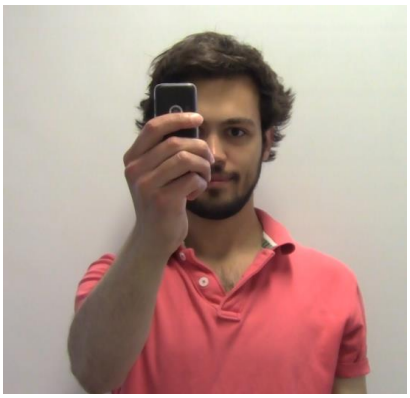


Figure 4.13: Turn on the camera.

5. CONCLUSIONS

5.1. Comprising the Given Tasks

In the evaluation process of the workshops, some of the tasks were combined with the others depending on their core values in metaphorical manner. Besides that, I decided to not to include some of the tasks in the final gesture set as some of them (like navigating on the map) were indeed hard for users to interpret in metaphorical manners as they had some difficulties to apprehend them in a different way. Also some of the tasks at the bottom of the first list (turn on the music player, turn back to home screen, turn on the phone) were not included in the final gesture set as there was not enough data on them to make evaluation. Because, they were actually suggested by different participants from different workshops. It would quite likely be possible to implement something on these tasks if there could be enough data gathered on it as well.

5.2. Analysis of the Workshops

It is fair to emphasize that the final gesture set elicited through workshops was not created on the base of statistical/quantitative analysis of the workshops. The final gestures for the given tasks were not chosen depending on how many people "voted" for the suggested gestures. Instead, it was more like understanding the core values of the actions and carrying them onto the decision process of the final design of the gestures. This kind of qualitative analysis of the workshops enabled me to use the workshops as stepping stone in order to reach to the final shape of the ideas. At the end, it was me, as a designer, deciding on what to choose. This approach could be put in the opposite side of counting the numbers of the actions that participants did in the workshops and eliciting the gestures according to that information. Many times, users suggested the same gesture for different tasks. At that point, it was me

choosing which gesture would fit to the defined task best due to its metaphorical values.

This kind of approach for the execution of the workshops might ensure a different way of workshop evaluation for designers where the statistics of the implemented ideas stay in the background; whereas the actual "meaning" of them comes forward.

5.3. Knowledge Contribution

In the context of interaction design, this study offers a knowledge contribution to the field of gestural interaction with a broad exploration of its background and also discusses its position in relation to the embodied interaction by examining the intuition and learnability coming through our body memories.

Putting the phenomenology into the center of the design context has strongly affected the way this research was achieved. To execute my research through this phenomenological approach, I propounded a novel method which is called "hacking the physical actions" by eliciting new gesture sets through close observations and workshops. This kind of exploration of the natural characteristics of the gestures also incorporated a derivate result referring to the exploration of the dead spaces of our interactions which are not involved in our bodily space formed by our relations to the existing devices.

This approach could constitute a source for the similar researches in this field as it could easily be modified based on the requirements of the specified research.

5.4. Practical Outcomes

As an outcome of this reserch, a motion gesture set for different interaction modalities were presented with an accompanying video[1] explaining the novel ways of interaction with an emphasis on the translation of our daily behaviours into the input modalities for our devices.

Documentation of these motion gesture sets might provide designers new openings about the adaptation of the current interfaces or creating new systems in two ways: replacing the touch screen gestures to have less visual dependence on the screen in

[1] Available at https://vimeo.com/67966553

distracted environments or being able to execute more than one task at the same time by using motional interactions together with the surface interactions.

5.5. Core Values

Although the elicited gesture set is a significant outcome, the way that I elicited these gestures constitutes the core value of this research. My method was based on the "meaning" of our intearactions and I intended to question our interactions in a broader context to envision our way to create upcoming interfaces rather than offering isolated design suggestions. There would be no meaning in offering only the practical outcomes of the research and making the reader to fix her attention on those isolated suggestions.

Secondly, this study could also be seen as an attempt to acknowledging "intuition" as something not completely far from us. It is not something flying in the blue sky; it is in our hands, if we could manage to understand the core meanings of what we are designing. Moreover, it is also quite significant to comprehend how we present intuitiveness to the users. If there are no provoking points reminding people how the suggested designs related to their own life, there would be no difference on putting user manuals containing long texts in front of the users. Even small nuances are enough to awake some intuitiveness in people's minds. That is what I tried to in the video representation.

5.6. Future Work

This study has been done with limited numbers of users mainly coming from Western culture. As stated in the first part, this study didn't cover the cultural aspects of the gestures discussed here. Cultural differences affect our relation with the objects and our body expressions are obviously changing from culture to culture. That could definitely be a topic for further long period researches as a continuation of this research.

As a future work, I would also like to use the core metaphoric values of the gestures discussed in this study as full-body input modalities where we don't need to have any

device in our hands. Recent researches on the wrist bands[1] which are gathering data from the electrical activity in the muscles will pull more attention to our bodies as in terms of *remote controlling.*

Use of the gestural inputs in social context is also highly encouraging topic which could be examined thoroughly in a further research as well. Use of these gestures in the daily life, with their social aspects will fairly be a topic of discussion after gestural interfaces become more and more common in people's daily life.

[1] See MYO wrist bands which will be started to be shipped in early 2014: https://www.thalmic.com/myo/

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APPENDICES

APPENDIX A.1 : Full List of Actions

APPENDIX A.1: Full List of Actions

Table A.1 : Full list of what participants did for each task in the workshops.

	Calling someone	Muting the incoming call	Answering the incoming call	Rejecting the incoming call	Going to the next/previous page / photo	Navigating on the map (right, left, up, down)
1	Bringing "mic" shaped object to mouth	Flipping "black thing" over	Bringing "mic" shaped object to mouth (microphone/megaphone move)	Scrubbing the sponge on the table (like cleaning and getting rid of that)	Unrolling the ribbon back and forth (seeing what is inside)	Panning the googles
2	Opening a box and put your voice in	Blowing to the open jar (extinguishing the candle)	squeezing the sponge (making smthng out out of it)	squeezing and crashing the bottle / hiding the bottle under your arm	Turn the banana right and left like turning the pages (european people's books)	Slideing the ruler on something (1. like drawing a line series on the paper. 2. like collecting the food on your cutting board)
3		Turn the cap of the bottle off		Turning something's actual surface down		
4	Blowing to can / directly speaking to the sponge	Holding the breath and touching the nose to sponge/ Suck the air from can	Bring to mouth and start talking	Take it away shake	Sqeezing the sponge with right hand to go next and vs. (object give him that possibility)	Tilting the object to control
5		Put your hand on it like putting your hand onto someone's mouth	Bringing it directly to your ear	Flipping the plate's surface which you interact down	Spinning the plate clockwise or opposite like a steering wheel	Tilting the plate to navigate something in it
6	1. Shaking the water filled water (sounds like calling somehow) 2. Selecting a match (person) from box and firing it	Pouring the alcohol gel on to incoming call	Shaking the maracas. (Shaking means action and it is something like you are waking it up)	Drawing a cross with a red pen		
7	Bringing black object to my ear	Closing the box to not hear	Shaking the maracas. (Shaking means action and it is something like you are waking it up)	Pushing the inner part of the match box towards inside to hide it	Twisting pill box to the right and left and tapping it with a finger (like taking the pill out) (Tap to stop moving, tap to move)	Putting the maracas on the table upside down and using the stick part as a joystick to navigate
8	Spinning the maracas in the air like a magic stick	squeezing the sponge	(we should make some actions to see who's calling) Using tape measure and sliding its tape out to see & push the button	Allow tape measurement to roll inside and its sounds associates to rejecting	Folding the page out/in to go nex/previous	Spinning the plate clockwise and vice versa when it is on the table and imagining there is some kind of arrows in it navigating you
9	Bringing soft fabric on your ear and rub with cheek to call (you don't really call much people in busy life. And you adjust specials)	Closing the device's mouth with a tape (shush!)	(It takes so much concentratiton with the actual phones) squeezing the foam to answer it instead of doing a lot of stuff	Smashing with a hammer	Using ruler like a music maestro and by swinging it in the air to the right and left	Using joystick shaped object to navigate
10	Turning the sprey bottle's lit off and bringing it into your ear (coming from really old school phones)		Moving the adjustable ruler into your ear and pushing the button on it.	Moving the adjustable ruler and close it to reject	Tilt the tape to right or left gently to go previous/next	Tilting the tape to the desired direction

Pan the screen view (right, left, up, down)	Zooming in/out	Snoozing the alarm	Deleting the selected item	Refreshing the page/ status / connections	Send the message
Panning the googles	Take the object close to your sight with your hands and vice versa	1. Push everything on the table away (pushing gesture) 2. Closing the top of the jar with the hand	Scrubbing the sponge on the table (like cleaning and getting rid of that)	squeezing the sponge (coz it is turning back to its is previous shape and refreshing itself)	Pushing something away to give it to someone (+ flying it away) (like a dove maybe)
Slideing the ruler on something (1. like drawing a line series on the paper. 2. like collecting the food on your cutting board)	Twisiting the screw up and down (coming from height)	Putting the glass jar sidelong to allow the sound pour away	Putting something inside and close the box (stay there! İ dont need you for a while!)	Shaking the head! (When you are absent minded you shake your head to refresh your perception)	Hand in the plate with a spinning like frisby
	Using the sensitive ruler's frame move	Rotating the wheel shaped thing on the table (to snooze it until it stops perhaps)	Cut with the scissors		Throwing the ball away
Panning the object in the axis like an actual mouse	Take the object close to your body with your hand and vice versa 2.Swimming example: 3D move to get somthng closer	Slamming on the sponge harshly	Throwing it away gesture	Turning the sponge (or plate is better) to see something new	Pressing on the sponge with the fingers. İf i am sending more than one person i am pushing it several times
	Turning the plate clockwise when it is seated on the table	Strangling the plastik bottle		Shaking the water filled bottle (it looks diffrent for a while and then turn back to the previous situation)	Closing the bottle's tap and throwing it away
	Using the ruler's moving part. To zoom in close it. Because it is closer to beginning (distance)	Hitting on my phone with a hammer. Or if i dont have a hamer slamming it with my hand	Using eraser and scrubbing with it to erase	Blowing your breath on the surface (like cleaning the dust)	Folding the fabric as if an envelope or letter to end the message
Putting maracas on the table upside down and using the stick part as a joystick and lie down the joystick on the table to pan.	Moving the google closer and away	Punching on the phone (politely)	Leaving the tape measure's tape inside (it sounds like when you put something into the garbage	Swiping the eraser on the surface (waves coming to the beach and erase your drawings on the sand)	Stamping it with a hammer like a finished letter. Stamping gesture
squeezing the sponge in diffrent levels	Look through into the big tape and moving it back and forth	Slamming on the sponge	Emptying the can/ bottle / plate	Blowing air inside.. (Fresh air connotation, freshness of the wind)	Closing the case (the sound coming out is associating the sendig action)
Using joystick shaped object to pan	squeezing it in to zoom in (because of the physical size)	Smashing it with a hammer	Spraying the screen and it will clean it out	(Refresh button is cool but boring) swing a cloth piece like a child game	Kick/ throw the bottle (to literally send smthng to somewhere)
	Look through into the small tape and moving it back and forth	Tapping on the object like we do with the old school alarm clocks. 2. more brutal like hitting with hammer 3. getting rid of gesture	Hammer action. Hitting on it to kill it.	Shaking the tape	

Unlock the keyboard	Go to silent profile	Turn on the camera	Turn on the music player	Turn back to Home screen	Turn on the phone
Open the box and make it work (revealing the action)	Closing my own ears with my hands	1. Looking into pipe like a telescope or periscope 2. Creating a square in the air with the fingers (Sixth sense thingy)			
Moving the ruler's frame and open its mouth	Putting it into my pocket (Hiding aspect)	Turning the black object up to the eye level to activate it. Looking it from hand perspective like painters do.			
Turning on the razor (because of its sound, it gives the message that i am active now)					
Starting to talk to it to unlock	Holding the breath and touching it to the nose	Looking into glass jar like a telescope or periscope.			
Open the bottle to release something	1. Putting your hand on it to make it silent 2.Using the moveable ruler to change the position of its mouth to adjust the volume				
Blowing towards to the object to activate it	squeezing the sponge	Put the googles on			
Swiping the surface of the ruler with the fingers (coming from Iphone)	Blowing or shuhshing towards to bottle	Looking through the pipe like a telescope		Folding it innerwards like i am colloecting my stuff now	
		(Shooting a picture is kind of weird metaphor. It shoots us with the light!) Sprayingthe view and capturing the picture			
(It is really hard to swipe with only one finger) wiping the surface with a bigger sponge	Putting someting into box and close it. Or only closing or folding the box	(I think it is looking through something) Putting the googles on to my eyes.	Shaking the Shak Shak (maracas) once (because it is obviously a music instrument and easy to correlate with a music)	Shaking the maracas twice (what if we make the musical instrument a phone, so every different "shak" will be diffrent command	Shaking the maracas once slowly
Spinning my finger on the chamber of the ribbon (Coming from Ipod)	Putting your hand on it to shush	Spinning my finger on the play (Coming from Ipod)			Squeeze the sponge (activate it) (time to wake up!)

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