Moral Impact of Design

Anticipating the moral impact of products-in-design with mediation theory and technomoral scenarios

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Introduction

We live in a profoundly technological world. Ever since the time we first started to make fire and use tools, human beings and technology have co-existed and co-evolved. We have created numerous technologies and have shaped their existence in our human world. But in its turn, technology has shaped our human existence. From the practical day-to-day interactions we have with others and the world around us, to the abstract image we have of ourselves and our place on this world, in history, and in this universe; technology can influence human beings in numerous ways.

All technology is created by human beings. From crafting a stone arrowhead to building the Large Hadron Collider; technologies and artefacts are conceived of by human minds and created by human hands. We create and shape technology, that in turn shapes us. By creating new artefacts, we have an effect on individual human beings and on our society. In this thesis I will investigate how we, human beings, can *foresee* what effects the artefacts that we create will have on us and our society. Specifically, I will investigate the discipline of industrial design and the profession of the designer: an individuals who's profession entails devising new artefacts that will likely be mass-produced and potentially be used by millions of individual users. How can these professionals anticipate the impact of their creations?

The goal of my research and this thesis is to help designers to anticipate the moral impact of their products-in-design. In order to do so, I want to introduce designers to theories and methods from philosophy of technology. Simultaneously, I want to demonstrate how concepts from philosophy of technology – that for someone not (yet) experienced with philosophy might seem very abstract – can form a valuable contribution to the concrete practice of designing. As such, I aim to develop my own contribution to both the discipline of industrial design, and that of philosophy of technology.

Design

What is design? The verb "to design" means "to intentionally conceptualize and create something that is meant to serve a specific pre-conceived purpose". Designing as an activity thus encompasses both cognitive actions, such as imagining, conceptualising, visualising, and planning, and creative actions of translating an idea into a physical shape. By the activity of designing, we create "something"; an object, a process, a piece of software, etc. Hence the term "a design", as a noun, that refers either to something that has been designed, or, to a an outline or plan for something to be created. I intentionally use the unrestricted term "something" in my definition to show that not only physical objects are designed. However, in my thesis I will fo-

cus on the design of objects; also referred to as "artefacts" (i.e. "an object created by human beings for a specific purpose") or "products" (i.e. "something grown or made to be sold or used").

The term design has come to have a broad meaning. We can make a distinction between different types of design, however; between what I call *aesthetic* design and *functional* design. Aesthetic design is to create a new physical form for a functionality that has already existed in society. Take for example a teacup; the functionality of containing a hot beverage has existed in society for a long time, but the physical shape of a particular teacup can be newly designed and different from other teacups. The same goes for clothing; its functionality of keeping human bodies warm has been around for ages, but still fashion designers come op with new physical forms of clothing. They are designing a new aesthetic for a pre-existing functionality.

Aesthetic design stands in contrast to functional design. Functional design is the creation of new functionalities, accompanied by a physical form. Simply put, functional design is the invention of new products. It introduces new technological functionalities into society. Functional design creates new artefacts, that can do things technology could not do before. For instance, some human tasks are now executed by artefacts (e.g. the washing machine), who execute these tasks in radically different ways (e.g. a computer "thinks" and "memorises" in a different manner than a human being) which can have all kinds of implications for humans and society. As such, functional design can have a greater impact on our society than aesthetic design. Therefore, from this point on when I discuss design I am referring to functional design.

Anticipation

Why would we want to anticipate the impact of new artefacts? Can we not wait and see what happens when new artefacts are introduced into society? No, we cannot. Technologies and artefacts have the potential to have an enormous impact on society, human life, our world and the ecosystem. These impacts are potentially destructive for all we hold dear, but could also bring much good to the world. It is irresponsible, and morally wrong, to bring such evil into the world if there was a possibility it could have been prevented. Likewise, it is wrong to refrain from promoting good. If we want to prevent ourselves and our fellow humans from unknowingly bringing evil into the world, we have two options. The first is that we do not bring anything into the world anymore; we do not design new products and we invent nothing new. We would also have to stop living, in that case. The second option is that we inform ourselves as well as we can about the thing we plan to bring into the world. We cannot know what the future will hold for us. We can however *anticipate the range of things that might happen*, so as to be prepared for the future. And by anticipating these possible consequences, we can discover whether we are bringing something good or evil into the world.

Therefore, it is necessary to anticipate the impact of new artefacts *before* they are introduced into society. At that point, we can still refrain from bringing the artefact into the world. Or we could change the artefact to eliminate morally wrong impact. For this reason, my thesis is focussed on anticipating the moral impact of new artefacts *during the process of designing them*. This allows the designer to steer the impact into a desirable direction, as much as possible.

Moral Impact & Ethics

I will focus my investigation of the potential effects of new artefacts on the *moral impact* of artefacts; impact that is related to our morality. *Morality* is the (implicit) code of conduct held by humans; it includes rules about right and wrong ways to act (i.e. norms), beliefs about what is good and bad (i.e. moral beliefs) and beliefs about what is valuable in life (i.e. values). I define *moral impact* as the total effect that an artefact has that is related to morality; as such, it is an

umbrella term that can cover multiple specific moral implications of an artefact. Moral impact is twofold. On the on hand, it concerns implications that have a moral load; i.e. that are good or bad. But on the other hand, technology can have an influence on what we consider to be good or bad, what we consider to be valuable, or normal and abnormal. In other words, technology can influence our morality itself. In this thesis, I will investigate the anticipation of both implications with a moral load, as well as implications for morality.

It is important to keep in mind the distinction between *morality* and *ethics*. Morality concerns our implicit code of conduct. I define ethics broadly as the reflection upon, and questioning of, (parts of) morality. Thus this thesis falls into the category of ethics. However, I want to clarify the position within the broad field of ethics that I want to take. We can distinguish between *normative ethics* and *descriptive ethics*. Normative ethics, generally speaking, is to answer the question "what is good?" or "what is right to do?" As such, it involves making moral judgements and prescribing norms. Descriptive ethics however is the study of morality as a phenomenon. It thus centres around researching what morality is, rather than making judgements.

Value Sensitive Design

In the context of design, a well-known example of normative ethics is Value Sensitive Design (Friedman, Kahn, & Borning, 2008). VSD is an approach to design on the basis of moral values, consisting of three types of investigation. First, *conceptual investigations* entails the philosophical investigation of which values are at stake in the design context, and defining these values. Second is the *empirical investigation* of the human context of the design; what values are actually held by stakeholders? How are they defined and what value trade-offs are made? Third is the *technical investigation* which entails both investigating how existing technologies support or hinder values, and, predominately, the design of technology to support the values identified in the conceptual investigations.

VSD has two general characteristics that are in juxtaposition with my own approach in this thesis. First, VSD is highly normative; it actively judges about what is good and bad. Second, VSD assumes morality to be static. These two characteristics show from their methodology. In the conceptual investigation phase, values are *predefined* before any technology comes into play, and valuated amongst each other. Concerning the technological investigations, it is stated that

> *"Value Sensitive Design adopts the position that technologies in general, and information and computer technologies in particular, provide value suitabilities that follow from properties of the technology. That is, a given technology is more suitable for certain activities and more readily supports certain values while rendering other activities and values more difficult to realize."* (Friedman et al., 2008, p. 4).

Thus according to VSD, values are only supported or hindered by technology, which means that values themselves are regarded as something static and objective. But values can change; how we define a certain value can change, as well as what we humans consider to be more or less valuable. Finally, the normativity of VSD is most explicit in the technical investigation phase, where technology is designed to specifically support certain values. VSD thus enforces a preconceived notion of what is good, through technology, without giving proper attention to the actual impact of the technology that is designed. All of this implies an underlying optimism about the possibility of control in VSD. VSD seems to assume that it can control technology and how technology affects human values.

In this thesis, I take a different position; a position based on descriptive ethics, rather than normative ethics. The two characteristics important for my approach are the following. First, I aim to avoid normativity; rather I take a neutral stance and research morality as a phenomenon. Sec-

ond, I assume morality to be dynamic; norms and values can change. In fact, this thesis centres around anticipating how morality can change in interaction with technology. Concerning the possibility of control, I try to be as realistic as possible. Initially, I do not aim to have control; I observe and investigate. I assume that both technology and morality can change in unforeseen ways. I will develop a method to anticipate such changes to the best we can. That does lead to a point where control will play a role; designing products after all assumes at least a certain amount of control. But we can never be in complete control; I urge the viewpoint that design does not entail complete control over technology, but rather steering or nudging technology and morality in a certain direction.

We can only make proper judgements if we are properly informed. In the case of design and morality, we need to be informed about the wide array of moral implications a product-in-design can have, before judging which implications are desirable. Therefore, my approach in this thesis is to practice descriptive ethics in the context of design. I will develop a method to anticipate how new technologies can affect morality in a broad sense; a method with which we can inform ourselves properly before making moral judgements. My thesis thus investigates morality as a phenomenon, rather than using moral beliefs as the basis for normative judgement. My research takes technology as the starting point and aims to refrain from judgement.

Problem Statement

So how do we anticipate moral impact of products-in-design? The method of Value Sensitive Design is too normative; it hardly involves non-normative research. Are there methods that can help us doing non-normative research about morality and technology?

In the discipline of Technology Assessment we find methods to anticipate and assess new technologies. These methods can however be very abstract; how then to translate abstract insights into the design of a concrete artefact? In this thesis, I will investigate a specific method from the field of Technology Assessment, namely the Technomoral Scenario Method developed by Tsjalling Swierstra, Marianne Boenink and Dirk Stemerding. This is a method for building scenarios that explore technomoral change; that is, the co-evolution of technologies and morality, and how they mutually influence each other. The technomoral scenario method provides a way to anticipate future impact on an abstract societal level. The technomoral scenario method is concerned with the macro-level of society at large.

Furthermore, I will investigate Mediation Theory, a post-phenomenological approach to the philosophy of technology, developed by Peter-Paul Verbeek. This approach to understanding artefacts and their impact on humans is focussed on individual artefacts, individual humans beings, and all the details of the interaction that they have with each other and the world. Mediation theory deals with the *micro-level* concerning individuals. The insights we gain with Mediation Theory are concrete and can be better translated to the design of artefacts. But mediation theory is not suitable for anticipating future impact on the societal level.

To clarify, the *micro-level* is concerned with individuals, or perhaps very small groups of individuals. Concerning technology, the micro-level concerns the interaction between artefact, user, and perhaps other stakeholders. The *meso-level* concerns socio-technical systems that are broader than user-artefact interaction, and include big technological systems and social practices. On the meso-level we find shared morality that is context-specific. The *macro-level* concerns society at large and abstract, collective moral beliefs, norms, and values.

In this thesis, I will investigate the anticipation of moral impact of artefacts on both the macro- and micro-level. I will argue that we need both levels to come to the best understanding and anticipation of moral impact of new artefacts. I will investigate and argue how we can combine

the macro- and micro-level perspectives. My research is guided by the following question:

> *How can mediation theory and the technomoral scenario method jointly contribute to the anticipation of the moral impact of products-in-design?*

Furthermore, I will investigate the following sub-questions:

> *Q1: how can designers analyse and understand the moral impact of their product-in-design on the micro-level?*
>
> *Q2: how can designers explore the moral impact of their product-in-design on the macro-level?*
>
> *Q3: how can the anticipation of moral impact on the micro- and macro-level be integrated?*
>
> *Q3: how can the anticipated moral impact of products-in-design inform design practices?*

Although I introduced three levels of society, namely micro, meso and macro, my research questions focus on the micro- and macro-level. The micro- and the macro-level form the extremes of a gliding scale, while the meso-level is the intermediate level. As such, the micro- and macro-level differ from each other the most, and in this thesis I will investigate these differences in relation to the anticipation of moral impact. While mediation theory is focussed on the micro-level, it is equipped to deal with the meso-level. The same goes for the technomoral scenario method; while it allows us to anticipate moral impact on the macro-level, it is suitable for dealing with the meso-level. As such, both mediation theory and the technomoral scenario method can yield insights on the meso-level, while their ability to yield insights on the micro- and macro level is very different. Therefore I will focus on the micro- and macro-level and, for the purpose of the thesis, leave the meso-level out of account.

Google Glass as Example

Since I am investigating the micro-level and macro-level moral impact of products-in-design it is fruitful to choose one example artefact, of which we can explore the wide range of moral implications. Throughout my thesis, I will use Google Glass as the example technological artefact. Glass is interesting both from the development is has gone through, as well as from its functionality.

Google Glass was first announced in June 2012, and it was initially made available to a limited group of selected “explorers” in April 2013. In May 2014 Glass became available for regular sales. However, in January 2015 Google stopped selling Glass to private consumers (Valk, 2015). So Glass has been for sale for less than a year, due to its high price, it never became popular for private consumers. Glass has been introduced into society in a very limited manner; therefore we cannot know what the (eventual) social, moral and societal consequences of Glass would have been. Glass however was developed maturely enough to understand its functionality and user-interaction. We can thus perform a mediation analysis solidly based in the actual functioning of the device. The fact that Glass was only introduced in a very limited manner makes it an interesting case for my thesis. First, we can still *anticipate* the moral implications of Glass; we can speculate what the moral implications of the introduction of Glass on a large scale would have been. Second, the limited introduction of Glass has provided a starting point to work from. Glass has given rise to public debate and controversies; these show what (some) controversial aspects of Glass are, which in turn can serve as points of departure for anticipating future moral developments.

In This Thesis

In the first chapter, I will discuss Google Glass, the artefact that I will be using as an example throughout this thesis.

In chapter two I will address the first sub-question, *how can designers analyse and understand the moral impact of their product-in-design on the micro-level?* I will discuss mediation theory and how it can help to understand the moral aspects of artefacts. I will provide a method for performing a mediation analysis of a product-in-design. I will demonstrate this method with the example of Google Glass. I will argue why mediation theory is insufficient for anticipating the moral impact of products-in-design.

In chapter three I will investigate the second sub-question, namely *how can designers explore the moral impact of their product-in-design on the macro-level?* I will discuss the technomoral scenario method; a method to anticipate technomoral change resulting from the introduction of a new artefact or technology. I will argue why the technomoral scenario method alone is not the most suitable for anticipating the moral impact of a product-in-design.

In chapter four I will answer the third sub-question, *how can the anticipation of moral impact on the micro- and macro-level be integrated?* I will argue why we need to combine the macro-level perspective on the moral impact of products-in-design with the micro-level perspective of mediation theory. I will develop a new method for anticipating the moral impact of products-in-design on both the micro- and the macro-level, which I call the Moral Impact Anticipation Tool. The MIAT integrates the building of technomoral scenarios with mediation analysis. I will demonstrate this method with the example of Google Glass.

In the fifth chapter I will discuss the last sub-question, *how can the anticipated moral impact of products-in-design inform design practices?* I will discuss how the insights from the MIAT relate to one another, and the the design features. I will discuss how these insights can inform design decisions.

Finally, I will provide a concluding chapter, in which I reflect on how my research questions were answered. I will discuss other insights I gained while researching and writing this thesis. Lastly, I will provide recommendations for further research on this topic.

Chapter 1
Google Glass

Google Glass is the technology of the future. It provides you with all the functionalities of a smartphone – but better. Glass is always there when you need it. You can instantly view notifications you receive. You can take photos anywhere anytime, with only a wink. No need to hassle and take your camera out of your pocket – it's already on your face! Glass is always present to capture every little moment. Making video's was never easier. Glass is always available to start filming, with a simple voice command. Glass continuously keeps you up to date; it shows you any information, real-time, right before your eye. Glass is all the technology you ever dreamed of.

Illustration 1: Google Glass in Use (Google, 2015)

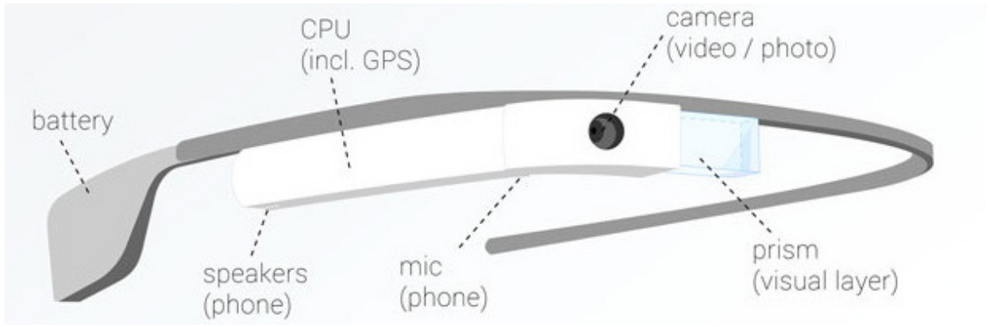


Illustration 2: Components of Glass (Missfelt, 2013)

What is Google Glass?

Google Glass is a wearable extension for a smartphone that the user wears on his face (Illustration 1). Glass is shaped like regular glasses, but can be used to make calls, surf the internet and make photographs.

Glass is shaped as a headpiece that partly covers one eye. Its made up from a frame that rests on the ears and hovers above the eyes, in which various electronics are integrated (Illustration 2). Its main feature is a projection prism, that transmits light into the eye, making it appear, for the user, as if a screen is hovering in the user's field of vision (Illustration 3). Glass is equipped with a small camera that enables making photographs and videos. Glass deals with audio in a remarkable way. In the right leg of the frame, a small piece of hardware is embedded, called the "bone conduction transducer". This consists of a small vibrating element that rests against the wearer's skull bone. By vibrating, the bone conduction transducer transmits the vibrations onto the wearer's skull and thus produces the audio directly into his head. Next to that, there is an option to use an earplug to transmit sounds into the wearer's ear. Glass is controlled by various voice commands (the typical "OK Glass" command, for instance), but can also be controlled by head movements (for instance, tilting the head up to activate Glass). Next to that, the right leg has a touchpad that can be used to control the device. Important to note is that Glass in itself is not a smartphone; it is merely an extension to it. To make and receive phone calls or text messages, Glass must be connected to a smartphone via the MyGlass application (see below).

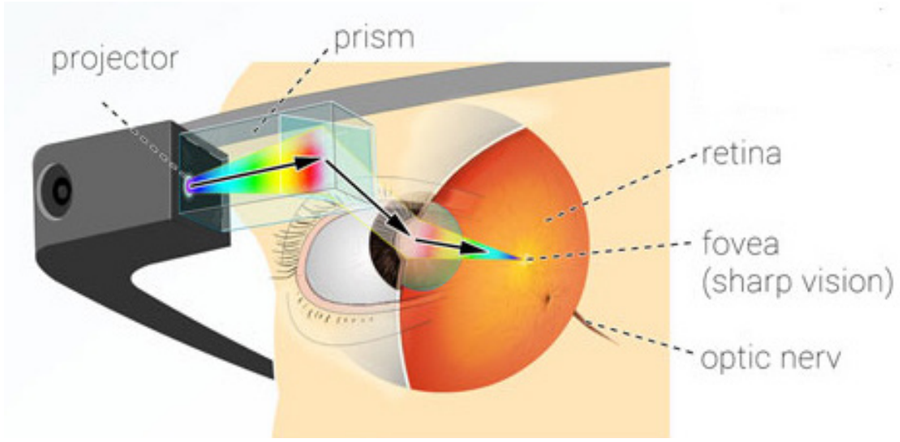


Illustration 3: Prism of Glass (Missfelt, 2013)

Software & Functionalities

There are a few software functionalities and applications that are crucial to the way Glass works. First, the MyGlass application mentioned above. MyGlass is an application that enables a connection between the Glass headpiece and a smartphone. Glass itself does not connect to the GSM telecommunication system, for it has no SIM card. Connecting Glass to a smartphone with MyGlass enables making calls via the Glass headpiece, and allows a connection to the mobile internet network. Glass itself only works with Wi-Fi. The connection also means that it is possible to manage the Glass device with a smartphone; e.g. one can manage the Glass applications via a phone, or download videos and photos to the phone.

Glass organizes information on a timeline, consisting of a series of information cards (Illustration 4). On this timeline are received notifications, actions that have recently been done (e.g. an internet search), and other information coming from applications. Users can browse through this timeline by swiping the touchpad. Notifications (e.g. when a text message is received) are announced by a sound. The user has five seconds to view the notification. If the notification is not viewed instantly, it can be found in the timeline.

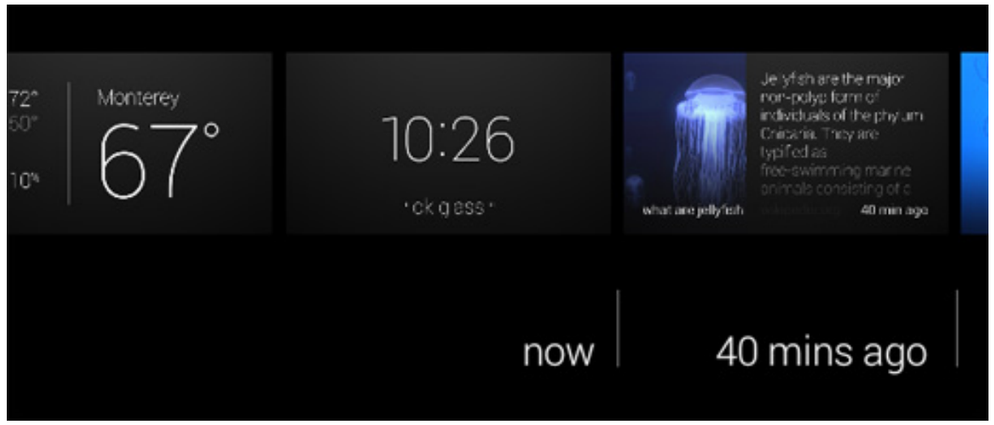


Illustration 4: Glass Timeline with Information Cards (Google, 2014)

Another application worth noting is Google Now. It is not exclusive to Glass, but seems particularly useful when used with Glass. Google Now is a digital personal assistant, that combines all kinds of information, into more information. It for instance combines information from the user's agenda with information about current traffic, and tells the user when he should leave for his appointment. It does all of this automatically. Google Now can access the user's personal Google Calender and Gmail, as well as Google Maps, GPS information and weather information. Furthermore, Google Now works in combination with online searches (e.g. by automatically showing the route to the restaurant that was searched online) and it is possible to ask questions directly to Google Now.

Applications for Glass

Many applications, usually called "apps", haver been developed for Glass. Applications are software programmes specifically developed for smartphones, often by third parties. Users can choose if and which applications they want to download and use on their device. Glass' functionality is thus partly contingent, because new functionalities can be added by the users, in the form of applications. This makes the aggregate of functionalities unique for each device.

Discussing in detail all currently existing apps for Glass is an endeavour too elaborate for the purpose of this thesis, but below I will discuss two examples of applications that are interesting because of their potential implications. These apps have been approved by Google for use on the Glass device.

Refresh

Refresh is an application that automatically provides the user with information about persons they are about to meet (Refresh Inc., 2014). Refresh needs to be linked to a personal digital calender such as Google Calender. It accesses the calender data to obtain information about whom the user is meeting. It either finds a full name, or uses algorithms to estimate the identity (e.g. when only a first name is mentioned). Refresh then searches online for publicly available information about that person. Such information can have a more personal and informal character, when the information is obtained from social networks, or a more formal character, when obtained from e.g. newspaper articles or a company website. The found information is then presented to the Glass user. It is also possible for the user to search manually for names; the further searching process executed by the app is the same. Refresh can be connected to social networks such as Facebook and LinkedIn, to enlarge the amount of information available. On e.g. Facebook, some information of an individual is only shared with his friends; if the user is Facebook friends with this individual, more information will be available for Refresh.

Social Radar

Social Radar is an application that combines location information with social networking, and provides its users with information about which people, who are in the user's virtual network, are in proximity in the physical world (SocialRadar Inc., 2014). Social Radar functions as a social network in itself, meaning that users have a profile and they can become friends with other users, thus creating a network. The app shares location information via the network; users that are in each others proximity are notified of this and are shown information about the other user. Furthermore, Social Radar can be linked to other social networks such as Facebook to utilize location information shared on those networks (Zax, 2014). Social Radar can be functioning constantly, thus using notifications to prompt users with information about people near them. However, privacy settings are elaborate and allow users to turn off the sharing of location data, and other kinds of information, temporarily.

Controversy Around Google Glass

Some controversies around Google Glass have arisen since its limited introduction to society.

It is important to investigate such controversies, because they provide an image of what is at stake regarding the introduction of this new technological artefact. Controversies and public debate show that there are serious concerns regarding Glass. Whereas Google and its enthusiastic fans are blatantly optimistic about Glass, many others express worries about negative aspects or implications of Glass.

For some, the concerns are so grave that they are trying to ban Glass from society altogether. Dutch civil rights organisation Vrijbit, for instance, is lobbying for a complete prohibition on Glass-like devices (Burgerrechtenvereniging Vrijbit, 2013), while organisation Stop The Cyborgs is pursuing similar goals in the United States (Stop The Cyborgs, 2014). But what are these organisations, as well as regular citizens, so worried about? Below I will discuss two examples of controversies around Google Glass.

Filming and Privacy

By far the most debated point concerning Google Glass is privacy. People who do not use Glass are afraid that users can take pictures or videos of them. These concerns encompass several aspects.

Firstly, filming with Glass is rather inconspicuous. Although Google claims it is clearly visible when Glass is being activated (because the prism lights up), this not clear at all when one is not close by the person filming or looking at them. Besides that, it would not be very hard to hack Glass so the prism does not light up when filming (Sexton, 2014). There is even an application, called Videoblack, available that prevents the screen from lighting up when filming (Uswak, 2014).

This leads to the second aspect of concern: the context in which photos are made. Since it is easy to inconspicuously make films and photographs, this can be abused in contexts where one would not want to be filmed or photographed (e.g. dressing rooms, at the beach, in a romantic restaurant, etc.). Even if nobody but the Glass user who took the picture ever saw the picture, the idea that someone is secretly taking photos of you is unsettling; hence the term "creep shots" for such secretly made photographs. of course it is possible with a regular camera or smartphone to take such pictures, but with Glass this can become much more probable and much easier (Sexton, 2014).

Thirdly, someone that is being filmed or photographed does not know who can see or access the film or photo. The Glass user himself probably knows with whom, or on which platforms (e.g. Google+ or YouTube) he shared the film, but people that appear in the film do not know this. Sharing a video online without the filmed person's knowledge or consent is possible with other devices too, but the inconspicuous manner in which filming is possible with Glass makes the likelihood of unawarely being filmed larger, and thus increases the likelihood of unknowingly and unwillingly ending up on YouTube. See for instance (Burgerrechtenvereniging Vrijbit, 2013).

Lastly, a concern that is perhaps less likely, but nevertheless deserves mentioning because of it severity. The concern is that third parties can watch through Glass' camera, without the user even knowing (Bartels, 2013). This has already been a concern for webcams and integrated webcams in laptops; a valid concern since it is possible to hack a webcam, and watching footage from a webcam that is not properly secured is actually very easy. It is possible that the cameras in Glass can be hacked in a similar fashion. This can be done by individuals with bad intentions, or perhaps by companies (e.g. Google itself trying to make more profit) or institutions such as intelligence agencies. In the last case, where intelligence agencies or the government are spying on us, this would imply an increase of the "surveillance society" (Stop The Cyborgs, 2014).

In any case, it is argued that Google Glass could lead to a *panopticon effect* which entails that because we all might be watched at all times, we feel less free (Sexton, 2014; Stop The Cyborgs, 2014).

Facial Recognition

Currently there is a concern that Glass utilises facial recognition so that users can obtain information about any passer-by. See for instance the experiences of Nick Sexton and Daniel Verlaan, both explorers of Glass (Sexton, 2014; Verlaan, 2014). They were often approached by strangers asking about facial recognition. At the moment, Google does not support facial recognition (Google Glass, 2014), but many suspect this is only temporary (Bartels, 2013). Concerns are voiced that applications developed by third parties can be used on Glass without consent from Google (Sexton, 2014); and that thereby facial recognition is possible.

An example of such an application specifically made for Google Glass that utilises facial recognition, is NameTag (NameTag, 2014). Currently it is not available via the official GoogleApps application store. NameTag is an application that utilises facial recognition in order to identify people. It is basically a search engine for faces. A face is scanned with the app (using Glass' camera), and the app searches the internet for publicly available photos that correspond to it (via social networks such as Facebook). It can match a face with a name. Furthermore, users of the app are required to create a profile that matches their face with their name, and possible other information such as their job or interests.

Technologies like the NameTag application on Google Glass can act as a gateway to an array of information about people on the internet. Of course nowadays it is possible to search for someone's name online. With Glass and facial recognition apps, it is possible to gain information about someone by just looking at them. The concerns and controversies about facial recognition are related to privacy, like the privacy concerns above, but in a different way. Unknowingly being filmed is regarded a privacy issue, because a Glass user can *disclose* information about someone, through the internet for instance. In that sense, a Glass user can have control over someone else's personal information.

Facial recognition concerns privacy in a slightly different manner; a Glass user can *obtain* information about someone through combined use of facial recognition software and access to the internet. Facial recognition therefore provides a new (and easier) manner in which Glass users can access information about others. So privacy in this case entails both providing and obtaining information about someone, without that person knowing or wanting that.

Glass as an Example Artefact

From the controversies described above, it becomes clear that Google Glass can have an enormous impact on our lives and our society. To better understand the full extent of this impact, we need a systematic way to *anticipate* impact. Over the course of this thesis, I will develop method to anticipate, specifically, the moral impact. I will apply this method to Glass as a demonstration of the method, and to gain new insights in the potential impact of Glass.

Concerning Glass, I will explore the following questions. How does Glass mediate the interactions between people? What are the relations between Glass, its users, and others? How can Glass influence the lives of users, non-users, and other stakeholders? How can Glass influence society in general? Can Glass alter existing social norms, or create new norms? What would it mean, if we all started wearing Glass?

Chapter 2
Mediation

In this chapter I will introduce mediation theory as an approach to understanding the role artefacts can play in the lives of users and other stakeholders. I will discuss the theoretical aspects of mediation theory and provide a method to analyse how artefacts mediate. From this, I will investigate how mediation can help us to understand the moral impact of artefacts. I will conclude this chapter by providing a method to analyse the moral impact of a product-in-design on the micro-level, and demonstrate this method for the example artefact Google Glass.

What is Mediation?

Simply put, mediation theory is the theory that artefacts mediate relations between humans and between artefacts and humans. In the past, philosophers of technology have regarded technology either as a determining force, that determines and shapes the social sphere, or as a subject of human control, that is determined and shaped by the social sphere. The view that technology determines and shapes the social sphere, is called *technological determinism*. This view entails two premises, the first that technology is an independent power that develops autonomously and follows its own dynamic; and the second premise is that technology is able to change culture (Verbeek, 2005, p. 136).

Currently, technological determinism is mostly seen as an inadequate view on the relation between technology and society. Surely, technology *can* have an influence on society, but to regard technology as the one and only all-determining power seems a gross overestimation of the actual influence of technology on society, because it negates human freedom. Furthermore, such a deterministic view puts forward an inadequate picture of what technology is, and what society is. Technological determinists like Karl Jaspers regard technology as one great entity; as Technology with a capital T. Likewise, society becomes Society. But in the current philosophy of technology, the general viewpoint is that there is no such thing as Technology with a capital T. There are individual artefacts, technological processes or techniques, abstract technological categories such as nanotechnology, and much more. By throwing them all in one pile and calling it Technology, we are unable to get a realistic view on how all these different technological entities function, how they relate to each other, to human beings, to society, etc.

On the other extreme is the view that society determines technology, and that technology is merely a neutral instrument for human goals. This view is called *instrumentalism*. Instrumentalism too is currently seen as a flawed viewpoint. Like determinism, it regards the collection of technological entities as one Technology, and the collection of social entities as one Society; thus it does not allow a realistic view on how all the individual technological and social entities

interact. Instrumentalists state that society determines technology. To a certain extent, they are right; technological artefacts are made by human beings, after all. But what instrumentalists fail to take into account is that technologies "do" things in the world and to human beings. How to understand what it is that these artefacts "do" to us? How can we see the relationship between technology and society, or better said, between technological entities and social entities in an adequate way?

Mediation theory poses an alternative view that is neither deterministic nor instrumentalist, for it denies the dichotomy between technology and society adhered to by both determinism and instrumentalism. Mediation theory regards technology as interwoven with the social sphere. Technological entities and humans mutually shape each other. Humans shape technology in various ways: by designing and manufacturing artefacts, but also by using them, using them in unexpected ways, or explicitly not using them. Technology, simultaneously, shapes society. Artefacts that get adopted by society can change society. Technology can influence the behaviour of individual people, which can expand to a change on societal level.

Not only are technology and society interwoven on an abstract level, in the sense that all the technological entities are intermingled with all the social entities, but individual humans and artefacts are interwoven too. One technological entity can be interwoven with one social entity. More importantly than painting an abstract world-view (technology and society are interwoven and mutually influence each other), mediation theory is about specific individual artefacts, and what they do with humans or other entities. I argued that artefacts are not neutral instruments. They do not form a neutral means for a human to act upon the world. An artefact is not a neutral object between the human and the world, but "a mediator that actively contributes to the way in which the end is realized" (Verbeek, 2005, p. 155). Mediation theory concerns how artefacts mediate the relations between humans, humans and technology, and humans and the world. Technological artefacts can influence the way someone acts upon the world, or experiences the world. In this chapter I will discuss three dimensions of mediation theory. First, I will discuss the *hermeneutic* dimension of mediation, or, how artefacts mediate human experience. Next, I will discuss how artefacts mediate how humans exist in and act upon the world, which is called the *existential* dimension of mediation. The existential and hermeneutic dimension form the proverbial two sides of the same coin. Last, I will discuss the *moral* dimension of mediation. The moral dimension encompasses both the hermeneutic and existential dimension; it is an abstract perspective from which to approach mediation.

The Hermeneutic Dimension of Mediation

The hermeneutic dimension of mediation concerns how artefacts mediate the human experience and interpretation of the world. Technological artefacts can shape how human beings perceive the world. An artefact can make aspects of the world appear different to us; coloured glasses make humans perceive the world in a different colour. But an artefact can also add things to our experience; infra-red goggles add information to the unmediated experience, by providing us with a representation of infra-red rays in the form of light rays.

When the relation between human and the world is mediated by an artefact, the human experience of the world is always *transformed* (Verbeek, 2005, pp. 130-131). Some aspects of the experience are *amplified* while other aspects are *reduced*. Take the example of looking at the world with infra-red goggles. Compared to looking at the world in the dark, the visual experience is amplified; we can see people, animals, and other heat emitting entities. But at the same time, the visual experience is reduced. We see things in far less colours than in daylight (either only shades of green, or highly saturated rainbow-colours). Amplification and reduction play a role in all mediations. In some cases, there is little amplification or reduction and the human experience is transformed only slightly, which Ihde calls a transformation of *low contrast.* Wearing sunglasses is an example of such a low contrast transformation; the world is perceived differently, but not that much. However, some transformations are of *high contrast*, meaning that the mediated experience differs greatly from the unmediated experience. If one would wear upside-down-glasses, the world would be perceived completely different than without the mediating artefact (though the human brain can correct this within ten minutes or so, but that aside).

So artefacts can mediate between humans and the world, and transform human experience of the world. Don Ihde distinguishes four types of relations between humans, technology, and the world (Table 1). The mediation is different for all four relations; in some, artefacts mediate directly, but in others they mediate indirectly. Below I will discuss the four types of relations and their characteristics.

Table 1: Human-Artefact-World Relations

	Direct mediation relation	**Indirect mediation relation**
Artefact in human focus	Hermeneutic relation I → (technology-world)	Alterity relation I → technology (-world)
Artefacts withdrawn from human focus	Embodiment relation (I-technology) → world	Background relation I (-technology/world)

Two of these relations are direct mediation relations. The first is the *embodiment relation*, where the technological artefact is embodied by the human, and the world is perceived *through* the artefact. The artefact is attached to the human body. Through the artefact, the human experiences the world in a different, mediated manner. The artefact itself is withdrawn from the person's attention. A simple example of an embodiment relation is wearing reading glasses. The user is literally perceiving the world through his glasses and experiences the world differently than without glasses. Other examples are a hearing aid, a telescope, and a blind person's stick. Note that an embodiment relation also has an existential side; embodied artefacts mediate human actions as well.

The second mediation relation is the *hermeneutic relation*, where the artefact provides the human with a representation of the world. The human thus experiences the world via the artefact, but this representation requires an interpretation from the human. In a hermeneutic relation, the artefact itself is within the attention of the human. An example of a hermeneutic relation is using a thermometer. This artefact provides a human with an experience of the world, namely the sensation of warmth or cold, but only via a representation, namely a number. Humans need to interpret what that number means (e.g. "I need my coat today"). Hermeneutic relations are associated with transformations of high contrast, because reality and the representation of reality differ to a large extent.

Ihde describes two more relations, the alterity relation and the background relation, in which the mediation takes an indirect form.

The *alterity relation* is a relation of direct interaction between the human and the artefact; including both mediated action and experiences. The human interacts directly with the artefact, where the artefact assumes the role of a *quasi-other*. We do not regard the artefact as a genuine other, because its options for interaction are limited (unlike an other human being, who would be regarded as a genuine other). Examples of alterity relations are the use of an ATM machine

or playing a computer game. In the alterity relation the mediation is indirect, because the human is not connected to the world via the artefact, but connects to the artefact itself. The artefact mediates human experiences in an indirect manner by influencing ideas about the world, or frameworks of interpretation.

The *background relation* is a relation where technological artefacts shape the background of human experience. The artefact functions at the background of human experience and the human will hardly interact with the artefact. An example of a background relation is the relation between humans and an air-conditioning system. The airco system shapes the world in which humans have experiences, by maintaining the temperature at a certain level. However, the human does not experience the world via the airco system, but rather has experiences in the world that is partly shaped by the airco system. The mediating role of the artefact is indirect.

Next to these four relations described by Ihde, Verbeek has introduced two other relations: the *cyborg relation* and the *composite relation* (Verbeek, 2011, pp. 144-147). First, the cyborg relation. The term "cyborg" is used widely to denote a hybrid of organism and technology; a living organism and technological parts have merged into one entity. The cyborg relation thus describes a relation between a human and an artefact, whereby the artefact has physically become part of the human being. A cyborg relation can be seen as an embodiment relation taken to the extreme; rather than being attached to the body, the artefact has *merged* with the body. The cyborg relation is visualised as follows: (human / technology) → world. An example of a cyborg relation is a person with a cochlear implant: an electronic implanted device that senses sound waves and translates them into stimulation of the nerves, thereby bypassing the damaged organs in the ear. Other examples are wearing prosthetic limbs, electronic heart valves, and deep brain stimulation.

The other relationship described by Verbeek is the *composite relation*. This relation can be seen as two relationships stacked onto each other: the artefact forms a relationship with the world, and we form a different relationship with the artefact. Crucial to the composite relationship, is that the artefact *constructs* reality. The artefact "experiences" the world in a certain way, that humans cannot. The artefact constructs a new reality for us, that we can experience. An example mentioned above is infra-red goggles. Human beings cannot see infrared, but the infra-red goggles can "see" (i.e. detect) infra-red rays. So the first relationship is that between the artefact and the world, where the goggles "see" infra-red rays we humans cannot see. Then the goggles construct an image that is visible to humans. Thus the second relationship is that between the goggles and the human, where the human experiences a reality constructed by the artefact. The composite relation can be visualised as follows: human → (technology → world).

The six relations described by Ihde and Verbeek can be used to analyse and describe mediation relations between artefacts, humans and the world. The relations can serve as a starting point to analyse technological mediation; for instance by questioning if the relation between an artefact, a human being and the world can be described as a hermeneutic relation, and if so, what is represented and how? Furthermore, one can question what it means, on a more abstract level, that the artefact in question represents reality. Investigating all Ihde's relations in this way can lead to the insight that an artefact mediates human experiences in a variety of ways. If we try to classify a certain type of mediation into one of these six relations, we might find that more than one relation applies; this could lead to a more nuanced picture of the mediation at stake. Next to that, Ihde's concept of transformation can provide insight; how is the mediated experience transformed as to the unmediated experience? Is the transformation of high or low contrast? What does such a transformation mean for us, and could it have consequences?

The Existential Dimension of Mediation

Verbeek uses the ideas of Bruno Latour to explain the existential side of mediation, or, how artefacts can mediate the way in which humans act upon the world and shape their existence (Verbeek, 2005, pp. 147-172). On the basis of Latour's philosophy is the existentialist thesis that entities are not predefined, but become defined in relation to other entities and the world. Jean-Paul Sartre famously posed that "existence precedes essence" by which he meant that human beings in the first place exist, they just *are*, and only in the second place become *what they are* by relating to the world and others. Latour extends this idea to artefacts, and poses that all entities in the first place exist, and secondly become defined as what they are in relation to other entities. What entities are emerges from the network of relations to other entities the entity is in. Latour's view that entities are defined by their network is crucial to the way Latour treats both humans and non-human entities. Latour rejects the dichotomy between humans and non-humans and treats them both equally as *actants* or entities that can do something. The word *actor* (or agent) is commonly used to denote someone that can act, but for Latour this word reinforces the human-object dichotomy; hence the term actant that applies to both human and non-human entities.

When human beings want to perform a certain action, they often use artefacts to reach their goal; the artefact and human act *together* to reach the goal. This acting together means that the human and the artefacts temporarily form a hybrid entity (i.e. a hybrid actant) that performs an action. By forming such a hybrid with a human being, a technological artefact shapes the way the human acts upon the world. It shapes possibilities and constraints for actions. It is this shaping of the action potential that we call mediation. The artefact comes to stand, figuratively speaking, between the human being and the world. Human beings have intentions to act upon the world, and artefacts can shape these intentions; the technological possibilities in a society can shape the range of intentions humans have. Next to that artefacts can help realize human intentions. By contribution to the realisation of intentions, artefacts shape the way in which these intentions are realized. Ergo, artefacts influence the way in which humans act; artefacts mediate human actions.

Latour distinguishes four existential aspects of mediation. First is the forming of hybrid actants, which Latour calls *composition*. When human and non-human entities together perform an action, they form one hybrid actant. This entails that agency is not seen by Latour as a strictly human property, but agency is distributed amongst all actants, human and non-human. A second aspect of mediation is *translation*, or the changing of *programmes of action*. What Latour calls the program of action, can be understood as the intention to perform a specific action. However, the concept programme of action applies to both human and non-human actants. For humans, it entails an intention to do something, while for artefacts it entails their functionality.

The third aspect of mediation is *reversible black-boxing*. It entails that although entities are defined by their network of relations, often this network is black-boxed; the network is rendered invisible. This implies that often, the network that defines an artefact is far more complex than becomes apparent at first glance. It is even often the case that what we consider to be one artefact, actually consist of multiple artefacts, that each have their own networks. Latour calls this phenomenon *reversible* black-boxing because the process of rendering the network invisible is reversible, for instance when one scrutinises an artefact to replace a small part.

Latour calls the fourth aspect of mediation *delegation* (Illustration 5). Delegation consists in the *inscription* of programmes of action into other actants. All artefacts contain in them programmes of action. Through these programmes of action, artefact tells the user what to do. This is called *prescription*. The designers of the artefact have *inscribed* the artefact with certain programmes of action. Latour calls this phenomenon *delegation*. Just as we sometimes delegate a

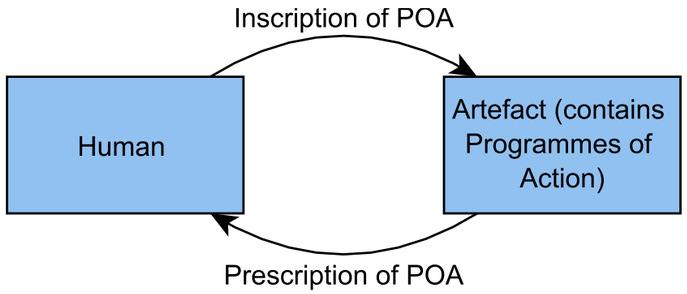


Illustration 5: Delegation

task to another person, that is, we need something done but ask another person to do it, humans delegate tasks to artefacts.

Latour's concepts can be used to analyse mediation relations. We can use the concept of composition to analyse the forming of hybrid actants in mediation; what actants are involved in the mediation relation, and which hybrid actants are formed? The concept of translation helps understanding how artefacts change actions; how did a specific mediating artefact change the programme of action as compared to unmediated action? How would different artefacts change programmes of action? Lastly the concept of delegation is useful in analysing not only how artefacts influence humans, but also how humans have influenced the artefact; what script does the artefact contain? What was inscribed into the artefact? What tasks were delegated? What programmes of action are prescribed by the artefacts to humans?

Method for Mediation Analysis

Verbeek presents a framework for the analysis of mediations (Verbeek, 2013) which forms the basis for my method of analysing mediation. To anticipate the future mediations of a product-in-design, we must try to understand what the product does as accurately as possible; we need to analyse what possible mediations could arise from this artefact. Verbeek proposes to analyse mediation on three distinct aspects of mediation; the *points of application* of the technology, the *types* of mediation, and the *domain* of mediation.

Points of Application

The concept of points of applications comes from the work of Steven Dorrestijn (Dorrestijn, 2012). The points of application concern the "places" on and around the human body where technological artefacts can have an effect on humans. These places should be interpreted as metaphorical categories. See Illustration 6 for the model by Steven Dorrestijn (Dorrestijn et al., 2014) and Illustration 7.

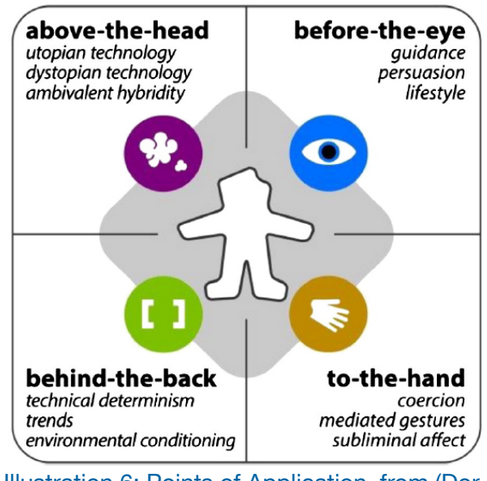


Illustration 6: Points of Application, from (Dorrestijn, Voort, & Verbeek, 2014)

The first point of application is called "before-the-eye" and it concerns mediations of a *cognitive* nature. Artefacts provide signals to humans, that require a cognitive interpretation, and in that manner influence our behaviour. Mediations in this category are such that the artefacts address the human decision making processes. In this sense before-the-eye mediation is comparable to Ihde's hermeneutic relationship, where artefacts provide humans with a representation of the world that requires human interpretation.

The second point of application is called "to-the-hand"; it concerns mediations of a *physical* nature. This can be in the form of an artefact being a physical coercion to human behaviour, as is for example the case with automatic revolving doors; they coerce users into a certain behaviour (wait for the door to open, do not rush, do not try to enter with too many people at the same time, etc.). However, to-the-hand mediation can also concern physical mediation in the sense that it concerns the human body; when we embody an artefact it mediates our perception and behaviour. Wearing sunglasses is an example of embodiment; it changes our experiences (i.e. the world appears to be darker) but can also change behaviour, for instance we can secretly stare at other people, thinking they will not notice because they can not see our eyes. Embodiment in this sense is not solely about experiences, as Don Ihde describes, but also about action and behaviour; writing with a pen is an example of an action where an artefact is embodied.

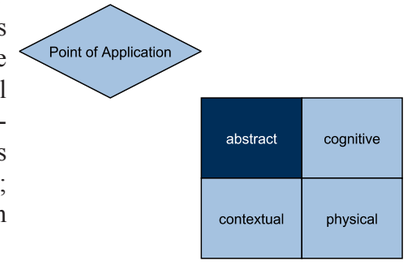


Illustration 7: Points of Application

The third point of application is "behind-the-back" and it concerns mediation of the background of human existence; or, the *contextual and infrastructural role* technologies play (Verbeek, 2013, p. 86). Some artefacts do not influence our experience or behaviour directly, but rather they influence the environment in which we have experiences and act.

The last point of application "above the head" is the most abstract. While the other points of application concern concrete artefacts and their effects on humans, the "above-the-head" concerns technology in general and its influence on humans. Within this point of application we find general philosophical claims about the relationship between technology and humans and society. The *deterministic* and *instrumentalist* views (as discussed on page 15) are examples of such views. Since designers design concrete artefacts, rather than "Technology" (as if it were one giant entity), this point of application is excluded from mediation analysis.

Types of Mediation

The second aspect of mediation that we can analyse is the *types* of mediation (Illustration 8). Artefacts influence humans in various ways; some artefacts force us to do something (e.g. the automatic revolving door mentioned above) while others influence us in ways so subtle we hardly notice them. Verbeek proposes four types of mediation: coercive, persuasive, seductive and decisive. To clarify these, the categorisation of these types of mediation along the dimensions of *force* and *visibility*, as proposed by Nienke Tromp (Tromp, Hekkert, & Verbeek, 2011) is helpful. We can distinguish artefacts that exert a strong force on humans from artefacts that exert a weak force. Next to that, we can distinguish influences with an explicit visibility from those with a hidden visibility. When an artefact exerts a strong force, but its influence is hidden, the mediation is *decisive*; meaning that an artefact decides for us. Verbeek mentions the example of a multiple story building without elevators; it is decided for the users that they will take the stairs, although implicitly. However, visibility is subjective; perhaps for someone who has difficulties with climbing a stairs, the lack of elevators in the building may be immediately

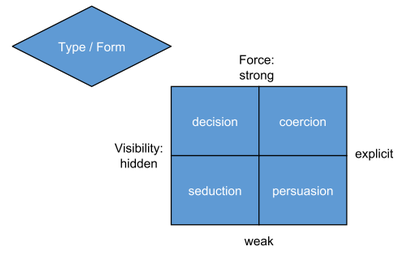


Illustration 8: Type of Mediation

apparent (and thus the visibility is explicit). Artefacts that exert a strong force in an explicitly visible manner, mediate in a *coercive* manner. The automatic revolving door mentioned earlier is an example of coercive mediation; the door forces a certain behaviour, but does this explicitly visible. Artefacts can exert a weak force on humans. When an artefact exerts a weak force in a hidden manner, there is a *seductive* mediation. Seductive and persuasive mediation may seem to closely resemble each other, but the key difference is that in a seductive mediation, the human is not aware of the influence, and probably regards his own behaviour as internally motivated (Tromp et al., 2011). This stands in contrast to the *persuasive* mediation, where the exerted influence is explicitly experienced by the user, although the influence is weak.

An important characteristic of both visibility and force, as they are used by Tromp, is that they are subjective; Tromp's framework deals with the force of an artefact's influence *as it is experienced by the user*. This entails that each individual user will have his own subjective categorisation of the mediations of artefacts. This means that we cannot definitively categorize mediation into types, as if they were objective. However, we can still use our own subjective judgements to make this categorisation, and thus analyse and gain more insight into mediation, provided we keep in mind that others may experience certain mediations differently.

Domains of mediation

The last aspect on which we can analyse mediation is the domain of the mediation (Illustration 9). Throughout this chapter I have discussed the existential (action, behaviour) and hermeneutic (experience, interpretation) dimension of mediation. These two form the first distinction between different mediations. The second distinction we can make is whether mediation relations concern individuals or groups (up to society at large); ergo between individual and social mediation.

Individual mediation can be existential; an artefact can mediate the actions and behaviour of an individual. Hermeneutic individual mediation concerns the experiences of an individual. Social existential mediation concerns social practices. Members of a society often all perform a lot of similar actions; there are certain things we all do. Because many people perform a certain action, a shared way of performing the action can emerge; i.e. everyone does it in the same way. On a societal level this entails that for certain actions, there is a certain standard way of executing them. Imagine for example a train station; we can observe many social practices there. At the staircases, people mostly walk on the right side; someone climbing stairs on the left side will bump into people. In the shops, people form neat queues when waiting for their turn. Etcetera. Artefacts can mediate our collective manners of doing things; our social practices.

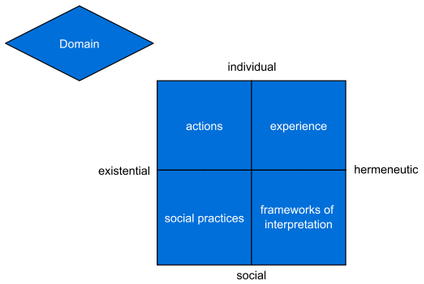
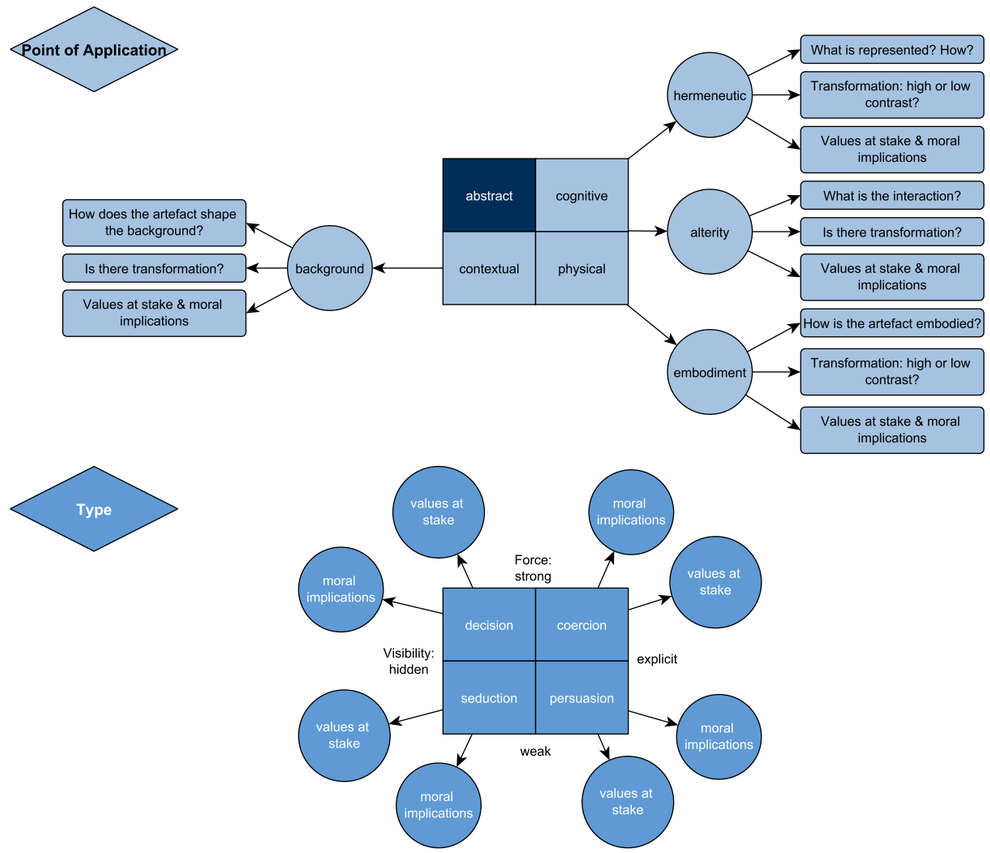


Illustration 9: Domain of Mediation

Social hermeneutic mediation concerns frameworks of interpretation. When we have an experience, we usually interpret this experience; i.e. we give it a certain meaning, in relation to prior experiences or knowledge and beliefs we have. The way we interpret things can be collective too. For instance, in our society the colour red when used in signs (in the broadest sense of the term) usually interpreted as meaning either a warning or something negative.

In summary, the analysis of mediation is based in three aspects, namely the points of application, the type of mediation, and the domain of mediation. From this analysis and categorisation we can start to think also about implications and consequences of mediations. See the visual summary below in Illustration 10.



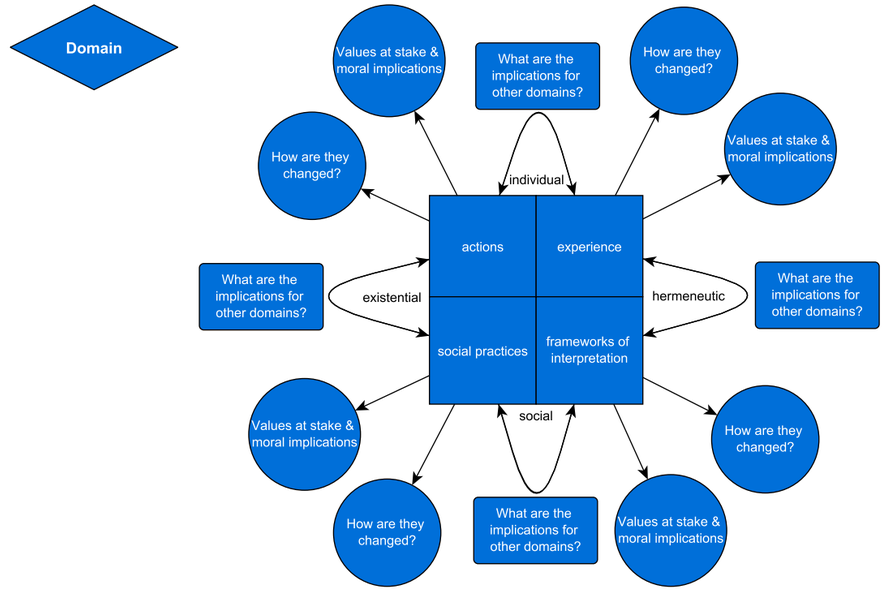


Illustration 10: Visual Overview of Mediation Analysis

The Moral Dimension of Mediation

Until now, I have discussed the hermeneutic and existential dimension of mediation, as well as a method to analyse how an artefact mediates. But this thesis is about the moral impact of new artefacts; thus we need to investigate how mediation theory can help us to analyse the moral implications of products-in-design. Before going into the moral dimension of mediation theory, I will discuss what the term *moral* means, and how it differs from *ethical*. The adjective *moral*, as well as the noun it stems from, *morality*, both refer to a code of conduct, or a set of rules of what is good. However, confusingly, we commonly use the term morality in two different manners; descriptive and normative.

As a *descriptive* term, morality refers to a code of conduct put forward either by a society, a group of people, or an individual (Gert, 2012). When we use the term moral in a descriptive sense, it means *concerning morality*. For instance, the term "moral development" means the process of development of a morality in children, and the term "moral agent" denotes an agent that acts in reference to a morality. Using the term morality in the descriptive sense often goes hand in hand with studying morality from a neutral standpoint. Each society, group of people, or individual, has a morality, or, a code of conduct. However, what this morality encompasses (i.e. the content of the code of conduct, the principles and values that are held) differs from group to group.

As a *normative* term, morality refers to a code of conduct that prescribes what people should do. In this normative sense, the term "moral" is used as a synonym for "good" or "right". Someone expressing that something is moral, usually means that it is in accordance with the code of conduct he subscribes to (whether or not he shares that specific code of conduct with a group or society, or not). When we say that stealing is immoral, we (usually) mean that it is a wrong thing to do. Or when a father says he wants his children to grown into moral adults, he usually means he wants them to be good persons, that act in accordance with his own morality. For someone who subscribes to a certain morality, the code of conduct is normative; it prescribes what I, as well as other people, should do.

The terms *moral* and *ethical* are often conflated, but they are not synonyms. Ethics is not the same as morality. Following (Swierstra & Rip, 2007, pp. 5-6) and (Boenink, Swierstra, & Stemerding, 2010, p. 3) I define ethics as *reflexive morality*; ethics is the reflection upon, and questioning of, (parts of) morality. As a philosophy student, I do ethics; I study morality. But in daily life, we do ethics as well, when we contemplate whether something is right or wrong to do, and why this is so. Morality is implicit; we do what we think is right automatically rather than deliberating our every action. Or, as Swierstra and Rip put it:

> *"In the pragmatics of daily life, morals exist mainly as routines which are considered to be self-evident so that people are hardly aware of their existence"* (Swierstra & Rip, 2007, p. 5).

So, in the remainder of this thesis, I will be *doing ethics* because I am *studying morality*. Morality is the set of beliefs we have about what is right and wrong. The term morality can both refer to such a set of beliefs that is held by one individual, or that is shared by a group of people (up to all members of society). For the current purposes, I will assume that there are certain *moral beliefs* (i.e. beliefs about what is right or wrong) that are generally shared by all members of society. These are general rules such as "it is wrong to harm someone". It is likely that the more detailed aspects of such a moral belief differ from person to person. For instance, one individual may belief that psychological harm (e.g. bullying) is far worse than physical harm, while another individual beliefs physical harm is the worst kind of harm. So the moral beliefs – the morality – of these two individuals differs, when it comes to details. But still they share a general moral belief. In this thesis I will focus on such general moral beliefs that are shared by large groups of people. I do not want to deny that moral beliefs can differ from one individual to another; but I am not going to research the morality of individuals.

A last remark about the term moral. I gave this section the title "the moral dimension of mediation". I use this term *moral dimension* as a collective term for *all the aspects of mediation that relate to morality*. Above, I have discussed for instance the existential dimension of mediation, or, how artefacts mediate our actions. Within the existential dimension, we can identify numerous moral aspects; i.e. aspects of mediation that relate to morality. The same goes for the hermeneutic dimension. The moral dimension is a different perspective to approach mediation; rather than investigating how actions and experiences are mediated, we now investigate how mediation relates to morality.

Morality and Mediation

Technological artefacts mediate how the intentions we have give rise to actions in the world. Artefacts can enable actions with a severe moral load that without the artefact would not (or hardly) be possible. An example is firearms. If you are really mad at someone, you may feel the urge to hurt that person. You may swear at him or physically hurt him. But if you were to have a gun in your hand, your intention to hurt the other person may result in the action of killing the other person. While it may be immoral to hit someone, they will usually suffer from it only temporary, and we might say that it is only 'a bit' immoral. If the execution of your intention is that you shoot someone, they may be killed. Killing another human being is seen as one of the most immoral things one could do; so suddenly, because the gun is present, the moral stakes in this situation are raised significantly.

The way in which we interpret our experiences can be closely tied to our moral beliefs. We have a framework in our minds, that we use to make sense of the world. We have built these frameworks over our lives; we have learned to associate things to one another, to understand causality, and what things to focus our attention to, for example. These "ideas about how the world works" include social factors and moral factors. And so we can interpret things we experience as having a moral load; as being wrong or right. Technology can influence this framework, and our moral ideas. Take for instance the consumption of meat. I grew up thinking that food came from the supermarket. My moral ideas about the treatment of animals will probably differ a lot from those of someone whose food is not produced in a heavily technological matter.

So technological artefact mediate actions with a moral load, and mediate our moral frameworks of interpretation; we can distinguish between the existential and hermeneutic dimension of the mediation of morality.

Existential

Firstly, the existential dimension of mediation; the mediation of human acting and existence in the world. As seen in the example of the gun, artefacts can change the execution of human intentions in a morally significant way. There are three ways in which artefacts have moral significance; first, the inscription of morality into artefacts; second, the normativity of products; and third, the users' own manner of using a product can be morally loaded. Above, I have discussed Bruno Latour's concept of delegation; designers inscribe programmes of action into artefacts, and artefacts in their turn prescribe programmes of action to their users. This same model applies to morality.

Take for example shopping carts in supermarkets, that have a coin lock. In order to get his coin back, the user must return the cart and relock it to the other carts. We could regard the under-

lying motive as a moral idea: it is wrong to not return the cart to the supermarket, because it is property of the supermarket (not returning the cart is then a form of stealing, and immoral). This moral idea is inscribed into the shopping carts themselves, by means of the coin lock. The carts are normative; they prescribe a rule.

Designers inscribe morality into artefacts. We might even go as far to say that *every* artefact has moral ideas inscribed into it. After all, the artefact has been made by a human being with a certain world-view, certain beliefs, and a certain morality. Assuming that designers design and make artefacts because they believe these artefacts will cause good in the world, the artefact carries in it the designer's belief about what is good. The inscription of morality into technology is not necessarily a deliberate or conscious process. Most of our actions are based on our implicit moral beliefs, but we do not explicitly refer to these moral beliefs every time we do something. Likewise, products will be inscribed with values or norms from the designer's morality undeliberately, rather than that designers will handle every little design decision as an ethical issue to be solved and with that deliberately choose what values or morality to put into their product. Of course it is possible to design moral ideas, or values, into a product deliberately. A well-known method for doing so is Value Sensitive Design (Friedman et al., 2008), which I discussed in the introduction (page 3).

Artefacts in their turn prescribe certain actions to users; they "tell" users how to use the artefact. In that same manner, artefacts can tell users that is it good to do something a certain way. Artefacts are normative; they prescribe to users what is good.

Users do not always follow the prescribed behaviours. In the example of the supermarket carts, some users may still take a cart home, despite the strong forces of the artefact to prevent this. Other artefacts may not have such clear moral ideas inscribed into them, but can obtain a moral load by how they are used by users. An example is the use of a kitchen knife. It was designed as a tool to cut vegetables and other food. It does not have strong moral ideas built into it, only the idea that it is good for people that they can cut vegetables in small pieces. A kitchen knife can be used however in a manner that does have a strong moral load. I can stab someone with a kitchen knife, and even kill someone. Hurting another person is a wrong thing to do. In this way, the kitchen knife, although it has no strong moral ideas inscribed into it, has mediated a relation between two humans in a strongly morally loaded manner.

Hermeneutic

Artefacts mediate our actions, but they also mediate our experience. So what is the hermeneutic dimension of the mediation of morality? We are not born with a certain morality. We do not have moral ideas pre-planted in our brains when we are fetuses in a womb. Rather, we develop a morality over our childhood and further lives; a process called *moral development*. As children, we learn that some things are wrong to do. In the first place, because adults tell us they are wrong. But as we grown up, we will learn from (social) experiences that certain things are good or bad. When discussing morality and experiences, and the mediation of those, it is important to distinguish experience from interpretation. Experience is the perceptual experience. Interpretation is the meaning we give to an experience. We can give meanings to experiences, because we posses a framework of interpretation; a framework consisting of all the things we have learned about how the world works. When it comes to mediation, there are thus two hermeneutic aspects that can be mediated; first, the experience, and second, the framework of interpretations. The work of Ihde showed how artefacts van mediate experiences. They can change the way we experience the world. Can they change the way we experience morality?

Technological artefacts can influence our frameworks of interpretation and our moral beliefs. Humans develop a morality over the course of their lives. Technological artefacts can steer or

influence this development. This can happen in direct, or more indirect manners. A direct way in which an artefact can influence moral beliefs is through the use of the artefact, while the existence of artefacts and technologies can influence moral beliefs in an indirect manner. Take for example the introduction of email. Imagine a large company where everyone has gotten a company email address. Some employees start using their email and are convinced of the advantages, but notice that other colleges never respond to email. The employees can develop the (moral) idea that everyone should read their email, because now questions go unanswered and unnecessary delays occur. However, for the other colleagues that do not use email, the existence of this technology can influence their moral ideas in an indirect manner. They may come to value personal contact more, and think that if one has a question, one should ask in person.

The Moral Status of Artefacts

I have argued that artefacts mediate morality; artefacts mediate actions with a moral load and influence our moral beliefs. I have argued that artefacts contain a morality; designers, whether intentionally or not, inscribe artefacts with moral norms and values. Does that mean that, when artefacts prescribe behaviour to users, artefacts are acting upon their morality? Are artefacts *moral agents*? The concept of moral agency concerns the ability of an individual for *moral reasoning* (reasoning in reference to a code of conduct of what is right and wrong), making moral judgements and acting upon them, and to be held responsible for their actions. Moral agency requires the possession of intentionality and some degree of freedom (Verbeek, 2011, pp. 12-13). In a certain sense, artefacts can act because they can do things. However, they do not have freedom to act in any way they want. In fact, they cannot even want things; they do not have a mind or thoughts. Artefacts do not have intentionality, they do not have freedom, nor can they reason and make judgements. So, the simplistic conclusion would be that artefacts do not possess moral agency. However, that view seems to imply that artefacts are neutral instruments, while in mediation theory we regard them as mediators, and in that sense artefacts do indeed *do* something. Bruno Latour's concept of composition states that humans and non-humans form a hybrid actor. Thus, humans and artefacts together can form a hybrid moral agent. Moral agency is distributed over human and artefact.

Method for Analysing Moral Implications

The next step in the analysis of mediation is to explore the moral implications of the mediation. So far, our mediation analysis method has mostly seemed to be a checklist. In principle, there is nothing wrong with that, and going through a checklist can be very insightful in itself. However, I want to go beyond this and dive deeper into mediation. I want to provide you with a way to analyse mediation in more detail and beyond the obvious. And, importantly, I want to provide a way to identify morally relevant aspects of mediation, so that we can analyse how the product-in-design mediates our actions and experiences with a moral load, and how the product-in-design can mediate our morality (our moral ideas, beliefs, norms, and the values we hold). It is possible to identify morally relevant aspects of mediation from the analysis of points of application, types and domain; but to investigate and identify morally relevant aspects of mediation, it is helpful to analyse mediation beyond points of application, types and domains, to gain broader insights in how a an artefact mediates.

A fruitful manner to gain broader insight in the mediations of a product-in-design is by analysing the *anthropological implications* of the mediations. *Anthropology* is the study of human beings, and it contains many sub-disciplines. Cultural anthropology for instance empirically studies human cultures and the various aspects of it. Biological anthropology empirically studies the human biology and our evolution. In general, anthropological research is empirical or

historical. However, *philosophical anthropology* is the philosophical study of human beings. Rather than doing empirical research, philosophical anthropology tries to answer more abstract questions, such as "what is the human being?" or "what is the essence of humanity?". My mediation analysis does not aim to define the essence of the human being; a big and abstract question like that would deserve an entire book on its own. Rather, I am taking inspiration from the discipline of (philosophical) anthropology; I propose to study human *characteristics* in relation to mediation. How does a product-in-design directly mediate human characteristics? Or, what are the long-term implications of the product-in-design and its mediation for our human characteristics? By analysing how a product-in-design mediates human characteristics, we move away from the concrete mediation of experiences and actions towards a slightly more abstract level. It yields more in-depth insights into mediation. Importantly, analysing the anthropological implications of mediation provides us with even more insights that can be analysed from a ethical point of view.

It is important to note that I am using anthropology as a *tool* for mediation analysis. In no way do I aim to provide the reader with an anthropological definition; i.e. a definition of what the human being is, what humanity is, or what the essence of man is, etc. Rather, my method proposes to analyse the mediation of (a few) human characteristics. For our current purposes, it does not matter whether these characteristics are essential to humanity or not. What matters is that we humans, generally speaking, have these characteristics, and that it is possible to investigate how these characteristics are mediated. For instance, a well-known anthropological definition is that given by Aristotle when he states that the human is a political animal:

> *"It follows that the state belongs to a class of objects which exists in nature, and that man is by nature a political animal; it is his nature to live in a state."* (Aristotle, trans. 1962)

For our purpose of mediation analysis it is irrelevant whether man is only, essentially or by definition, a political animal. What matters is that we humans indeed all live in some sort of political system, and that humans thus have the characteristic of being political. Therefore we can analyse how artefacts mediate this characteristic.

Practically speaking, there are two approaches to the analysis of anthropological implications. The first is to use the insights on points of applications, types of mediation and domains of mediation, and from these try to discover which human characteristics are at stake in the mediations. However, my preferred method is the second one; to actively explore how a certain artefact can mediate human characteristics. For this, one chooses a number of human characteristics and investigates what implications the product-in-design can have for these characteristics. For example, a human characteristic that can be investigated is *having emotions*. Questions to ask are, for example: "how does the product-in-design mediate what kind of emotions we feel?", "how does the product-in-design mediate our expression of emotions?". Or we can investigate characteristics of a more social nature, for instance, that humans have a strong bond with relatives and often live together with their family. We can then question how a product-in-design mediates the family life at home, or when family members are apart from each other.

Moral Implications

The last step I propose for mediation analysis is to explore and identify the *moral implications* of the product-in-design. By performing a mediation analysis, we have gathered many insights on the point of application, type and domain of mediation, as well as on the anthropological implications of the mediation. The last step is to review these newly gained insights, and investigate what the morally relevant aspects of mediation are.

It is fruitful to first analyse the artefact itself and its mediations from an ethical perspective, before investigating the moral implications of the mediations. First, we can investigate the moral load of the mediations themselves. It is possible that the way in which an artefact mediates is morally right or wrong, regardless of the consequences resulting from the mediation. For instance, when we investigate the type of mediation (i.e. decisive, coercive, seductive, persuasive), we might find that in a specific context e.g. a decisive mediation is wrong. For instance, in a medical context, it can be morally wrong to have an artefact decide for a patient, because the patient has the right to informed consent. Even if the result of this mediation is morally good (e.g. the patient is cured), we may still find the means, the mediation itself, morally wrong. Second, we can analyse the moral delegations, as explained above. What moral ideas are *inscribed* into the artefact by the designer? And in turn, what moral ideas or norms are *prescribed* to the user by the artefact?

We can distinguish two types of moral implications. First, and perhaps most obvious, are the *implications that have a moral load*. When an artefact mediates an action, this can result in an action that is morally loaded; i.e. that is considered from the perspective of a certain morality to be good or bad. We thus investigate what actions, experiences or behaviours result from the mediations, and what their moral load is.

The second type of moral implications are the *implications for morality*. Artefacts can mediate the way we think, what knowledge we have, and our beliefs. They can thus mediate our moral beliefs, i.e. our morality. How does, or can, an artefact mediate the moral ideas held by and individual user or stakeholder? Eventually we want to investigate how artefacts mediate our collectively shared morality. This however is no easy task; in the rest of this thesis I will develop a method to explore the moral implications of products-in-design on a societal level, concerning our shared general moral beliefs. For now, we focus on the implications of a product-in-design and its mediation on the morality of individuals.

Mediation Analysis of Google Glass

In this section I will perform a mediation analysis of Google Glass. This serves a dual purpose. First, to better understand our example technological artefact Google Glass. But secondly and more importantly, I want to demonstrate what insights mediation analysis can provide for understanding how artefacts function and influence people's lives. I want to explore and analyse what mediation analysis yields, what kind of insights is provides, and what its limitations are.

In this analysis I will distinguish between on the hand the hardware of Glass or the physical characteristics, and on the other hand the software and applications. I will distinguish various features and functionalities of Google Glass, and analyse these with the mediation analysis framework explained on page 18. From these initial findings, I will analyse some *anthropological implications* of Glass and the way it mediates. I chose three human characteristics on which I will focus. First of all, *social relationships*: how can Glass affect the way we relate to friends, our family, or strangers? This human characteristic is relevant for Google Glass because it is closely related to the notion of privacy, that is the pivotal point of many controversies around Glass. The second anthropological aspect is our individual sense of *identity*: how does Glass influence the way we see ourselves? From the reviews of Google Glass we have seen that non-users started seeing Glass users differently. This raised my interest in exploring how Glass mights affect how users see themselves. As the last human characteristic, I will discuss the influence Glass can have on our *attention*: how do we distribute our attention over everything in our lives, and how can Glass affect this distribution? Mobile telephones have long been regarded as a disruption of our attention, so what about Glass? These three anthropological aspects are very broad, so rather than trying to provide the reader with a complete and definitive answer, I will

point out some interesting issues.

Lastly, I will discuss the *moral implications* that follow from the first steps of the mediation analysis.

Glass as an Embodied Artefact

The most striking feature of Google Glass is that it is worn on the user's face, even when it is not actively used. The artefact is always *embodied*.

POA, Type, Domain

The embodied characteristic of Glass correlates to the physical (to-the-hand) point of application. This corresponds to the embodiment relation as described by Ihde. The type of mediation of the embodiment of Glass can best be categorised as coercive. Glass must be embodied in the specific way of wearing it on you face, in order to function; thus the force is strong. It is clearly visible that Glass must be embodied in this way; the type of mediation is coercive. Glass' embodiment mediates in all four domains. It changes the individual experience and actions. Currently, when Glass is a rare sight, the embodied feature mediates the social domain in the sense that most people (non-users of Glass) will experience the Glass-user differently.

Anthropological Implications

Because Glass is always embodied, Glass is always *present* to the user. This can have implications for the way the user experiences and is present in the world. Because Glass is always present, it has the power to constantly attract the user's attention. Glass can do this actively through notifications, but also passively, when the user constantly initiates interaction with Glass (for instance to see if there are new notifications), perhaps as part of an information-craving lifestyle.

Because Glass is worn on the user's face, it literally stands between people who are interacting with each other. This can have implications for social relations between people; how they perceive each other and act towards one another. A non-user of Glass may for instance be suspicious of the Glass user, thinking he might be filming.

Another important aspect related to the embodiment of Glass, one that mainly mediates social relationships, is that only the user can see Glass' screen. Others can see the prism lighting up, but can hardly discern details of what a Glass user is viewing. This creates this a physical separation between a Glass user and someone he is interacting with; as mentioned above, Glass literally stands between them. But more importantly, the fact that only the user can see Glass' screen creates a cognitive barrier between the user and others. Another person cannot (easily) see whether the Glass user is interacting with Glass, and even if the other could see this, it is completely opaque what then exactly the Glass user is doing with Glass. Compare this to a smartphone; one can clearly see that another person is interaction with his phone, and usually one can take a peak at what the smartphone user is doing. Glass can diminish the transparency of social interactions; it potentially creates secrecy around Glass users.

Furthermore, because Glass is on the user's face, the user may experience the virtual world not only to be more present, but also closer to himself. This can have implications for one's sense of identity. Likely, users of Glass will identify more with the virtual realm (and their virtual social contacts) than users of smartphones who keep their gateway to the virtual realm in their pockets, or people who do not have a smartphone and thus not carry the virtual realm with them all the time.

Moral Implications

The interaction between Google Glass and its user is opaque for others, who are physically present. This is likely regarded as normal (and morally neutral) by Glass users, but may be seen as morally wrong by other stakeholders. The same applies to an increased interaction of Glass users with the virtual world; while users themselves likely see no harm, others may find this behaviour worrisome.

Camera

Glass' camera mediates social relations, as discussed in the section on controversies around Glass (page 10). Filming or photographing is very easy with Glass. Users of Glass can make photographs and videos without using their hands, namely by speaking a voice command. Photographs can also be made by winking. Unlike is the case with current smartphones or cameras, the user does not need to re-position the device itself; e.g. a camera needs to be re-positioned from hanging around your neck to before your eye, to look through the viewfinder. The camera is always ready for the user to take a photograph or make a video.

POA, Type, Domain

For the user of Glass, the main point of application is physical; Glass works in new physical manner, and gestures are mediated. However, if we regard photographing from the perspective of the subject being photographed, the main point of application is the background. Even if the subject is aware of being photographed, the interactions with the technology (by the user) are taking place in the background.

The type of mediation that is at play from the perspective of the user is persuasion; users are persuaded to take (more) photographs. From the perspective of the subject, the visibility of this mediation is low, and the force is very strong, since the subject (especially the unknowing subject) has no power to influence the mediation; thus the type of mediation is decisive.

Glass' functionality of photographing and filming possibly mediates in all four domains. Firstly, concerning the domain of individual experience, users can see photographing as very easy and can interpret is as an action that requires little to no prior consideration. This is linked to individual action; users make photographs and videos very frequently.

The social domains are influenced by both users and subjects. Frequent or near-constant photographing can become a social practice, for both users of Glass, as well as users of other devices. Concerning frameworks of interpretation, both users and non-users of Glass can believe that being photographed is always an option. This may have consequences for their behaviour (e.g. they act less free because they feel less free) or for the values they hold, for instance when ideas about privacy change.

Anthropological Implications

The option that Glass users can be filming anytime anywhere can create new social norms and practices. Frequent or near-constant photographing can become a social practice, for both users of Glass, as well as users of other devices.

However, Glass' camera can also mediate the user's own life and especially one's sense of identity. Since taking photos is so easy, users can be seduced to record their every move with photography. What does it mean for one's sense of self when that person records his whole life in photographs?

Furthermore, photographing with Glass is tailored to making photographs of the user's personal experiences from his personal point of view, and stimulates sharing photo's on social media.

Glass in that sense encourages the idea that others find it interesting to see what what you are doing from your point of view. This can increase one's sense of self-importance; thus affecting personal identity.

Moral Implications

For a subject being photographed, the type of mediation is decisive when the subject is unaware, or coercive when he is aware of being photographed. Both types of mediation imply that the subject has no control over being photographed, which can be morally wrong, depending on the context.

An important moral implication of the easy and inconspicuous way that Glass makes photographs and videos is that is becomes very easy to invade someone else's privacy; Glass users may even do so without intending to.

Notifications

Google Glass, like any mobile telephone, prompts the user with notifications. Notifications are announcements that something has happened. For current smartphones, notifications usually announce the following events: a message has been received (e.g. SMS or Whatsapp message); an email is received; a calender appointment is about to happen; and updates are available. Google Glass notifications are similar in what they announce. A notification consists of a sound being played, and information is displayed on the screen of Glass. The user has five seconds to view the notification information. After five seconds, this information is moved into the timeline history to be viewed later.

POA, Type, Domain

The main point of application that plays a role in notifications, is cognitive, because it concerns information. However, multiple relations (as described by Ihde) are at play. Firstly, there is a hermeneutic relation between Glass and the user, because Glass provides the user with a representation of reality; the fact that a certain event happened is represented by the sound. Second, the user is in an alterity relation with Glass, because there is a direct interaction with the artefact itself. However, the alterity relation is alternated with an embodiment relation; the user is interacting with the world through the embodied artefact.

The type of mediation at play here is seduction. Glass seduces users to view (and respond to) notifications immediately. Although the visibility of the notification itself is explicit, because the explicit sound and information, the fact that the user is being pushed into a certain behaviour has low visibility. The force is also low; hence the mediation is seductive. A possible implication of this type of mediation can be that the user has an increased sense of urgency about notifications, and behaves correspondingly, thus always checking notifications immediately.

The domain that is most prominent in this mediation is the domain of individual experience; it is generally the case that notifications bring a certain experience to the user (predominantly, the perception of sound). However, in some cases, the domain of individual action will be involved, since users are seduced to immediately respond to the notification sound.

The way notifications mediate can have implications for individual experience and interpretation; one can experience the presence of virtual others, people who are "present" via a virtual medium such as Glass, as being more present, or their communication can be regarded as more urgent. Furthermore, implications for general frameworks of interpretation can be that virtual others are regarded as more important than others that are physically present. This can imply for our social practices that we are communicating more and more via mobile devices.

Anthropological Implications

Notifications, of all mobile telephones, mediate the user's behaviour and experiences by regularly drawing attention to the device; thus forming a distraction to whatever the user is doing. This was already the case for the first cellular phones, although the amount of notifications was significantly lower due to the lack of Whatsapp, email, a Facebook app and news updates in these mobile telephones. However the particular manner in which notifications are handled by Glass can have more severe effects on the user's attention. Because the notification disappears into the timeline after five seconds, the user can experience an increased sense of urgency regarding notifications. The user is seduced to view each notification immediately. This can have further implications for the user's experiences of social relationships. One can, for instance, experience the presence of virtual others as being more present and more important, or their communication can be regarded as more urgent. This can imply for our social practices that we are communicating more and more via mobile devices. Glass thus mediates the user's attention, and through that, social relationships between people.

Moral Implications

Glass' increased demand on human attention can have morally loaded implications; for instance concerning safety when participating in traffic. Or one might find that the mediation in itself, the way in which Glass constantly forms a distraction, is wrong. On the other hand, others may find the increased opportunities for communication of Glass positive.

Mediation Analysis of Glass Applications

Applications combine various physical characteristics of Glass with software into specific functionalities. I will discuss two types of applications, that each have a specific 'pattern' of various aspects of mediating; augmented reality applications and subject-related applications.

Augmented Reality Applications

Several applications on Glass create augmented reality, where a layer of information is superimposed on reality perceived by the user. Reality thus is augmented with virtual information. Google Now can be seen as a form of augmented reality, although not in the straightforward sense that it augments visually experienced reality. Google Now creates a general augmentation of reality, that mostly appeals to our cognitive processes and interpretation of reality. Google Now automatically takes information from various sources (e.g. Gmail, internet search, calender) and combines this into more detailed information (e.g. "there is a traffic jam on the way to your appointment so leave early") which is presented to the user. Another, more straightforward example of an augmented reality application is navigation. Glass adds a layer of navigation information to the reality visually perceived by the user. Glass shows navigation information (e.g. which turn to take) in real-time (i.e. at the moment the user should take the turn), based on GPS information. Furthermore, the application Social Radar is a form of augmented reality. Social Radar combines virtual social networking with location data; it prompts users when people in their virtual network are in proximity in the real world.

Points of Application

There are two points of application for augmented reality applications. The first is cognitive; since it concerns information being presented to the user, that appeals to human decision making processes. The second is the background; augmented reality applications like Google Now automatically collect and processes information in the background of human attention. In terms of Ihde's relations, there is a hermeneutic relation because information is provided to the user,

as a representation of reality. For instance in navigation applications aspects of the physical world, such as streets, are represented as arrows on a screen. Moreover, there is an alterity relation between Glass and the user, because the user directly interacts with the artefact, and focusses his attention on the device itself. This alterity relation is quickly alternated with an embodiment relation where the user is experiencing the world through Glass. Lastly, we can even identify a background relation, because the artefact gathers and processes information in the background of the users attention. Important to note is that the user's experience is *transformed*, not by changing the original perception, but by adding something to it.

Type of Mediation

When we investigate Google Now as an example of an augmented reality application, we find that the mediation of Google Now is of three types. It is coercive; the information Google Now generates is presented to the user automatically, with strong force and high visibility. It is decisive, because Google Now gathers information automatically with a strong force and hidden visibility. Concerning the user's behaviour resulting from Google Now, users can be either coerced or persuaded to do what Google Now says they should do, depending on how strong the force is perceived.

In the example of navigation, the type of mediation can be regarded as persuasive or coercive, depending on how strong the force is perceived. I think this mediation is coercive; since users deliberately turn on navigation in order to follow its directions, these directions hold a strong force over them.

Domains

Both the individual and the social domain can be affected by augmented reality applications. For example concerning Google Now, in first instance the individual domain is mediated; Google Now provides certain experiences to the user and can affect the users actions and behaviour. It is likely however that Google Now will also affect the social domains, even though this is currently not so visible yet. Perhaps frameworks of interpretation can be affected such that being late becomes unacceptable, since everyone is expected to know all relevant factors for being on time.

A similar analysis can be made for other augmented reality applications. In the case of navigation applications; individual experiences change (experience the world through and with navigation clues), as well as individual actions. An implication of this mediation for individuals could be that they become dependent on navigation functionalities such as that of Glass, to find their way (instead of for instance remembering routes or understanding directional signage). We can imagine social implications of navigation applications as well. In the social domains, the widespread use of navigation can have effects on our frameworks of interpretation. Finding one's way has a very social aspect to it, almost as if it were a collective responsibility; directional signage is widespread in our society. However, increased use of personal navigation devices might lead to finding one's way being regarded as an individual responsibility; and consequently, in the domain of social practices, to the disappearance of directional signage.

Anthropological & Moral Implications

Augmented reality applications have the most striking impact on the attention of the Glass user. When using, for instance, a navigation application on Glass, the user is simultaneously immersed in the augmentation layer (that is, the virtual world of the screen) and is perceiving the real world. But humans cannot focus their attention on two things at once; in reality, we switch the object of our attention really fast. In case of Glass navigation, the user constantly switches between looking at Glass (hermeneutic and alterity relation) and looking *through* Glass (embodiment relation) at the world.

Navigation may not have obvious implications for social relations; the implications for social relationships of the augmented reality application Social Radar are more salient. Social Radar combines social media with augmented reality. The app functions as an online social network; but it collects GPS data about the users. This way, the application can notify users when people from their network are in proximity. How does this application affect social relationships? What is striking is that this application to some extent bridges the gap between physical-world friendship and online friendship. The applications seems to stimulate physical-world interaction with all online friends. This can be experienced as somewhat confusing. Within our collection of physical-world friends, we somehow make conceptual distinctions between e.g. "best friends", "party friends", and "vague acquaintances". But social media networks label all relations between people with the same term: "friends". The nuances that humans put into social relationships are not inscribed into online social networks. So in online social media networks, our physical-world conceptions of friendship are disrupted by using one term for all types of relationships. Social media prescribes to its users that all friends are equal. However, social media has been around for a while and we have gotten used to the way it treats friendship. But now Social Radar disrupts our new conceptions again, by translating the uniformity of online friendship into the physical-world, where such uniformity of social relations may not be desirable.

Subject-related Applications

In some Glass applications not only a user and the device are involved, but also another person; this third person is so to speak the *subject* of the functionality of the application. I have already discussed photographing and filming with Glass; if a third person is being photographed, he is the subject of the photography functionality.

The application NameTag is subject-related in the same manner. NameTag functions as a search engine for faces utilising facial recognition. The user scans a face of someone with Glass' camera, possibly without that person knowing. The data about the face is used by the app to search online, to find a matching face. This face match typically comes from public social media profiles; information that is publicly available online, such as the subject's name and possibly other information, is then displayed by the app in Glass' screen. The application Refresh works is a similar manner, but it utilises calendar information rather than facial scans. Refresh automatically accesses a user's calender to obtain data about which subject(s) the user is about to meet with. It searches online for information about this person (both from social media and public information). In the analysis below, I will take NameTag as the example application; Refresh mediates in a very similar manner and photographing is discussed above.

Points of Application

NameTag, from the perspective of the user, can be seen as a form of augmented reality. The points of application involved are cognitive and physical. Relations between the app and the user are embodiment, hermeneutic and alterity. From the perspective of the subject, the point of application is the background; this mediation is similar to the mediation of photography of a (unknowing) subject. There is a background relation between NameTag and the subject.

Type of Mediation

From the perspective of the user, NameTag is persuasive; it persuades the user to use the application, with a low force and explicit visibility. From the perspective of the subject, NameTag is decisive. Since the subject does not know if he is being scanned and searched, the visibility is

hidden. The subject has no influence over this process, he cannot control the app, and thus the force is strong.

Domain

Since subject-related applications involve both the user and third-person subjects, by definition the social domain is mediated; however, in first instance social relationships are mediated, as explained below. How this mediation of relations between people translates eventually to social practices and frameworks of interpretation is hard to foresee. Concerning the individual domain, how a user interprets other people can change because the user can get to know more about this person, if he wants. This awareness of potential knowledge might change how he interprets the subject, but also how he might act towards other people.

Anthropological & Moral Implications

Subject-related applications clearly can have an impact on social relationships. These applications create a duality between the Glass user and the subject; both users and subjects interact with Glass, but in completely different way. The user instigates and controls the interaction with Glass, and obtains the information from Glass about the subject. The subject is involved in this interaction by the user, but possibly completely unknowingly and unwillingly. This thus creates two perspectives on the same mediation. From the user's perspective everything is all fine and dandy; the users will likely regard the mediation as morally neutral or as positive. The other perspective is that of the subject. The subject has no control over this interaction, which in itself can be regarded as morally wrong. From the subject's perspective, the mediation is decisive. This can affect social relationships in the way that the *power relations* become skewed. The Glass user holds a certain power over the subject. Firstly in the sense of "knowledge is power", the user has knowledge over the subject, but not vice versa. Moreover, the user has power over the subject because the user is in control over the interaction between user, Glass, and subject, while the subject has no control over this interaction. This may lead non-users of Glass to see Glass users differently. They may, in a sense, fear them, or feel other negative emotions towards them.

But what is interesting about the vastly different situations that the user and the subject are in, is that both of them are part of society. Both the perspectives of users and subjects can contribute to the forming of social norms and practices. This however can easily lead to controversy first, as seen in the section about the controversy around filming with Glass (page 10).

Limitations of Mediation Theory

In the mediation analysis, predominantly the effects of Glass on individuals have become apparent. However, as we saw with regard to the controversies around Glass, these do not only concern individuals. In the controversy around filming and privacy for instance, we see various groups of people (amongst others, Glass users and privacy advocates) that have formed conflicting moral beliefs around technologies like Glass. Glass users do not see any problems, while privacy advocates regard Glass as a threat to their privacy and freedom. Glass has an influence on the abstract values that are held in our society. We see thus that Glass actually does not only effect individuals, but groups of people, and potentially the whole of society. Unfortunately, mediation theory is underdeveloped when it comes to analysing and understanding the mediating roles of an artefact on society at large. In this section I will explain why mediation falls short in this regard.

First of all, let us recapitulate what the goal of mediation theory and analysis is. In our context, that of the design of new artefacts, mediation analysis is utilised to gain new insights on how

the product-in-design could function in the use context. We want to anticipate these mediations during the design process, so we can use the insights gained to make better design decisions. The insights from mediation analysis are fed back into the design process and serve as a basis for further decision-making. This includes decisions about desirability, that is, decisions based on ethical consideration. Mediation analysis thus serves (in part) as a basis for ethical assessment of the product-in-design. More generally, mediation helps to investigate how the product can or will function, so as to shape the functionality of the product to desirability.

We want to explore not only the human-product interactions, but also the influence of the product-in-design on the social domain (social practices and frameworks of interpretation) in order to determine desirability of these influences, and derived from that, desirability of functions of the product or the product as a whole. What is it about mediation theory that makes it inadequate to grasp the social domain? There are two characteristics of mediation that play a role here: a limitation in dealing with levels of society, and a limited prospective view.

Levels of the Social Domain

The social domain concerns people. However, there are different magnitudes in which we can think about social things. Going on a date with one other person is a social activity, but so is watching a sports game with millions of people. The word "social" covers everything from two people to the entire population of planet earth. So what are the social magnitudes that mediation theory deals with, and is capable of dealing with? We can best think of social magnitudes in terms of micro-, meso- and macro- levels (Illustration 11). This distinction is often used in sociology and provides a useful framework for conceptualising society.

The smallest social level is the *micro-level*. For our present purposes, I will define the microlevel as concerning the individual or a small group of people. This is in line with *microsociology* that studies individuals, face-to-face relationships and the construction of meaning (Calhoun, 2002, p. 287). Mediation on the micro-level concerns the interaction between artefact and user, possibly including other stakeholders (like the subject of a photo). Mediation analysis on the

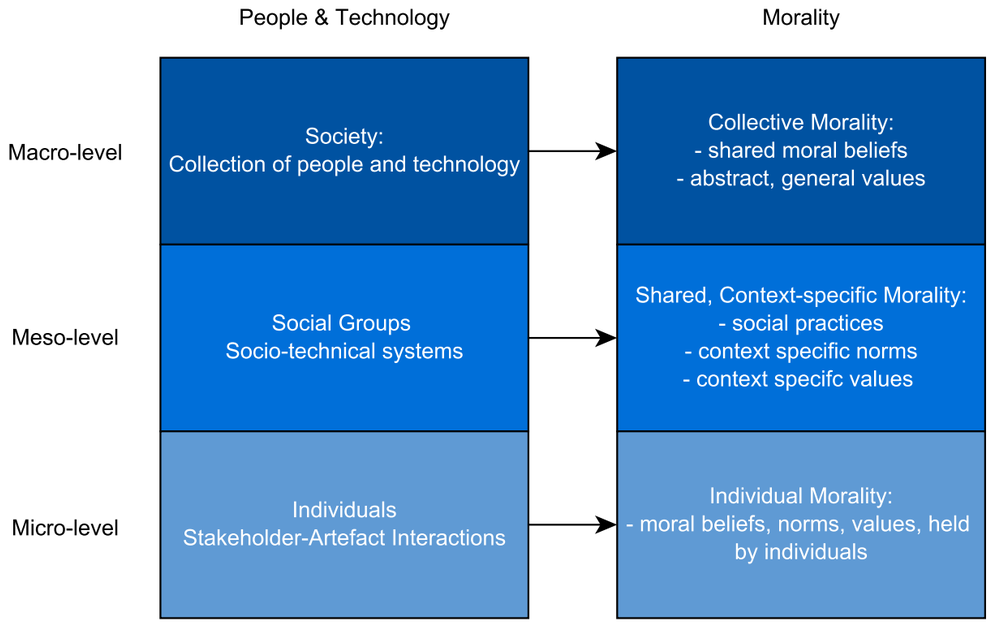


Illustration 11: Micro-, Meso- and Macro-Level

micro-level concerns how the product is used and the way it mediates the life of an individual stakeholder. For the purpose of this thesis, I will equate the micro-level with the individual domain, as discussed in the section about mediation analysis (page 20).

The second social level is the *meso-level*; it encompasses intermediate-sized social units (Ballantine & Roberts, 2013) that are bigger than those on the micro-level, but smaller than those on the macro-level. Mediation on the meso-level concerns the use and position of an artefact in a socio-technical system. The meso-level is where we find established technical systems and social practices; mediation analysis on the meso-level investigates how new artefacts would interact with (even uproot) such socio-technical systems, including relevant social practices and morality. We can locate a shared morality on the meso-level; though this likely concerns moral beliefs that only apply in the context of a specific socio-technical system. An example of such a meso-level socio-technical system is a hospital. In a hospital, there are many practices specific to that context, and shared moral beliefs and norms that are different in the rest of society. For instance, the principle of informed consent (i.e. patients need to be fully informed about and give permission for e.g. treatments) plays a big role in a medical context, while in other areas of society it is less relevant.

Lastly, the biggest social level is the *macro-level*. It concerns aggregates of individuals, up to society at large (Liao, 2003). This includes wide-spread social practices, shared general moral beliefs, norms and values. Mediation on the macro-level concerns how artefacts mediate the general and abstract morality that is shared by (almost) all members of society. Note that what exactly "society" means can differ still from smaller societies (e.g. the local society of Enschede), via medium size societies (e.g. "western society") to large societies (e.g. the global society). Coming back to the source of this distinction, sociology, we must note that *macrosociology* does not only study populations and social systems on a large scale, but also at a *high level of abstraction* (Calhoun, 2002, p. 287). Likewise, in this thesis, dealing with the macro-level is more abstract than the micro-level, because insights concerning the *large scale* are necessarily more generalized.

Mediation theory is focused on the microlevel. Mediation deals with interactions between artefacts and users, and possibly other stakeholders, such as the "subjects" of photography, as discussed in the analysis above. However, how does use of an artefact relate to a broader social context? Mediation theory provides little clues about how to go beyond the realm of interactions with individuals, and investigate influences of the technology on a broader and more abstract social level. Mediation theory stresses that technology can influence morality, but is does not give us a method to deduce from the mediations on micro-level how the macro-level of morality is affected. In other words, how does mediation of morality held by individuals (micro-level) translate to effects on collective morality; our abstract norms and values that we share with all members of society (macro-level)? Mediation theory does not provide adequate means to deal with the social domain, and its relation to the individual domain. Mediation gives us no way to anticipate, imagine or analyse *how* these two domains influence each other. The social domain is left to the complete imagination of the person doing the analysis. Mediation theory does not provide a way to systematically flesh out our imagination into a sturdy vision, or an array of possible visions, of how the social domain could be influenced.

Temporal Dimension

When we want to analyse the influences of a certain artefact on the social domain, this analysis has a temporal character. We can look back at the past to investigate what has happened (how did an artefact mediate?), we can regard the current mediations, or we can look forward and anticipate the future. In the design process, we anticipate on the future; we take a prospective approach and anticipate on possible mediation in the future. However, mediation theory is optimal for the present.

Mediation analyses is most informative when used retrospectively, because there is actual empirical evidence. If we, for instance, now want to investigate how mobile telephones mediate our lives, we have a short history from which we can empirically research how mobile telephones influenced our personal lives and the social domain. We can investigate how customs, habits, and ideas have changed in meso-level contexts of use (e.g. mobile phones in the classroom) and in the macro-level (e.g. how society has changed, what social norms have arisen, around the mobile phone). This can be very informative in itself, but for a designer working on a new product, it is of little help.

But mediation is still informative in the context of the present. Unlike in a retrospective analysis, we cannot use empirical evidence to investigate what actually happened, but mediation gives us tools to analyse what is happening. Especially when is it relatively clear how a product functions, we can derive from that, using mediation theory, a lot of insight about how the product interacts with users and non-users, and what influences it can have on their lives.

However, when it comes to the future, the story becomes more complicated. In the present time analysis we take society as it is, including the morality we currently hold. We introduce a variable, namely the new artefact, and try to figure out what happens. But if we want to anticipate the more distant future, we cannot rely on society being as it is now. Society might change; social practices, social norms, but also individual ideas and behaviours may change radically. If we want to anticipate the mediation of an artefact in the distant future, we are faced with two variables; both the technology and society are. Mediation gives us little to no tools to anticipate social change as an independent force. However, what may seem to make this situation more complicated, but actually makes it easier to understand, is that the two variables (society and the technological artefact) influence each other and thus co-evolve. Mediation can help us develop ideas about that mutual influence; e.g. when we see that making photographs is very easy with Glass, we can well imagine that ideas about privacy concerning being photographed can change. However mediation theory lacks a *systematic* way to flesh out these ideas, and to look beyond the most obvious. Concerning the example of changing ideas about privacy, mediation gives us little tools to think about how privacy ideas changes, and to systematically flesh out the various ways in which it might change.

In Conclusion

In this chapter, I have demonstrated that mediation theory is a fruitful approach to understanding how artefacts affect the lives of users and stakeholders. I have shown how mediation theory can help to analyse and understand the moral impact of products-in-design on the micro-level. However, as I have discussed, mediation is limited to dealing with this micro-level. Mediation theory is under-equipped to deal with the macro-level of society and the long-term future. Therefore, I will investigate the anticipation of moral impact on the macro-level in the next chapter.

Chapter 3

Technomoral Scenarios

In this chapter I will discuss how designers can explore the moral impact of their product-in-design on the macro-level. I will introduce the technomoral scenario method: a method to anticipate technomoral change concerning a new technology. I will discuss the theory behind the method and the method itself. I will argue that the technomoral scenario method is, in its current form, not the most suitable for application in the design process.

Technology Assessment

In the last chapter I have argued that mediation theory is focussed on the micro-level of society (individuals and very small groups), while we also need to anticipate the macro-level. Furthermore, mediation theory provides insufficient tools to anticipate the future.

In this chapter I will introduce ideas and theories from a slightly different field of the philosophy of technology, *technology assessment*, that can help both with dealing with the macro-level of society and with the future. Technology assessment is an umbrella term that refers to practices of ethically evaluating technology. We can distinguish two different types of technology assessment; *empirical* and *speculative*. The *empirical* type of technology assessment investigates actual technologies (or artefacts) that exist in society, and the ethical issues that arise from these technologies. Such research can also explore potential solutions to the ethical issues. Empirical technology assessment is retrospective; it looks backwards in time to investigate a technology that has already been introduced into society. This does not entail that empirical technology assessment is necessarily historical research that looks years or decades back into the past; but it necessarily needs to look into the past at least somewhat in order to be empirical. An example of empirical technology assessment could be to investigate websites such as Pirate Bay, and whether pirating films is morally wrong, considering that we generally regard stealing to be wrong. Questions to be asked could be: is online piracy stealing? Why is stealing wrong? Why do so many people pirate films online? Do they consider it to be wrong? Empirical technology assessment thus investigates existing technologies, but also related practices, in terms of ethics.

The other type of technology assessment is *speculative* technology assessment, which investigates technologies that do not exist in society yet. These technologies can range from technol-

ogies that are actually in development but not on the market yet, to science fiction technologies that might someday be part of our society. Most work however is done on the so-called New and Emerging Science and Technology (or NEST); technologies that are in early stages of development and thus only exist "in the laboratory" and are not further introduced into society yet. Because such technologies do not have a place in society yet, it is not possible to empirically investigate them. Rather, we need to *anticipate* what their consequences might be. We can distinguish anticipation from assessment; anticipation refers to the practices of exploring what the societal consequences might be, while assessment refers to the normative evaluation of such potential consequences. Speculative technology assessment thus consists of both anticipation and assessment. Speculative technology assessment is prospective; it looks at a potential point in the future where the technology is part of society. One might wonder what the use of such speculative technology assessment is. After all, if the technology is not part of society yet, or perhaps does not even exist in any concrete form, how than can we *know* what the ethical issues are? The answer is simple: we cannot *know* what the ethical issues are, period. But we can imagine, speculate, and think about what the ethical issues *might* be. Speculative technology assessment is of vital importance in innovation processes. Introducing new technologies and artefacts into society without having any clue what their implications might be, is, to say the least, very unwise. The same goes for products that are being designed; since they are not on the market yet, we cannot know what the ethical issues are, but we can perform a speculative technology assessment. And we should. Since artefacts can have an enormous impact on human beings and society, those that design these artefacts have a responsibility to consider what this impact might be and whether it is desirable. Therefore, speculative technology assessment should have a place in any design process.

Dealing with the Future & Macro-Level

Before diving into detail on methodologies of technology anticipation and assessment, I discuss dealing with the future and the macro-level of society in general.

The future is unknown to us. We cannot empirically research it. Research into the future can never give us facts, simply because the future has not happened yet. We cannot know what *will* happen; we can however explore what *might* happen. Research into the future is always *speculative*, but we can try to make these speculations as plausible as possible. It is useful to keep in mind when reading this chapter, that I do not consider the future to be one pre-determined course of events that is destined to happen. Rather, I see the future as a realm of possible events that might happen. In that sense, there are multiple possible futures. The idea of multiple possible futures is crucial to the type of anticipation of the future that I will present here: the building of scenarios. Scenarios are narratives about possible future courses of events. Scenarios enable us to create multiple stories about what might happen in the future. Such stories can be very different in content, but none of them can be "right" or "wrong" in the present time since they describe possibilities rather than actualities. In that sense, anything is possible; thus building multiple scenarios around one subject (say, Google Glass) is not a self-contradictory action. Of course some possible futures may seem to be more likely to us than others; they are more *plausible*.

Dealing with the macro-level of society can be difficult. Society can be seen as an entity in itself, but is still made up of millions of humans and non-human entities that play a role in it. When we try to form a coherent idea about a characteristic of society, we might think this is impossible because society is made up of millions of people that are all different. But all those different people still have a lot in common. It is those things we share in general that we can investigate. So when discussing how technology impacts morality, I do not want to claim that

everyone in our society has the exact same moral beliefs. I claim that there are general values that most people in our society hold (although how much they value this in relation to other values can differ), and as such form a characteristic of the macro-level of society.

So how do we characterize society? We can distinguish between "hard" and "soft" impacts of technologies, discussed below. These are related to "hard" and "soft" ways of characterizing the macro-level of society. The "hard" way of characterizing society is by quantification and the use of statistic data. Statistics allow us to describe, for instance, welfare and its distribution, or the distribution of votes in political elections. And such data can be used to investigate long term trends; which can be extrapolated to form an idea of how things will develop in the future. As such, we can anticipate, for instance, a growth in unemployment. But we can also characterize society in a "soft", qualitative manner, and describe in words what our society and culture is like. We can describe, for instance, what values we hold dear and thus look at phenomena from a different perspective. Take the example of unemployment; we can use statistics and economic calculations to describe the phenomenon of unemployment and anticipate how it will develop. But we can also describe unemployment in a "softer" manner, looking at values and ideas that play a role in this phenomenon. We could describe for instance that unemployment is regarded a societal problem, because we value the practice of working. And that the phenomenon of unemployment is defined by what we consider to be employment; a paid job, rather than for instance a mother working to care for her children.

I want to stress that in this chapter, and the whole thesis, I am not dealing with the "hard" characterization of society; rather I take a "soft" perspective. My approach to the macro-level is not in numbers and statistics, but in content, in words and descriptions.

Soft Impacts

In the anticipation of the impacts of an emerging technology, a distinction can be made between "hard" and "soft" impacts (Swierstra & Te Molder, 2012). Again, the distinction between "hard" and "soft" concerns different perspectives on the same phenomena. Hard impacts are the impacts of new technologies we find with the hard perspective; the soft perspective yields insights into the soft impacts. Hard impacts are often framed in terms of *risks* to (human) health, safety, and the environment, while soft impacts are the impacts of a social nature, such as the impacts on culture, morality and politics. Swierstra and Te Molder identify three aspects that distinguish hard from soft impacts. Firstly, the values at stake; hard impacts concern only the values safety and health, while soft impacts concern other values such as autonomy, democracy, and freedom. Secondly, hard impacts are quantifiable; risks can be expressed by probability (e.g. the chance is 1,3 % that...) and harm can be quantified as, for instance, the number of people that get sick or die. Lastly, hard impacts have a clearer causal link to the technology than soft impacts.

Swierstra and Te Molder argue that in current technology assessment practices, too much focus is on the hard impacts and thus the hard perspective, while soft impacts are ignored. They explain for instance that the the causal link between technology and impact that is characteristic of hard impacts creates a sense of responsibility in relevant stakeholders, while the less obvious causal links of soft impacts cause stakeholders to not feel responsible for these impacts. But this focus on hard impacts does not entail that soft impacts are less important. Of course we should assess new technologies on their safety, but it is no less important to investigate how that technology may affect our sense of identity, our moral ideas, and the way we interact with each other; these "soft" impacts have an equally important role in what constitutes our society. In this chapter I will discuss the technomoral scenario method for anticipating the impact of a technology on morality; thus a type of soft impact.

Technomoral Change

The technomoral scenario method is a way to anticipate the soft impacts, especially technomoral change, of an emerging technology, by building scenarios. Before explaining the method, I will discuss the concepts that form the basis of this method. I base my explanation of the technomoral scenario method on the work of Tsjalling Swierstra, Marianne Boenink and Dirk Stemerding (Boenink, Swierstra, & Stemerding, 2010; Stemerding, Swierstra, & Boenink, 2010; Swierstra, Stemerding, & Boenink, 2009) .

As said, technomoral scenarios are a way to anticipate *technomoral change*. The term "technomoral change" is used to denote a certain view on the relationship between technology and morality. This views assumes that technology and society mutually influence each other; technology and society *co-evolve*. The concept of technomoral change entails that morality can change (and thus is not universal or objective, as some philosophers assume) and that technology and morality thus co-evolve (Swierstra, 2013). When we try to anticipate technomoral change (or moral change in general), we end up in a paradoxical situation. On the one hand, we imagine a world where morality is different from ours. But simultaneously, we still are our present selves, with our own moral ideas and beliefs; we can have a normative opinion about morals of the future. This "paradox" is described by (Swierstra et al., 2009) as the tension between *moral futurism* and *moral presentism*. Moral presentism entails favouring current morals over potential future ones; and with that judging future technologies with current morality. On the other extreme, moral futurism entails the blind acceptance that morality will change, period, and that it will simply follow technological developments. One might think that such a paradoxical situation leaves with no right way to act; rejecting any potential changes in morality on forehand (moral presentism) is wrong, but so is blindly accepting any change in morality (moral futurism). However, I would stress that we can at least try to find a middle ground and a good way to act around the tension between moral presentism and moral futurism. After all, doing nothing entails blindly accepting changes. We should not reject *any* change in morality, we should reject changes *for the worse* in morality, and promote *changes for the good*. I am very well aware that this entails judging potential moral change from our own contemporary moral beliefs, and can thus be explained as a form of moral presentism. However, through the method I present in this thesis, we can learn to take a distance from our own moral beliefs. That we way can judge moral change from a more neutral perspective; thus escaping from moral presentism as much as possible.

To better understand and anticipate technomoral change, we can distinguish different levels of morality (Boenink et al., 2010). On each of these levels, moral change is characterized by a different *pace* of changing. On the *macro-level* of morality we find abstract values and principles that have proven robust over time. For example, the principle of non-maleficence ("do not harm others") has been valued in our society for ages. Morality on the macro-level can change, but this will happen very slowly. Boenink et al. mention the growing importance of the value of autonomy in the twentieth century as an example of such macro-level moral change. On the *meso-level* of morality we find *moral regimes*: rules and procedures that are a concretisation of the values and principles on the macro-level, "applied" to specific practices. Such moral regimes can change faster than the macro-level principles, but are still quite robust. Lastly, the *micro-level* of morality concerns dealing with specific moral issues, in specific circumstances. Or as Swierstra and all. describe: on the microlevel we locate ethical questions and their answers such as "do we ask a ten year old patient for informed consent?" (Swierstra et al., 2009, p. 132). Dealing with such concrete questions creates niches for doing ethics. Within these niches, moral change occurs most frequently. It is important to keep in mind that this distinction between levels is meant as a helpful tool in thinking about morality, and not as a strict dichotomy.

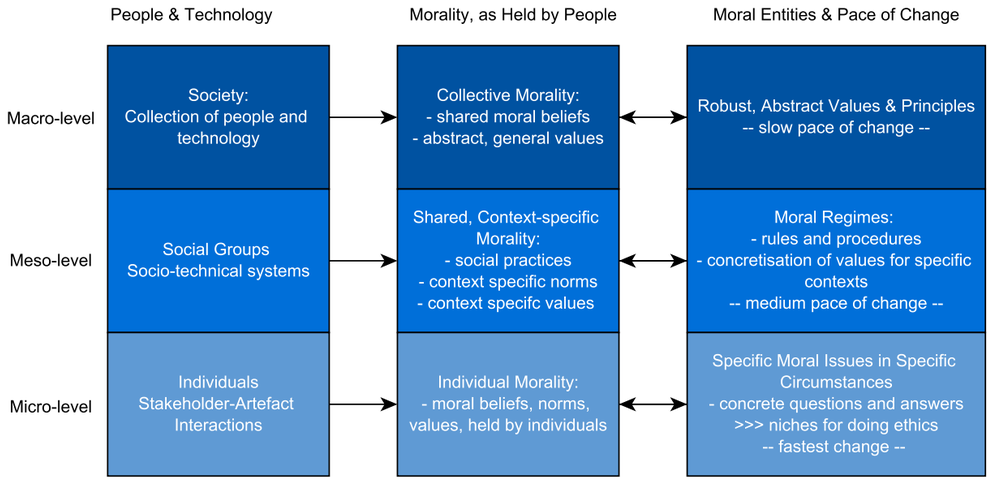


Illustration 12: Morality on the Micro-, Meso- and Macro-Level

Furthermore, changes on each level do not happen independently from the other levels. When we ask and answer concrete ethical questions on the micro-level, our answers will be influenced by abstract values or principles from the macro-level. But likewise, moral changes on the micro-level can lead us to gradually change our moral principles on more abstract levels.

In the last chapter, I have discussed the distinction between macro-, meso- and micro-level concerning mediation. The levels I distinguish correspond to those of Boenink et al., but the way the distinction is approached is different. I approached morality on different levels as *morality held by people*, and thus I distinguished between individual and collective morality. Boenink et al. approach the levels from *moral entities,* such as a value, an ethical question, and a moral regime. Note that Boenink et al. do not use the term "moral entities", I merely use this term here to clarify our different approaches. See Illustration 12 for a visual overview.

NEST-ethics

The technomoral scenario method uses NEST-ethics (Swierstra & Rip, 2007) to construct scenarios. NEST-ethics is the term used to denote the pattern of ethical argumentation that takes place in ethical debates on New and Emerging Science and Technology (Swierstra & Rip, 2007). Swierstra and Rip found that in ethical debates on different subjects, the same *types* of arguments were voiced, and in the same stages of the debate. For instance, it is likely that in both a debate about genetic modification of food crops, and in a debate about research with embryonic stem cells, an argument will be raised that the technological practice is morally wrong, because it is unnatural. Swierstra and Rip analysed ethical debates and found that there are types of arguments that recur in (almost) every ethical debate on new science or technology. They reconstructed this pattern of ethical argumentation, describing what types of arguments are voiced, and by what type of counter-arguments these are met. They found that debates usually have a certain order in which different ethical issues are discussed. Debate at first focusses on the consequences of the technology, thus consequentialist arguments are voiced. In a later stage, rights and duties are debated and deontological arguments are voiced. Distributive justice comes into play later, and lastly the good life is debated.

Furthermore, Swierstra and Rip describe meta-ethical views that play a role in ethical debate. A straightforward example is the difference between technology optimists, who believe technology is the solution to our problems, and technology pessimists, who believe technology is the

cause of our problems. Even though pessimist do not necessarily literally voice these beliefs or use them as arguments in the debate, these underlying views play a key role in the position one takes in a debate and the arguments that he will likely voice. The same goes for optimists of course.

The technomoral scenario method uses these patterns to construct a controversy around the new technology. The NEST-ethics patterns of argumentation are a framework without content. The framework specifies what *types* of arguments are given and their order. But in making the technomoral scenarios, the framework is filled with content. I will further explain this with an example from (Swierstra et al., 2009). In ethical debates around new technologies, the consequences of the technology are discussed first. So, the first type of argument in the NEST-ethics pattern is the following: proponents of the technology put forward promises (i.e. positive consequences) of the technology. In the scenario of Swierstra et al. about the obesity pill, this is given content as follows:

> *"Its proponents will stress the pill's beneficial consequences, e.g. that it will cure the obese and prevent others from becoming obese, so that society no longer will be burdened by costs generated by obesity."* (Swierstra et al., 2009, p. 128)

So in the scenario, the type of argument is filled in with content about the obesity pill. Lets take another example. According to the NEST-ethics pattern, these promises are contested by the opponents of the technology, based on their plausibility (amongst others); thus the argument is that the promises are not as plausible as the proponents argue. Filled with content, such an argument could be:

> *"It is not plausible that this pill will reduce the costs society needs to make. Since the pill itself is very expensive, society will still be burdened with the costs of preventing obesity."*

By filling the whole NEST-ethics framework with content, a (speculative) ethical debate is created; this is an important step in the creation of technomoral scenarios. Before going into detail on all the types of arguments that are part of the NEST-ethics framework, I will first explain the technomoral scenario method.

The Technomoral Scenario Method

Boenink et al. explain the starting points in which the method is based (Boenink et al., 2010, pp. 8-10). The first starting point is the distinction between ethics and morality. Morality is the set of implicit values and norms we hold, while ethics is the explicit reflection on these values. As I explained before in this thesis, but like to stress again: doing ethics is not just for philosophers. Every human being does ethics when for instance they think about what they value in life or about the solution to a moral dilemma. Besides this view on morality and ethics, Boenink et al. specify their view on the means and goals of technology. They explain that often, the *means* by which a certain goal is to be achieved as not regarded as an ethically relevant issue, in contrast to the *goal* that is subjected to ethical debate. However, they state that in technology, means and goals are closely intertwined; thus means should play a role in ethical consideration as well.

The second starting point for the technomoral scenario method is the the way in which moral change is dealt with. Moral presentism should be avoided by keeping an open mind to moral change. Furthermore, the distinction between three levels of morality (described above) can help to imagine moral change.

The third starting point is the anchoring of speculation. As discussed above, dealing with the future always involves speculation; such speculation can take wild and free-floating forms.

The technomoral scenario method however aims to ground speculation about the future in the present and the past, by making *historically informed* speculations. This is done in three ways. First, by analysing the evolution of moral practices and regimes (including past ethical debates) relevant to the new technology. Second, By using the NEST-ethics pattern that has been empirically found to occur in ethical debates (Swierstra & Rip, 2007) as a guideline for speculating about new ethical debates around the technology. Third, historical knowledge is used to judge the plausibility of closures of the controversies; historical knowledge on relevant moral regimes can indicate which parts of morality are more robust, and which are more likely to change.

The last starting point for the technomoral scenario method is that ethical debates take place in a broader moral context. Proponents and opponent of a new technology do not only voice certain ethical arguments, they have an (implicit) meta-ethical belief about the relation between technology and society (e.g. technological determinism vs. social construction). These meta-ethical beliefs should be taken into account in the building of scenarios; they can be included in the form of meta-ethical argumentation as is described in the NEST-ethics framework.

Three Step Method

The technomoral scenario method proposes a three step method (Illustration 13) for the development of scenarios, most explicitly described in (Boenink et al., 2010). The first step consists of *sketching the moral landscape* and is intended to provide a starting point from which to build the scenario. The current and past situation around the new technology is described. The technology to be discussed in the scenario is delineated. Relevant morality is described; the evolution and present state of relevant moral practices, beliefs and moral regimes is described. This includes giving an indication on past and present relevant moral controversies, and how these were solved.

The second step consists of *generating potential controversies* around the technology, using the NEST-ethics as a guideline to generate possible ethical arguments voiced in debate. This includes three sub-steps. The first is to list the promises and expectations concerning the new technology. The second step is to imagine potential objections against these promises or expectations. The third step is to construct chains of arguments; which reactions and counter-reactions follow on the initial promises and the objection to them? Throughout the entire step of generating potential controversies, the NEST-ethics patterns can be used; they provide the *type* of arguments and their usual order, which then in the scenario can be completed with *content* of these arguments concerning the new technology. Furthermore, the meta-ethical arguments

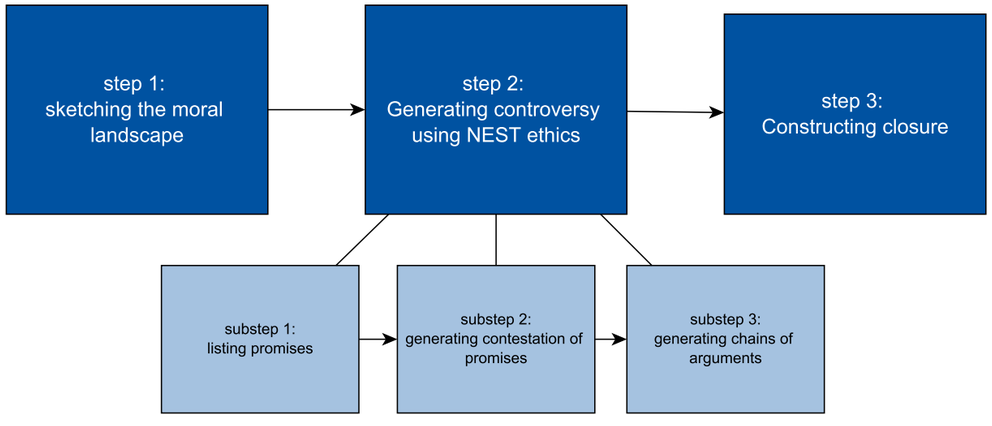


Illustration 13: Overview of the Technomoral Scenario Method

described in NEST-ethics can be used to enrich the generated arguments; they can be used as a moral background for another argument or as stand alone arguments raised in controversy.

The third step consists of *constructing closure* of the controversy, by judging which possible resolutions are plausible. After generating a variety of opposing arguments in step two, this step aims to construct resolutions to the controversy. Closure, or the "solution" to the controversy, is not to mean that suddenly there are no ethical disagreements anymore or that all the ethical issues are solved. It means that by some action or event the debate is (often partially or temporarily) closed. If we take for instance the privacy controversy around Google Glass, closure has occurred in the form of private owners of semi-public spaces such as bars and restaurants banning Glass from their premises. Constructing closure to the controversy described in the scenario is done by imagining which resolutions might be plausible, given the history of technomoral change relevant to the new technology and controversy in question. The first way to judge which resolution is plausible is by investigating which parts of morality that are questioned in the controversy have proven robust, and which are more likely to change. As a rule of thumb, morality on the micro-level will change first, and later can lead to change on the meso-level and eventually the macro-level. The second way to judge plausibility is by comparing them to long-term societal developments (e.g. the increasing importance of autonomy) or to path dependencies; the relocation of successful solutions to different contexts. Furthermore, constructing closure can be approached from the technological side or the moral side. From the technological side it is possible, for instance, that anticipated downsides of the technology turn out far less severe, or that the technology is altered to take away concerns. From the moral side, it can for instance be decided that the technology is desirable enough to introduce despite counter-arguments.

Step 2 and 3 can be iterated (several times) to build a scenario that covers a longer period of time.

Step Two: Using the NEST-ethics Pattern

The second step of the three step framework for building technomoral scenarios consists in generating a controversy by using the NEST-ethics pattern of arguments. Since this step is quite elaborate, I explain it in this separate section. In this section I will go into detail on all the types of arguments that form part of the NEST-ethics framework. For a compact overview, please see Appendix A.

As discussed, generating the controversy has three sub-steps: 1) listing promises, 2) listing objections against promises, and 3) constructing a chain of arguments. Sub-step 1 and 2 together make up the NEST debate about consequences. Sub-step 1 coincides with the first argument (1.a.1) in NEST-ethics: proponents put forward promises (i.e. positive consequences). Sub-step 2 coincides with the counter reaction to the first argument: opponents contest the promises along four aspects, namely: 1.b.1 the plausibility of the promises is questioned; 1.b.2 promises are contested based on the ratio of benefits and (non-financial) costs; 1.b.3 it is questioned whether better alternatives to the NEST exist or are possible; and 1.b.4 it is questioned whether the benefits are really benefits.

Sub-step 3 is constructing a chain of arguments. For this, we need to follow the chain as presented in the NEST-ethics framework and fill it in with content. The first type of arguments are *deontological* arguments, concerning rights and duties. In general, proponents of the technology will appeal to certain principles, usually certain rights or duties (2.a). However this appeal to principles is often implicit, and part of the putting forward of promises (1.a.1). There are however two explicit arguments based on principles: proponents of the technology argue that certain stakeholders have a right to the technology, either 2.a.1 positive (i.e. "they have the

right, period") or 2.a.2 negative (i.e. "it is allowed because it does not harm others"). The counterarguments of technology opponents usually target 2.a, the principles that are appealed to by proponents. This is done in four ways: 2.b.1 the principle appealed to is argued to be wrong; 2.b.2 the principle appealed to is right, but it does not apply in this case; 2.b.3 the principle appealed to is right, but opponents interpret and apply the principle in an opposite manner; and 2.b.4 the principle is right, but in this case it is subordinate to another principle.

After deontological arguments, *justice* arguments are raised. Before any arguments from technology proponents or opponents are raised, the question "what criterion is acceptable for distribution of the technology?" is implicitly raised and answered. There are four possible answers, that could be endorsed by both technology proponents and opponents. The first answer is "equality" (3.1) which entails that everyone should benefit from the new technology equally, which usually boils down to arguing that everyone should have access to this technology, if they want. The second answer is "merit" (3.2), a criterion also known as *justice as desert* which entails that the benefits of the technology should go to those who *deserve* it (Swift, 2006). Usually, such desert is attributed to the efforts one has put in achieving something. Merit as a criterion for the distribution of new science and technology does not make much sense. Only a handful of scientist or developers have put effort in developing this specific technology, and in that sense deserve its benefits. That either means the rest of society would not deserve the technology, or desert needs to be attributed by another criterion; either way it becomes a near-impossible task to determine who deserves the technology. Furthermore it can of course be argued that merit as a criterion for distribution is less just than equality or need. This brings us to the third answer: "need" (3.3) is the criterion for fair distribution of the benefits of this technology. This criterion entails that those who need it (the most) should get the benefits from the new technology. The last answer (3.4) is "chance" which means it is justified to leave it up to chance and contingency who get the benefits of the technology; a point of view rarely defended in ethical debate. The NEST-ethics pattern deals with the answers 3.1 equality and 3.3. need. For both criteria, proponents argue that the trickle down effect (i.e. the technology will eventually be cheap and available to all) will ensure that the technology and its benefits are distributed justly (3.1.a and 3.3.a). Opponents however argue (3.1.b and 3.3.b) that such a trickle down effect needs political help, thus that it must be ensured that the technology is cheap and available.

Here, I add something to the NEST-ethics framework. Swierstra et al. empirically found that justice arguments concern the distribution of *benefits* of the technology. However, if we are to use NEST-ethics as a tool for scenario building, we should look at the complete picture of justice arguments, and also consider fair distribution of *disadvantages* of the technology: the financial and non-financial costs, and the risks and hazards. Note that these arguments are not derived from empirical research of actual debates, as Swierstra and Rip have done, but from scrutiny of the NEST-ethics framework and common sense.

The first criterion for fair distribution of disadvantages is 3.5 *equality*. Those in favour of the criterion will argue that 3.5.a the disadvantages of the new technology should be shared equally by all members of society, while those against this criterion argue 3.5.b equal distribution of disadvantages is unfair. The second criterion is *merit* (3.6) or justice as desert. Surprisingly, merit as a criterion for distribution of disadvantages seems to make much more sense than as a criterion for fair distribution of benefits. Those in favour argue that 3.6.a the disadvantages should be carried by those who deserve to: those who gain advantages should in proportional measure carry the disadvantages. Usually this comes down to both commercial companies that developed the technology, and consumers that bought the technology. However, opponents argue that 3.6.b justice as desert is unfair when it comes to disadvantages; because it is still near-impossible to establish who deserves the disadvantages. The third criterion is 3.7 *need*; those in favour argue

that 3.7.a those in society that are in most need (i.e. those worst off) should be spared from carrying costs and risks. Opponents however argue that 3.7.b the criterion of need is invalid when it comes to disadvantages; nobody needs a disadvantage. The last criterion is 3.8 *chance* which entails it is fair that disadvantages are distributed by pure contingency. Although it is unlikely that chance will be put forward as a completely fair criterion, some may argue that 3.8.a it is unavoidable that some individuals will be subjected to disadvantages by pure chance. Opponents of this criterion argue that 3.8.b distribution of disadvantages by change is unfair and morally unacceptable, and that maximum effort must be spent in preventing distribution by chance.

After the debate on distribution, the last type of arguments according to the NEST-ethics pattern are *good life* arguments. In this good life debate, arguments are raised that are based on a certain view of what a good life (for everyone) is. Technology proponents endorse the view that a good life means to strive forward, and will raise arguments based on this (4.a.1). Opponents endorse the view that a good life means to obey to pre-given limits (4.b), and can raise arguments that appeal to various such limits (4.b.1 to 4.b.5). Eventually, good life issues are often framed as being private issues (4.a.2).

Meta-Ethical Views

Swierstra and Rip have also identified a few meta-ethical issues that play a role in controversy. These issues do not have a clear place in the NEST-ethics pattern of argumentation, but are underlying viewpoints that can form a basis for the arguments discussed above. These meta-ethical viewpoints can however result in specific types of arguments. They can be used in step two of the technomoral scenario method to broaden the array of arguments. Each meta-ethical issue and its resulting arguments can be inserted anywhere between the various ethical subjects (consequences, rights/duties, distributive justice, good life).

The first meta-ethical issue concerns the opposing world-views of *technological determinism* and *social construction*. Technology proponents (1.a) are likely to appeal to determinist views, thereby rhetorically diminishing human agency. Two common arguments are: 1.a.1 the course of technological development is predetermined by logic internal to technology itself, and 1.a.2 international competition forces technological developments. These arguments are countered by (1.b) a general appeal to social forces; i.e. technology is influenced (or shaped) by social forces, thus it can be steered in desirable directions.

The second meta-ethical issue concerns technology *optimism versus pessimism*. Technology optimists regard (2.a) technology as the solution to our problems, while pessimists (2.b) regard technology as the cause of our problems.

The third issue is the *dual way in which is drawn on past experiences*. Generally, technology proponents (3.a) use past experiences to give credibility to their argumentation in favour of the NEST. Opponents however (3.b) use past experiences as a warning and to argue for precaution. This can result in a specific pattern of argumentation, where the proponents (3.a.1) announce a new technology and stress all its promises. Opponents react by (3.b.1) stressing the newness of the technology, so as to demonstrate the uncertainty around the technology and the ignorance of its possible effects. Proponents then use an argument from precedent (3.a.2): the new technology is presented as being nothing unusual. Future developments are thus legitimised with by appealing to the past and present; Technology X was acceptable in the past, this new technology is the same, and therefore, acceptable. Opponents however use a reversed strategy, namely an argument from consequent (3.b.2). They de-legitimise the past and present by applying criteria for a desirable future; e.g. if we want to future to be X, we should do Y and refrain from doing Z right now.

The fourth and last meta-ethical issue concerns *moral presentism* and *moral futurism*. These viewpoints, explained on page 42, can give rise to specific arguments. Technology proponents like think from moral futurism (4.a), while opponents likely adhere to moral presentism. Proponents use the arguments from precedent (3.a.2) to argue that there are no ethical issues (4.a.1). Or they use the habituation argument (4.a.2): that technology induced moral change is inevitable, thus morality will be reconsidered when people are used to the technology. Technology opponents can use three types of arguments based on moral presentism for instance simply that (4.b.1) the technology is immoral as it is. The second type is the slippery slope argument (4.b.2): opponents stress the temporal dimension of moral corruption, arguing that the technology will inevitably invoke further technological steps that will result in applications that are (very) immoral. Third is the colonisation argument (4.b.3): stressing spatial dimension of moral corruption, opponents argue that development must be stopped before it can spread and used for wrong goals (“fall into the wrong hands”). Moral corruption arguments usually lead to proposals for moratoriums or self- and other-containment.

Example of a Technomoral Scenario

So what does the technomoral scenario method result in? I will shortly discuss the scenario presented by Swierstra et al. about the obesity pill (Swierstra et al., 2009, pp. 126-130 and 133-135). This pill is, as of yet, a fictional technology; but Swierstra et al. explain that it would be a genomics based pill that would allow users to consume all they want without gaining body weight. Swierstra et al. present their scenario in four stages: status quo, novelty, conflict and closure.

In the *status quo* stage, Swierstra et al. present an overview of current moral routines related to body weight. They explain that two different discourses exist in our society. The first stresses individual responsibility; e.g. it regards obesity as a sign of a lack of willpower of an individual. This discourse uses mostly deontological (i.e. duties) and good life arguments. The second discourse stresses the influence of the environment on people. Its main argument is that the environment should be modified to stimulate a healthy lifestyle. Arguments are mostly consequentialistic or related to justice.

In the *novelty* stage, the new technology is introduced: the obesity pill. Swierstra et al. present some possible promises (i.e. beneficial consequences) that would be put forward by proponents of the pill. An example of a consequentialist argument is that proponents argue that the pill will cure and prevent obesity, so that society is no longer burdened by the costs of this affliction. An example of a deontological argument is that proponents claim everyone has a negative right to the obesity pill (i.e. they can use it because it does not harm others). Furthermore, Swierstra et al. describe that proponents of the pill appeal to the trickle down effect (a justice argument), and to the good life argument that humanity should overcome nature.

In the *conflict* stage, Swierstra et al. first present deontological arguments put forward by opponents of the pill, who adhere to the discourse stressing individual responsibility. An example is that opponents argue that the principle of autonomy is wrongly interpreted by proponents; using the obesity pill is not justified by individual autonomy, but contradictory to autonomy. Consequentialist arguments by the opponents are described next; for example, that the obesity pill will result in empty hedonism. Swierstra et al. Next give the word to the technology opponents that adhere to the discourse stressing environmental influence. They first contest the promises based on plausibility: the pill will likely not eliminate obesity, because people perhaps cannot afford the pill or lack the discipline to take the pill. Consequentialist arguments are voiced, for instance: the obesity pill leads to a further medicalisation of society. Deontological and good life arguments play smaller role for adherents to the environmental influence discourse, but a

good life argument that is voiced is the *technological fix* argument: this pill tries to solve a social problem with a technological means.

Next, the reactions from the proponents of the obesity pill are described. Counter-arguments to the opponents adhering to the individual responsibility discourse are mostly deontological arguments, stressing the principle of autonomy as the right of consumers to make their own choices. Lastly, the counter-arguments against adherents of the environmental influence discourse are given. Swierstra et al. describe an argumentation strategy that stresses the importance of actual consequences over being overly moralistic in advance; arguing that results are necessary before a real verdict can be given, and thus, the pill should be available to consumers.

The last stage of the scenario deals with *closure*. Swierstra et al. have constructed a closure that highlights moral change, rather than technological change or technomoral change. The closure is started by providing the obesity pill to a small group of patients that have no other options, thus creating a *niche*. Moral change begins to become apparent when the boundaries of the patient group are contested by other obese people; they feel they qualify for the pill as well. In this discussion, obesity is more and more seen as a disease, rather than as the result of bad habits that can be changed. Thus moral judgements of people with obesity shift from "it is your own fault" towards "you are sick, you cannot help it". The moral ideas about obesity change, precisely *because* there is a medicine; if there is a medicine, obesity must be a *disease*, right? Obesity thus loses its moral load; it is no longer seen as a morally bad condition people afflicted on themselves, but as a morally neutral diseases that one cannot help having. This moral change paves the way for further distribution of the obesity pill. Swierstra et al. describe a further consequence of this moral change: since living a "hedonistic" life is no longer "punished" by becoming obese, such hedonist lifestyle loses its morally bad image and becomes more and more widespread.

Limitations of Technomoral Scenario Method

So, what can the technomoral scenario method provide to us? It is an excellent manner to explore technomoral change, and how technomoral change results from ethical controversy around a new technology. The technomoral scenario method deals with morality as a characteristic of our society on the macro-level. The building of technomoral scenarios is a systematic way to explore the future.

So we have a method to anticipate the moral impact of artefacts on the macro-level, but this method seems unsuitable for the context of design. We have seen that Swierstra et al. in their scenario are dealing mostly with *moral* change. What about the co-evolution of morality and technology? Furthermore, Swierstra et al. hardly discuss the artefact itself, the obesity pill. From our context of design, that is, the conception and creation of artefacts, it seems strange not to discuss artefacts in detail. In the next section, I will further investigate the technomoral scenario method in relation to design.

The technomoral scenario method deals with "techno" and "moral" aspects, and especially their mutual interaction. However, the balance between dealing with "techno", "moral", and "technomoral" tends to gravitate towards "moral". This is closely related to the way in which technology is discussed in the literature on the technomoral scenario method (Boenink et al., 2010; Stemerding et al., 2010; Swierstra et al., 2009). Mediation theory deals with technology on a concrete level, namely that of concrete artefacts, often in concrete use situations. But the technomoral scenario method discusses technology on a more abstract level. Below I will present my analysis of how the technomoral scenario method deals with technology, and argue why this leads to a method that is more suitable for use purposes in the upstream phases of innovation, the research and development of technologies in general, than for the downstream phases of innovation, the design and development of products[1].

In analysing how technologies are discussed in the literature about the technomoral scenario method, I have investigated two characteristics. Firstly, on what level of abstraction is technology dealt with, and second, how detailed are the descriptions of the technologies? Since 'the amount of detail' is hard to qualify I am describing it with relative terms. I am aware of the subjective nature of such terms. Therefore, my main focus is on the 'levels of abstraction'; the 'amount of detail' serves as a supplement to strengthen the arguments concerning levels of abstraction. To characterize the level of abstraction, I have used the framework by Brey (Brey, 2012), which distinguishes three levels. First and most abstract, the *technology* level, which encompasses general technologies (i.e. collections of related techniques). Second is the *artefact* level, that encompasses artefacts (i.e. a physical configuration that when operated correctly produces a desired result) and procedures (i.e. a sequence of actions that, performed correctly, provides a desired result). Thirdly, the *application* level concerns use; an application is a specific manner of using an artefact, or physical configuration of an artefact for a particular context of use.

All papers, in their theoretical parts, use the terms "technology", "technological development" or "NEST" to indicate the subject of the technomoral scenario method. In general, the technomoral scenario method deals with technology on the most abstract level (the technology level), but there are differences in the way specific technologies (in examples and in the scenarios) are delineated.

Stemerding et al. discuss "genetic susceptibility screening"; a technique and thus on the technology level. Concrete examples of involved artefacts are given, such as "biobanks" and "genomic micro-arrays" (Stemerding et al., 2010, p. 1138). Stemerding and al. do not discuss anything on the application level (i.e. concrete use situations). Their discussion of technologies takes place predominantly on the most abstract level, with a few exceptions that can be categorised in the artefact level. Concerning the amount of detail in which the technologies are described, indications are provided on how the technology works, but a clear all-compassing description is lacking. The focus of this paper lies on *practices* made possible by technology, rather than the technology itself.

Swierstra et al. discuss the "obesity pill", a fictional medical device. It is described as

> *"a genomics based drug that would allow people to consume all they want without gaining body weight"* (Swierstra et al., 2009, p. 126).

This pill is a concrete artefact, so they deal with technology on the artefact level. However, technical details are deliberately excluded from their discussion; Swierstra et al. state that

> *"how this pill would work need not concerns us here"* (Swierstra et al., 2009, p. 126).

Boenink et al. discuss multiple technologies in their scenario. On the most abstract level, their technology in question is "biomedical nanotechnology" (i.e. "molecular medicine"). In the scenario, various artefacts derived from this general technology are featured; "biobanks", "theranostic systems", "point of care applications" and "wet sensors" (Boenink et al., 2010, pp. 17, 29, 22, 25). The artefacts are described in enough detail to understand *what* they do, although *how* these artefacts work could be elaborated on. Furthermore, the scenario contains examples of artefacts linked to a user group and context, and thus are on the application level. For instance a home test for colorectal cancer is discussed (Boenink et al., 2010, p. 22); this artefact

1. This chapter is based on my earlier work (Claas, 2015).

has the use context of “home”. An example of an application for a specific user group is the “ingestible sensor for top sportsmen” (Boenink et al., 2010, p. 26). The paper of Boenink et al. thus deals with technologies on all levels of abstraction, and is compared to the other papers the most detailed in describing the technologies.

In short, in the theoretical parts of the papers, the authors discuss “technology” and “NEST”, and thus on the most abstract level (i.e. the technology level), but in the scenarios, specific technologies and artefacts from all levels of abstraction are discussed.

The Under-Discussion of Technology

I have explained that technology is discussed on the most abstract level, and that in the presented scenarios examples are given of artefacts and applications. How does this specific manner of discussing technology relate to the method?

In the parts of the papers that discuss the theory behind the method, technology as a concept is hardly discussed. Discussions about, for instance, the authors’ definition of technology, or the general patterns of technology development are missing. This contrasts the extensive discussion of morality as a concept. Morality is defined and distinguished from ethics (Boenink et al., 2010, p. 3; Swierstra et al., 2009, p. 122) and the multiple levels of morality are discussed (Boenink et al., 2010, p. 9; Stemerding et al., 2010, p. 1135; Swierstra et al., 2009, p. 132). Moral change (Boenink et al., 2010, p. 9) and technomoral change (Swierstra et al., 2009, p. 120) are defined and explained. Other concepts related to morality that are discussed are moral futurism and presentism (Boenink et al., 2010, p. 2; Swierstra et al., 2009, p. 135), moral imagination (Swierstra et al., 2009, p. 121), and NEST-ethics. Thus in discussing the theory behind their method, the authors deal with the concept of morality more thoroughly than with the concept of technology. This is in line with the manner in which technology is discussed. Technology is discussed on the most abstract level, which leaves it vague. Little technical detail is discussed that could alleviate this vagueness. On the other hand we see morality being discussed both extensively, and thoroughly. Thus technology is under-discussed compared to morality.

The explanation of the technomoral scenario method deals with “moral” aspects more extensively than with “techno” aspects. The discussion on starting points for the method (Boenink et al., 2010, pp. 8-10) is predominantly related to morality. Most striking is “the aim for historically informed speculations” where history means past ethical debates and the history of moral practices. The three step method (Boenink et al., 2010, pp. 10-14) gives more equal attention to technology and morality. The first step, sketching the moral landscape, both describes the technological development that is subject of the scenario, as well as relevant moral practices. The second step is to generate moral controversies using NEST-ethics; it deals with ethical debate concerning the technology, and shows the link between technology and morality in technomoral change. The discussion of the third step, constructing closure, inclines slightly towards morality. Plausibility of possible resolutions is in first place judged by the robustness of certain parts of morality involved, and secondly by long-term societal trends and path dependencies. It is mentioned however, that in scenarios closure can be explained both by technological developments and moral developments.

Thus in explaining the method, dealing with morality more extensively than with technology is continued. This means that the method is inclined towards dealing with the “moral” aspects more extensively and thoroughly than with the “techno” aspects. It would logically follow from a method inclined towards dealing with the “moral” aspect of technomoral change, that the outcomes, the scenarios, discuss morality more extensively than technology. However, there are differences between this balance in the three presented scenarios; I will discuss these and the relation between the scenarios and the way in which technology is discussed. I must note here that the differences between the presented scenarios are in part due to the varying lengths of the papers. Furthermore, there will always be contingency in the outcomes of the technomoral scenario method, since scenario building is not a mathematical formula but an activity that requires the researcher’s own imagination and creativity.

Boenink et al. discuss biomedical nanotechnologies on all levels, and in their scenario *technological change* is most extensively discussed of the three scenarios. Various artefacts and applications are introduced, constituting a line of technological development. Both technological and moral change, and their co-evolution, become clear. The inclination towards morality is diminished in the presented scenario.

Swierstra et al. discuss the obesity pill, an artefact, but their scenario has a deliberate focus on moral change (Swierstra et al., 2009, p. 134). A wide array of ethical arguments is extensively discussed, but no technological developments other than the obesity pill are introduced. This heavy focus on ethical controversy and moral change is in line with the lack of technological detail on the obesity pill. However, both the heavy focus on morality, and the non-detailed discussion of the obesity pill, seem contradictory to discussing technology on the artefact level; a level concerned with technological details, e.g. on functionality and user interaction.

Stemerding et al. discuss genetic susceptibility screening. In the scenario various new practices, made possible by technologies, are introduced. The scenario focusses on the mutual interaction between the screening practices and regulation, and the ethical debate concerning screening practices that influences regulation. This scenario differs from the others in that its focus lies on practices, “derived” from technology, and regulation, “derived” from morality and ethical debate. In contrast, Swierstra et al. focus on morality and ethical debate, while the scenario of Boenink et al. is so extensive that it encompasses technology, morality, practices, and regulation. In the scenario of Stemerding et al, technology can be seen as under-discussed, but this is not due to over-discussion of morality; the discussion of regulation (as the “moral” aspect) is balanced with the discussion of practices (as the “techno” aspect), and their co-evolution is stressed.

Implications for Use Purposes

I have argued that the technomoral scenario method discusses technology on the most abstract level, and that the method inclines towards dealing with morality more extensively than with technology. How do these characteristics of the method relate to the purposes for which the technomoral scenario method can be used?

The technomoral scenario method is developed as a tool for policy makers to anticipate ethical controversies around new technologies, but it can also be used in public debate involving other stakeholders to broaden its scope (Boenink et al., 2010, p. 33). It is argued that the technomoral scenario method helps policy makers and other stakeholders to recognize future controversies, understand how these controversies are shaped, and manage potential controversies by investigating plausibility and desirability of the scenarios (Stemerding et al., 2010, p. 1142).

When the technomoral scenario method is used as a tool to anticipate ethical controversies concerning a specific technological development, the inclination towards morality can be fruitful. A strong focus on morality, such as in the scenario of Swierstra et al. can provide detailed insights into a broad array of ethical arguments in such a controversy. The technomoral scenario method is suitable however for more than just anticipating *ethical controversies* since with this method we can anticipate *moral change*, which is broader than controversy alone. Since we can anticipate this potential moral impact of a technology, the technomoral scenario method can serve as input for the *assessment* of the new technology; if these are potential implications of

this technology, do we want to introduce this technology into society? Using the method as a broad form of anticipation and input for assessment can be very fruitful for guiding innovation processes. In its current form, where technology is abstractly discussed, the methods suits most to upstream phases of innovation: the phases in which technology development takes place, but no concrete artefacts have been developed yet.

However, the design of products is a downstream phase of innovation. For our current purposes, exploring the moral impact of products-in-design, the technomoral scenario method is not the most suitable. The discussion of technology on the most abstract level, with few details on functioning, and the general under-discussion of technology in the method has some disadvantageous implications for using the technomoral scenario method in design processes. First, the way in which technology is discussed in the literature on the technomoral scenario method does not suit the way in which designers deal with the products they are designing. Take for instance the scenario on the obesity pill by Swierstra et al. Their discussion of this artefact goes into much detail on the different moral viewpoints that surround this technology, but not at all on the functionality details of the technology itself. They explicitly state that

> *"How this pill would work need not concern us here."* (Swierstra et al., 2009, p. 126).

That leads, although not necessarily intended by the authors, to a situation in which the artefact is seen as one coherent whole. The artefact, the obesity pill in this case, becomes a *black box*: we can know the results it produces, but we cannot "see inside" the product to know how it functions. This means we can only regard the artefact as this complete whole, and that in terms of technology assessment we are faced with a choice between having the product completely as it is, or not at all. But designers and developers of products do not see artefacts as one indivisible whole. They are the creators of the artefacts; they can open the black boxes and see what is inside. They are able to see different functionalities, or see the various potential ways in which to shape the product-user interaction. For a designer, a product-in-design is a *collection of features* rather than a black box. Features include functionalities, but also aesthetic aspects; every variable that is part of the product can be described as a design feature. Whilst designing, designers constantly modify this collection of features; eventually a coherent collection is created that makes up a consistent product. A designer does not see a product-in-design as a black box that will either become part of society, or not. A designer will usually design a product with the intention to introduce it into society. So the question that a designer asks is not "should this artefact be introduced into society or not?" but rather "what potential features of this artefact should be introduced into society?" This is an essentially different question, that requires a different approach. The technomoral scenario methods suits best to the question whether the whole artefact (as a black box) is desirable or not. Because technology is under-discussed, the technomoral scenario method leaves little room to regard the product-in-design as a variable collection of features, each of which can have its own implications and its own desirability.

This leads to the second disadvantageous implication of the technomoral scenario method for the use in the design process. Because the method deals with technology on an abstract level, it leaves open a large scope of possible futures. For instance, "nanotechnology" is an abstract technology and can develop in numerous ways; it has a broad scope of possible futures. But "socks with antibacterial nanomaterials, meant for elderly people, that work in this-and-this specific way" is an application that can have drastic social impact, but the *scope* of possible implications (thus, possible futures) is smaller. The purpose of technomoral scenarios in the development of an artefact or application is not to explore the future with a broad and diverse scope; this leaves so many options open that it does not yield sensible feedback for product design. The reason for this is that when scenarios cover a very broad scope of possibilities, it is very difficult to investigate the *relationship* between these possibilities and the various design features. Therefore, it is hardly possible to understand the impact of specific features, and thus to assess specific features of a product in design. The scope of possible futures is smaller when discussing technology on the most concrete level, thus when discussing concrete artefacts in concrete use situations. Adding more technological detail on functioning and user interaction further decreases what options are left open.

In Conclusion

I have discussed the technomoral scenario method as an approach to anticipating the moral impact of technology on the macro-level. The technomoral scenario method explicitly deals with the macro-level and the long-term future. However, it deals with technology in an abstract sense and inclines towards dealing with morality more extensively than with technology. The technomoral scenario method is, in this form, not very suitable for designers creating concrete artefacts. In the next chapter, I will propose adaptations to the technomoral scenario method to make it fitting in the context of design.

Chapter 4

The Moral Impact Anticipation Tool

In this chapter, I will discuss how the anticipation of moral impact on the micro- and macro-level can be integrated. In chapter two, is discussed that mediation theory is limited to the micro-level. In the last chapter I have discussed that the technomoral scenario method deals with the macro-level, but lacks a strong connection with concrete design practice. In this chapter, I will explain how mediation theory and the technomoral scenario method can complement each other in the context of design. As such, they will form aspects of the Moral Impact Anticipation Tool, a method for anticipating the moral impact of products-in-design on the micro-and the macro-level. I will use this method to build a scenario around Google Glass.

Below I will shortly summarize the advantages and disadvantages of technomoral scenarios for use within the design process. See Table 2 for an overview.

First, let us look back at mediation theory. Mediation theory is a great way to investigate and understand what artefacts do beyond technical functionality and user-product interaction. Mediation allows us to explore the impact of an artefact (or product-in-design) on the lives of users; how does an artefact influence our behaviour and our experience of the world? Furthermore, mediation can be used to explore how artefacts affect our humanity, i.e. that what makes us human. I called this the “anthropological implications” of artefacts and their mediations. Lastly, mediation theory helps us to understand and analyse how morality is mediated by technological artefacts; both the technological mediation of our moral ideas, as well as the mediation of actions with a moral load. These together form what I call the “moral impact”. However, mediation theory has two clear disadvantages. The first is that it does not provide tools to analyse

mediation beyond the micro-level of society: that of individual users and perhaps very small groups of stakeholders. The second is that mediation does not have any systematic means to anticipate future mediations; mediation theory is "present-spective" or retrospective and lacks means for prospection.

The technomoral scenario method has two advantages that complement mediation theory's disadvantages. The technomoral scenario method is focussed on the macro-level of society, dealing with technomoral change on this abstract social macro-level. Moreover, the technomoral scenario method is explicitly prospective; the method allows us to systematically explore possible futures. However, the technomoral scenario method has its own disadvantages. Firstly, the method deals with morality more extensively than with technology, creating an inclination towards under-discussing technology. Furthermore, technology is discussed on an abstract level and with severe lack of detail on technological functionality. This has a few disadvantageous consequences for the use of this method in the context of design. First, the artefact under discussion becomes black-boxed, diminishing the ability to investigate the individual features that make up the product. Secondly, the scope of possible futures is so broad that it yields no usable feedback for the design process; the scope of possibilities is so broad that investigating the relationship between future possibilities and design features becomes very difficult.

So neither mediation theory nor the technomoral scenario method on its own can provide us the insights that we need in the design process. We need both methods to get an understanding of social impact of the product-in-design, both on micro- and macro-level. Furthermore, we need the technomoral scenario method to explore future mediations of the product being designed. In the next section I will elaborate on the combination of mediation and technomoral scenarios; how can we combine them to use the best of both methods?

Table 2: Comparison of Mediation Theory and the Technomoral Scenario Method

	Mediation Theory	**Technomoral Scenario Method**
Advantages	1. beyond technical functionality and user-product interaction 2. analyse and understand the impact of artefacts on behaviour and experience 3. analyse and understand anthropological implications of artefacts 4. analyse and understand the moral implications of artefacts	1. deals with macro-level of society 2. prospective: systematically explores possible futures
Disadvantages	1. only deals with the microlevel 2. retrospective or "present-spective".	1. under-discussion of technology (abstract level, lack of detail) 2. black-boxing of technology 3. too broad scope of possible futures

Towards Integration

By combining mediation theory with technomoral scenarios, we can create a way to systematically explore the future of artefacts and their mediations; this would be hard with mediation theory alone. But importantly, while exploring the future, we can think from the starting point of technology or the product-in-design; something that is difficult in the technomoral scenario method without the insights from mediation theory. So how can mediation theory and the technomoral scenario method best complement each other's disadvantages?

Before going into what *mediation theory* can contribute to technomoral scenarios, we can look at what a more elaborate discussion of the *"techno" aspects* can yield for the technomoral scenario method. I critiqued the technomoral scenario method on the following three points: 1) the "techno" aspects are generally under-discussed compared to the "moral" aspects; 2) the technology is discussed on the most abstract level, which does not suit concrete product design; and 3) there is a lack of technological detail when discussing technologies and artefacts.

Thus, we need to do three things: 1) discuss the "techno" aspects equally to the "moral" aspects; 2) discuss technology on the most concrete level of applications, in our case: products-in-design; and 3) discuss technologies and artefacts in more detail. Note that discussing technology on the most concrete level and in more detail can contribute to discussing "techno" aspects equally to "moral" aspects!

Discussing technology on the most concrete level, in our case, as products-in-design, and discussing the products in more detail (e.g. technical functionality, user-product interactions, and other design features) has three general advantages for technomoral scenarios. First, it provides a better understanding of the technology in question from the start on. This may prevent that somewhere in the process of building scenarios, our creative work is halted by the realisation we do not know how the technological artefact we are dealing with actually works. Second, it leads to a smaller scope of possible futures to be explored, which can help us to investigate and understand the relations between possible future events and our product and its features. Third, it brings us into the mindset of regarding the product-in-design not as a black box (i.e. something that produces a result, but we cannot know how it does this), but as a *collection of design features*, each of which is changeable, and has its own desirability.

Discussing technology concretely as products-in-design and with ample details, also has three specific advantages for building technomoral scenarios. First, it can provide clues about future technological development; knowing how a product functions makes it easier to see or imagine the next technological steps in development. Second, technological functionality can provides clues to the contents of controversies that may arise. For instance concerning the obesity pill, the use of certain nanoparticles in one's body can make the product controversial due to health risks, while if the pill would cause genetic modifications, certain types of arguments (e.g. "playing god") are more plausible than others. Third, user-product interactions can provide us with clues to the content of controversies, including values that are at stake. For example, different values will be at stake in controversies around medical products used by individuals at home (e.g. autonomy) or by doctors in the hospital (e.g. responsibility towards patients).

So far the advantages of discussing technology on a concrete level and in more detail; what can *mediation theory* contribute to the technomoral scenario method? Mediation theory provides insights on how the product-in-design mediates the user's *experiences* and *actions*, and how products can *mediate morally loaded actions*. Such morally loaded actions, as well as the role the artefact plays in them, can be subjected to ethical reflection and raise ethical questions. This can indicate the subject of the controversy in technomoral scenarios. Remember the example of the gunman, where the gun mediates the user's behaviour, possibly resulting in the shooting

of another person? A, perhaps obvious, ethical question is if we as society want such artefacts. Such ethical questions are clear clues as to the content of controversy around this technology; and thus, they provide a great help to building technomoral scenarios.

Diving deeper into mediation theory, I explained that each mediation has a *point of application*, a *type*, and a *domain*. These insights too can raise ethical questions, and thus provide clues to the content of ethical controversy on technomoral scenarios. From analysing mediations, we can investigate *anthropological implications*: how does the artefact and its mediations affect our humanity (i.e. human characteristics)? Insights on anthropological implications of the product-in-design can make clear what *values* are at stake with this product. It can also make clear, at least on the individual micro-level, how these values are affected. From this, we gain clues about the content of possible controversies: the values at stake can become the subject of controversy. The way in which values are affected for individuals can indicate how values may change on macro-level. For instance, concerning Google Glass, we saw that Google Glass literally stands between people, and creates a cognitive barrier between the user, who can see the screen, and others, who cannot. Let us take this cognitive barrier as an anthropological implication of Glass. Values at stake here could be *openness* versus *secrecy.* For the user, these values are affected in the way that secrecy becomes more normal. This may become the subject of controversy; opponents may condemn Glass for causing secrecy to become more important in our society. These changing values on the micro-level also provide clues to moral change on the macro-level; the growing normality of secrecy for Glass users may entail that secrecy becomes more normal for everyone in society.

Lastly, mediation theory helps us to understand *moral implications* of an artefact and the way it mediates. Mediation analysis can yield the insight that an artefact mediates the moral beliefs of individuals. In building technomoral scenarios, we can use these insights as clues for the way moral beliefs on the macro-level of society may change. With mediation theory, we can analyse how the morality of individuals is mediated; we thus analyse mediation of morality on the micro-level. Not only can we analyse how the morality of *users* is affected, mediation theory gives us insights on how *other stakeholders* are affected by the artefact and thus how their morality can be mediated. In the case of Google Glass, I have provided various examples of how non-users of Glass (e.g. the "subjects" of secret photographing) are affected differently than users; their individually held moral beliefs will be mediated differently. We thus gain insight in different ways that individually held morality is mediated. These insights can be used in the building of technomoral scenarios. In step 2 of building a scenario, we generate a controversy by filling in the NEST-ethics framework of arguments. In this controversy, two parties are opposed to each other: proponents and opponents of the new technology. We can thus use the insights from mediation analysis to fill in the arguments from both parties. Even if mediation theory would only provide insights in one specific mediation of morality (e.g. only mediation of the morality held by users, not that of other stakeholders), we can use this as a starting point for giving content to the arguments of one party in the controversy. Then we follow the NEST-ethics framework and generate a controversy with elaborate argumentation. We construct closure to this controversy, in which we speculate about how morality on the macro-level has changed, as well as moral change on micro- and meso-level. Ergo, we translate the insights on the mediation of morality on the micro-level to insights on moral change on the macro-level via NEST-ethics and the building of technomoral scenarios. With the technomoral scenario method, we can speculate how changing morality of individuals on the micro-level stands in *relation* to changes in shared morality on the macro-level.

Not only does mediation theory form a valuable contribution to the technomoral scenario method, technomoral scenarios are a valuable extension to mediation theory. I have discussed that mediation theory is focussed on the micro-level and does not explicitly provide a method to deal with the future. Exactly these "gaps" can be filled with the technomoral scenario method. The technomoral scenario method deals with the macro-level; by combining mediation with technomoral scenarios, we can use the insights from the microlevel to speculate about the macro-level. Furthermore, the technomoral scenario method explicitly takes a prospective view. It provides a systematic way to explore the future.

Method

So how do we combine mediation with technomoral scenarios in the context of design? If we want to use the insights from mediation analysis in the building of scenarios, the technomoral scenario method needs some adjustments. Below I present my adjusted version of the technomoral scenario method, which I named the Moral Impact Anticipation Tool.

Starting Points

Above, I have discussed the starting points in which the technomoral scenario method is based. These are, in short: 1) the distinction between ethics and morality; 2) the overlap between the means and goals of technology; 3) avoiding moral presentism and understanding morality in three levels; 4) anchoring speculation in (moral) history, thus making historically informed speculations; and 5) taking into account meta-ethical views.

To use the technomoral scenario method in the context of design, we need to elaborate these starting points. First of all, the second staring point: the overlap between means and goals of technology. This staring point entails that we should not only see the goals of technologies and artefacts as something worthy of ethical debate, but the means as well. This is very much in line with mediation theory. Mediation can serve here as a way to better understand the means by which an artefact fulfils its goals; and thus identify potential ethical issues in the way the artefact fulfils its goal. The way in which an artefact functions can in itself deserve ethical reflection; mediation analysis helps to better understand this functioning. A clear example of this is the *type* of mediation, that I discussed on page 19. As I have discussed, the type of mediation itself can be subjected to ethical questions. We can wonder for instance whether it is morally permissible to *seduce* consumers to buy healthier foods, since they may not be aware that their shopping decisions are being influenced. On the other hand, with the insights from mediation theory we can observe that shoppers in the supermarket are already being seduced to buy unhealthy snacks (especially at the cash register, where a large array of candy bars are displayed). Thus mediation help us to better understand the *means* by which an artefact fulfils its goals (i.e. the functionality), but it can also shed light on the broader context of such means.

The second adjustment I will make to the starting points is to the fourth staring point; anchoring speculation. Boenink et al. argue that speculation should be *historically informed*. The history of moral practices and past ethical debated provides a starting point for the scenario, and the history of moral change is used to judge which closures are plausible. However, this provides us with only one side of the story of technomoral change; what about the "techno" side? Therefore, I add to this starting point: speculation should be *technologically informed*. This is done in two ways. First, by analysing the history of the technological development, which can provide clues as to how the technology or artefact will develop in the future[1]. If we take for instance the technological history of Google Glass, some helpful insights could be that mobile telephones have gained more and more functionalities, and that wearable computing is ever increasing in popu-

1 This is relevant when building a scenario that cover a long period of time and in which various artefacts are introduced. However, that may not always be the type of scenario built by designers, for they would likely prefer to built a scenario around the one artefact they are designing.

larity and diversity. The second way in which scenarios should be technologically informed is by analysing what the technological artefact does. What are its functions? How does the user provide input to the artefact? In what ways is the artefact present in the user's life? Questions like these, that we can answer with help from mediation theory, help us to better understand the artefact and to diminish the scope of possible futures.

MIAT: a Five Step Method

Based on my elaborated starting points, I will add two steps to the technomoral scenario method. This means the Moral Impact Anticipation Tool includes technological details, is able to deal with technology on the concrete artefact and application level, and that is based in the new starting point of *technologically informed speculations*. The MIAT includes a mediation analysis, to clarify how mediation theory and technomoral scenarios can enhance each other.

The first two steps set the base for speculation about technomoral change, by zooming in on the artefacts itself. The third step places the artefact in a broader context, both in terms of technology and morality. The fourth and fifth step then are the generating of potential controversy and constructing closure.

Step 1: Artefact Description

The first step is to provide a detailed description of the product-in-design that is to be the subject of the scenario. Even if the product is still in a conceptual phase of development, the details that are known should be listed here. Some questions to be answered are: 1) what is the goal of the artefact? What is it intended to do? 2) What are the means by which it fulfils this goal? How does the product function? 3) What are the interactions between user and product? How does the user provide input to the product? How does the product provide output? 4) By whom is the artefact intended to be used? What is characteristic or special about this group? 5) In what context is the product intended to be used? What is characteristic about this context?

Step 2: Mediation Exploration

In the second step, the potential impact of the product-in-design on the user's life is analysed; thus the micro-level impact of the artefact are explored. Mediation theory is used to gain insights on the implications of the technology. This entails using insights from mediation analysis done earlier in the design process. However, if my adjusted version of the technomoral scenario method were to be used as a stand alone research tool, this means that within step two of the method, a (succinct) mediation analysis should be performed. Questions to be answered are: 1) how does the artefact mediate the user's experiences? How does it mediate frameworks of interpretation and ideas? 2) How does the artefact mediate the user's actions? How does it mediate long term behaviour? 3) What are the points of application of the mediations? What are the type of mediations? In what domains are the mediations located? 4) What could be the anthropological implications of the mediations? What values are at stake, and how are they affected for individuals? 5) What are the moral implications of the mediations? How are moral ideas of individuals affected? How are morally loaded actions mediated?

Note that, since mediation does not happen in a vacuum, it is fruitful to review the insights from step two after completing step three, the sketching of the technomoral landscape. After all, the macro-level of society forms the context in which micro-level mediations take place; as such the macro-level structure shapes the possibilities and constraints for action on the micro-level. When designing an artefact or technology that is closely related to a specific social practice or socio-technical system, it can be fruitful to investigate this practice or system first, as part of step three, before investigating the mediations.

Step 3: Technomoral Landscape

The third step is similar to the first step described by Boenink et al., that of sketching the moral landscape. However, having an overview of the technological landscape, as well as getting an understanding of how technology and society have co-evolved in relevant ways is equally important to understanding the moral landscape. Hence I propose to sketch the *technomoral landscape*; giving attention to morality, technology and socio-technical developments. I propose to work from technology to morality in nine sub-steps. However, as longs as all topics are covered the order of the steps can be reversed or changed.

First, an overview is given of the technological developments that have led up to the artefact in question. This can include the history of general technological developments, or a description of concrete artefacts that can be regarded as predecessors of the artefact. Second, the relevant long-term and general technological trends that have played a role in the technological developments are listed. Third, an overview of the technological landscape is given, including the current state of affairs.

Since technology and society co-evolve, some relevant developments cannot be classified as belonging to either the technological landscape or the moral landscape. Hence sub-step four to six provide the opportunity to explicitly deal with *socio-technical* landscape. So, fourth, the relevant socio-technical history is described; what developments, in which technological and social factors played (almost) equal roles, have led up to the current state of affairs? The fifth sub-step then is to list general socio-technical trends. Sixth, an overview of the contemporary socio-technical landscape is provided.

The last steps deal with the moral landscape. Sub-step seven entails providing a history of moral developments: what moral similar moral controversies have arisen in the past, and how were they resolved? Sub-step eight is to list relevant long-term moral trends that play a role. This can include listing moral values that have played a role in prior controversies, that have proven to be robust. Finally the ninth sub-step is to provide an overview of the moral landscape.

Step 4: Generating Controversy

The fourth step is the same as the second step described by Boenink et al. The fourth step consists of generating potential controversies around the technology, using the NEST-ethics as a guideline to generate possible ethical arguments voiced in debate. This includes three sub-steps. The first is to list the promises and expectations concerning the product-in-design. The second step is to imagine potential objections against these promises or expectations. The third step is to construct chains of arguments; which reactions and counter-reactions follow on the initial promises and the objection to them? For the complete description of this step, see page 46.

Step 5: Constructing Closure

The fifth step is the same as Boenink et al.'s third step, but with an equal focus on both "techno" and "moral" aspects of technomoral change. The fifth step consists in constructing closure of the controversy, by judging which resolutions are plausible. This should be done from both the "moral" and the "techno" aspect. The moral aspect as described by Boenink et al. consists in judging plausibility of resolutions by investigating which parts of morality are robust and which are likely to change, followed by comparing the resolutions with long-term societal developments and path dependencies. The techno aspect consist in comparing possible resolutions to long-term technological development to determine the plausibility of the technological aspects of the resolutions.

Different Types of Technomoral Scenarios

With these five steps, it is possible to build different types of scenarios. Below I will provide some recommendations on how to use these steps for different scenarios and different purposes. Before doing so, I will explain two terms that I use. First, the *iteration of steps*: by iteration I mean that within one scenario, the various steps are repeated to create a scenario that covers a longer period of time (and which covers multiple new artefacts and multiple controversies). By *multiple scenarios* I mean creating more than one scenario on the same subject, in which each scenario explores a different course of events.

The most obvious type of scenario in the context of design is a scenario that deals with one artefact (the product being designed), and explores broadly its impact on the individuals, as well as on society. For such a purpose, I would recommend developing multiple scenarios, each with one iteration of steps. Steps one (description of the artefact), two (mediation exploration) and three (sketching the landscape) are to be done once. However, it is helpful to speculate about various different effects of the artefact in step two, the mediation exploration. Each of these different effects can then be the basis for the further development of one scenario. Thus steps four (generating controversy) and five (constructing closure) are executed several times, each based on different insights from step two.

On the other hand, it is possible to create a scenario to explore technological development; such a scenario would include multiple artefacts and multiple controversies. For such a scenario, I would recommend iterating all the steps, to create a narrative that includes multiple artefacts.

MIAT Scenario about Google Glass

In this section I will demonstrate the Moral Impact Anticipation Tool by building a scenario about Google Glass. I will only describe one scenario, as a proof of principle.

Step 1: Artefact Description

The first step of my method for building a technomoral scenario is to describe the artefact that is to be the subject of the scenario. In the context of designing, we thus describe our product-in-design in as much detail as is available.

Google Glass is a wearable extension to a smartphone. It is worn over the user's eyes, as a pair of glasses. Glass aims to make the functionality of a smart phone easier accessible. Glass can be used to make phone calls, make photographs and videos, and to surf the internet. Glass is shaped much like a pair of regular glasses. It has a "screen" in the form of a miniature projector and prism that enable projection directly into the eye. Glass is mostly operated by voice commands, such as "OK Glass, take a picture", but it can be operated by swiping and tapping the right leg of Glass, that contains a touch pad. Glass is not aimed at a specific target group, although it was initially only made available to a selected group of "explorers"; mostly technology enthusiasts and influentials hand-picked by Google. Glass is not aimed at a specific context of use; like a smartphone, it is intended to be used anytime anywhere. For a more detailed discussion of Google glass, see Chapter 1 on page 7.

Step 2: Mediation Exploration

In step two, we explore the micro-level impact of the product-in-design by analysing how the artefact mediates.

Below is a short summary of my mediation analysis from chapter 2. For more details, please refer back to page 27.

Considering Google Glass in general, we see that Glass is an embodied artefact, that is worn on the users face, even when it is not actively used. It is always *present* to the user. Glass has the power to constantly attract the user's attention. Furthermore, because it is embodied, Glass literally stands between people, creating a physical and cognitive barrier. Only Glass users can see what they are doing with Glass. The values of secrecy and openness in social interactions are at stake in this mediation. Lastly, because Glass is constantly present, the virtual world, that is accessed through Glass, is constantly present. This can lead users to identifying more with the virtual world and people that are virtually present. There is thus a possible shift in the valuation of the virtual world versus the physical world.

An important piece of hardware of Google Glass is its camera, which enables easy and inconspicuous filming and photographing. This can make both users and non-users of Glass feel that being photographed is always an option. Especially in the public space, this can have implications for social behaviour, and for the way we conceptualise the value of privacy.

Glass prompts its users with notifications; a user then has five seconds to view the notification, otherwise it moves into the timeline where it can be viewed later. The type of this mediation is important here; Glass users are *seduced* to view notifications immediately. From this, they can experience an increased sense of urgency and importance regarding notifications. This implies that users are willing to give more attention to Glass' notifications, compared to smart phone notifications. This too can lead to an increased valuation of the virtual world over the physical world.

Step 3: Technomoral Landscape

The third step consists in sketching the (metaphorical) landscape in which the artefact is introduced. I will describe the technological landscape, including a short history of relevant technological developments, and the moral landscape consisting of relevant moral practices.

Technological Developments

Glass has been introduced predominantly in Western cultures, where there already was a firmly settled technological landscape containing various mobile computing devices. Below, I will provide a short history of the smartphone.

In the 1990's, the first smartphones were developed. Their functionality was much more elaborate than that of the "regular" mobile phones; they were designed for text-based functionalities, and could connect to the internet. In 1992 the first smartphone, named Simon, was introduced by IBM (Martin, 2014). It had a monochromatic touch screen that could only be operated with a stylus and its functionalities included sending fax messages, email, a calender and of course calling. In 1996, the Nokia 9000 communicator was the first

Illustration 14: the Nokia 9000 (Nokia Museum, 2012)

in a long line of similar smartphones. It featured a hardware QWERTY keypad, and introduced the functionality of web browsing. From the outside, the Nokia 9000 looked like a regular mobile phone, but it could flip open to reveal the keypad and touchscreen (Illustration 14). Until 2006, the vast majority of smart phones had the same features as the Nokia 9000. Designs vary and different phones could open, flip, rotate, and slide in numerous manners; but they all share the QWERTY keypad and stylus operated touch screen. While the regular mobile phone is becoming vastly popular among the large public in the period from 1999 to 2006, the smartphone is predominantly aimed at and used by business users. However, from 2004 on the usage of smartphones increases and the smartphone slowly enters the consumer market.

In June 2007 Apple launched the first iPhone, which meant a small revolution for the smartphone, both in functionality, as well as in looks and features. In terms of functionality, the iPhone had drastically improved web browsing software, which allowed significantly better quality in displaying websites. Furthermore, the iPhone allowed users to install applications developed by third parties; as such, users could add desired functionalities to their device. In terms of features, the iPhone had two drastic differences from all previous smartphones: it had a large full-colour finger-operated touch screen and the hardware QWERTY keypad was replaced with a software keypad that appeared on the touchscreen when necessary. The iPhone set the standard for virtually all new smartphone models, up until today. The "old" generation smartphones with hardware keypads quickly disappeared, and the vast majority of new smartphones were a so-called "slab" model like the iPhone. These new "slab" smartphones were marketed at a broad public; today, the sales and usage of smartphones is widespread.

In 2008, Google started playing a role on the mobile telephone market when they launched their operating system Android OS. Google partnered with HTC, a company that produced the smartphones that run on Android. Currently, Android is run on devices from various manufacturers.

General Technological Trends

There are a few general technological trends that are apparent in the developments of mobile communication devices. First and perhaps most obvious: mobile telephones become more and more widespread. Nowadays, "everyone" has a mobile phone, some people have multiple (e.g. work and private). Secondly, mobile communication devices themselves have gained more and more different functionalities. Wearable computing, for some time, became ever more diverse; various products other than the mobile telephone became available, such as mobile music players (from cassette player, via Disc-Man, to iPods and mp3-players), mobile telephones, PDAs, cheap digital camera's, tablet computers, e-readers, etc. Smartphones however are an integration of various devices (phone, PDA, music player, camera). Through the smartphone, the variety of wearable computing devices is diminishing. However, the number of different functions per device has greatly increased. Lastly, mobile communication devices are getting smaller mostly due to developments in battery technology that enable ever smaller but more powerful batteries. When we consider the history of the mobile telephone, we see that the phone has taken up a position ever closer to the human body. The first mobile phone was attached to a car, GSM phones and smartphones are positioned in one's purse or jeans pocket, and Glass and comparable devices are positioned on one's face.

This has led to a technological landscape anno 2015 in The Netherlands, where almost everyone has a mobile telephone, whether a GSM phone or a smartphone. In the home context, landline telephones are gradually disappearing. Mobile telephones are used anytime anywhere, both for private purposes and in work contexts.

Socio-Technical Developments

Technology and society develop together in a a process of co-evolution; therefore some developments do not fit into either the "techno" or the "moral" category but are clearly socio-technical. Below are two important socio-technical developments concerning mobile telephones and our society.

Land-line telephones were (and are) often used by multiple people; for instance, family members or office colleagues share one telephone. Since the mobile telephone however, telephone communication has become a personal affair, rather than a collective affair. Mobile phones and smartphones are hardy ever shared by multiple users; they are truly individual devices. But the shared land-line telephone is disappearing as well; e.g. in many families, family members now all own an individual smartphone. Related to this is a development described by (Lacohee, Wakeford, & Pearson, 2003): mobile telephones are closely related to the process of teenagers emancipating themselves from their parents.

The mobility of telephones as had led to a socio-technical trend of individuals become ever more "connected"; but this connection is through virtual and technology-enabled communications. Especially smartphones with their numerous communication channels (calling, SMS, Whatsapp, Facebook, Happening, etc.) provide users with a near-constant stream of communication advances, and the ever luring possibility to not only to respond to these communication advances of others, but to sent out new advances to others. Individuals are constantly reaching out to each other.

Moral Landscape

The socio-technical developments described above go hand in hand with moral developments. We can explore the moral landscape along the lines of the three anthropological implications that I have focussed on: attention, social relations, and identity.

Concerning attention, we see that ever since the widespread introduction of the mobile telephone, there have been debates about the influence of mobile phones on our attention. Explicit rules and implicit moral standards have developed around the use and non-use of mobile phones. For instance, in schools the use of a mobile telephones is often not allowed. In other settings, such as a business meeting or a romantic date, it is simply "not done" to use your mobile phone, or even to have it ringing and bleeping; it thus has become a norm that in some contexts, we do not allow our mobile phone to disrupt our attention. Another example, that was again debated for Google Glass, is the use of mobile phones while driving a vehicle. The Dutch law states that it is only allowed to use a mobile phone whilst driving if the phone is "hands-free"; thus the driver can still give enough attention to the traffic situation. Similar debates have been held around Google Glass, though no legislation explicitly dealing with Google Glass in traffic was developed in the Netherlands.

If we consider the mobile phone, the smartphone or Google Glass in relation to identity, we can hardly ignore other technologies that are strongly identity related. Social media platforms such as Facebook, Twitter and Instagram are incredibly popular. Their common denominator is that the social interactions on these platforms are, so to speak, supply-based. Users offer something (e.g. a status update, a picture, a "tweet") and others may or may not react on that. Older social media platforms, such as Hyves or CU2 were demand-based; if a user wanted to engage in an interaction with another user, he had to go to that person's profile page and leave a message. Compared to these older social media, the new social media are more egocentric. Phenomena such as the "selfie", a self-portrait usually taken with a phone, are clearly in line with this trend of increasing egocentrism. So how does that relate to the smartphone and Google Glass? The integration of camera in the smartphone allowed users to take photographs anytime anywhere.

In interaction with the social media platforms easy photographing became easy sharing of photo's online. Glass makes the sharing of photographs even more egocentric. Everything that is photographed with Glass literally has the point of view of the user. The smartphone allowed for photo's of oneself; Glass only allows for photo's from oneself. Rather than sharing an outsiders perspective on yourself (as in the selfie), Glass users share their own perspective of the world.

Lastly, considering social relations, we can see that the development of the mobile telephone has had a profound impact on our social relations. With a (mobile) telephone, people can maintain social relationships over long distance more easily. Our way of communicating and our social interactions have changed in co-evolution with telecommunication developments. The mobile telephone gave us text messaging (SMS), which became very popular; not only as a manner of communicating "important" information, but also a a manner of communicating for the fun of it. In the same time period online text based communication channels emerged, such as chat-rooms and instant messaging programmes (e.g. MSN messenger or ICQ), that too made text based communication a form of leisure. With the smartphone came applications such as Whatsapp, that allow leisurely chatting with a group of people. of course communicating as a leisure activity has existed before, and still exists alongside, the mobile telephone; we still go to parties and chat with people. The (mobile) telephone however gave us a new medium for such leisurely communication and has allowed us not only to casually chat with people we see regularly, but also with people who live far away. Thus the (mobile) telephone geographically extended our social circles of people with whom we communicate on regular basis as a leisure activity. Or, to describe it in buzzwords: we are always "connected" to each other. Our constant connectedness has led us to develop the expectation towards others that they are always available for communication; being available for communication has become a social norm. Furthermore, our social interactions are increasingly with virtual others, people that are "present" through the virtual world, rather than people that are physically present. This seems a worrisome development to many people.

Step 4: Generating Controversy

The fourth step of my method entails generating a moral controversy, based on the NEST-ethics framework. I will follow three sub-steps: first, listing the promises of the artefact, second, generating potential objections against these promises, and third, constructing a chain of arguments and counter-arguments.

Sub-step 1: Promises & Expectations

Since Glass has actually been – in a limited manner - introduced into society, we can use the actual promises and expectations put forward by Google and technology proponents for our scenario.

When studying the promises put forward by Google, I found that the meta-ethical pattern of "drawing on past experiences" (meta-ethical argument 3.a.1) was clear in the way Glass was presented to the world, and the promises that were made. Although Google announced Glass with much ado and sensation (meta-ethical argument 3.a.1), content-wise their promises entailed an improvement of current smartphone functionalities (meta-ethical argument 3.a.2). When controversy around Glass increased, Google started presenting Glass more and more as "nothing new". This becomes clear for instance in the rhetorical strategies used to dismiss "myths" (i.e. public concerns) about Google Glass (Google Glass, 2014).

As said, the promises put forward by Google (1.a.1) mostly entailed an improvement of functionalities of smartphones. They main focus in marketing was stressing how Glass makes smartphone functions easier accessible and therefore faster and easier. A clear example is the focus on hands free and immediate access to filming (through operating Glass by voice commands), so the user "never misses a moment".

Sub-step 2: Objections

In reviews of Google Glass, a more realistic picture of Glass is sketched; Glass turns out to work far less smoothly than expected (Verlaan, 2014). Implicitly, the reviewer thus contests the promises made by Google based on their plausibility (1.b.1).

Organisation such as Vrijbit and Stop The Cyborgs question whether the benefits put forward by Google really are benefits, by regarding these benefits from a broader social perspective. They argue that (1.b.4) easy and inconspicuous filming is not at all a benefit, but a threat to the general public and the privacy of citizens.

Furthermore, the meta-ethical argument put forward by Google that Glass is nothing new (meta-ethical argument 3.a.2) is implicitly counter-argued by opponents, who stress the new features of Glass, and how Glass differs from other products such as the smartphone (meta-ethical argument 3.b.1).

Safety issues around Glass are debated after a woman in the United States was fined for wearing Glass while driving her car. Google argues that (1.a.1) Glass makes driving more safe, because the driver does not need to take his eyes of the road. A traffic safety expert argues that (1.b.1) this is nonsense; Glass still forms a distraction and the driver will be unable to give his attention to the traffic situation.

Sub-step 3: Chain of Arguments

From this point on, the content of the arguments is speculative. I have based these arguments on insights from mediation analysis. First, that the value of privacy becomes contested; second, that the valuation of the virtual world in relation to the valuation of the physical world increases; and third, that secrecy becomes more prevalent in social interactions (because the virtual world is only accessible to the Glass user and not to physical others). Furthermore, NEST-ethics helps to generate arguments that are less based on the actual workings and mediation of the product, but more on general rhetorical strategies.

Phase 1: Global Release of Google Glass

After Glass was initially only made available to selected "explorers", Google decided to start selling the product via regular electronics stores worldwide.

Rights & Duties

From the moment Google announced their global sale of Glass, action groups such as Vrijbit started protesting. They increased their efforts to get Glass banned, claiming it is destructive for personal privacy. Google reacted by stressing that consumers have the freedom to make their own choices in what they purchase; they thus (implicitly) appeal to a right to individual freedom (2.a.1). Vrijbit tried to undermine these arguments by arguing that (2.b.1) this principle is wrong. They argue that the "consumer freedom" that Google advocates is in reality not limitless, because governing agencies regulate what products are available on the market. Currently they only regulate with regard to safety and health; institutions such as TNO test products on safety standards. Vrijbit argues that our society needs institutions that regulate and test products with regard to privacy; we thus needs privacy standards.

Justice

Upon the release of Google Glass, the device is still expensive. In the Netherlands, Glass was sold for €1650,- which is about twice the price of top range smart phones, and about five times the price of the cheapest smart phones at that time. Google stresses that (3.1.a) eventually, Glass will become cheaper and thus available to everyone in society. There is little further debate about fair distribution, since the opponents of Glass keep arguing that Glass should not be distributed at all in the first place.

Developments

While the debates about privacy and safety continue, the Dutch government takes no action to interfere in the sale of Google Glass, and it is thus still available in stores. The sales of Glass in the Netherlands went in two phases. Upon the first release, a large group of technology enthusiasts purchased Glass; at all the stores long cues had formed, even overnight. The sales remained high for a few weeks, and suddenly there were Glass users everywhere. While the sales diminished after the first few weeks, Glass became a more and more common sight in the streets. Media attention for Glass slowly died out and there was less and less attention for the views of groups like Vrijbit. Meanwhile, Google continued to advertise Glass. Six months after the release, the sales of Glass slowly started to rise again. At this point, Glass had become a fairly common sight in public spaces, there was hardly any negative publicity about Glass anymore, and the price had dropped slightly. About a year after the release of Glass, a survey by Dutch newspaper NRC showed that Glass had become a rather accepted technology by most Dutch citizens. Glass proved most popular amongst teenagers and students; 41% said they would surely buy one if they could afford it. Amongst adults, only 5% held this view; by far the largest group (58% of respondents) were positive or neutral about the technology, but indicated they would not buy it for themselves. The remaining 37% of adults expressed a negative opinion about Google Glass, ranging from "it's a nonsensical plaything" to "it's a dangerous device that should be forbidden".

Phase 2: Introduction of Facial Recognition

Little more than a year after its global release, Google announced they will approve of facial recognition applications for Google Glass. This re-opened the debate.

Consequences

Google put forward the following promises (1.a.1). Their main argument is that facial recognition will make us more social. They state that facial recognition can improve interactions with others, it can help us connect to strangers and make new friendships. Glass' facial recognition, so it is promised, will improve our social relations with each other.

Various opponents of facial recognition software voice counterarguments. An argument focussed on privacy is that (1.b.2) even if facial recognition makes us more social, we pay for that with our privacy. Facial recognition violates personal privacy, so it is argued, and this cost is not worth the benefit of improved social relations. Others question whether we really need Glass and its facial recognition for our social relationships (1.b.3). After all, they argue, we have always had social interactions without facial recognition software and they were just fine (meta-ethical argument 3.b). Furthermore, they argue that people already interact so much with electronic devices, and if we want to avoid a future of complete dependence on technology, we should not allow facial recognition software to take over our social interactions (meta-ethical argument 3.b.2 and 4.b.2). Finally, a popular philosopher gained much media attention because of his latest book about social relations in our contemporary age. He argued that (1.b.4) we should not strive for being more social and having more social relationships. He questions whether being social is valuable in itself (i.e. it has *intrinsic* value) and argues that is it merely a evolutionary survival strategy; its value is merely *instrumental*. Furthermore, he argues that (1.b.2) even if we find social relationships valuable, they are subordinate to the intrinsic good of personal growth, forming and reflecting on one's identity, and self-fulfilment. He argues that in modern Western society, people are already burdened with so many social obligations, that we suffer from "social stress" and become incapable of personal growth.

Rights & Duties

Action group Vrijbit regained serious media attention in the debate about privacy. They increased their efforts in their lobby to get Glass banned and organised meetings and protests in cities throughout the country. Vrijbit's main argument remained that each citizen has the right to privacy. Vrijbit called upon the government to protect this right.

Google tried to keep itself out of this debate. However, various groups of technology enthusiasts and liberal political action groups formed a de facto pro-technology movement. They stressed the value of individual autonomy by arguing that (2.a.1) citizens have the right not to be belittled or paternalised by the government. In their rhetoric, they often appeal to the values democracy, and again freedom and autonomy. The anti-Glass movement responded by acknowledging the principle appealed to by the pro-technology movement, but applying it in a different manner (2.b.3). They argued that indeed, individuals have the right to freedom: the freedom not to be filmed or subjected to facial recognition. They thus conceptualise privacy as a certain type of freedom. Furthermore, they argue that (2.b.4) the type of freedom the pro-technology movement defends is indeed a valid right, but subordinate to the right to privacy.

The pro-technology movement again stresses that filming with Glass is no different from filming with a smartphone (meta-ethical argument 3.a.2). Since society has accepted smartphones as harmless, we must accept Glass as harmless; thus individual consumers have a right to own and use Google Glass since it does not harm others (2.a.2).

Developments

Meanwhile, two students at the University of Twente developed an application for Glass that combines facial recognition with existing social media applications, called "Face-app". While working on their app, the students quickly found that others reacted negatively on the idea of a facial recognition app. Being aware of the negative image of facial recognition, the students aimed to develop an app that explicitly stimulated social interactions, rather than "creepy" or "stalker-like" behaviours[2]. Face-app was an instant hit on the university campus, and soon other student communities started using it. Google quickly bought the application and heavily advertised it amongst teenagers and students. The popularity and sales of Glass and Face-app amongst these age groups increased drastically.

Another group of students used these developments around Face-app as a research subject, and investigated what influence Face-app and Glass had had on their student community. They found that their fellow students who used Face-app found it easier to strike up a conversation with someone they did not know before. Face-app users indicated that they made more contact with others in the physical world and spent less time on other social media that are solely virtual (Whatsapp, Facebook, etc.). The students got their results published in a popular-scientific magazine and various news papers. The pro-technology movement used their research to argue that "facial recognition brings people together".

2 In the next chapter, I will elaborate on the specific design features of the - fcitional - Face-app application, when I use it as an example for how insights into technomoral change and mediation can be used in design.

Justice

Partly due to the popularity of Face-app, Glass and its facial recognition functionality had regained popularity and were generally regarded more positive. Vrijbit and other groups in the anti-Glass movement gradually shifted their area of attention. Although Glass had slightly dropped in price, it was still an expensive product, and Vrijbit started using this fact in their protest. They argued that Glass is an elitist product. Only the rich can afford Glass, and thus they will be the consumers that shape the use of Glass, and shape how we deal with privacy. Thus, Vrijbit claimed, because the elite can afford such technologies, they will determine for everyone in society what privacy is and how we humans and our technology deal with privacy. Furthermore, they argued that (3.7.a) those in society who cannot afford Glass become its victims. Their privacy is threatened, and they are unwillingly subjected to facial recognition; i.e. they are subjected to disadvantages, while they should be spared from those.

The pro-technology movement did not argue against the increasingly political arguments of Vrijbit. Rather, they mock their political standpoint and by their rhetoric try to put Vrijbit and the whole protest movement in a bad daylight. Implicitly, they appeal to the good life argument that mankind should always strive forward (4.a.1).

Step 5: Constructing Closure

> *In the last step, a plausible closure of the controversy is constructed; how is the controversy "solved"? What resolutions are plausible, judging from both the "moral" as well as the "techno" aspects?*

Media attention for Vrijbit and the protest movement dies out; both the activists and their arguments are hardly taken seriously anymore. Google Glass and Face-app are still increasing in popularity. Glass and its facial recognition functionality have become accepted by the majority of citizens.

"Techno" and "Moral" Aspects of the Closure

In the past, moral controversies around mobile telephones all slowly died out and the technology became accepted; morality was often adjusted to technological developments. That suggest a similar technomoral development around Glass.

Furthermore, in a socio-technical landscape were we are ever more "connected" it is a plausible development that we become connected in ever more different ways; thus through facial recognition as well. We see that in a trade-off between the values of being social or being connected on the one side, and privacy on the other side, being social is generally valued more. Thus privacy concerns eventually are regarded al less important.

When it comes to the values at stake, privacy was heavily debated in relation to Glass. However, privacy is hard to conceptualise and ever since we started using the term, we have been re-defining it. That suggest that despite the initial protests regarding threatened privacy, we eventually re-define what privacy is. And thus, we do not regard new technologies such as Glass as threats to our privacy anymore.

Lastly, in the recent past we have seen that people are often not fully aware of the privacy they are giving up when using technologies such as Facebook. This can be partly attributed to their own negligence, when they did not read the terms of service or privacy statements. However, such legal documents are often complex and from using the technologies themselves, it remains completely opaque what in what ways privacy is given up. On the other hand, there are numerous people who are fully aware of what they are giving up, and value what they get in return more. They for instance know that on a certain social media platform, they give up intellectual property rights, but value belonging to that platform more.

In Conclusion

In this chapter I have proposed a new method for the anticipation of moral impact of products-in-design: the Moral Impact Anticipation Tool. This method integrates the anticipation of moral impact on micro-and macro-level. Mediation theory and the technomoral scenario method are combined, to utilise the strengths of both approaches. Simultaneously, the two approaches complement each other to overcome both their limitations.

The MIAT provides insights in the moral implications of the way artefacts mediate, and what technomoral change can accompany new artefacts. In the next chapter, I will discuss how to use these insights on the anticipated moral impact on the micro-level (i.e. moral implications of mediation) and on the macro-level (i.e. technomoral change) in design practice.

Chapter 5

MIAT Informs Design

In the last chapter, I have introduced the Moral Impact Anticipation Tool for developing techno-moral scenarios informed by insights from mediation analysis. In this chapter, I will show how the insights that we gained from using the MIAT can be used by designers; I will discuss how the anticipated moral impact of products-in-design can inform design practices.

So far, I have discussed that the micro-level anticipation of moral impact, using mediation theory, and the macro-level anticipation of moral impact, using technomoral scenarios, both are informative in their own way. Therefore, I have argued that mediation analysis and techno-moral scenarios need to be combined, and provided MIAT as a method to do so; in order that we can investigate the product-in-design both on the micro-level and on the macro-level. It is important to realise that the macro-level anticipation and the micro-level anticipation are not completely separated and independent; they are simply different approaches to the same thing. Design features, mediations and technomoral change are all aspects of the same product-in-design. In the Moral Impact Anticipation Tool, mediation analysis is informed by studying design features, and technomoral scenarios are built based upon insights from mediation analysis. The physical informs the micro-level of people and their morality, which in turn informs the macro-level of society and shared morality. See the overview in Illustration 15.

In this chapter I will discuss how the macro-level informs the micro-level, and how this in turn can inform the physical layer of design features.

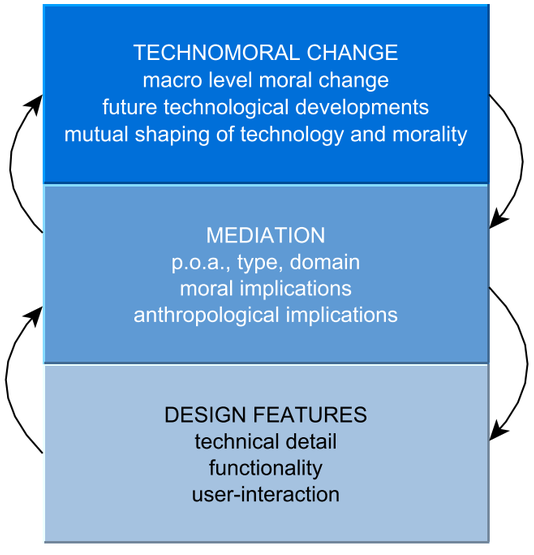


Illustration 15: Design Features, Mediation, Technomoral Change

Anticipation of Moral Impact

First, a short recapitulation of how we anticipate the moral impact of a product-in-design. Through the MIAT we can find an array of moral implications of the product-in-design that together form the moral impact. It is important to execute both the mediation analysis and the building of the technomoral scenario, in order to get a complete overview of the moral implications of the product-in-design.

If we solely investigate the design features and technical details of the product-in-design, we will not be able to anticipate the moral impact of the product-in-design. Perhaps we will find some hard impacts: issues related to safety and risk. But the spectrum of issues that deserves ethical reflection is much, much broader than safety alone. Morality and ethics are by definition related to human beings. So if we merely study a physical thing, deprived from its interaction with people and a broader social context, we will not find many people-related issues. We must investigate the product in interaction with people or the larger social context to be able to anticipate the moral impact.

Mediation analysis provides an overview of aspects of the product-in-design that are related to individual people. With mediation analysis, we can investigate what the moral implications of a product-in-design and its mediations are; these moral implications are twofold. On the one hand, moral implications concern implications that have a moral load; meaning implications we consider to be morally good or bad, to various extents. A moral implication can for instance be new behaviour (or changed behaviour) that is considered to be morally good. Take for example Questionmark, an application for smartphones that provides users with information about supermarket products, concerning sustainability, animal welfare, human rights, and public health (Questionmark, 2015). This information can stimulate users to make more well-considered choices when grocery shopping. Such incidental acts can become regular behaviour; in this case, the behaviour of always buying the more sustainable choice.

On the other hand, moral implications concern implications for our morality; that is, our moral beliefs, norms, and values. Artefacts can influence our moral ideas. Again, let us take Questionmark as an example. Because it informs its users about the sustainability of their shopping choices, it makes the users more aware of the value of sustainability. And thus it is likely that users will adopt this moral inscription for themselves and start to value sustainability more.

The mediation of our morality is not always obvious or easy to identify. In the example of the application Questionmark, we see that the value of sustainability is mediated because this is literally what the app is about. But for other products it is less obvious what values are at stake and how they are mediated. We can identify such mediations by thorough mediation analysis. However, technomoral scenarios can be of great help in identifying how a product-in-design mediates our morality. The mediation layer informs the technomoral change layer, which in turn informs the mediation layer (Illustration 16). Through mediation analysis, we can find that a product-in-design mediates the moral ideas of individuals; artefacts can mediate what values we hold, how we define them, and how important we consider them to be. These

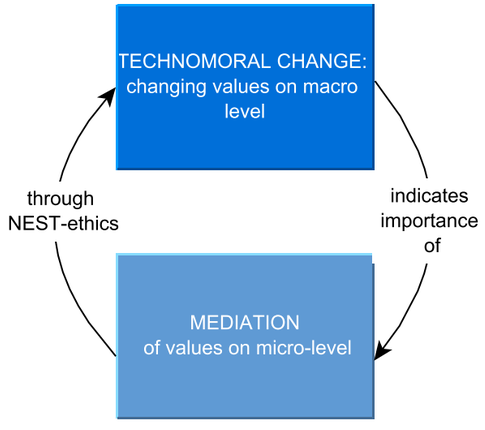


Illustration 16: Mediation and Technomoral Change Mutually Inform Each Other

insights in changing values and morality on micro-level can be utilised to build technomoral scenarios and thus gain insights in changing values on the macro-level. Through NEST-ethics, we construct a controversy where proponents and opponents of the product-in-design bring forward ethical arguments and counter-arguments. We can thus use the insights on changing morality on the micro-level as the content of the NEST-ethics pattern.

On the other hand, insights on technomoral change on the macro-level can inform mediation analysis. From technomoral scenarios we gain insights in what potential technomoral changes may occur on the macro-level. We thus see how collectively held norms and values can change. A changing value on macro-level is an indication that this value deserves special attention on the mediation layer: how is this value meditated? What changes take place on the micro-level? On the other hand, the stability of certain norms an values on the macro-level can indicate constraints for changes on the micro-level. Through sketching the socio-technical landscape and building the scenario, we can find that certain values are robust and thus unlikely to change rapidly. This indicates that on the micro-level, such values are unlikely to change radically; but will change minimally. As such, insights on potential technomoral change help us to pinpoint and further investigate the mediation of morality.

All in all, in order to anticipate the moral impact of the product-in-design, we need to investigate not only the design features, but also the mediations and the potential technomoral change. Thus, we need to go through all the steps of the MIAT to anticipate moral impact. We have "built up" or analysis towards anticipating technomoral change. Now we must "go down" and to investigate how we can use these insights gained in actual design practise (Illustration 17). And we must readjust our conception of the moral impact on a certain level if we find influences from another level. For instance, we may find after anticipating the moral impact on the macro-level that a certain mediation in fact has implications for morality, that we initially did not discover.

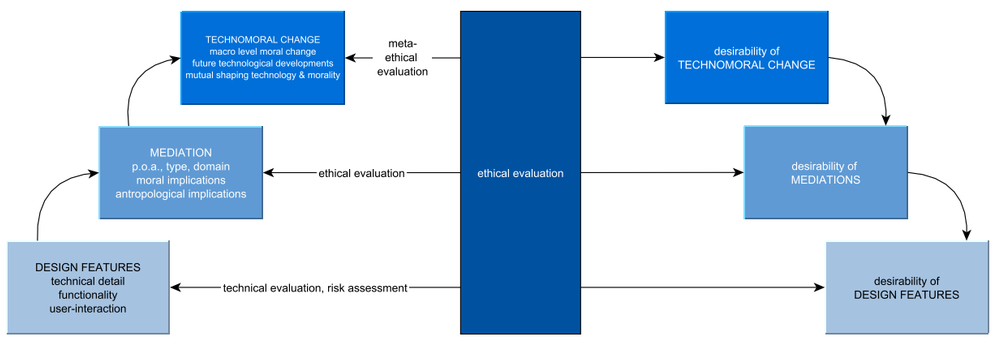


Illustration 17: Overview of Insights from MIAT and their Relations

Feedback Into Design

In this thesis so far, I have discussed how to anticipate the moral impact of the product-in-design. But what do we do with insights on moral impact? The whole reason we have been gathering knowledge about mediation and potential technomoral changes is so that, eventually, we can *steer* moral impact. We want to anticipate potential consequences of a new product, while we still can do something to prevent or change them; therefore we anticipate how a product will mediate morality and what technomoral changes will accompany it, while we are still in the phase of designing the product. So we have come to the point where we have created an overview of how the product-in-design will mediate morality on the micro-level, and what technomoral change may occur on the macro-level. We need to use these insights to improve

our product-in-design. That entails that we must judge which mediations we want our product to have; in other words, which mediations are desirable, and which are undesirable? The same holds for the technomoral changes we anticipated. We must judge which technomoral changes are desirable so as to adapt our product-in-design to steer towards those desirable technomoral changes.

Judging whether things are desirable entails that we are doing ethics: we are reflecting on whether we consider them to be morally good or morally wrong, or something in between. When we have decided what we consider to be desirable mediations and technomoral changes, we must somehow use these judgements as feedback into our design process, and adapt our product-in-design. In the next section, I will focus on the step of using the judgements as feedback for design. I choose not to go into detail on *how* to make these judgements, i.e. on how to do ethics. The field of ethical theory (i.e. theories on how to determine the moral load of something) is extremely broad. There are numerous ethical theories, that all differ from each other; from the most basic principles to minute details. Unfortunately, in the entire history of philosophy and ethics there has not yet been a consensus among scholars on which ethical theory is correct, or the best. Therefore, I do not want to prescribe a certain ethical theory.

But more importantly, the goal for this thesis has been to develop a research tool, to *investigate* how morality is affected by new products, rather than to make *judgements* from a moral standpoint about products-in-design. My focus is on analysing and researching without inherent judgements; throughout this thesis I have been dealing with morality in a descriptive, rather than normative sense. I have strived towards unbiased investigation, rather than towards making normative claims. Therefore, I do not want to connect the Moral Impact Anticipation Tool to an ethical theory. I leave room open for each individual designer, philosopher, researcher or other person using the Moral Impact Anticipation Tool to use the ethical theory that he or she prefers.

Technomoral Change

Through building technomoral scenarios, we gain insights into the potential technomoral changes around the product-in-design. Through meta-ethical evaluation we may find that some of these potential changes are more desirable than others. And even if we do not deliberately evaluate potential technomoral changes, we usually have a moral intuition that tells us whether such changes would be desirable. However, if we judge future morals from our current moral viewpoints, we have fallen prone to *moral presentism*: the idea that our current morals are superior to any future morals. This goes against the whole idea of technomoral change: namely that morality changes, our moral beliefs change, and that morality in a certain era is not "better" or "more true" than morality in another era. It is simply different; but equally valid. However, idly sitting by and letting morality change in whatever direction is immoral too; leaving us with the paradox between moral presentism and moral futurism. Furthermore, we must not forget we are dealing with a lot of uncertainty as well; we cannot know what technomoral changes will happen. How should we, as designers or researchers of products-in-design, deal with this paradoxical and uncertain situation?

Boenink et al. discuss that technomoral scenarios enhance the *reflexive character* of ethical debate and decision-making (Boenink et al., 2010, p. 33). Technomoral scenarios show us that morality can change; they thus show us that we cannot blindly rely on our current moral beliefs to judge potential future changes. Technomoral scenarios require meta-ethical evaluation; after all, we are ethically evaluating changes in morality. Seeing changes in our own morality distances us from our own moral ideas. It forces us to look at our beliefs, rather than looking at the world *through* our beliefs. We thus reflect on our own morality in a distanced manner; hence

Boenink et al. call this phenomenon *reflexive distance* (Boenink et al., 2010, p. 34). Reflexive distance enables ethical evaluation from a perspective less determined by our own morality. Therefore, we move away from moral presentism; the idea that our current morals are superior to any future morals. After all, we judge in which direction we want moral change to happen; thus negating the idea that our current morality is not allowed to change in any way because it is superior to any other possible morality. through our reflexive distance we can avoid moral futurism as well; the laissez-faire attitude of letting morality change in whatever direction. We avoid moral futurism, because we are not idly sitting by. We are anticipating future technomoral change so that we can intervene and steer technomoral change. So, building technomoral scenarios familiarizes one with the phenomenon of technomoral change, which creates an ethical mindset of reflexive distance; thereby avoiding both moral presentism and moral futurism.

Building technomoral scenarios improves our ethical mindset, but how can investigating and speculating about technomoral change improve our design practices? First of all, I want to stress the importance of being aware of the phenomenon of technomoral change, for designers. By following my method, designers become aware that technomoral change can occur, and that their product can be the instigator of technomoral change. This awareness is in itself an important asset for designers. Considering the potential technomoral change that may accompany a product-in-design must become part of the design mindset. It makes designers more sensitive to the long-term consequences of their product-in-design, on an abstract societal level. But it also creates a better sensitivity to the here-and-now social context of a product-in-design. It helps designers to see their products as a social configuration, rather than a merely physical configuration. Regarding the product-in-design as a social configuration yields more consideration for the social aspects of a product-in-design; what does a product-in-design do to people and their relationships? As such, awareness of technomoral change eventually helps to sharpen our view on mediations and make us more sensitive to seeing how artefacts mediate social relationships.

By building technomoral scenarios, designers gain the knowledge *that* technomoral change may occur, as well as *what* technomoral changes might happen. The designer thus has knowledge that the rest of society does not have yet; after all, the product is still being designed. But the designer knows that technomoral change is a phenomenon that concerns everyone in society. And since the designer is the only one to know about it yet, he has the responsibility to involve the rest of society.

The individual designer then has the responsibility of making the first step(s) to involve society; simply by firstly involving other individuals. By urging a sense of responsibility to these involved individuals, they can spread the involvement further. And so on. In this sense, a societal awareness can be created about the technomoral change that can accompany a new product. This awareness should imply that we shape and steer technomoral change.

Designers should involve society, as to "prepare" society for the new product and the changes it may bring along. However, designers can of course change their products as well. If the technomoral scenarios show technomoral changes that, from our current moral perspective, intuitively feel morally wrong, the designer may start to doubt whether this product-in-design should even be introduced into society. Unfortunately it is impossible to deduce the desirability of the product (or certain design features) directly from an anticipated technomoral change. How a product leads to technomoral change is neither straightforward (because other factors have an influence as well), nor certain (because we cannot know the future). There is no direct causal relation between a product and a certain technomoral change. Thus we also cannot directly "track back" from the anticipated technomoral change to the product. The relation between the product and technomoral change is never direct. What then, to do with our insights in potential technomoral change?

Mediation

The insight *that* technomoral change can occur is of paramount importance here, because it makes the designer responsible for the involvement of society. Insights in *what* technomoral changes may occur can however, though indirectly, be fed back into the design process. We can connect moral change on the macro-level, for instance a changing value (e.g. how we interpret a value, how important it is) to the mediation of values on the micro-level. This connection is not direct, in the sense of "macro value change A always corresponds to micro value mediation X". This connection is merely an indication that the mediations of these values deserve extra attention. Thus if we find through building a technomoral scenario that certain values change, we should regard this as an incentive to investigate these values on micro-level; how does the product-in-design mediate these values?

Mediation analysis shows us how a product can mediate values on the individual level. Products can affect what individuals consider to be good, bad, normal and abnormal. However, as I have discussed in this thesis, moral mediation is more complex than that. It is not as if there is some independently existing moral idea in our head and the product is a morally neutral entity, not containing any values in itself, that can somehow affect this independent moral idea. As I have argued in the discussion on Latour's work (page 17), the product itself is value-laden. The product is inscribed with a vision on what is good, bad, or normal. A product is a material definition of a value. Within each mediation, and each design feature, is a vision on what a certain value entails. Remember, for example, the Glass application Social Radar; an app that notifies the user when contacts from online social networks are in proximity in real life. This application does not only prescribes that it is good to be social, it also defines what "being social" means; namely interacting in the offline world with people to whom you are connected in the online world. Designers are thus not only *putting forward* certain values, they also *define* what these values are. And with that, they influence how users and other stakeholders conceptualise these values. It is important that designers realise that by designing products, they are defining values, and morality in general. Only if they realise this, they can reflect on their definition of these values. By investigating what norms and values are inscribed in a product-in-design, and how these are defined, designers can evaluate mediation in a *meta-ethical* way. We investigate the morality incorporated in the product-in-design, and how the product-in-design mediates the morality of individuals. Whether deliberately or unconsciously, we then ethically judge this morality and how it is mediated; thus a meta-ethical evaluation. Designers should ask and answers questions such as "are these the values I want my product to promote? Do I stand by this definition of these values?" Exploring these issues individually can be difficult and yield too narrow results; it is therefore recommended to collaborate in meta-ethical reflection with, for instance, target users, other stakeholders, ethicists, or fellow designers.

How do we use insights into mediation in design practice? The way in which an artefact mediates is based in its functionality, its physical construction, or in short: its design features. Does this mean that we can deduce insights about design features (e.g. about desirability) from insights about mediations? Yes and no. Yes, because we can investigate the relationship between certain design features and certain mediations and find a specific design feature to play a crucial role in a specific mediation. If we want to change this mediation, we can assume that changing this specific design feature will change the mediation; although further tweaking and changing other design features as well may prove to be necessary.

However, no, we cannot deduce insights about design features from insights about mediation. Like the connection between technomoral change and mediations, the connection between mediations and design features is not a straightforward and certain causal relation. Mediation is not determined solely by design features. Humans beings and their actions, as well as the context

in which the artefact is placed, influence the mediation too. That being said, the connection between mediation and design features is more straightforward and more certain than the connection between technomoral change and mediation. If we keep in mind that the connection we found between mediations and design features is never certain, we can use this connection to alter mediations by altering design features. Such an alteration should be regarded as experimental and we must keep an open mind that mediation may turn out differently than expected after all.

Design Features

As discussed above, both technomoral change and mediation are (indirectly) connected to design features. Throughout this thesis I have described a method to gain knowledge: knowledge about the (potential) mediations of a product in design and the potential technomoral change that may emerge from the product-in-design. In this chapter I have been describing what to do with this knowledge; after all, we want to gain this knowledge in order to improve our products-in-design. As designers, we are (mostly) in control over our product-in-design. If we want to steer the mediations of our product-in-design, we must do this though the design of the product. Likewise, as designers the best way to steer technomoral change is through the product. In the previous sections I have explained how technomoral change and mediation are connected to design features. So ultimately, it comes down to doing something with the design features of the product-in-design.

Designing is rarely a process without iteration. Whether deliberately or unconsciously, designers often repeat steps of the process, revise earlier made decisions, and change design features on the basis of new insights. Almost always, before making design decisions, multiple options are explored; ranging in thoroughness from e.g. brainstorming alternative options, to developing several design concepts in detail. Simply and abstractly put, the designer alternates between making decisions and reflecting on these decisions. The same approach should be used when it comes to (re)designing based on insights from the Moral Impact Anticipation Tool. These insights should be used to reflect on design decisions made earlier. As such they can provide input for new design decisions. Importantly, we must keep reflecting on mediation and technomoral change throughout the design process. Say that a designer has found through my method that a certain mediation is undesirable, and he decides to try and change this mediation. He can only investigate whether the mediation has changed by again performing a mediation analysis. As such, my method, and the theories of mediation and technomoral change, must remain part of the design process as one of the criteria on which to base decisions and reflect on decisions.

When using the MIAT, and especially when using the gained knowledge and insights to (re) design the product-in-design and its features, it is important that designers are creative and have a critical attitude. Designing is a creative activity; most people would find this obvious. However, doing research, especially in the field of philosophy of technology, is creative too. Building technomoral scenarios requires various types of imagination, and mediation analysis requires looking beyond the obvious and "thinking outside the box"; both creative activities. Translating the insights from my method to design features too is a creative action, because it is extremely case-specific. There are so many possible ways in which artefacts can mediate, and there are so many possible design features (and combinations of features constituting a product), that it is impossible to know all the possible connections between mediations and design features. And so it becomes impossible to formulate general guidelines, in the form of "mediation A is always morally wrong and it always is connected to design feature X so design feature X should always be avoided, instead use design feature Y." Unfortunately, when dealing with mediation, with morality, with the future and with a creative activity such as designing, we cannot think in

terms of “always” because there is too much uncertainty and too much is depended on context. Whether an individual designer considers a specific mediation to be desirable for his product depends on the product, its design features, the context of use, the intended users, the designer him/herself, the moral beliefs of the designer, the culture the designer grew up in, the mediation and all its implications, and the possible technomoral changes the designer anticipated, and much more. So because it is impossible to provide general guidelines, the designer must be creative and do some hard thinking himself, rather than just applying some pre-made rules.

Furthermore, it is important to have a critical attitude. In my experience, studying anything that relates to morality and ethics, often comes with a lot of moral intuitions. Being critical towards these first intuitions helps to understand why one intuitively feels something is right or wrong. It helps to reflect on, and question, one’s own moral beliefs. Thus it creates an open mind towards moral ideas and the reflexive distance necessary for thinking and evaluating on a meta-ethical level.

Example Redesign of Google Glass

In this section, I will provide two examples of how the insights we have gained through mediation analysis and the building of a technomoral scenario can be used as input for design. First, I will discuss a possible re-design of Google Glass in its entirety, and second, I will discuss the design of a facial recognition application.

Before discussing the new designs, let us first recapitulate some of the insights from mediation analysis and technomoral scenarios; these will form the basis for the new designs. Through mediation analysis, we have found that because of the embodied nature of Glass, Glass literally stands between people. This creates not only a physical barrier between people, but more importantly, a cognitive barrier. The interaction between a Glass user and the device is completely opaque to another person, which creates secrecy around the Glass user. This affects social relationships, especially through subject-related applications: applications for which there is an interaction between Google Glass, the user, and a third person or “subject”, such as photographing and filming, or the application Social Radar. Such applications create inequality in power relations between Glass user and the subject; the Glass user has a great amount of control, over the interaction with Glass and over the subject. The subject however has almost no control and may not even be aware that he is part of the interaction. Furthermore, we found that Glass heavily attracts the users attention to the virtual world. Glass brings the virtual world the the foreground of the user’s experience, leading to an increased interaction and identification with the virtual world over the physical world. In the technomoral scenario, we speculated that controversies about privacy will maintain, and will flare up when new developments around Glass are introduced.

Redesigning Google Glass

Based on the insights described above, I propose three main goals for the redesign of Glass. First, the new Glass should diminish the division between the physical world and the virtual world. Second, the interaction between Glass and the user should be more transparent. The third goal is closely related to the second; the new Glass should make it more difficult to violate other people’s privacy, so that it will not be (perceived as) the big threat to privacy it is now.

I propose to re-design Glass as follows. Rather than using a tiny prism that projects light into the user’s eye, the new Glass uses a transparent screen, that covers one eye (Illustration 18). This means that everything that the Glass users sees on the screen, is also visible from the outside. When Glass is not used, the screen is completely transparent and Glass appears to be a

Illustration 18: Re-design of Glass
(PNGimg, 2015) (Feelgrafix, 2015). Image editing by Laura Claas.

regular pair of glasses.

The new Glass will enable the following mediations. When the user is interacting with the virtual world, this becomes visible in the physical world as well; therefore, an interaction with the virtual world becomes an interaction with the physical world. The division between physical and virtual world that Google Glass (and other artefacts such as smartphones, laptops, etc.) created, is made much smaller. This can have a twofold effect. First, Glass users will diminish their interactions with the virtual world, because they want to keep things private. Second, when users are interacting with the virtual world, this is shared with others in the physical world. Thus, the value of openness or transparency is stimulated, rather than secrecy. This can improve the way Glass users are regarded by non-users, and provide new opportunities for social interactions. Furthermore, it emancipates a non-user to take control over the interaction between himself and a Glass user. The current design of Glass does not clearly show when there is an interaction between Glass and its user; thus a Glass user can use Glass unnoticeably whilst having an interaction with another person. His attention should be with the other person, but is in fact with Glass. Through the increased transparency, the non-user becomes aware of the lack of attention given to him and can call the user to account.

Lastly, the new Glass forms a significantly smaller threat to privacy. Glass users are now forced towards the other side of the privacy issues. Before, they were always the ones infringing on the privacy of others. Now, because the screen shows something that is personal to them, Glass users become the ones that give up part of their privacy as well. They are at least confronted with an explicit choice to give up their privacy or not. This means that now, there is a fair trade-off. If a Glass user would want to, for instance, secretly film someone else he would simultaneously expose himself, because Glass shows to the world that he is filming. In this mediation, privacy becomes a matter of personal identity as well. The Glass user is forced to reflect on what parts of his personal self he is willing to show to the world.

Potential Implications

We can wonder how the re-designed Glass will mediate our attention. Rather than a small screen hovering in the upper right corner of the users field of vision, Glass now present the user with a “layer” of information placed over his experience of the physical world, that is either

completely off, or unavoidably present. When the new Glass is inactive, it is likely that is is far less distracting; there is nothing hovering in the users field of vision. However, when the re-designed Glass is active it might be equally or even more distracting, since the "screen" is much more saliently present.

Redesigning an Application for Facial Recognition

In my scenario (page 67) I described a fictional application for Google Glass called Face-app, which combines facial recognition with social media. I said that the developers of this app deliberately designed it to stimulate social interaction, rather than an anti-social ("creepy" or "stalker-like") behaviour. So, what would the design features of such an application be?

The goals for the Face-app application are the following. First, to stimulate users to form new social relations. Second, to provide a non-intrusive support to social interactions. Non-intrusive means that the applications does not demand the users attention in a way that disrupts the social interaction. Third, the application must intrude other people's privacy as little as possible.

I would propose the following features for Face-app. First, it is only possible to access information after a face has been "scanned" for more than one minute; a mere photograph is not enough. However, the app allows for natural behaviour so the user does not need to stare straight at someone for a long time. Second, the image of the face needs to be above a certain size, which corresponds to the person to whom the face belongs being within two meters distance from the Glass user. Third, information that is accessed online is given sparingly. The first information given is the subject's name. Each subsequent minute, a small new piece of information is provided. This information is taken from social media profiles. Fourth, after the face has been scanned for five minutes, information is provided on which social media platforms are used by the subject. This also enables the user to directly send a friend request (or the equivalent of that) to the other. Fifth, non of the information that is accesses by Face-app, nor the footage of the other's face, is stored; neither on Glass itself, not on an external server.

These design features, especially duration of the "scan" and the close distance, make Face-app unusable for situation where the Glass user is observing the subject without the subject knowing. The long intervals between new pieces of information stimulate the user to engage in conversation with the subject, thus stimulating the forming of new social relations. Forming of new online social relations is stimulated by enabling an easy way to connect on social media.

Note that *privacy* is defined in a specific way within this application. The application does access information that the subject may not have disclosed during the specific interaction with the Glass user. However, the only information that is accessed, is information that the subject himself has disclosed on social media. Thus the (moral) standpoint advocated by the designer, and inscribed into the artefact, is that privacy is not violated, because the subject already disclosed this information about himself.

Potential Implications

Quite obviously, a facial recognition such as Face-app will have implications for social interactions, the the way we form social relationships. But if facial recognition becomes accepted in society, it can also have implications for our personal identity, and especially the way we profile ourselves or are being profiled by technology. Face-app takes information from social media. These two technologies (face-app and social media platforms) thus present an image of someone that is by necessity only is a tiny fragment of someone's real personality. We can question whether we find that desirable. But social media in its current form is already only a limited representation of ourselves. We, as users of social media, maintain and stimulate that limited image. We only post things on Facebook that fit into our own image of who we want to be; we actively construct a limited image of ourselves. An app such as Face-app can enhance this image construction, and make the image even more limited.

Face-app can enrich our social relations, because users can make new contacts more easily. But there is a danger that Face-app actually impoverishes our social relations. Imagine the following situation. You are at a birthday party where you only know the person throwing the party. The other people you have either never met, of perhaps vaguely recognize. You are in a group conversation about a generic subject. Using Face-app, you try to gain some more personal information about your conversation partners, to find a starting point for a get-to-know-you conversation. With person A, you seem to have nothing in common. Person B however has the same hobby as you do. Who would you approach first?

Chances are high that you will choose the person with whom you have something in common. Humans often have the tendency to stick to familiar things. In interaction with technologies, this tendency can be further and further enlarged. Personalisation filters are filters that personalise for instance Google search results or a Facebook timeline, based on past behaviour on that medium. For example, if you never "like" something a particular friend posts, eventually his posts will not show up in your Facebook timeline anymore. Very simply put, personalisation filters make sure we only see what we already were interested in. We can end up in what Eli Pariser has called "filter bubbles"; our own, ever narrowing worlds where only information tailored to ourselves is available.

> *"Left up to their own devices, personalisation filters serve up a kind of invisible autopropaganda, indoctrinating us with our own ideas, amplifying our desire for things that are familiar and leaving us oblivious to the dangers lurking in the dark territory of the unknown."* (Pariser, 2011, p. 15).

Facial recognition applications can create such a filter bubble effect in our physical-world social relationships. of course, even without technology we often make new contacts with people with whom we have something in common. But we also go to parties full of strangers and interact with people with completely different ideas and lifestyles than ourselves. There is a danger in facial recognition apps, and other technologies that mediate our social lives, that they will impoverish our social relations because they stimulate interactions with people who are very much like ourselves.

In Conclusion

In this chapter I have demonstrated how the anticipated moral impact of products-in-design can inform design practice. I have discussed that insights on technomoral change (i.e. macro-level moral impact) can inform mediation analysis, and the micro-level anticipation of moral impact. Mediation analysis then in turn informs design decisions on design features. So the anticipated moral impacts on the macro-level indirectly inform design practice, via the layer of mediation, while anticipated moral impact on the micro-level can directly be connected to design features. However, it must be noted that these connections between design features and moral impact always contain an element of uncertainty and contingency that cannot be overcome.

Conclusion

In this thesis I have provided my answer to the question

> *How can mediation theory and the technomoral scenario method jointly contribute to the anticipation of the moral impact of products-in-design?*

In this concluding chapter I will shortly recapitulate how the research question was answered. I will discuss how the three sub-questions were answered, after which I will discuss how the general research question was answered.

Moral Impact on Micro-Level

In chapter two, I answered the question

> *How can designers analyse and understand the moral impact of their product-in-design on the micro-level?*

I discussed mediation theory as a manner of understanding the role that artefacts play in the lives of users and other stakeholders. Mediation theory poses that artefacts are no neutral objects, but *mediators* that actively contribute to the way in which ends are realised. We can distinguish two main ways in which artefacts can mediate with relation to morality. First, artefacts mediate actions with a moral load (i.e. that are morally good or bad). Norms and values are inscribed into the artefact, which prescribes these to the user; thus artefacts are normative and can prescribe morally loaded actions to users. Artefacts can also mediate actions with a moral load with complete disregard to their inscribed morality. Second, artefacts mediate morality itself; since artefacts are normative they can have an influence on moral beliefs. Artefacts can also indirectly mediate our moral beliefs through the interactions between the artefact and other people.

Mediation theory is limited, because it is only equipped to deal with the micro-level; it lacks a systematic method to anticipate what moral impact a product-in-design will have in the long-term future and on the societal macro-level.

Moral Impact on Macro-level

In chapter three, I answered the question

> *How can designers explore the moral impact of their product-in-design on the macro-level?*

I discussed the technomoral scenario method as a way to anticipate long-term macro-level

moral impact of products-in-design. The method entails building scenarios to anticipate the technomoral change (i.e. the co-evolution of technological developments and changes in morality) that can result from the introduction of a new artefact or technology. Scenarios are built by constructing a moral controversy around the technology, and constructing plausible resolutions to them.

There are two main limitations to the technomoral scenario method for the context of design. First, the method treats technology as a *black box*, while designers regard a product-in-design as a *collection of design features*. Second, because technology is treated at an abstract level, a large *scope of possible futures* is left open; the future is so contingent that investigating the relations between possible futures and design features becomes practically impossible.

Moral Impact Anticipation Tool

In chapter four, I answered the question

> *How can the anticipation of moral impact on the micro- and macro-level be integrated?*

I proposed a new method, which I call the Moral Impact Anticipation Tool, for building technomoral scenarios that is tailored to the purpose of anticipating the moral impact of products-in-design. Mediation theory contributes to the building of technomoral scenarios. It provides insights in the moral load of mediated actions. Mediation analysis provides insights how individually held morality of users and stakeholders is affected, which can form the basis for generating the arguments of the two opposing parties in the controversy. The MIAT includes five steps: the description of the product-in-design and its intended context of use; a mediation analysis; describing the technomoral landscape of the product-in-design; generating controversy using the NEST-ethics framework; and constructing closure to the controversy.

Informing Design Practice

In chapter five, I answered the question

> *How can the anticipated moral impact of products-in-design inform design practices?*

I discussed that design features, mediations and technomoral change all form aspects of the same product-in-design. Design features inform mediation analysis, which informs the building of technomoral scenarios. The resulting insights on technomoral change again inform the anticipation of moral impact on the micro-level. I explained that moral implications do not have a straightforward relation with design features. In order to use the insights on moral impact as feedback into the design process, we must investigate the indirect connections between macro-level impact and micro-level impact (and with that, between technomoral change and mediation), and again between micro-level impact and concrete design features. Furthermore, I argued that the MIAT provides designers with a mindset of reflexive distance and regarding products as social configurations, both of which are beneficial for (re)designing products with a sensitivity to their moral impact.

Anticipating Moral Impact of Products-In-Design

The overall question that has guided this thesis is

> *How can mediation theory and the technomoral scenario method jointly contribute to the anticipation of moral impact of products-in-design?*

I this thesis, I have shown that mediation theory operates on the micro-level; it concerns individuals and individually held morality. I have shown that the technomoral scenario method is concerned with the macro-level of society at large and collective morality. I have demonstrated that the anticipation of the moral impact of a product-in-design needs to concern both the micro-and the macro-level in order to provide a complete overview of the full moral impact. I have shown how the anticipation of moral impact on both levels can be integrated by developing the Moral Impact Anticipation Tool. The MIAT uses mediation analysis to anticipate the moral impact of a product-in-design on the micro-level. The insights from this analysis are used to inform the building of technomoral scenarios, with which the macro-level moral impact of products-in-design is anticipated.

MIAT & Normativity

In the introduction, I discussed Value Sensitive Design as an example of a normative way of doing ethics, and described my own aim to practice ethics in a descriptive manner. Value Sensitive Design is highly normative, and it assumes morality to be static. The implication of these two characteristics is that VSD is optimistic about the possibility to control technology, and how technology relates to values.

The Moral Impact Anticipation Tool is a way to create an informed basis for normative judgement. Rather than being thrown into the deep of ethical reflection, normativity, and making judgements, designers can first understand how morality is affected by the artefacts they create. MIAT is in the first place a research tool to study morality as a (dynamic) phenomenon, rather than to make normative judgements. MIAT is realistic in acknowledging that full control over technology, morality and future developments is not possible, while still urging humans to use the amount of control that they have over new artefacts and technologies in an informed and responsible manner. MIAT teaches us to look *at* our morality and the way it relates to technology, rather than judging technology *from* our morality. This means we can learn to take a position of reflexive distance, improving the quality of our eventual moral judgement of technology.

Recommendations for Future Research

A next step in the development of the Moral Impact Anticipation Tool is to further research how the MIAT relates to existing design practices. Such research would take a more practical and experimental form. Of interest is the interaction between MIAT as a research tool and existing design processes. In what type of process is MIAT most fruitful? What can MIAT contribute at different stages of the design process? How does MIAT influence other steps and stages of the design process?

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Appendix A

NEST-Ethics Overview

Type of arguments (and ethical subject)	Type(s) of arguments put forward by technology proponents	Counterarguments by technology opponents
1. Consequentialist Arguments (consequences)	1.a.1 putting forward promises (positive consequences)	1.b.1 contestation of promises based on plausibility
		1.b.2 contestation based on ratio of benefits and (non-financial) costs
		1.b.3 questioning possibility or existence of a better alternative
		1.b.4 questioning if argued benefits are really benefits

Type of arguments (and ethical subject)	Type(s) of arguments put forward by technology proponents	Counterarguments by technology opponents
2. Deontological Arguments (rights, duties)	2.a proponents (implicitly) appeal to certain principles (e.g. rights or duties)	2.b.1 contestation of principle: principle is wrong
	2.a.1 stakeholders have a positive claim / right to the technology	2.b.2 acknowledge principle, but argue it does not apply in this case
	2.a.2 stakeholders have a negative right to the technology (it's allowed because it does not harm others)	2.b.3 acknowledge principle, but interpret and apply in opposed manner
		2.b.4 acknowledge principle, but argue it's subordinate to another principle

Type of arguments (and ethical subject)	Arguments in favour of the criterion	Arguments against the criterion
Justice Arguments (what criterion is acceptable for distribution of advantages?)		
3.1 equality	3.1.a trickle down effect ensures technology will benefit all eventually	3.1.b trickle down needs political help
3.2 merit		
3.3 need	3.3.a trickle down effect ensures technology will benefit those in need eventually; if absolute welfare increases, the absolute position of those in most need improves	3.3.b trickle down needs political help; if not the divide between those best off and those worst off will increase (relative welfare of those worst of diminishes)
3.4 chance		

Type of arguments (and ethical subject)	Arguments in favour of the criterion	Arguments against the criterion
Justice Arguments (what criterion is acceptable for distribution of disadvantages?)		
3.5 equality	3.5.a disadvantages should be shared equally by all members of society	3.5.b equal distribution of disadvantages is unfair; another criterion should be applied
3.6 merit	3.6.a justice as desert: disadvantages of the technology should be carried by those who deserve it (e.g. commercial companies deserve to pay costs of technology development, consumers who buy a product deserve to carry a risk)	3.6.b the criterion of justice as desert is unfair; establishing desert is near-impossible. Carrying costs and risks should be limited to as few individuals/ agencies as possible. (or a different criterion of fair distribution should be applied).
3.7 need	3.7.a those in need should be spared from carrying costs and risks; it is fair that those in society who are better off carry more costs and risks.	3.7.b the criterion of need cannot be applied to disadvantages and is thus invalid, and unfair.
3.8 chance	3.8.a it is unavoidable that some individuals will be subjected to costs or risks by chance	3.8.b it is unacceptable that individuals are subjected to disadvantages by chance; we must do everything in out power to prevent distribution by chance.

Type of arguments (and ethical subject)	type(s) of arguments put forward by technology proponents	Counterarguments by technology opponents
Good Life Arguments	4.a.1 humankind should always strive forward and transgress frontiers	4.b obeisance to pregiven limits
		4.b.1 religious limits: do not play god
		4.b.2 natural limits: do not create monsters
		4.b.3 antropological limits: complete mastery over the environment dehumanises us
		4.b.4 ontological differences: do not solve a social problem by technological means
		4.b.5 cognitive limits: do not unleash powers we are unable to control
	4.a.2 proponents are likely not to counter-argue, but to relocate the discussion from the public to the private sphere	

Meta-ethical Viewpoints and Arguments

Meta-ethical issue	Proponents' arguments	Opponents' arguments
1. Technological determinism vs social construction	1.a proponents appeal to determinist views, (rhetorically) diminishing human agency	1.b voluntairists counter: technology is influenced by social forces, it can be steered
	1.a.1 the course of technological development is preordained by an internal logic	
	1.a.2 international competition forces technological developmen	

Meta-ethical issue	Proponents' arguments	Opponents' arguments
2. Optimism vs pessimism	2.a optimists: technology is the solution to our problems	2.a pessimists: technology is the cause of our problems

Meta-ethical issue	Proponents' arguments	Opponents' arguments
3. Dual way of drawing on past experiences	3.a past experiences are used to give credibility to arguments in favour of NEST: general arguments in favour of technology (e.g. technology has helped humankind to progress)	3.b past experiences are used to warn and argue for precaution: general arguments cautioning against technology (e.g. technologies always had unintended side-effects)
→ Specific pattern arising from these meta-ethical views	3.a.1 recognition and announcement of a novel technological option and its promise	3.b.1 newness is stressed to demonstrate uncertainty and ignorance of the (possible) effects of the technology
	3.a.2 argument from precedent: the new technology is presented as nothing unusual (i.e. rhetorical move from "revolutionary" to "ordinary"). Future developments are legitimised in terms of criteria from past and present (i.e. in the past this was acceptable, this technology is the same, thus it is acceptable)	3.b.2 argument from consequent: the past and present is de-legitimised by applying criteria derived from a desirable future (i.e. if we want this desirable future, then now we should / shouldn't do this

Meta-ethical issue	Proponents' arguments	Opponents' arguments
4. Moral Change (moral futurism vs moral presentism)	4.a. Proponents likely think from moral futurism	4.b Opponents likely think from moral presentism, and appeal to moral corruption
	4.a.1 argument from precedent (see above): the new technology is similair to accepted technologies, thus there are no ethical issues	4.b.1 the new technology is immoral as it is
	4.a.2 habituation argument: technologically induced moral change is inevitable, morality will be reconsidered when people are used to the technology.	4.b.2 slippery slope argument: stresses temporal dimension of moral corruption. argues that the technology will inevitably invoke further technological steps that will result in applications that are (very) immoral.
		4.b.3 colonisation argument: stresses spatial dimension of moral corruption. argues that development must be stopped before it can spread and used for wrong goals ("fall into the wrong hands").
		→ moral corruption arguments usually lead to proposals for moratoriums or self- and other-containment