MASTER THESIS

TECHNOLOGY APPROPRIATION REVISITED

MEDIATION THEORY AS A NEW PHILOSOPHY OF TECHNOLOGY FOR INFORMATION SYSTEMS RESEARCH

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Management Summary

The goal of this study is to understand the use of information technology such as smartphones or social media. Users of either Apple or Android phones often feel the brand as part of their identity. They are Apple-users, or Android-users. With social media users are often in debate on what to share with whom. Questions revolve around whether or not to share party pictures with colleagues or being 'friends' online at all with these colleagues.

There are different ways to review the use of such technologies. Within Information Systems (IS) research, there are three main lines of thought:

1) User acceptance theory: the central question is predicting how likely a certain type of user is to accept a certain type of technology. This is achieved by focusing on the user's opinions of the technology. A young person that views mobile internet access as useful and easy to use is more likely to accept the smartphone technology than an older person who does not see the added value and focuses on the difficulty of using a smartphone.

2) Technology appropriation models: in use of a technology, its meaning is transformed by the user. Someone unfamiliar with smartphones may not see its difference from an 'old' cell phone. However, for an experienced smartphone user, the smartphone presents a world of possibilities.

3) Structurational model: technology is both the product and the medium of human action. In appropriation, users attribute a specific meaning to the technology, as described above. However, that technology also mediates human action by facilitating and constraining the performance of certain actions. Mobile internet access provides numerous chat and instant messaging services and thus new ways to contact other people. Because of these services, making a 'traditional' phone call may seem off, let alone to send an expensive SMS.

This study proposes a new philosophy to conceptualize the use of technology: mediation theory. In a classical approach, technology is conceived as a neutral instrument. Someone wants to contact a friend, and uses his cell phone as a means to his pre-defined ends. However, an instrumental view does not help to understand the influence of the smartphone as opposed to a regular cell phone. But on the other hand, opening the door to 'influence of technology' leads to a deterministic view in which technology is a big system controlling our lives. Such a view leaves no room for assessing the many different uses of technology.

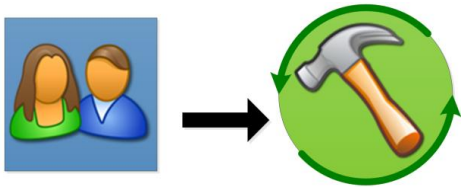
Instead of viewing technology as either a neutral instrument or as a deterministic system, technology can be conceived as a medium. In the use of technology, certain aspects of our perceptions and actions are amplified and reduced. Binoculars amplify what the user looks at, but reduce the scope of vision. A hammer amplifies the force exerted on a nail, but reduces precision. The technology influences how a user relates to the world by mediating perception and action. A smartphone thus constitutes a very specific form of communication.

Appropriation changes not only the meaning attributed to technology, but also the way in which technology mediates perception and action. As a user appropriates the smartphone, the smartphone will mediate his view of communication different from before he knew the possibilities of a smartphone.

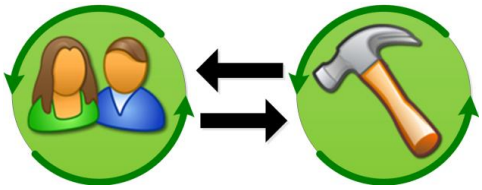
The three different approaches from Information Systems all have hidden assumptions in how they address the use of technology. These hidden assumptions concern the presupposed human-technology relation on which the theories base their analysis. Using philosophy of technology, it is possible to make explicit and analyze the assumptions concerning the human-technology relation. There are three basic conceptions of the human-technology relation, corresponding to the three types of IS theory:

1) In user acceptance theory, the user and technology are predefined and separate entities. The view of technology is instrumental, and interaction has the character of internalization at best. In IS terminology, this means that the user and the technology are two independent variables, the only dependent variable being 'acceptance'.

2) In technology appropriation, the user is defined first and independent of technology. The technology is then defined in relation to this user. This presents a phenomenological view of technology, in which the user constitutes the technology. In IS terminology, this means that technology is the dependent variable, and the user is the independent variable.



3) In the structurational model and in mediation theory, both the user and technology are defined in relation to one another. The user attributes meaning to the technology in appropriating it. Thus the technology is constituted by the user. Additionally, the technology mediates the user's perception and actions. This means that the user is co-constituted by the technology. In IS terminology, both the user and the technology are dependent variables, both dependent on each other.



This study uses philosophy of technology to analyze the human-technology relations presupposed by IS theories. These three interpretations of the human-technology relation also provide three interpretations of the concept appropriation. The applicability of these interpretations is validated empirically using the iVitality case study. This closes the loop on what could be called a meta-analysis of the conception of technology in Information Systems theory.

The concept of appropriation is used to bridge the two domains of Information Systems and Philosophy of Technology. Both domains can benefit from this relation, which can be explicated as Philosophy of Information Systems.

Acknowledgement

In the past few months I have appropriated doing research on the concept appropriation. The theory of mediation tells me that in the mindset of doing research, I will start so see things as I want them to be. The research on appropriation mediates my perception, so that I will find things to call appropriation. In addition, I developed an understanding of appropriation that made matters even worse. As I appropriate researching appropriation, the mediating effects of doing research become stronger. At the university we appropriate the appropriation of skills and knowledge, theories and concepts, methods and research frameworks. And we then use these theories to appropriate aspects of the world around us. At the institute of appropriation, we appropriate the appropriation of appropriation.

And for this I am thankful.

I wish to thank everyone who helped me in this process of appropriation. First of all the company Rotterdam Community Solutions, which supported this study as an internship. And in particular Marc Rijnveld and Aad Nales, who helped me relate the theoretical constructs back to the everyday practice of IT business. I also wish to thank the people at the Leiden University Medical Center for allowing me to hitch a ride on the iVitality project. Here Simon Mooijaart and Liselotte Wijsman helped me set up and execute the empirical research. Above all I thank all the participants who I have interviewed and who used iVitality for this research.

Special thanks also go out to my two supervisors at the university, without whom this would not have been possible. I thank Klaas Sikkel and Peter-Paul Verbeek for allowing me to undertake this expedition and shaping the academic context within which I could finish my master in such an exciting way. As they both represent two different departments, feedback on my work was characterized by two very different perspectives. Together they made sure that what I claim to be a bridge between their departments of Information Systems and Philosophy of Technology has an equally solid foundation in both domains.

My friends, fellow IT students and the philosophy students all supported me throughout this process. Either by letting me go on about a subject in which they were not really interested, or by welcoming new ideas that they are themselves not familiar with. My parents have supported me in three different studies at two universities, and in the final months moving from Enschede first to Rotterdam and recently back to Amsterdam.

I have experienced this entire process together with my girlfriend, without whom this would not have been half as much fun. It has been quite a ride, and sharing it has made the low points less blue and the highlights more sunny. For every way in which she helped and supported me, I thank her.

Contents

1 Introduction: the cell phone as part of our identity

How do information technologies impact our society? We talk of technology changing our society since the industrial revolution. This change has shifted gears over the past few decades with the rise of computers and Information and Communication Technologies. And we shifted gears once more with the internet, cell phones and social media. How can we understand the role of these technologies in the changes that we have witnessed the last years? This question, when placed in the business context, is one *raison d'être* for my own Master programme, *Business Information Technology*. The goal is to explore the impact of information technology on businesses, for example in e-businesses such as Amazon or Facebook.

To understand the use of technology, I first turn to Information Systems (IS) research. However, these provide quite different interpretations of technology use. How these different interpretations can be related to one another is unclear. For this, philosophy of technology is drawn upon for a more thorough understanding of technology use. This is provided in terms of mediation theory. The philosophical substantiation of mediation theory provides the necessary tools to reassess IS theories. A theoretical framework is developed that explicates which interpretation of the human-technology relation is presupposed in IS theories. This theoretical framework is validated empirically using the iVitality case study, a research platform and e-health application.

To get a better feeling of the problems this study tries to understand, let's first take the example of our cell phones, on which we have come to rely every day and everywhere we go. We rely on being able to always call anyone, anywhere and anytime. We also rely on being reach*able* every moment; being unable to answer a call is considered a strange thing. With smartphones our expectation to have mobile internet access can be added to this. Carroll et al. (2001, p.5) even point to mobile phones being an important aspect of young people's identity, quoting two participants: "*I feel kind of naked without my phone*" and "*It [the mobile phone] gives you an identity: this is who I am, this is* ***my*** *number*". In the domain of smartphones, Apple has become such a strong brand that people were standing in line for hours to visit the new Apple store in Amsterdam when it opened in March of 2012 as the first official Apple store in the Netherlands (iPhoneclub website). Everyone who knows Apple also knows of the many lawsuits between different smartphone companies, of which Apple vs Samsung is probably the most notorious (Wikipedia Apple vs Samsung). More on the 'dark side' of this technology are the scandals related to Foxconn, a major supplier of iPhone and iPad components. These scandals include the terrible working conditions, and the related suicides of employees (Wikipedia Foxconn). A more unorthodox use of the cell phone is its use in Improvised Explosive Devices (Wikipedia IED), which are used in terrorist attacks such as the Madrid train bombing (11M) in March of 2004 (Wikipedia 11M). Another questionable aspect of the cell phones we use daily, is the rare minerals in components, mined in East Congo where violations of basic human rights are committed on a daily basis. This has been reported in various documentaries and publications, such as Bloedmobieltjes (Nourhussen, Stok, 2011).

Similar far reaching effects can be seen in the use of social media such as the popular website Facebook. Just about everyone has an online presence as their profile on Facebook. Of course not everyone, but those not on Facebook are at risk of missing out. In my personal environment I have heard on multiple occasions of people missing a social event because they are not 'on Facebook'. As we post just about every personal picture and other personal information on Facebook, our own notion of privacy has changed radically. On the other hand there are many criticisms on the way Facebook as a company deals with the privacy of its users (Wikipedia Criticism of Facebook). Also related to Facebook are two dramatic events in 2012, the 'Facebook-rellen' and the 'Facebookmoord'. What became known as the Facebook riots in the media, started as a Facebook event for a girl's sixteenth birthday party in the small town of Haren in Groningen. This girl had accidentally made it a public event, and the online community picked it up and turned it into 'Project X Haren'. On the actual day of the event, a crowd of thousands turned up. This , resulting in riots, dozens of injuries, dozens of people arrested, and over one million euro in damages (Wikipedia Project X Haren). An even more dramatic event in 2012 was the murder of a 15 year old girl, committed by a 14 year old boy, which became known as the 'Facebookmoord'. This started when two girlfriends had an argument, which continued on Facebook. One of the girls "hired" a 14 year old boy to kill the other (Wikipedia Facebookmoord).

How can we understand these aspects related to cell phones and social media? Let's first take a look at what we know in IS research. This domain focuses first on humans dealing with information systems, mostly in a business context. But a broader interpretation of the IS allows for people's interactions with information technologies, technologies such as the cell phone and social media. Because these technologies transcend and blur the boundaries between business and social. We use the same cell phone to make our business calls and our social calls. And social media provide new ways to connect to friends and also offer companies various marketing channels. Within IS literature, the two main approaches to address our use of technology are *user acceptance* and *technology appropriation*.

User acceptance theory tries to predict the likelihood that a given users will accept a given technology. This prediction is made based on a number of variables identified as being determinant in a person's intention to use a technology and his actual use of that technology. These are variables such as perceived usefulness and social influence. A young person likely perceives a smartphone with mobile internet access as very useful and social influence is probably also a strong factor in his decision to go for the newest smartphone. For an elderly person however, having mobile internet access may not be perceived as useful and social influence may also not be favoring the smartphone. The same goes for social media, where younger people often outnumber the elderly, as perceived usefulness and social influence is different for the two user groups. While this theory is very useful for the first step, to predict likeliness of adoption, it does not help us beyond this point. User acceptance theory does not touch on the issue of identity related to our cell phones and Facebook profiles. The next line of IS literature is technology appropriation, which provides a more dynamic interpretation of technology.

Technology appropriation explicates how we transform technology during use of that technology. This adds to user acceptance, as is shows *why* young people

have a different attitude towards smartphones and social media. While using a technology, the user makes the technology his own by appropriating it. This is a process which transforms the meaning of the technology for that user. Two different users will appropriate the technology in two different ways. In appropriation of the smartphone technology, young people will ascribe meaning to it as being useful. In addition they may feel strong social influence related to the connectivity offered by mobile internet access. Elderly people have appropriated the cell phone technology, but do not see much added value of mobile internet access. In a similar fashion, a person with many contacts on Facebook will appropriate it as a rich medium connecting him to the world. However, a person who has only a few friends online will not appropriate Facebook as a different kind of website than a news site; he will not appropriate the 'social' aspect. With technology appropriation, the focus lies in a dynamic understanding of technology. As the technology is appropriated, it actually becomes something else. In this sense, we can ascribe our identity into the phone that we use, as we make it *our* phone. But this still does not address how to phone provides *us* with a sense of identity, such as a person being an *iPhone-user* or an *Android-user*. Some sort of feedback from the technology to us is still missing in IS literature.

To address this aspect of missing feedback, this study introduces a new theory for understanding our use of technology: mediation theory. The technologies that we use influence how we perceive and act upon the world around us. Binoculars enlarge what you see, but reduce the breadth of your sight. A hammer amplifies the force you exert on a nail, but reduces your striking precision. Technology thus mediates our perception by amplifying some aspects and reducing other aspects. Technology also mediates our actions by amplifying some parts and reducing others. This provides a new interpretation of the cell phone. Talking on the phone can reduce the distance experienced and enlarge our communication capabilities. As the phone mediates our communication, it influences how we relate to the world and to others. In similar fashion, the use of social media amplifies our connection to the people we know and reduces the difficulty to reach a broad audience. The use of social media has an impact on how we perceive and act in relation to other users of the technology. Thus, the technology we use co-constitutes how we relate to the world around us. Being an iPhone-user influences how we relate to the people we interact with. In co-constitution, not only our concept of technology is dynamic, but our understanding of the human becomes dynamic too. To bridge the two domains of IS literature and Philosophy of Technology, a new understanding of appropriation is developed that follows the line of mediation theory. This is essentially an extension of the mediation theory, which focuses on how we come to be a smartphone user: we have to appropriate the smartphone.

A comment on mediation theory is its strong focus on *use* of technology, while technologies such as the mobile phone and social media also have a strong influence outside of use. An important aspect of our cell phone is being reachable, as something different from making an actual call. With social media, an important aspect is your online presence and visibility. Having a Facebook profile allows you to be found online, even when you are doing something else. This aspect is addressed by developing a new interpretation of technology appropriation. When you first use a hammer, you are clumsy and still have to learn how to wield it

properly. As you practice, you appropriate the hammer and the hammer becomes more useful to you as described above. However, the hammer becomes more useful to you because you changed. In appropriation, you make *hammering* part of yourself; you change and in turn, the meaning of the technology changes. What you can do with a hammer changes and in turn what the hammer means to you changes. While appropriating a mobile phone, you make part of this technology part of who you are. This changes you and makes you rely more on your phone, and in relying more on your phone you ascribe a different meaning to it. This is a reciprocal process that changes the user and the technology. If you become a social media expert, you can develop a certain style across different online media. This is a change in who you are and a change in the meaning these social media have for you. It is this change in you that lasts beyond the actualized use of technology. This aspect is what I call a *hybrid presence* that exists between you and the technologies that you have appropriated. You are still an iPhone-user (or an Android-user) after you put your smartphone away. The hybrid presence between a user and his iPhone is still very active when the phone is not actively used. As you appropriate the technology, you let this technology influence your identity.

The next step in bridging the two domains and two interpretations of technology appropriation is by explicating the human-technology relations underlying the theories discussed. The theoretical model developed in this study presents three basic human-technology relations. (1) In user acceptance theory the technology is what it is and the user has certain ideas about the technology. These ideas relate to whether the technology is useful or not, or if its use is socially interesting or not. Underlying this model is a static human-technology relation. This relation views technology mostly as instrumental, and its potential use being perceived useful or not. (2) Appropriation models in IS explicitly state that technology is dynamic. The meaning of technology is changed during use of that technology. This is a somewhat more dynamic human-technology relation, in which the meaning of technology depends on the user of the technology. (3) In mediation theory, both the technology and the user are dynamic. We are the ones ascribing meaning to the technology, making it dynamic. But the technology also influences how we see and act, making us dynamic. This is a recursive relationship, as appropriation changes the meaning of the technology, it in turn also changes how the technology mediates our perceptions and actions.

An empirical case study on the use of a blood pressure e-health application shows that in use of technology, aspects of all models are present. Some participants have certain views of the technology and these views have not changed at the end of the trial. Some participants explicitly change what the technology means for them. And for some participants, use of the application really changes how they experience blood pressure. In order to bridge IS research and Philosophy of Technology, this study develops and validates a new understanding of technology appropriation.

Chapters two and three provide the theoretical background of this study. Chapter two uses Delaney (2010) as an introduction to present an overview of IS literature. The user acceptance theory presented is UTAUT (Venkatesh et al. 2003). Technology appropriation is a central concept in Adaptive Structuration Theory (Poole, DeSanctis, 1989), the Structurational Model of Technology (Orlikowski,

1992), and the Technology Acceptance Model (Carroll et al., 2001). In addition, a sociocultural perspective on appropriation is provided by Rogoff (1995). Chapter three presents first mediation theory, following strictly Verbeek (2000). After that, a new interpretation of appropriation is developed using technological presence (Kiran, 2012), affordance (Gibson, 1986), and technical mediation after Foucault (Dorrestijn, 2011).

Chapter four is the centerpiece of this study, presenting the theoretical framework. This framework explicates the three human-technology relations underlying the different models and theories presented in chapters two and three. The graphic depiction of this framework shows how the new interpretation of technology appropriation also requires a new understanding of the human-technology relation. We thus need a dynamic and reciprocal understanding of our interaction with technology when assessing information technology, mobile phones, or social media; a dynamic and reciprocal relationship in which both the user and the technology change and change each other.

Chapter five presents the empirical case study: iVitality, an e-health application for smartphones to measure blood pressure, developed by Rotterdam Community Solutions for the Leiden University Medical Center. In the case study, eight participants will use iVitality, a combination of a blood pressure meter and a smartphone app, to measure their blood pressure on a daily basis over a period of one month. The results of interviewing the participants show that aspects of all theories appear. The case study thus empirically demonstrates that a richer understanding of technology appropriation is required to fully appreciate the influence that technology can have on us.

Chapter six is the concluding chapter, reviewing the work presented throughout this study. The conclusion presents three major contributions that represent respectively chapters three, four and five. As a whole, this study contributes by bridging Information Systems and Philosophy of Technology. To relate the two domains, this study revisits the concept of technology appropriation.

2 Context: appropriation in information systems literature

2.1 Introduction

The goal of this study is to understand and analyze the use of information technologies such as the smartphone and social media. In Information Systems (IS) research, there are a number of theories that focus on the relation between human behavior and technology, as shown by Patrick Delaney (2010). However, it is unclear if these theories provide a coherent picture of how to understand technology use. This chapter sets out to present an overview of prominent IS theories and how these theories address the use of information technology.

The goal of this chapter is to summarize how we can understand the use of information technology from the perspective of IS. However, as will become apparent throughout the chapter, the different theories provide a conceptually completely different understanding of the use of technology. This raises the question how to assess these different conceptual views of technology.

Delaney (2010) devotes one chapter of his thesis to discussing popular IS frameworks on which he bases his own substantive model for the context of anesthetics. This chapter follows this selection of theories as an introduction into IS literature. In addressing what he calls the '*human-technology interplay*', Delaney makes a distinction between three theoretical backgrounds: *adoption studies*, *appropriation models*, and a *sociocultural literature*. An overview of the literature used is presented in Figure 2-1; the models in **bold**, on the bottom of each column will be discussed in this chapter. Adoption studies is presented on the far left, as the Technology Acceptance Model and Universal Theory of Acceptance and Use of Technology (UTAUT). The center three models are the appropriation models. To the far right is the sociocultural literature, represented by 'participatory appropriation'.

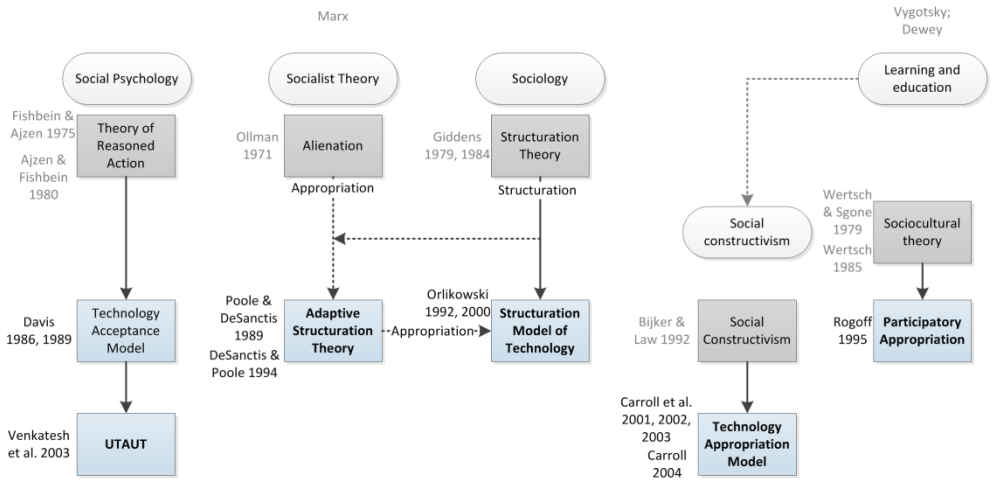


Figure 2-1: Overview of Appropriation in IS Literature

Marked in grey are the sources on which these theories are based. The scope of this study is limited to exclude these sources, because I want to focus on the meaning of concepts and constructs within IS theory. However, the figure provides overview of theoretical backgrounds drawn upon by IS theories.

A central theme in the models Delaney (2010) develops is *technology appropriation*, which he takes from these IS frameworks. In its most basic understanding, appropriation is the process of incorporating a new (information) technology into an existing (work) context. It is obvious that the use of technology is strongly related to this process of appropriation. This chapter shall look more closely at what it exactly means in the different IS theories.

After presenting and discussing the different IS theories, Delaney (2010) critiques them for having a narrow focus on either organizational context or personal use. He goes on to construct a substantive model for the medical context of anesthesia that combines elements of all appropriation models. The meaning of appropriation used by Delaney is that of importing a technology into a new context, and in the process transforming the technology.

Section 2.2 will discuss user acceptance models such as the Technology Acceptance Model and UTAUT. These models focus on predicting the likelihood that a certain kind of user will accept a certain kind of technology. Section 2.3 presents the three dominant theories that all use technology appropriation as a central concept: Adaptive Structuration Theory, Structurational Model of Technology, and Technology Appropriation Model. These theories focus strongly on the process of appropriating a new technology. Section 2.4 discusses a sociocultural interpretation of appropriation. This theory, called Participatory Appropriation, highlights the fact that appropriation happens through participating in activity and that this changes the participant.

2.2 User Acceptance Models

For an (information) technology to be of value to a company, e.g. by improving productivity, they must be accepted and used by the employees of that company. Research in user acceptance of new technology is indicated to be one of the most mature areas in IS literature (Venkatesh et al., 2003). User acceptance models explain variance in people's intentions to use technology. This section presents the basic concepts and methods of user acceptance research.

User acceptance research tries to identify those variables that indicate users' intention to use a new technology and actual use of that technology. One of the first serious models created is the Technology Acceptance Model (TAM) (Davis, 1989), which correlates *perceived usefulness* and *perceived ease of use* to users accepting the technology. This model states that a person who perceives a new technology as useful and as easy to use will be likely to accept and use the new technology. Since then, a number of different user acceptance models have been developed by different authors. Finally, Venkatesh et al. (2003) combined all these models into the Universal Theory of Acceptance and Use of Technology (UTAUT). This section discusses first the constructs of UTAUT, and then looks more at acceptance research and its scope.

User acceptance models assume the following basic concepts: users will have (1) an *individual reaction* to use of the technology, they will have (2) *intentions* to use the technology, and there will be (3) actual *use* of the technology. Actual use (3) is the dependent variable, and intentions (2) have been established as a predictor of use (Venkatesh et al., 2003). The individual reactions influence both intentions and actual use. However, what these reactions are is different in each of the acceptance models. In TAM, perceived usefulness and perceived ease of use have the place of individual reactions, influencing intentions and use. UTAUT combines eight previous user acceptance models into one.

Resulting from the combination of eight user acceptance models, UTAUT consist of four main variables that influence intentions and actual use, shown in Figure 2-2. In addition, there are four key moderators that influence the strength of each variable. The first two variables are *performance expectancy* and *effort expectancy*; they resemble perceived usefulness and perceived ease of use from TAM. The third variable is *social influence*, referring to what the user believes others will think of him if he uses the technology. Finally, *facilitating conditions* refers to the user's belief that support exists for use of the technology. These four main variables are all moderated in different ways by the user's *gender*, *age*, *experience*, and *voluntariness of use*.

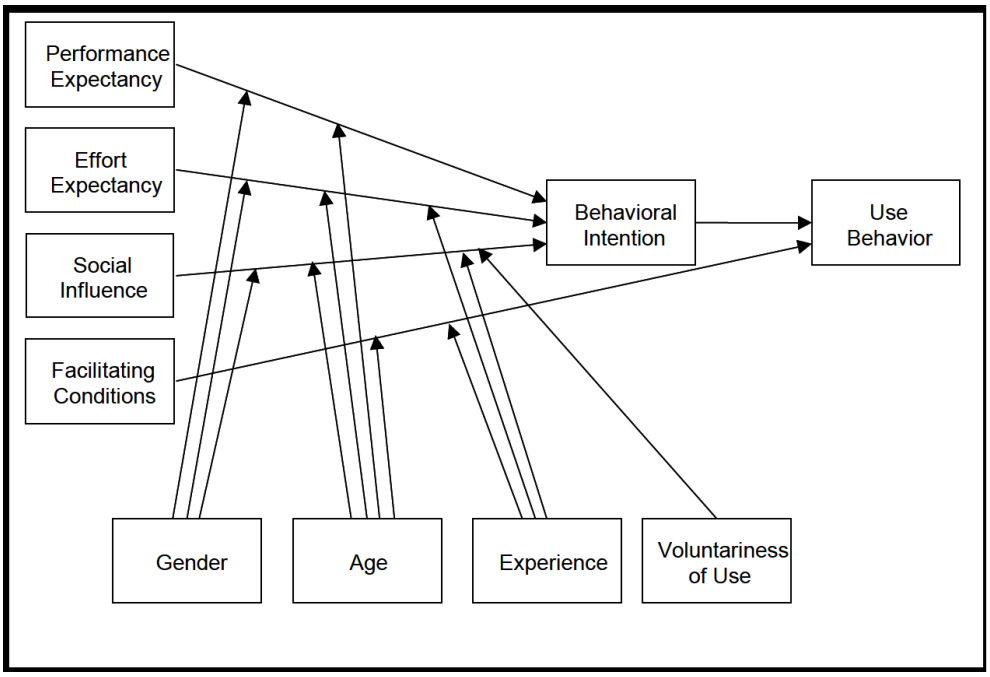


Figure 2-2: Universal Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003, p.447)

User acceptance models have a strictly defined scope. The goal of these models is to predict the likelihood that a given user will accept a certain technology. This is intrinsically related to the way these models are created and also used. Surveying large number of (potential) users gives a correlation between the main variables and the dependent variable, 'use'. In constructing UTAUT, social influence is apparently found to correlate to use; thus, all other things being equal, someone who feels positive social influence is more likely to accept the technology. On the

other hand, variables such as self-efficacy are not placed in this model, for they are theorized not to be direct determinants of intention (Venkatesh et al., 2003).

A dominant line of research within IS literature is user acceptance models. These models focus on a number of main variables that determine a person's intention to use a new technology. The scope is thus also limited to predicting the likelihood of this person accepting the technology. User acceptance research does not address the process of users starting to use a new technology and making it part of their (work) processes. This is an aspect central to appropriation models, discussed in the next section. However, user acceptance research addresses the first prominent question, whether or not certain types of users will be likely to accept and use new technologies introduced.

2.3 Appropriation models

Appropriation was first introduced in IS by Poole and DeSanctis (1989) as part of their Adaptive Structuration Theory. This section explores the different interpretations of appropriation in IS literature. Appropriation is often a part of a model that describes use and meaning of technology. Within these models, appropriation is used to explicate how the meaning of technology changes in the use of that technology. The first subsection discusses Adaptive Structuration Theory. The second subsection goes into the Structurational Model of Technology. And the third subsection presents the Technology Appropriation Model.

Adaptive Structuration Theory

Adaptive Structuration Theory (AST) is the first to introduce the concepts of *appropriation*. In this section, I explore what appropriation of a technology means in AST. Appropriation was first broadly defined as the process of users altering a system as they use it (Poole and DeSanctis, 1989, p.150). Later, this changed to "the immediate, visible actions that evidence deeper structuration processes" (DeSanctis and Poole, 1994, p.128). First, the concepts of AST will be presented, after which some attention will be given to the conception of human-technology interplay.

AST builds on two important concepts, structuration by Giddens (1979), and appropriation by Ollman (1971). Technology provides social structures that can be described in its *structural features* and in the *spirit* of the technology (DeSanctis and Poole, 1994). Structural features are described to be the capabilities offered by a technology. The technology's spirit is the general intent, promoting certain values underlying a set of features. For example, social media can be described in terms of its features as the communication possibilities they offer. On the other hand, one might think of social media's spirit to promote openness and transparency. However, the technology also has to be appropriated by the users. As per the definition above, appropriations are those actions that point towards structuration processes. *Structuration* is to put a structural feature into action, and in doing so produce and reproduce social structures. For example, use of social media in a company can re-affirm an open social structure.

There are four aspects to the process of appropriation: *appropriation moves*, *faithfulness* of the appropriation, *instrumental uses*, and *attitudes*, as shown in

Figure 2-3. (1) In appropriation moves, users may directly use the system, relate it to other structures, constrain its use, or make some judgment (positive or negative). (2) An appropriation can be faithful, which mean that its use is in line with the technology's spirit. However, appropriation of a technology may also be unfaithful, which does not mean that it's bad, just that its use is not in line with the technology's spirit. (3) Instrumental uses concerns what the technology is used for. This can be task activities, managing group processes, or influence others. (4) The fourth aspect, attitudes points to whether the users experience comfort in use, respect for the technology, and feel challenged to use the technology.

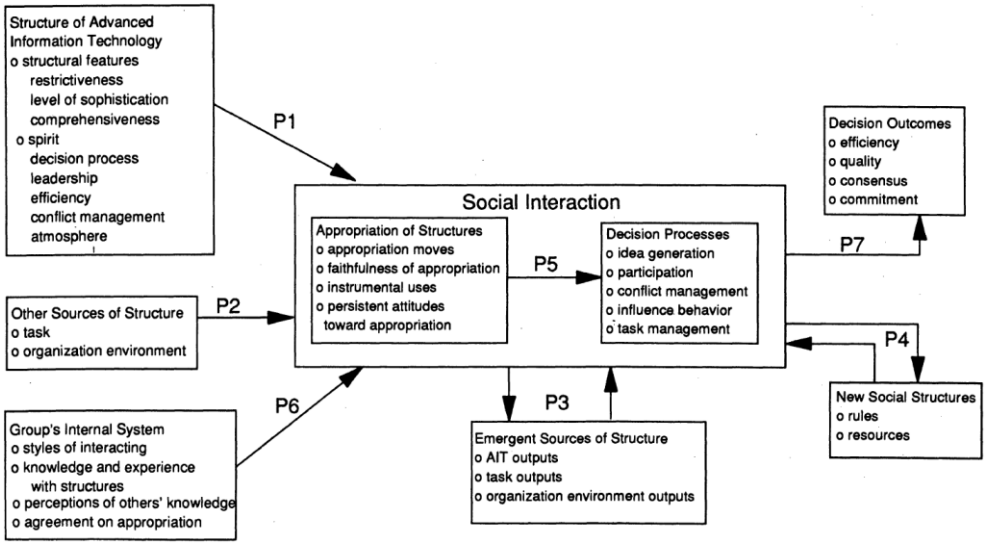


Figure 2-3: Summary of Major Constructs and Propositions of AST (DeSanctis and Poole, 1994, p.132)

In describing the use of technology, Poole and DeSactis (1989) use appropriation to explicate that the meaning of technology is dynamic. People will often not use technology only in pre-defined way. Instead, users will alter the system in using it, during appropriation of the technology. "This implies that the realization of any object may differ across cases and that the object itself can change as people change their mode of using it" (Poole and DeSanctis, 1989, p.150). An IS can thus change as people use it differently. The same system can become something different in two different companies.

AST draws on structuration and appropriation to analyze technology. Technology is related to social structures, and made active by having users appropriate it. With users appropriating technologies, the technology can be changed. AST has made a big step in IS literature: the technology suddenly becomes dynamic. In the next section, the notion of structuration is more elaborately introduced in Orlikowski's (1992, 2000) Structurational Model of Technology.

Structurational Model of Technology

Compared to AST, the Structurational Model of Technology (SMT) stays closer to structuration theory. In this section I will explore the main concepts of the model. SMT tries to offer an alternative to a view of technology as either objective force or as socially constructed product. This subsections first presents structuration

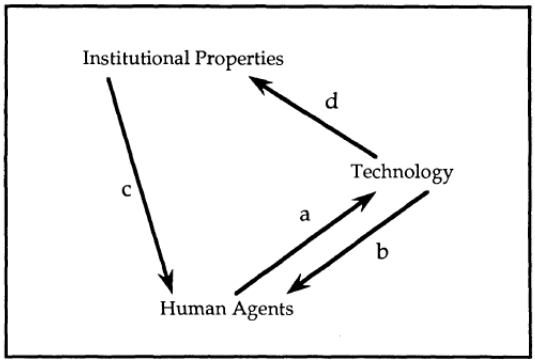
theory as described by Orlikowski (1992), followed by her application of this theory to technology.

Structuration, drawn on extensively from Giddens (1979, 1984), starts with noting that humans have a great deal of knowledge that they use in production and reproduction of their encounters with other people. Over time, the rules and resources we use in such social encounters become standardized and institutionalized, forming structural properties (of an organization). For example, the way we greet and address our colleagues at work. In such encounters, we draw on these social structures. At the same time, use of the structures reinforces them. This is called the *duality of structure*: the rules and resources mediate our actions, and at the same time our actions reaffirm those rules and resources that we use. While Giddens does not address technology, Orlikowski (1992) suggests that we should understand technology as one kind of structural property. Technology then becomes an instantiation of some of the rules and resources that constitute the organizational structure.

Orlikowski's (1992) SMT consists of three components that share four main relationships, shown in Figure 2-4. The three components are *human agents*, *technology*, and *institutional properties* (structures). The first relationship, between human agents and technology, (a) is called *technology as a product of human action*. By appropriating a technology, humans ascribe shared meaning to the technology. This notion of appropriation appears to be similar to that of Poole and DeSanctis (1989), and is the technological version of Gidden's reinforcing of structural properties. The second relationship, between technology and human agents, (b) is called *technology as a medium of human action*. Technology mediates activities, by facilitating the performance of certain kinds of work. At the same time, by facilitating in a particular manner, it also constrains the performance. Technology mediates by simultaneously enabling and constraining.[1]

Orlikowski (1992) limits her discussion of the relations between human agents and structural properties to those influences that have to do with technology. The third relationship (c) is called *institutional conditions of interaction with technology*, and points from structure to the human agent. The use of technology, as any action, is mediated by the rules and resources of our social structure. As such, the influence of our social structures may explain (in part) how the same technology may be appropriated in two different ways by two different people. The final relationship, between technology and structures, (d) is called *institutional consequences of interaction with technology*. This relationship also refers back to the original notion of structures, this time the fact that they are reinforced (or changed) in use. In use and appropriation of technology, there is a feedback to the rules and resources drawn from. In this feedback, the use of technology, like any other social action, reaffirms some structures and may change others.

[1] This is actually a very important aspect of mediation theory discussed in the next chapter. Chapter 3 will go into this aspect of mediation in great detail.



ARROW	TYPE OF INFLUENCE	NATURE OF INFLUENCE
a	Technology as a Product of Human Action	Technology is an outcome of such human action as design, development, appropriation, and modification
b	Technology as a Medium of Human Action	Technology facilitates and constrains human action through the provision of interpretive schemes, facilities, and norms
c	Institutional Conditions of Interaction with Technology	Institutional Properties influence humans in their interaction with technology, for example, intentions, professional norms, state of the art in materials and knowledge, design standards, and available resources (time, money, skills)
d	Institutional Consequences of Interaction with Technology	Interaction with technology influences the institutional properties of an organization, through reinforcing or transforming structures of signification, domination, and legitimation

Figure 2-4: Structurational Model of Technology (Orlikowski, 1992, p.410)

The SMT is similar to AST in the sense that the meaning of technology becomes dynamic through appropriation. However, Orlikowski (1992) goes even further by staying closer to structuration. Our actions become mediated, and for technology this means that the performance of certain kinds of work is facilitated and constrained. What this means for the conception of human agents will be discussed in greater detail in the next chapter.

SMT analyzes technology use in terms of four relationships between human actors, technology and social structures. Structuration theory is used to reconceptualize the relationship between technology and organizations. The following section zooms in on the youngest appropriation theory, the Technology Appropriation Model from Carroll et al. (2001). Of the IS literature presented in this chapter, SMT is the only theory that explicitly uses the concept of mediation.

Technology Appropriation Model

In the Technology Appropriation Model (TAM*)[2] (Carroll et al., 2001), the transformation of technology in the process of appropriation is explicated strongly. Central to the model is the distinction between technology-as-designed and technology-in-use. In this section, I explore the implications of this radical

[2] the asterisk to differentiate from the other TAM, which is the Technology Acceptance Model

interpretation of appropriation. First, the components of TAM* are explained, and finally the implications of the model are discussed.

Carroll et al. (2001) provides no reference for the concept of appropriation; instead, technology appropriation is presented as a given part of IS literature. The process is formalized in a model, the TAM*, which explicates that technology is transformed in appropriation, by differentiating between technology-as-designed and technology-in-use. These are also the three main components of the model: *technology-as-designed*, the *process of appropriation*, and *technology-in-use*, presented in Figure 2-5.

Technology-as-designed is basically what comes out of the factory. This component is further specified with *attractors* and *repellents* (Carroll et al., 2002), aspects of the technology that makes a potential user want to engage with it, or leave it alone. If the technology is discarded, this is called *non-appropriation*. If however, the user chooses to engage with the technology, the process of appropriation is entered. So far, this is quite similar to the user acceptance models discussed above.

If the technology fits with the user, it will indeed be appropriated. This is checked against certain *appropriation criteria*. However, for every appropriation criterion, the technology may not live up to it and be *disappropriated*, which can also happen at a later time e.g. when the user's demands of a technology have changed. If the technology is appropriated, it is transformed into technology-in-use. This is not static, what technology-in-use is continues to change over time. Technology-in-use can be reinforced by *higher-order-drivers*, of which three are identified for this particular case: power, identity, and fragmentation. These are three themes which are important to young people (struggle with identity and power, and leading a fragmented life); a technology that resonates with these themes is likely to account for more durable appropriation.

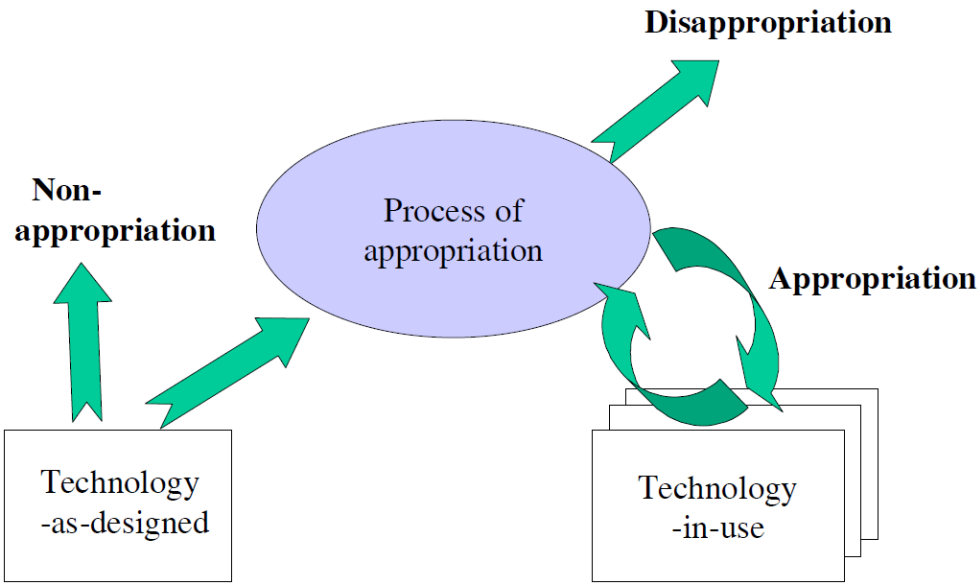


Figure 2-5: The technology appropriation model (Carroll, 2001, p.4)

In the first paper (Carroll et al., 2001), research findings are presented which indicate that the technology is not only transformed in appropriation, but also impacts the users in very specific ways. In the case of young people and mobile phones, the impact was identified in identity, power and fragmentation. For example, two participants are quoted: "*I feel kind of naked without my phone*", "*It [the mobile phone] gives you and identity: this is who I am, this is **my** number*" (Carroll et al. 2001, p.5). However, in the extension of the model, these aspects where formalized as reinforcers; if the technology fits the user's needs related to these drivers, its use will be reinforced.

The TAM* formalized the transformation of technology in three components: (1) Technology-as-designed, (2) Process of Appropriation, and (3) Technology-in-use. The basic notion of the technology changing in appropriation is much the same as that of Poole and DeSactis (1989). The TAM* presents a model of technology appropriation that is very straightforward and easy to understand. In the next chapters we will look further into the impact of technology on its user.

Summary

This section presented three prominent theories of technology appropriation in IS literature. Poole and DeSanctis (1989) developed a theory of technology use based on structuration and appropriation. Key in this theory is the idea that technology is not static, but rather dynamic as users ascribe meaning to it in the process of appropriation. Orlikowski (1992) provides an interpretation of technology as a certain kind of structures, which adds the notion that technology mediates our actions. Carroll et al. (2001) present a strong model that explicates how the meaning of technology is transformed.

2.4 Sociocultural background: Participatory appropriation

Coming from a sociocultural background, Rogoff (1995) does not focus on technology at all. However, within the context of learning and child development, she presented a critical new interpretation of what she calls participatory appropriation. This section looks to compare this conception of appropriation to the meaning it has within IS literature. First, Rogoff's concepts of apprenticeship, guided participation, and participatory appropriation will be discussed. Then, more attention will be given to the meaning of appropriation in this contexts and how it relates to IS literature.

Rogoff (1995) identifies three planes of focus in sociocultural activity: *community*, *interpersonal*, and *personal*. Of course these planes are not separate, but strongly interconnected. For obvious reasons, they are discussed one by one, and as such related to respectively *apprenticeship*, *guided participation*, and finally *participatory appropriation*. Apprenticeship draws on the metaphor of craftsmanship, which focuses on development of participation by the lesser experienced participant. This metaphor is extended to include any other organized activity, focusing attention on both the activity itself as the relation to practices and institutions. Guided participation refers to communication and coordination between people participating in activity; 'guidance' pointing to direction offered by

cultural values and other people, and 'participation' pointing to observation and involvement.

"*Participatory appropriation* refers to how individuals change through their involvement in one or another activity" (Rogoff, 1995, p. 142). The term appropriation is used to contrast to internalization, which is viewed as a process of taking something static across a boundary from the external to the internal. Internalization makes two assumptions that Rogoff (1995) contests. The first is a separation between the person and his social context, and the second is that of static entities concerned with mere acquisition of objects such as knowledge and skills. Addressing the first assumption, an activity is inherently dynamic, as it is constituted by its participants. The person participating is also part of the activity. And the second assumption is addressed with the development involved in participation, as the person changes and becomes prepared for future engagement in similar activities.

Having made this contrast between appropriation and internalization, Rogoff (1995) identifies three interpretations of appropriation:

1) The first interpretation of appropriation is the same as internalization, where something external is imported. In the context of IS, the user and the technology remain separate, static entities, which become disconnected again once the person stops using the technology.

2) The second interpretation is basically an extension of internalization. Something external is imported, and in the process it is transformed to fit the new context. In IS literature, this relates to the popular interpretation of appropriation, where a technology is internalized and in the process transformed.

3) The third interpretation is Rogoff's (1995) concept of participatory appropriation. The focus lies not just on use, but on participating in an activity. And in participation, the user himself changes. Thus, for IS this means that focus should be on taking part in a technological activity and the personal change that this participation brings about. How we should deal with this notion of change related to technology will be further developed in the next chapter.

Rogoff (1995) presents a radical new interpretation of appropriation, which focuses not so much on use, but more on activity and change. For IS this means that not only the technology is transformed in the process of appropriation, but also the user of the technology. This sociocultural perspective aligns very well with a mediation theory that will be presented and developed in the next chapter.

2.5 Conclusion

In trying to understand the use of smartphones and social media, this chapter used Delaney (2010) as an introduction to present a number of prominent IS theories. However, these theories provide different conceptualizations of technology use. User acceptance theory (Venkatesh et al. 2003) focuses very much on user opinions. This means that the user and technology are first defined independently of one another, and then the theory zooms in on the user. In technology appropriation (Poole, DeSanctis, 1989; Carroll et al. 2001) the technology is explicitly transformed during use. This means that the user is defined first, and the technology is defined in relation to this user.

The structurational model of technology (Orlikowski, 1992) focuses more closely on translating the core concepts of structuration to technology. This involves defining technology as a medium of human action, facilitating and constraining performance. However, it is unclear what this means for our understanding of the user of a technology. In addition, participatory appropriation (Rogoff, 1995) is defined as a 'third interpretation' of appropriation, opposing it to internalization and an extended form of internalization. The 'second interpretation', defined as internalization and transformation in the process, seems similar to technology appropriation. Apparently there is thus also another interpretation of appropriation in which the user changes as a result of participating in (technological) activity.

All these theories have very different implications for how we understand technology and the user, and thus the use of technology. To understand the use of smartphones or social media is not a trivial matter. Within IS literature, we miss the philosophical tools to assess these different conceptions of user and technology.

The next chapter presents mediation theory, a philosophy of technology that views technology as a medium of both action and perception. This philosophical exercise will shed some new light on how to understand the use of smartphones and social media, and further provide tools to address human-technology relations implied by the IS theories.

3 Mediation: technology as a medium of intentionality[3]

3.1 Introduction

There are many different ways to understand the use of Information Systems (IS). The previous chapter presented only a few theories, but these already have at least three different interpretations. With every step to make a theory richer in explanatory power, the theory becomes more complex. It appears that a line can be drawn through these theories, indicating the rising level of complexity in how to explain the use of technology. This rising complexity consists of a more dynamic understanding of the meaning of technology use. And these more dynamic models seem to cover more aspects of how we use technologies. User acceptance theory focuses solely on the user's opinion of a technology. Technology appropriation theory explicates that we should understand technology as dynamic. The meaning of technology is transformed in use. And finally, the structurational model added mediation of actions, and participatory appropriation emphasized that the participant in an activity changes through participation.

In order to figure out how to deal with these different theories of varying complexity, this chapter dives into the philosophy of technology. Specifically, mediation theory is used to develop a substantiated understanding of technology use. This chapter develops a new interpretation of appropriation that is in line with mediation theory. This new interpretation is actually very similar to participatory appropriation, as will be shown in section 3.5. Finally, a new concept is developed to account for things such as a sense of identity that people develop based on their mobile phone: hybrid presence.

The context of mediation theory is a philosophy of technology called 'postphenomenology'. Contrasting an instrumental or deterministic view of technology, technology is interpreted as a medium through which users relate to the world. An instrumental view presents technology as mere means to an end; a user decides what he wants to do, and may choose to use technology to accomplish those goals. A deterministic view presents technology as a big system that allows only one outcome from the use of technology.

Mediation theory provides a different view of technology, one in which the use of technology mediates our actions and perceptions. This concept is similar to technology as a medium of action in the structurational model of technology. If we use a hammer, we can hit a nail with more force, but less precision. Using binoculars enlarges what you look at, but reduce the breadth of your vision.

[3] This chapter is based on a previous paper, written for the course Philosophical Anthropology and Human-Technology Relations, which is taught by Peter-Paul Verbeek at the University of Twente for the Master program Philosophy of Science, Technology and Society.

Section 3.2 provides an overview of a postphenomenological philosophy of technology, following Verbeek's (2000) interpretation. This section revolves around mediation theory, focusing on how using artifacts mediates our actions and perceptions, in turn making us hybrids of human with technology. Section 3.3 investigates the background relation further, looking at how we are influenced by technologies that we do not currently use. Idle technologies can influence us with the possibilities they offer by being present. However, some artifact can have a different presence for two different people, which is elaborated in section 3.4. This individual aspect is developed using affordances, which are constituted between a person and his environment, and are thus unique for that person. Finally, section 3.5 focuses on the process of constituting technology-relations and affordances, a process called appropriation. As a person appropriates a technology, he makes it part of who he is, allowing the technology to mediate his intentionality, even when the concrete artifact is not there; through a hybrid presence.

3.2 Postphenomenology, an overview[4]

Central to mediation is hybridity: we become hybrid with the artifacts we use. A carpenter is hybrid with his tools, a driver is hybrid with his car, and a musician is hybrid with his instrument. In this hybridity, intentionality becomes distributed over human and technology as mediation co-constitutes us. The goal of this section is to investigate postphenomenology as an alternative to a strictly instrumental or deterministic view of technology. The classical view of technology comes from a modernist worldview in which subjects and objects belong to two different realms that are totally separated. So how do we get from being an autonomous subject to being a mediated hybrid with distributed intentionality? Several steps are indeed required for the current understanding of postphenomenology. The two most important concepts are Martin Heidegger's phenomenology and Don Ihde's technology-relations.

From the perspective of a modernist tradition, technology is described as being instrumental. We humans are autonomous subjects, authors of our own lives and environment. Technology must be seen in terms of neutral tools, which we use for whatever intentions we have with them. At best, the tool becomes a carrier of our conscious intentions. A carpenter's tools are no more than a means to construct or mend things; the car is no more than a means of transportation. As neutral instruments, technology and artifacts are never more than means to an end.

Contrasting this static worldview is Heidegger's dynamic notion of *Being*. According to Heidegger, reality does not exist on its own, but *comes into being* for someone. A mountain in the Alps is veiled, until someone looks. As someone looks at the mountain, it is revealed for this observer: it comes into being. The way in which the mountain comes into being depends on the observer. For a religious person, the mountain may be home to a monastery. For a sportsman, the mountain may hold climbing or skiing challenges. For a miner, the mountain may be a

[4] Postphenomenology as depicted in this section closely follows the interpretation of different authors by Peter-Paul Verbeek (2000; 2005).

bundle of minerals to be mined. *Being* is not static existence, but something active: we constitute reality. Thus, what things *are*, depends on who is looking. Meaning is ascribed to things as those things are revealed to us. The way we look determines what meaning we ascribe to things. According to Heidegger, the current way of looking at things is '*Technology*'.

Technology is not the tools and machines we use. Technology, capital T, is a mindset: a specific way of looking at the world. Technology reveals the world as a bundle of resources for us to use and manipulate. Because of this mindset, everything we see is revealed to us as raw materials. The mountain is not longer home to the monastery, no sports challenges, nor local nature and wildlife. The mountain can only be revealed in terms of resources, raw materials and ore. We do not see the mountain only as ore because of the mining technologies we have. It is the other way around: we created these mining technologies because Technology revealed the mountain to us as resources to be mined. Heidegger explains this with his famous example of the hydro-electricity dam in the river Rhine. It's not the case that we see the river as an energy source because of the electricity dam. Instead, we built the dam because we revealed the river as an energy source: resources to use and manipulate.

Because of Technology, we reveal everything around us only in terms of resources and raw materials, to be used, manipulated, and exploited. We can no longer see things for their beauty, only their function and use. Even more, we even see people as nothing more than resources to use, manipulate, and exploit. In this lies Heidegger's *greatest danger*. Everything around us, including other people, exists only as means to our ends, never as ends in themselves. The deterministic view of technology comes from this greatest danger: Technology will inadvertently produce massive systems to efficiently handle resources and there is no escaping this way of thinking. However, this argument goes beyond the influence of individual artifacts, reducing all technologies in one big swoop to Technology as a way of thinking. Verbeek critiques this as being *transcendentalist*, mistaking the mindset that brought forth our machines for the individual artifacts themselves.

In order to find a way in between the instrumentalist and deterministic views of technologies, we turn to individual artifacts. Following Ihde, all artifacts *amplify* certain things and *reduce* others. When looking at the mountain, you can see the entire mountain, but miss the details. Now if you use binoculars, what you see is amplified, but the breadth of what you can see is reduces. Having a hammer in hand when walking into a room makes those things stand out that have to do with hammering; other objects don't stand out as much. This is the turn from phenomenology to *post*phenomenology. In phenomenology, the world is dynamic through revealing. In postphenomenology, the artifacts we use influence *how* things

are revealed. This is called mediation[5], because the artifact mediates between us and the world. In mediating, an artifact influences how things are revealed to us, influencing our perception and our actions.

The pair of action and perception is combined in *intentionality*. The first meaning of intentionality is the one we all know, our intention to act. Thus intentionality points towards action. In relation to artifacts, use of a hammer amplifies the force exerted on a nail, while it reduces the precision as opposed to touching the nail with one's finger. This way, the hammer mediates our actions. The second meaning of intentionality, following Heidegger, is a certain directedness of our perception. You don't just think, you think *about* something; you don't just look, you look *at* something; you don't just listen, you listen *to* something. In this directedness, intentionality also points towards perception. When sliding your finger over an old blackboard in a classroom, you feel old chalk residue. If you then slide over the same blackboard holding a pointing stick, you no longer feel the chalk residue, but you do feel small imperfections in the blackboard's surface. The stick reduces the feeling of chalk residue, but enhances feeling the surface; the artifact mediates our perception. Through amplification and reduction, artifacts mediate our intentionality.

Focusing on individual artifacts, we can look at Heidegger's work on tools. Tools can exist for us in two ways: *ready-to-hand* and *present-at-hand*. In normal use of a tool, it is ready-to-hand and your focus is not on the tool but on the task performed. When using a hammer to hit a nail, your focus is not on the hammer itself. The hammer withdraws itself from your attention and steers your attention to hitting the nail. In using a tool, the focus is on the tool's function; the tool is ready-to hand. Now if something unexpected were to happen, for example the hammer breaks, the tool suddenly jumps back into the foreground demanding attention. In its non-functioning, the hammer becomes present-at-hand, demanding attention on the tool itself rather than on the tool's function. An artifact that is present-at-hand does not divert attention somewhere else, but stays in the foreground.

When using an artifact, a person enters a technology-relation with the artifact. Ihde created these technology-relations building on the idea of artifacts being ready-to-hand and present-at-hand. Ihde's four technology relations are depicted in Figure 3-1. The first technology-relation is embodiment, corresponding to the artifact being ready-to-hand. A person wearing a pair of glasses does not look at the glasses; the glasses become *embodied* by the wearer. The glasses withdraw themselves from attention and mediate the wearer's eyesight. In terms of amplification and reduction,

[5] Although the concrete constructs are different from those in the structurational model of technology, the fundamental notion of mediated actions is the same.

the glasses amplify the wearer's visual perception and reduce their own presence. The second technology relation is *alterity*, corresponding to the artifact being present-at-hand. In the example of the ATM, the focus is on the interaction between the user and the machine in order to get money. Alterity refers to the interaction with the artifact as quasi-other. This technology-relation enhances the artifact as device to interact with, and in demanding attention on the interface reduces the rest of the environment.

The third technology-relation, in between embodiment and alterity, is *hermeneutic*. In this relation the artifact constructs and image of something that does not exist on its own. Rather, the image is a reflection of something else in the world. This is better shown with the example of the thermometer: it tells you the temperature. However, the temperature of something is not a magical number attached to that object. This number is constructed by the thermometer. Hermeneutic refers to interpretation; a radio telescope will provide a visual interpretation of radio waves from stars. The hermeneutic technology-relation amplifies a specific interpretation of the world, while reducing the way this interpretation is constructed. The fourth technology-relation is the *background* relation. Artifacts in the background shape the context, while people do not interact with them. In some way the technology is both present and absent. The refrigerator makes a distinct humming noise when cooling. As I am not actively interacting with the refrigerator it is absent, while in its noise it is present in the background. Another example of the background relation is nuclear weapons; while we do not interact with them, they are present in the background, shaping the context of our modern society. It is the artifact's influence on the context that is amplified in this technology-relation, while the artifact's presence itself is reduced.

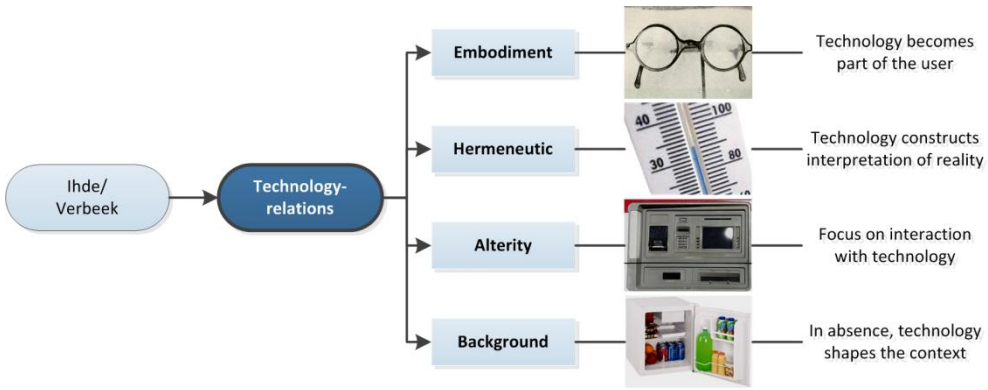


Figure 3-1: Ihde's four technology-relations, after Verbeek (2000)

An artifact can often be engaged in different ways, corresponding to different technology-relations. These four technology-relations are not exclusive to certain artifacts, nor are they separated. An artifact can be used in different technology-relations, possibly with multiple relations at the same time. These relations reflect different aspects of the artifact. I will

illustrate this further with two examples: obstetric ultrasound and the cell phone.

The first example is Verbeek's famous example of obstetric ultrasound, pre-natal imaging of the fetus. A pregnant woman goes to the hospital for a pre-natal scan of the fetus. The doctor operating the device has an embodiment relation to the scanner-head which he moves over the woman's stomach, looking for the fetus through the device. He also has an alterity relation to the device when operating its technical interface. The doctor alternates between these technology-relations during the procedure, switching his attention back and forth between the device and the pregnant woman with fetus. Both the doctor and the pregnant woman have a hermeneutic relation to the device as it presents a visual image of the fetus. This image, as a visual interpretation of ultrasonic signals, strongly amplifies the fetus as a separate entity from the pregnant woman. Outside of this specific occasion, every pregnant woman has a background relation to the ultrasound technology, shaping what it means to be pregnant in our society.

Another example much closer to my personal experience is the use of cell phones. While talking to someone on the phone, the phone becomes embodied, strongly enhancing communication capabilities, while reducing the experience of the direct surroundings and the actual distance between the two callers. Almost all applications on your phone, be it the contact list on a simple cell phone or an app on a smart phone, will engage you in a hermeneutic relation. The app presents an interpretation of the people you know in terms of their contact information; or the weather forecast, or public transport schedule. The most prominent alterity relation is when you receive a call, the phone demanding that you answer the call by ringing loudly. Cell phones have had tremendous impact on all of us, for example in our expectations. We expect of ourselves and of each other that we can call anyone and be called by anyone, anywhere at any time. It is becoming exceedingly abnormal to be out of reach from call, sms, email, chat, social media, whatsapp, etc. This influence is present event when not actually using the cell phone. Thus in a background fashion, the cell phone shapes our context when absent from actual use.

In these technology-relations, our intentionality (action and perception) becomes mediated through amplification and reductions. The artifacts we engage with amplify some parts of our actions and perception, and reduce others. The way in which the world is revealed to us is influenced by the artifact we use. Our intentionality is no longer strictly our own; instead, it is mediated. In phenomenology, we constitute reality by revealing. In postphenomenology, we are co-constituted by the artifacts, because they mediate the way in which the world is revealed. We then are no longer fully

autonomous subjects, but become hybrids with the technologies that co-constitute us. A visual interpretation of this is presented in Figure 3-2.

As we enter a technology-relation with an artifact, we become *hybrid* with that artifact. The artifact mediates our intentionality, influencing the way we constitute the world, and thus co-constituting us. This notion of hybridity may feel strange and alarming. However, it is much more familiar than one might think. We actually have specific names for people who are hybrid with their artifacts: a person who is hybrid with his tools is called a *carpenter*; a person who is hybrid with his musical instrument is called a *musician*; a person who is hybrid with his car is called a *driver*; a person who is hybrid with his computer software is called a *programmer*. It may seem weak just to sum up a few professions, but the point is to show the intertwinement of artifacts in our everyday lives. Every person's intentionality is technologically mediated. We are all hybrids with things such as our clothing and houses, with our cell phones and email, and the car, bike or public transportation.

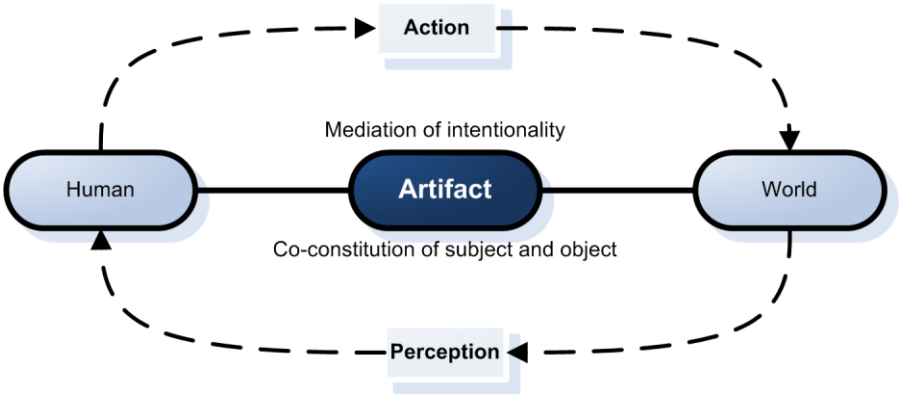


Figure 3-2: Visual interpretation of Verbeek's postphenomenological framework.

Postphenomenology offers a new way of thinking about technology, contrasting an instrumental or deterministic philosophy of technology. Take for example the gun legislation debate: one side opposes guns, saying that "*guns kill people*", while the other side responds with "guns don't kill people, *people kill people*." What happens is that the former side presents a deterministic argument against gun ownership: more guns will necessarily lead to more violence, period. The other side counters with an instrumental stance: the gun is a neutral tool, if someone wants to kill another person, he will find a way. The postphenomenological way out of this standoff is to propose a radical different philosophy of technology: the artifact is a medium. The gun mediates intentionality, and the person becomes a hybrid: a *gunman*. Obviously, it's not the gun alone that does the killing, but neither is it the man on his own who kills anyone. For a gunman, the possibility to kill is strongly amplified.

Mediation theory approaches IT as a medium of our intentionality. Our IT is no longer considered as either a neutral instrument or a deterministic system. The next step lies in further developing the background relation we have to technologies that we don't actively use. Most of Verbeek's work focuses on how technologies that we use mediate our intentionality. With the internet, a big aspect of its impact lies in its continuous presence, while we are not always using it. The internet's presence offers a lot of possibilities for potential action. This aspect is not yet captured within Ihde's technology relations, and will be further developed using the work of Asle Kiran (2012). The next section investigates technological presence, our possibilities and our existential horizon.

3.3 Technological Presence

So far, mediation theory focuses very much on the technologies we use, and how they mediate our intentionality. The goal of this section is to investigate further how this concept of mediation can be extended to include the artifacts we have in our possession, but are not currently using. An important piece of this puzzle is that we constitute ourselves in part as our future plans. The starting point is Ihde's background relation, which is similar to idle artifacts lying around in the house. These artifacts offer all kinds of possibilities for our future plans.

To illustrate what this chapter is about, let's review a couple of examples that we normally enter one of the technology relations with, but that also influence us when not using them. The first example, used some times already, is the hammer and other similar tools. Use of these tools can be characterized as being embodied by the user. However, these tools also influence us when not in use, as owning more tools allows for more things at home to be fixed. Similar to using a hammer, a car can be embodied: the quality of the road experienced through the car, the weather's impact on your driving experience, etc. But when not actually driving, people still think of the distance between two cities in terms of 'hours driving', and in their daily planning rely on their car working properly for driving to work the next day. When talking on the phone, we embody it and focus our experience on the conversation. When not talking, the phone is in your pocket or bag, yet you rely on being reachable. Similar things happen with the internet, especially with mobile internet access. You are not always using it, but continuously rely on the possibilities, such as searching for some information online or making a purchase in a web store, to always be there.

Kiran (2012) starts by empowering the background relation we have to different technologies, as we take these technologies for granted. We rely on the roads when driving, we rely on electricity for our home appliances, and we rely on cell phone coverage for mobile communication. We organize our

lives in accordance with these background technologies. So instead of characterizing them in their being absent, we should focus on their presence. This aspect of taking things for granted is also part of idle artifacts that we do not currently use. At home, we take for granted that the car outside will start when we leave. Walking in the street, we take for granted that anyone can call us on the cell phone in our pocket. Relying on the cell phone in one's pocket for being reachable gives the cell phone a *technological presence*.

Use of the cell phone can be characterized in the embodiment relation. However, the *availability* of making a call is more like a background relation with the cell phone. We rely on the possibilities that the idle cell phone in our pocket offers. The idle cell phone's presence makes potential phone calls available. As we rely on the possibilities of all these idle artifacts we have, what we take for granted are the artifacts' potential uses. The idle artifact's potential uses are what constitute the artifact's technological presence.[6]

The potential uses of an artifact influence our future possibilities and plans. Part of how we constitute ourselves is our future plans and what we see ourselves as being able to do. Kiran (2012, p.16) quotes Heidegger: "we *project* ourselves *as our own possibilities* in-the-world towards the future-as-horizon." Imagine your own future to be a landscape, bounded by an *existential horizon*. What lies in between you and this existential horizon are those things that you see yourself as capable of doing in the future.

Adding an artifact to this changes our capabilities. A cell phone offers the potential to call someone. Now the possibilities between you and your existential horizon have changed. In line with mediation theory, technological presence will amplify some things and reduce others. The cell phone's presence will amplify the possibilities for calling and may reduce the possibility to be polite to one's fellow train travelers. This form of mediation presents a new way of co-constituting the subject, as opposed to actual use of an artifact in Ihde's technology-relations. The two are illustrated together in Figure 3-3; the upper arrow points to the label 'Use', presenting a compacted version of Figure 3-2.

[6] Kiran (2012) uses Pierre Lévy's *virtualization* here; I do not use this concept.

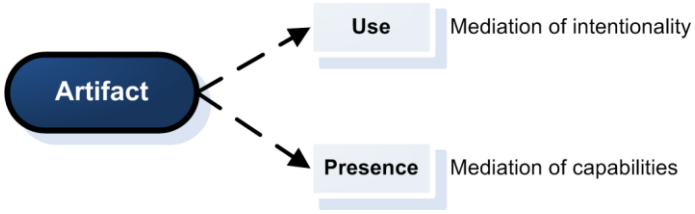


Figure 3-3: Mediation by use and by presence.

In addition to amplifying and reducing our capabilities, there is a second interpretation of technological presence. This aspect remains much closer to the effects on experience described in Ihde's technology relations. Making a phone call, and in doing so embodying the cell phone, enhances the experience of the person on the other end of the line. Even more so, the phone call reduces the experienced distance between the two people. However, you don't need to be making the phone call to experience this. The cell phone's presence already reduces the experienced distance to the people we know.

This effect is not merely a result of potential uses, becoming hybrid with the technology changes how a person relates to the world around him. This also became apparent in the iVitality case study interviews. One of the participants[7] used the iVitality application to monitor his blood pressure for medical reasons. Using iVitality was so simple, that measuring his blood pressure was no longer a reminder of being sick. iVitality's technological presence co-constituted him as someone who was not sick anymore. This was not related to Ihde's technology-relations as he was not measuring at that moment. Nor was the blood pressure device itself present to offer the possibility of measuring at that moment. Yet still, the person I talked to was changed compared to the interview a month earlier. A different interpretation of iVitality's technological presence mediated how he related to the world, in this case his own health. This interpretation of presence mediates intentionality in much the same way as Ihde's technology relations, but without direct engagement of the artifact. This second interpretation of technological presence will be further elaborated in section 3.5 Appropriation.

Mediation theory focused very much on actual use of artifacts in technology-relations. This section explored mediation outside of use. Next to technology-relations, two interpretations of technological presence were developed. The first follows Kiran's argument, which focuses on potential use and our future capabilities. As we constitute ourselves partly as our possibilities, new possibilities offered by an artifact's presence co-constitute us. The second interpretation of technological presence remains much closer to the way Ihde's technology-relations mediate our intentionality. In both cases, it is clear that idle artifacts mediate how we constitute ourselves.

[7] Participant number 5: see sections 5.4 Interview results per participant and 5.5 Analysis of the results.

We already established that IT should be understood as a medium through which we approach reality. IT then mediates our intentionality in different technology-relations. As demonstrated in this section ITs also have a technological presence, which also mediates our intentionality and our capabilities. The internet's presence offers us a lot of new possibilities that we could not even have conceived of a few years ago. Additionally, we often feel we live in a smaller world as the internet's presence connects us to everyone and everything in the world. So far in developing technological presence, the concept has remained very general towards personal experience, as if every person is influenced the same by an artifact's presence. In use of technology, the technology-relations make it a personal affair. The artifact only mediates the intentionality of the person who engages it. This personal aspect will be developed for technological presence in the next section, using James Gibson's (1986) Affordance.

3.4 Affordances

The artifacts in our environment afford us all kind of uses; often one artifact affords multiple uses. The goal of this section is to further develop technological presence by adding a personal aspect. My devices afford me different kind of uses that they may not afford someone else. *Affordances* was introduced in this context by Asle Kiran (2009). This section investigates the original source, the work of Gibson (1986).

A simple understanding of affordances tells us that a car affords driving. In addition, a car may afford killing yourself in a car-crash, it affords moving a lot of shopping goods, and affords going to a drive-in movie theatre. A cell phone obviously affords making a phone call, but it also affords use of various applications, it affords throwing, and might even afford being used as a beer opener. So far, affordances do not present anything new compared to technological presence. However, there is a strong individual aspect to it that has not yet been developed in presence. In the most basic sense, of all the cars in the street, only your car affords the conventional uses. To get a better understanding of this aspect, I will first dive into its source of origin.

Gibson (1986) introduced *affordances*, in relation to what an animal's environment affords that animal. Part of affordances clearly lies in the objects around us, pointing to the material world in which we live. But in this short description, it also becomes clear that the affordances are specific to this particular animal, pointing to our subjective experience of reality. Very much in line with a postphenomenological philosophy of technology, affordances are constituted between subject and object. Of course there are no affordances without an object to afford them. Just a well, there are no affordances without a subject to constitute them. The following quote confirms this quite definitely:

> "an affordance is neither an objective property nor a subjective property; or it is both if you like. An affordance cuts across the dichotomy of subjective-objective and helps us understand its inadequacy. It is equally a fact of the environment and a fact of behavior. It is both physical and psychical, yet neither. An affordance points both ways, to the environment and to the observer." (Gibson 1986, p.129)

Gibson (1986) focuses on animals, talking also of the human animal, and explicates that an object affords different things to different animals. A tree affords climbing to a squirrel, while it does not afford this to most humans. On the other hand, a door handle affords grabbing and opening a door to humans, but not to most animals. "[Affordances] have to be measured *relative to the animal*. They are unique for that animal." (Gibson, 1986, p.127). The same distinction between affordances being different for different types of animals can be made between two people. In order for a car to afford someone driving, he needs to know how to drive and preferably also have a driver's license with him, he also needs the keys to the car, or less preferably, know how to hotwire the car. Under normal circumstances, a car that you do not have the keys to does not afford driving. The car's affordances are thus different for the two people, if one is the owner and the other his neighbor.

Affordances are exactly those potential uses that an idle artifact's technological presence offers us, illustrated in Figure 3-4. This means two things. First, what an artifact affords us is constituted only by a subject and object together. Or as Gibson (1986) put it, affordance points both ways, to the environment and to the observer. And second, talking of these capabilities in terms of affordances, forces us to realize that the capabilities offered by technological presence are individual. Sure, we all experience a door handle's affordances to be grasped, but our experience can still differ. For example, if this door handle is on my door and the door is locked, the door handle affords someone else to grasp it, but not to open the door. It only affords opening the door in combination with having the key. Just like the door does not afford opening to a squirrel, neither does it afford opening to other people in normal circumstances.

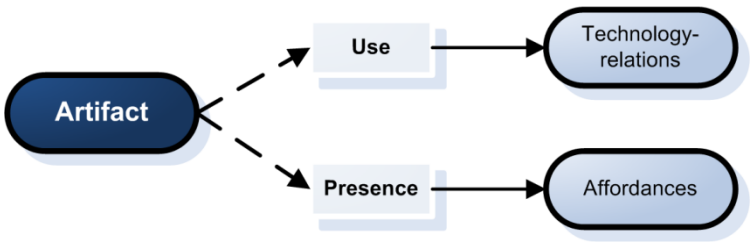


Figure 3-4: Affordances, co-constituted in an artifact's presence.

There is, however, some difficulty in use of the concept affordance, as other interpretations are dominant. These interpretations, placing an item's

affordances within the item itself, independent of a subject.[8] Such an interpretation does not seem very strange for someone not acquainted with postphenomenology and co-constitution. An artifact's affordances then become the set of all possible uses the artifact could potentially be used for, given its materiality. However, as affordances have to be constituted, they can never exist separate from a subject. The confusion comes, I believe, from the following quote:

> "The concept of affordance is derived from these concepts of valence, invitation, and demand but with a crucial difference. The affordance of something does *not change* as the need of the observer changes. The observer may or may not perceive or attend to the affordance, according to his needs, but the affordance, being invariant, is always there to be perceived." (Gibson 1986, pp. 138-139)

This requires two answers, first an elaboration of Gibson's use of *invariant*, and second a postphenomenological answer to what is stated here. When using the word invariant, what Gibson means is not that affordance is a fixed aspect of an object. Coming from ecological psychology, Gibson describes how we perceive objects with the term invariant.

As you move around an object, for example a tree, what you eye literally sees, the optic array, dramatically changes. However, you are still able to recognize that it is in fact the same tree. The same goes for a teacup in your hand, as you turn the cup, you eye perceives different shapes as the optic array changes. Still, you recognize it is the same cup: this remains invariant. As you recognize a teacup from different angles, you recognize from these different angles that the cup affords holding water. In this respect, the teacup's affordances for you are invariant. The affordances don't change if you hold the cup in your hand, or if it's placed on the table, or on the other side of the room.

The second answer is a critical postphenomenological reply to the above quote. Using mediation theory, 'the need of the observer' co-constitutes this observer; following from that, affordances will be constituted differently by this observer. However, this small detail aside, Gibson's notion of *environment* as being 'co-constituted' by an animal and its surroundings is a very postphenomenological interpretation, especially for someone who does not have the vocabulary or knowledge of postphenomenological concepts.

An idle artifact can have a technological presence that co-constitutes us. However, the things that such an artifact affords us are different for every

[8] Within the domain of IT, the most common conception of affordances is by Donald Norman (1999), who makes the explicit distinction between *real* affordances and *perceived* affordances. From a postphenomenological perspective, this distinction is not useful, because all affordances are co-constituted by a person and an artifact.

person. The artifact's affordances are co-constituted by the individual person and the artifact. As such, affordances can be seen as an alternative to technology-relations when not actively using the artifact. In this light, affordances add a personal aspect to technological presence. What the internet affords us is different from person to person.

Mentioned briefly above, aside from owning the car or having access to the car keys, a person also has to know how to drive for the car to afford him driving. In the sense of learning to drive, constituting hybridity is a process, whether in technology-relations or technological presence. Someone who can not yet drive can not embody the car yet, and the car will also not have a technological presence. This process of becoming hybrid with a technology is called *appropriation*. Without appropriating a technology, there is are no technology-relations and no affordances. The next section will further develop this concept and its relation to hybridity.

3.5 Appropriation

Humans and artifacts are hybrids, which we actually know well in many examples such as a carpenter, driver, musician, gunman, or programmer. Hybridity mediates our intentionality when engaging an artifact in one of the technology relations. And hybridity also mediates our capabilities when idle artifacts afford us various things. When driving, the road can be experienced through the car: the car becomes embodied by the driver. When at home, the car outside affords a driver to go out for a ride. However, such technological hybridity does not just instantly come into being the moment we see or hold any artifact. Most artifacts require work to learn: a person has to learn how to drive and learn how to play a musical instrument.

The goal of this section is to further investigate this process of hybridization. The process in which a person becomes hybrid with a technology is called *appropriation* of the technology. Appropriating a technology requires work; it takes training and practices to become hybrid. In the previous chapter, an overview was presented of the role of appropriation in Information Systems (IS) literature. While in these models appropriation is rather one-directional, Barbara Rogoff (1995) presents a rather different concept of appropriation. This interpretation of appropriation is the starting point for this section. After that, I will continue to further provide a postphenomenological development of the concept, using Steven Dorrestijn's (2011) work, which interprets Michel Foucault as a philosopher of technology. Finally, the second interpretation of technological presence mentioned in section 3.3 will be further elaborated, based on the insights into appropriation.

The focus of appropriation in IS literature is on the integration of a new Information Technology (IT) into an existing context. The context of study is often a business context, and what business it is and how the IT is

appropriated determines what meaning is ascribed. This means that depending on the company appropriating the IT, the technology is transformed to fit the context. Contrary to this perspective, Rogoff (1995) focuses on change as individual development resulting from the appropriation process. This process is called participatory appropriation, contrasting it to internalization. Internalization implies a separation between a person and his context, separating internal from external, and constituting both as static entities. In this perspective, internalization is acquisition of an object, importing it across the boundary from external to internal.

Rogoff (1995) identifies three uses of the word appropriation. (1) The first is the same as internalization: something from outside is brought in. (2) The second is an extended version of internalization: something external is brought inside, and this object is transformed in the process to match the new context. This is consistent with the conventional use of appropriation in IS literature, where *change* refers to transforming the meaning of the technology. (3) The third interpretation is Rogoff's, coming from a sociocultural domain, which focuses on a person participating in an activity. As a person who participates in an activity is also part of the activity, it makes little sense to conceive of the two as separate entities. Appropriation is the process of change and development of the person who participates. Change refers here to personal development resulting from participating in an event.

Rogoff (1995) focuses strongly on participation in sociocultural activity: "The concept of *participatory appropriation* refers to how individuals change through their involvement in one or another activity, in the process becoming prepared for subsequent involvement in related activities" (Rogoff, 1995. p.142). However, it's not hard to view the use of an artifact as an activity. Participating in the activity of using technology prepares us for related activities of technology use. Basically, use of technology is training for further use, and training is also change of the person. Taking driving lessons, participating in the activity of driving, changes the person as the person appropriates driving. Appropriation is this process of personal change, the process that leads to hybridization of the person: the person becoming hybrid with the technology and the technique. But before we get there, we start with training.

Foucault is well known for his work on the role of discipline in our society. However, Dorrestijn (2011) interprets him as a philosopher of technology, identifying two distinct figures[9] of mediation. The first figure, called technical determination of power relations, refers directly to the disciplinary

[9] What Dorrestijn calls a 'figure' is similar to a specific interpretation of a concept.

institutions, for which the Panopticon[10] serves as ultimate example. It is however the second figure that I am most interested in, the *training of technically mediated routines*. Dorrestijn presents two examples of instructions for training writing in school and directives for shooting in the military, which break down the gestures into descriptions of which part of the body to use and which part of the artifact. It is this training of routines that is presented as the fusion or the hybridization of human and artifact that is central in postphenomenology.

> "what is specific to Foucault's analysis is that it becomes clear that these fusions between humans and technology are not just given, but have to be forged by training. The revelation of the aspect of training (drilling in the military context), facilitates awareness of the transformative mediations of such mundane technologies, the use of which seems very natural and not morally significant. The mediation effect in these examples does not have the form of an inescapable coercion, but takes the form of a structuring of routines. By drawing attention to the degree of training necessary for these routines to function, Foucault makes clear that the pencil and rifle are not just used, but become integrated into the user's mode of existence." (Dorrestijn, 2011. p.10).

This second figure of technical mediation provides us with two insights into the concept of hybridity. First, it requires work; and second, the artifact becomes part of the user. I will first elaborate this first notion, connecting it to appropriation.

Every technology requires some training for proper use. Learning to drive a car and learning to play musical instrument are two examples that are institutionalized in driving schools and musical schools. To engage such an artifact in one of the technology relations, to embody them, takes a lot of practice and training. In case of the car, one's attention is at first focused very much on operating the car: controlling the gas, checking the mirrors, shifting gear. Only as these actions become routine, a person can really switch his attention from controlling the vehicle to the road and the traffic. Kids learning to play a musical instrument have to practice a lot: first on where to place their fingers, then to form accords, then on the timing. As these actions are practiced enough, attention can be switched from striking an individual accord to playing a song. A person training to use an artifact has to make all these individual gestures 'his own'. To engage an artifact in such a technology relation, a person has to *appropriate* the related techniques. Thus, hybridity requires appropriation of the artifact, illustrated in Figure 3-5.

In the same way that being able to embody a pencil, rifle, car, or musical instrument requires that you appropriate the related techniques, to constitute affordances also requires appropriation of the artifact. A car or a musical instrument generally does not afford driving or playing a song to an animal.

[10] The Panopticon is a circular prison, conceived by Bentham's, in which guards can monitor all prisoners from a central position. The (possibility of) constant monitoring influences how people, in this case prisoners, behave.

In much the same way, these artifacts do not afford proper use to untrained users. Sure anyone can make a car go forward, and make noise with a musical instrument. But this is something quite different from the affordance of real participation in traffic, or playing the instrument in a band. The individual aspect of technological presence is not only in ownership, but also in techniques. The technological presence of a car or guitar is rather different for someone who is hybrid with these technologies, as they afford him certain possibilities that they do not afford an untrained user. A computer with internet connection will have rather limited affordances for a person who has never seen a computer before. As such, a software program such as Word or Photoshop, which has an overwhelming amount of functionality, can still have very few affordances for an unskilled user. The affordances are also constituted by appropriation.

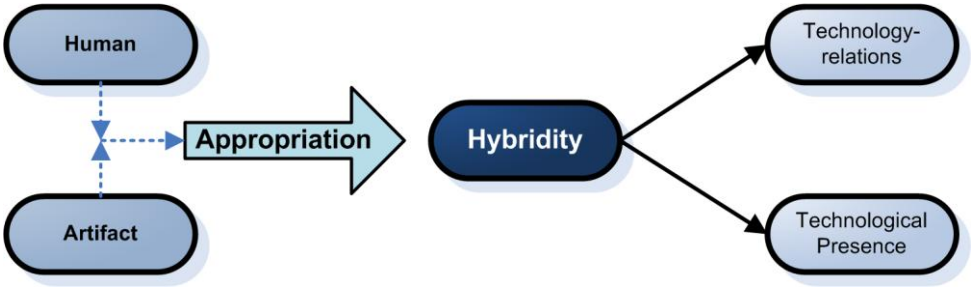


Figure 3-5: Constituting hybridity requires appropriation of the artifact.

The second insight into appropriation provided by Dorrestijn's second figure of technical mediation is that an artifact becomes an integrated part of the user, as stated above. This becomes very clear when thinking of using an artifact in terms of techniques. Driving a car requires certain techniques, playing an instrument requires certain techniques. In appropriation of an artifact, these techniques become part of the hybrid user. This aspect of hybridity constitutes a second interpretation of technological presence introduced in section 3.3 Technological Presence.

As you make the cell phone part of who you are, it makes the people you know seem closer to you. Not because you are currently making that one call (embodiment). Not because of the direct possibilities (affordances). But because appropriation of the cell phone technology creates a technological presence for you: a technological presence that reduces your experienced distance to other people. In the same way, appropriating the car technology makes you think of longer distances in terms of 'hours driving'. In terms of IT, having experience or skills in software development can provide a certain way of thinking for problem solving. Appropriating Excel makes you come up with ways to calculate problems in ways you could otherwise never have conceived of.

Appropriation of technology constitutes a *hybrid presence* that closely resembles mediation through technology relations. This aspect is illustrated

in Figure 3-6. This hybrid presence mediates intentionality not in direct use, and not in the way affordances are physically related to present artifacts. In part this presence is characterized by the absence of the artifact described in Ihde's background relation. However, the technology being present inside the person mediates both intentionality and capabilities, *similar* to technology relations and affordances, in terms of how reality is experienced and in term of what is perceived as possible. For example, a normal resident of the Netherlands will have appropriated different aspects of the internet technology. As a way of disclosing reality, the internet is an important source of information and news. In terms of capabilities, most people are familiar with the possibilities of online shopping and social media.

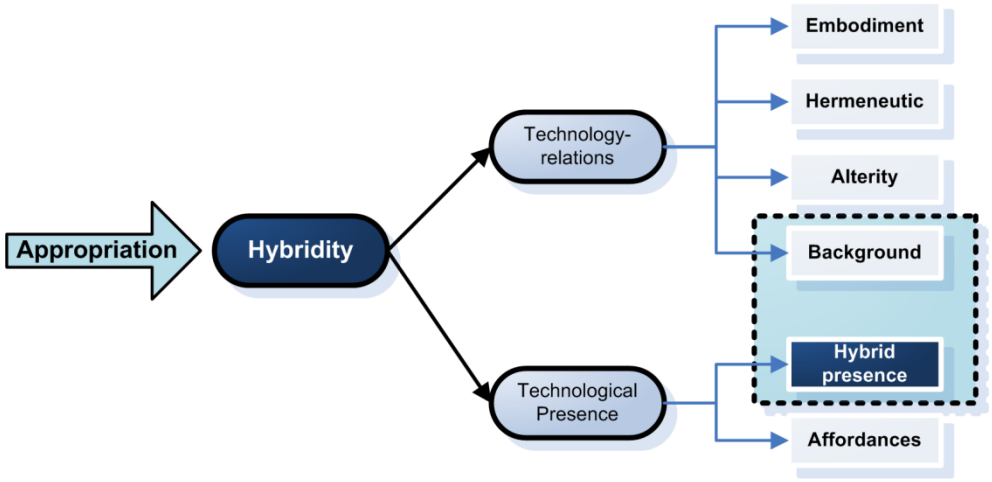


Figure 3-6: The second figure of technological presence.

It is this hybrid presence, which constituted by user and technology in the appropriation of that technology by making part of the technology a part of the user; this hybrid presence that makes people relate to the world in a very specific way, a technologically mediated way. Appropriating Facebook makes the personal profile an actual part of one's identity. And being active on Facebook also adds a way in which we connect with the people we know. It is also this way in which I want to interpret the quotes from the Technology Appropriation Model research: "*I feel kind of naked without my phone*", "*It [the mobile phone] gives you and identity: this is who I am, this is* ***my*** *number*" (Carroll et al. 2001, p.5). In order for the first situation to occur, someone must forget his phone, or have forgotten to recharge in time, thus not be used or be present. However, the feeling naked is the kind of attention-demanding that is otherwise described in technology being present-at-hand, and thus similar to the alterity relation. The feeling of identity otherwise related to embodiment.

It is also in this way that we can understand the case study participant[11] who appropriated iVitality as a way to be a healthy person. Not in actualized use, or in immediate presence, but in having made the iVitality technology part of who he is, he can now be a person free from sickness and treatment. In appropriation, the technology becomes part of the user. In this sense, the technology can be present even when the physical artifact is not, and can thus also mediate intentionality in similar fashion to the technology-relations.

This section presented different aspects of technology appropriation. First explaining how this aspect relates postphenomenology to concepts in the IS domain. Second, this concept was philosophically substantiated using the work of Dorrestijn (2011) to relate appropriation to Foucault's work. After that, the necessary link between appropriation, the technology relations and technological presence was elaborated. Finally, a second interpretation of technological presence was developed: hybrid presence. This new concept shows that the physical artifact does not have to be present for a technology to co-constitute us. In hybridity, we are already co-constituted subjects.

3.6 Conclusion

Mediation theory provides a postphenomenological philosophy of technology that offers a way out of the instrumental/deterministic dilemma. We should view humans and technology as tied together, for technology mediates our perceptions and actions (intentionality) and thus co-constitute the subject. The use of technology is better understood as entering a dynamic and reciprocal relation with artifacts.

Mediation theory is further extended using technological presence; idle artifacts provide us with certain possibilities, changing what we see ourselves as capable of. We should interpret this technological presence in terms of affordances, which explicates that the technological presence has to be individually constituted by a user and a technology. We constitute these affordances through appropriation of the technology; this is the process of hybridization through training. Appropriation of a technology constitutes a hybrid presence between the user and the technology, as the technology becomes part of the user. This way, while the actual artifact can be absent, a technology can still be present and still mediate the way in which we relate to the world around us.

This chapter offers a new understanding and philosophical substantiation of the concept appropriation. In addition, a new concept is developed that follows from appropriation: hybrid presence.

[11] Participant number 5: see sections 5.4 Interview results per participant and 5.5 Analysis of the results.

If we relate these findings back to IS literature, we can shed new light on the differences between the theories. In user acceptance theory, the user and technology are defined independently of each other as separate entities. Technology will have the character of instrumentalism as the key question focuses on whether or not the user will accept this technology. Technology appropriation in IS literature defines first the user, independent from the technology, and then defines the technology in relation to the user. The meaning of the technology is constituted by the user, which implies a phenomenological view of technology. Finally, the structurational model talked of mediation, and participatory appropriation also emphasized personal change through participation. These two theories imply a postphenomenological understanding of the use of technology.

The next chapter further elaborates this relation between philosophy of technology and IS theories. This is done by exploring the human-technology relations implied by each of the theories presented in chapter 2.

Mediation theory provides a way to critically reflect on how technology is conceptualized in IS literature. Using this perspective helps further theory development to adequately understand how we deal with new technologies such as smartphones and social media.

4 Theoretical framework: three human-technology relations underlying IS theories

4.1 Introduction

In order to understand how a theory in Information Systems (IS) literature analyzes the use of a smartphone or social media, we must understand what human-technology relation is implied by the theory.

Chapter two presented a number of different conceptions to say something about the use of technology. The first is user acceptance theory, focusing on the user opinions and whether or not this user will accept the technology. The second is technology appropriation, explicating that technology is transformed in use. The third is the structurational model, adding that technological structures mediate our actions. And the fourth is participatory appropriation, focusing on the personal change as a result of participating in (technological) activity.

Chapter three presented a philosophically substantiated alternative conception of technology use: mediation theory. At the end of the chapter, the philosophical insights were related back to the IS theories. This resulted in a classification of the theories into three groups: (1) instrumental (user acceptance), (2) phenomenological (technology appropriation), and (3) postphenomenological (structurational model and participatory appropriation).

This chapter will elaborate this categorization further, by explicating what these classifications mean in terms of the human-technology relations. The goal of this chapter is to make clear which human-technology relations underlie theory in IS literature. This results in the construction of a theoretical framework that forms to heart of this study. This framework combines the models of IS literature and the concepts of mediation theory in terms of their underlying human-technology relations.

Section 4.2 reviews user acceptance models. Section 4.3 reviews the use of appropriation in IS literature. Section 4.4 presents a new interpretation of appropriation, following the mediation theory developed in chapter 3. This interpretation of appropriation is similar to the core purpose of structurational model of technology and participatory appropriation.

4.2 Static conception of human-technology relation

In user acceptance research, the technology is presupposed as a static entity. This is in line with a modernist worldview that places humans and technology in two separate realms. The technology is a static external entity that is itself not part of the models. The models focus on the user's opinions of the technology, and the resulting intention to use and actual use. The underlying human-technology relations, presented in Figure 4-1, are the same modernist views that approach technology first as instrumental. The interaction between humans and technology is one of static exchange. The character of such an exchange is what Rogoff (1995) calls internalization: something external is imported.

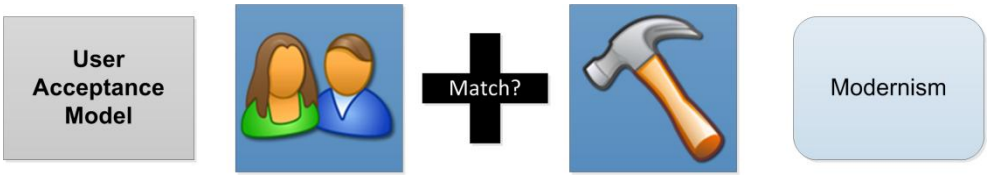


Figure 4-1: The human-technology relation underlying user acceptance models[12]

This does not mean that user acceptance models are useless. The authors provide a solid empirical basis that allows them to predict with relative accuracy the likelihood that a person will use a technology based on that person's experience with the technology. These models have a sharp focus to answer one critical question (acceptance), and identify variables that have a determining influence on the likely use of the technology. However, the questions concerned in this study fall outside the strict scope of user acceptance models. In predicting the likelihood of user acceptance, there is no attention for the process of appropriating the technology, or further implications of such a process.

4.3 Phenomenological conception of human-technology relation

To explain the title of this section, I will dive right into the philosophy. In a phenomenology, we constitute the world around us. We live in a world to which we ascribe meaning dynamically. It is this dynamic worldview that underlies the use of appropriation in IS literature. Depending on the context and the users, the meaning of an IS can be different things. The use of appropriation in IS literature constitutes a more dynamic relation between humans and technology. In the process of appropriation, users transform the meaning of the technology.

Opposed to user acceptance models, Adaptive Structuration Theory focuses on the processes and nature of technology use. To address this issue, Poole and DeSanctis (1989) introduced the concept of appropriation in the IS literature. They define appropriation roughly as the process in which technology is transformed by the users. The Technology Appropriation Model further explicates this notion of transforming the technology, by making a distinction between technology-as-designed and technology-in-use. During appropriation of a technology, the user changes technology's meaning, which is drawn out as a transformation from technology-as-designed to technology-in-use. The human-technology relation that underlies this dynamic view of technology is presented in Figure 4-2.

[12] User and Tool icons from findicons.com, 2-10-2012:
User icon: http://findicons.com/icon/15315/users_1,
under Freeware non-commercial license
Created by Iconaholic/Jono Hunt: http://iconaholic.com/
Tool icon: http://findicons.com/icon/226908/package_development ,
under GNU/GPL license
Created by Icon King/David Vignoni: http://www.icon-king.com/

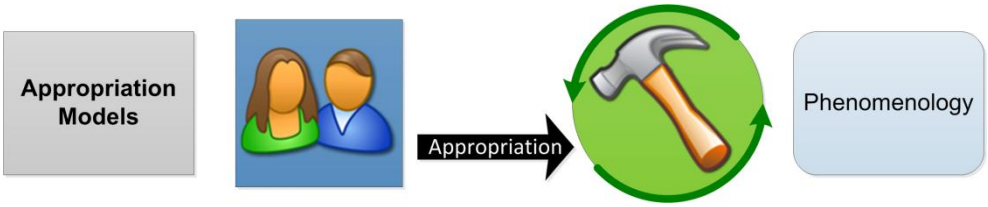


Figure 4-2: The human-technology relation underlying 'appropriation' in IS literature

The character of this relationship is Rogoff's (1995) second interpretation of appropriation, which is basically an extended version of internalization. Something external is imported, and in the process transformed to fit the new context. Although appropriation models present a dynamic view of technology, the start is a situation with two presupposed separate entities. This is also why Orlikowski (2000) later distances herself from appropriation. According to her, appropriation as used in IS implicates the adoption of embedded structures within the technology. The notion that an appropriation can be 'unfaithful' highlights that use of a technology can mismatch structures embedded in the technology.

Although embedded structures do no fully correspond to a phenomenological perspective, this interpretation of the human-technology relation certainly has aspects of a phenomenological philosophy of technology. And the dynamic view of technology presented in appropriation models offer a good move forward. For such models indicate how the same IS can have two different meanings, and thus become two different systems, in two different companies. However, there is no attention to how the company is impacted by use of this new technology. The final missing component in these models is the missing feedback from technology to the users.

4.4 Postphenomenological conception of human technology relation

Where phenomenology poses a dynamic worldview, postphenomenology explicates the influence that this world has on us. In the Structurational Model of Technology, it is implied, but not explicated, that users are indeed co-constituted by technology. These different theories are very compatible, much like Rogoff's (1995) third interpretation of appropriation that was also used in chapter 3.

Orlikowski (2000) omits appropriation in favor of staying closer to structuration theory, for she considers it a too static view of the structures related to technology. In structuration, the rules and resources of our social structure mediate our actions. And in turn, our actions reaffirm the rules and resources that were just drawn upon. In mediation theory, the concepts are presented in reverse order, but the underlying logic is similar. We constitute the world around us – which structuration theory describes in terms of structures – and in turn, the world co-constitutes us – rules and resources mediate our actions. Orlikowski (1992) extends structuration theory to include technology, and states (Orlikowski, 2000) that we enact emergent structures in interaction with the technology. In turn, the technologies mediate our actions by facilitating and constraining the performance of certain kinds of work.

This character of facilitating and constraining can be seen as analogous to amplification and reduction in Ihde's technology relations presented in chapter 3.

Instead of omitting appropriation, I suggest a richer interpretation of the concept. A new interpretation that is similar to Rogoff's (1995) interpretation as a process of personal change through participation. In this interpretation, appropriation necessarily leads to the constitution of technology, which in turn mediates our actions and perceptions, co-constituting the user. The human-technology relation underlying this interpretation is presented in Figure 4-3. In this view of the human-technology relation, appropriation does not have the character of internalization of something pre-existing and static. Rather, appropriation has the character of hybridization.

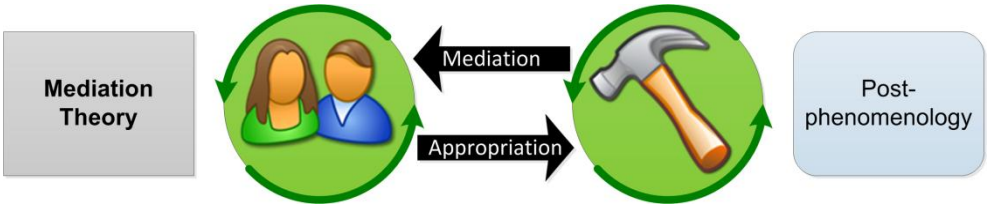


Figure 4-3: The human-technology relation underlying mediation theory

This final model offers a postphenomenological interpretation of appropriation, which is based on a more dynamic human-technology relation than used in the tradition interpretation of appropriation in IS literature. In essence, this model is a different version of Figure 3-2: Visual interpretation of Verbeek's postphenomenological framework. Figure 4-3: The human-technology relation underlying mediation theory puts more emphasis on the dynamic understanding of the subject as opposed to previous IS models.

4.5 Conclusion

This chapter explicitly connects the different theories and the philosophical assumptions they make about the human-technology relations. These are classified in three categories, presented in Figure 4-4.

1) First is user acceptance theory, in which the user and technology are separately and independent from each other defined, before looking at interaction. The only 'dependent variable' is the question whether or not this user will accept the given technology. This accounts for a static view of the human-technology relation, in which interaction has the character of internalization.

2) Second is technology appropriation, in which technology is explicitly transformed in use. However, the user is first defined independently of the technology, which implies a static aspect in this model. The technology is then defined in relation to this user as the dependent variable. Appropriation in this interpretation is similar to internalization, but with the explicit addition that in the process the external entity (technology) is transformed to fit the new context. As the meaning of the technology is constituted by the user, use of technology has a phenomenological character.

3) Third is the structurational model and participatory appropriation. In the structurational model, technology mediates our actions. This relates directly to

mediation theory. Participatory appropriation, contrasting to internalization, explicates the interwoven character of participant and activity and emphasizes personal change through participation. In both these theories, the human is constituted in relation to something else (technology or participation). Thus, both the user and technology become a 'dependent variable' of one another. The human-technology relation is a dynamic one that reciprocally constitutes the technology in relation to the user, and the user in relation to the technology. This co-constituting relation has a postphenomenological character.

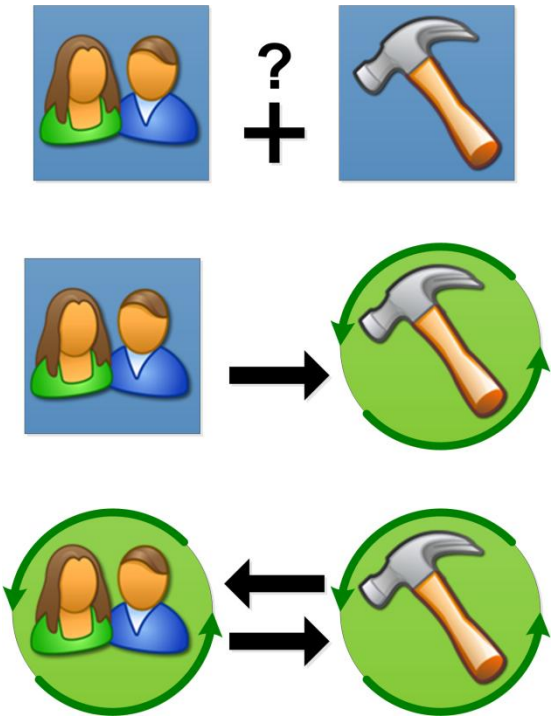


Figure 4-4: Theoretical framework summarizing the human-technology relations underlying IS theories.

The three conceptions of the human-technology relation underlying theories in IS literature can be characterized as (1) modernist, (2) phenomenological, and (3) postphenomenological; in which the use of technology is (1) static, (2) constituting, or (3) co-constituting.

This theoretical framework allows for comparison of different interpretations of appropriations; more like internalization, or more like hybridization. The next chapter sets up an empirical case study to validate how we can understand appropriation. This case study is iVitality, a research platform and e-health application that allows blood pressure monitoring from home. Eight participants will be interviewed before and after they have used the application for a trial period of one month. The interviews at the end present specific results with respect to whether and how participants have appropriated the application.

5 Empirical research: the iVitality case study

5.1 Introduction

Scientific theory does not stand on its own, but corresponds to some aspect of the world around us. We thus test our theories to see if there is coherence between the theory and empirical evidence (Procee, 2011). This case study investigates the effects using an e-health application. The application is a combination of a Bluetooth blood pressure meter and app on the user's smartphone, allowing users to monitor their own blood pressure over an extended period. From an Information Systems (IS) perspective, iVitality is such an information system, and thus represents the technology approached in the theory. The participants will be interviewed, so that they can describe their experiences in their own words.

So far, we have discussed several theories on how people engage and use technology, corresponding to three basic human-technology relations modeled in the theoretical framework. The goal of this case study is to empirically validate whether or not the third model of the human-technology relation actually exists. This third model is that of co-constitution, in which an artifact co-constitutes its user. If such co-constitution occurs in the case study, that means appropriation can have such a co-constituting influence on the person appropriating an artifact.

A preview of the results shows that aspects of all theories appear. In the case of some participants, user acceptance theory comes a long way explaining the data. In other cases, the technology is given a different meaning. Appropriation transforms the meaning of the technology. However, in two cases these theories are not sufficient to adequately explain what happens. The artifact presents the world behind the technology in a very specific manner. In appropriating of the artifact, the users become co-constituted. To have the theory be coherent with the empirical data requires a richer understanding of technology appropriation.

The e-health application concerned in this case study is iVitality, a digital research platform that allows participants to measure their own blood pressure at home. In turn, this provides researchers with the opportunity to scale medical experiments up, and outsource part of the monitoring to the participants and the technology. The participants use the iVitality app on their smartphone and a Bluetooth blood pressure meter to measure their blood pressure every day, for a trial period of one month.

The main research method consists of semi-structured interviews with all participants at the beginning of the trail and again at the end. This way, any changes brought about by using iVitality can made visible at the end of the month, by comparing their experiences to before they had used iVitality. The interview setup and questions represent the constructs in the theoretical framework, searching for indications of the aspects in the different IS theories.

In the design of empirical research, an important issue is validity (Wieringa, 2010). Validity is the concern of justifying that the case study forms a coherent structure between the theory and empirical evidence. There are three aspects of validity: (1) construct validity, (2) internal validity, and (3) external validity.

1) The question of construct validity is that what you measure is an actual representation of a construct in your theory. For example, if you wish to measure the use of cell phones, you can measure the amount of minutes called, but this leaves out text messages or internet data usage. Is what you are measuring representative of what you want to know, are the measures indicators of the construct you are looking for? The issue of construct validity will be addressed in section 5.3, when discussing the research methods.

2) Internal validity addresses whether the case study provides coherence between theory and empirical data. For example, given all data on cell phone use, your case study is internally valid if the theory covers the evidence presented in the case. Are you able to analyze the data in terms of theoretical constructs? The issue of internal validity is discussed in section 5.5, when making the analysis based on the interview results.

3) External validity points to whether or not the case results and conclusions van be generalized. For example, if you found a relation between cell phone use and how much money someone earns, can external validity asks that you can extend the conclusions beyond this particular case. Does the relation found also apply to other companies, other industries, or other countries? The issue of external validity is discussed in section 5.6, when relating the case study results to the theories presented earlier.

Section 5.2 introduces the iVitality research platform central to this case study. Section 5.3 elaborates the research methodology. This section also addresses the issue of construct validity. In developing interview questions that bridge the theoretical constructs and the perspective of the participants, four development interviews were conducted with people who had used iVitality during development of the application. A total of eight participants used iVitality, the results of the interviews are presented in section 5.4. For three of the participants, user acceptance theory is enough to cover their interaction with iVitality. Three other participants provided a new meaning to iVitality distinct from how it is first presented to the users. Finally, two participants could really find a place for iVitality in their engagement to health, and this engagement definitely changed through the use of iVitality, indicating co-constitution of user and technology. In section 5.5, these results are analyzed from the perspective of the different IS theories, following the theoretical framework developed in chapter 4. Section 5.6 concludes this chapter with the contributions of this chapter in light of the study.

5.2 The iVitality research project

iVitality is a digital research platform for medical research, using smartphones and health sensors. The goal is to provide a generic research platform allowing participants to measure different things at home, using their smartphone. Researchers can outsource measuring to the participants, and monitor a particular aspect over an extended period of time for little costs. The initiative for iVitality comes from the Institute of Evidence Based Medicine in Old-age, a research institute associated with the Leiden University Medical Center. For participants, use of the application provides insight in their own health. In the current version, the iVitality focuses on monitoring blood pressure, reaction time, activity and sleep (iVitality website).

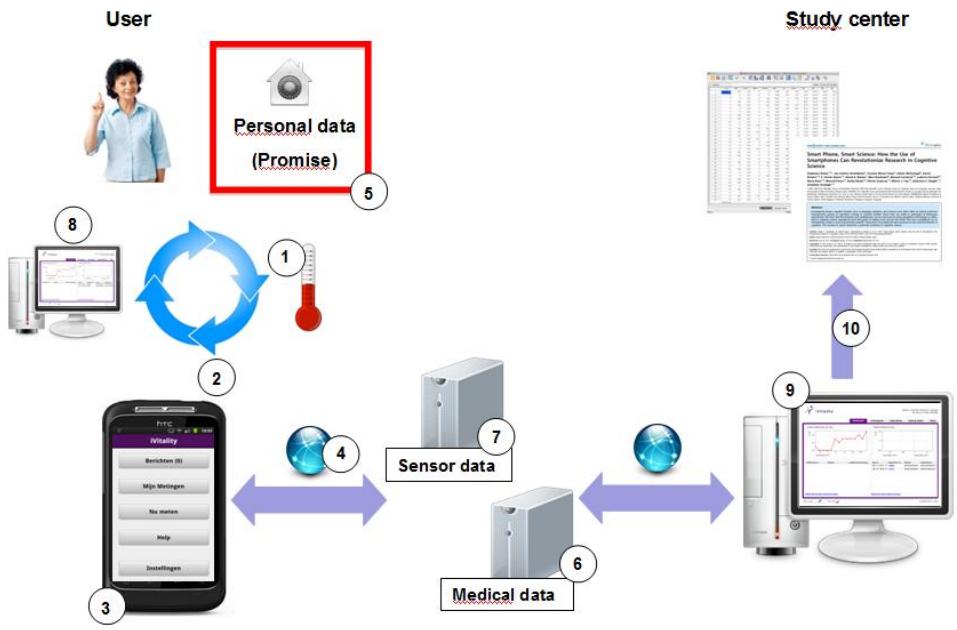


Figure 5-1: Overview of iVitality components

	Component
1.	Sensors for measuring a participant's health.
2.	Bluetooth connection between sensor and smartphone.
3.	iVitality app for the smartphone.
4.	Internet connection between smartphone and databases.
5.	Database with participant personal data.
6.	Database with medical data.
7.	Database with sensor data.
8.	User website.
9.	Website for research-doctor.
10.	Statistical export of sensor and medical data.

Form the medical perspective, iVitality is a research platform first. This is an important note, because e-health applications focus mainly on relocating healthcare moves from the hospital to the patients themselves, while iVitality's emphasis is on medical research. All participants sign a form of informed consent, which is standard procedure in medical research. It is important to note two things about the technological setup. First, all participants' personal data and all medical data are stored on two separate servers (5 and 6 in Figure 5-1 above). Second, only the research-doctor can make the connection between the two and get the complete picture (9 and 10). This is important in case the research data indicate a person with risk of high blood pressure, the doctor has to contact this person so as to advise him to see his general practitioner. For this study however, none of these things were viewed or used. All empirical research consisted of interviews with participants concerning their experience in using iVitality and their personal views of health and blood pressure. The medical research parameters state that participants are aged 50 to 70; have never been diagnosed with dementia or any other memory condition; have never had a cerebrovascular accident[13] (CVA); and have experience in the use of cell phones and email. However, since this is not a

[13] A stroke, in Dutch: beroerte of herseninfarct.

medical study, there parameters were not of importance. Several of the participants were aged under 50 and one had a CVA.

In this version, the sensors (1) consist of a blood pressure meter, reaction time, activity, and sleep. The blood pressure is a separate device, with cuff to put around the left arm, and one button 'start'. Reaction time is measured with a mini-game in the app. Activity and sleep use several of the smartphone's sensors to construct an image of the participant's activity and sleep. Currently, blood pressure is the only external health sensor connected via Bluetooth. However, the application can easily be extended to support other sensors as well, such as blood sugar measure. For the next version of the smartphone app there are also different mini-games in development, to measure different aspects of cognitive capabilities. With multiple sensors, iVitality can become a personal health platform.

From the participants' perspective iVitality is an e-health application first. The research aspect was part of their motivation in the sense that they wanted to help further research and development in e-health applications and get a first contact with the technology. For some participants the motivation was specifically related to blood pressure, which meant a medical motivation for participating.

The iVitality application is built by the software development company Rotterdam Community Solutions (Rotterdam Community Solutions website). The smartphone app's start screen provides several modules, presented in the leftmost screen in Figure 5-2. 'Berichten' is a message services allowing contact with the research-doctor. 'Mijn Metingen' provides a graphic overview of the measures, such as the one shown in the rightmost screen in Figure 5-2. 'Nu meten' is the most used function, leading to measuring blood pressure and reaction time. The first time a participant measures his blood pressure, the app makes a Bluetooth-pairing with the blood pressure meter. After that, the app automatically connects to the blood pressure meter, shown in the screen second from left in Figure 5-2. 'Help' provides some answers to frequently asked questions, and 'Instellingen' allows the participant to share information about medication or quit the study.

Figure 5-2: several screenshots of the iVitality smartphone app.

In addition, the app asks a question concerning the participant's health once or twice a day. The question pops up in a screen, overlaying other apps, reminding the participant of iVitality in a quite strong manner. The questions are for example:

"how many glasses of alcohol have you had in the past 24 hours?" or "has one of your parents even been diagnosed with dementia or any other memory condition?" Some of these questions are asked once in the whole duration of the study (questions such as the latter one about dementia). Other questions are asked more frequently, to provide an extended view of the participant's health in a similar fashion to blood pressure measuring (questions such as the former one about the use of alcohol). Finally there is a user website which offers mostly the same functionality as the smartphone app, aside from the sensors. The main added functionality compared to the smartphone app is an extended view of the graphs. While the app always shows a fixed number of days for the graphs in 'Mijn Metingen', the website allows widening and shortening the scope of the graph, presented in Figure 5-3.

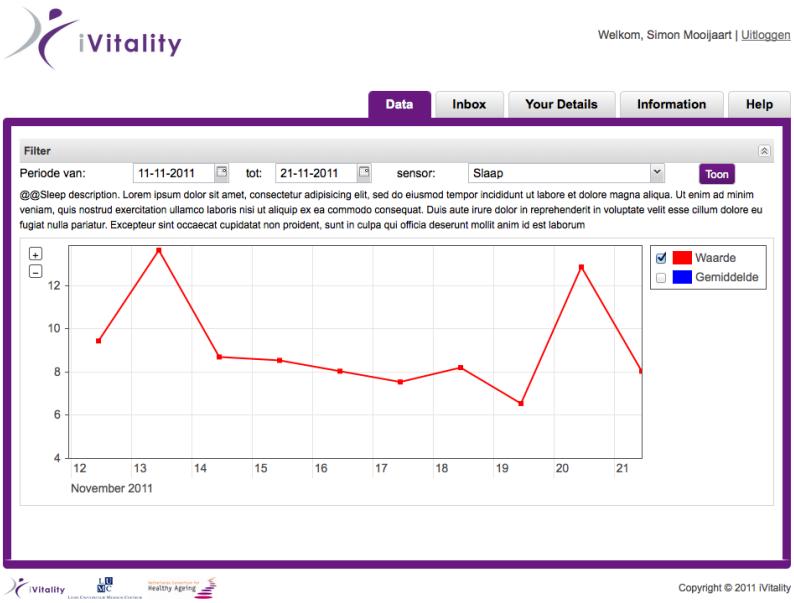


Figure 5-3: screenshot of the user website.

iVitality provides a generic research platform for medical researchers. The current version of the application focuses on blood pressure, as a blood pressure meter is currently the only external device that can be used. For the users, iVitality is an e-health app allowing them to monitor their blood pressure. Participants will be interviewed about their expectations and experiences using iVitality. The methodological support for the empirical research concerning this case study is presented in the next section.

5.3 Methodology: interviews before and after

The goal of the case study is to find empirical data implicating different interpretations of appropriation. The technology in this case is iVitality, an e-health application for blood pressure monitoring. Participants are asked to measure their blood pressure every day for a trial period of one month. These participants are interviewed at the beginning and again at the end of the trial.

In order to discriminate between three models in the theoretical framework requires qualitative data gathering. Each of the participants has to be probed for hints relating to their opinion of the technology, what meaning they ascribe to it and how it mediates blood pressure for them. The research method is semi-structured interviews with the participants.

Because technology appropriation is a process, each participant is interviewed before and after the trial period. The two interviews allow for comparison of the participant's views without the technology and with the technology. All interviews were in Dutch as all participants are Dutch. All interviews were transcribed and collected in a separate appendix.

As mentioned above, construct validity is concerned with measuring the right things. This means that variables, in this case interview questions, must represent a theoretical construct to be used in analysis. This representation is first built on the theoretical framework presented in chapter 4. Secondly, as these are interview questions for users of an application, the questions must bridge between the theoretical framework and the participant's perception. To deal with this aspect, four interviews were conducted for the further development of interview questions. These four development interviews were held with people who had used iVitality in the previous months, during development of the application. They had used the application off and on over several months and had used multiple versions. The goal of these interviews was to tune the interview questions so that they represented the constructs in the theoretical framework, and connected to the experiences and vocabulary of iVitality users.

The first lesson from these interviews is that as much as the entire first half of the interview can be introduction. This often serves one of two purposes: to blow off steam, or to get the interviewee going. Most people have some ideas prepared in their head which they want to tell about. The introductory part gives the interviewee the chance to speak his mind, before he has to answer any of the real questions; this allows them to 'blow off steam'. Other interviewees are not very talkative, and need some more time to start up. Some relatively harmless chatter that does not directly focus on the subject allows them to set their mind to the interview setting.

In relation to the study, two main themes arose: (1) e-health applications and (2) health. These two correspond to the technology and the world presented by the technology. With respect to how the interviewee viewed the themes, there is a difference between a general level and a detailed level. This difference exists first as (1) e-health applications in general and iVitality specific, and (2) health in general and blood pressure specific. Another difference between the general and detail level was in how the questions were answered, related to either a global notion of e.g. iVitality, or a personal opinion of iVitality.

When asked for their opinion of e.g. e-health applications, a lot of interviewees answer in very broad terms, referring to 'the general public'. For example: "e-health applications are very useful for patients of chronic diseases" (not from an actual interview). However, to get the interviewee to give his own personal opinion required a lot of probing and follow-up questions. Many of the follow-up questions are based on things the interviewee previously said, asking them to give their personal opinion on the subject, or to relate it to another topic in the interview. This

made the interviews less structured, which is not necessarily good or bad, it was simply what these interviews required. The interview protocol is presented in Appendix A.

A total of eight participants were interviewed. They used iVitality for a trial period of one month. Each participant was interviewed before and after the trial period. The participants were found through convenience sampling. These eight participants are in no way an adequate sample statistically representing the (target) population. The empirical aspect of the study searches for a proof of existence concerning a postphenomenological interpretation of appropriation. The number of participants who appropriate iVitality do not represent a percentage of some population. The analysis based on the interview results is not a statistical or quantitative one; it's a qualitative analysis of the results indicating the applicability of different theories.

5.4 Interview results per participant

The interview results are presented per participant. The first half points to the begin-interview, while the second half points to the end-interview. Four of the participants mentioned raised awareness of blood pressure, but in the end only two of eight participants had given the use of iVitality a place in their perception of blood pressure and health.

1) The first participant told that she had measured her blood pressure in a similar fashion at home (without an app), some 15 years ago. However, this had made her very unhappy, as she described that because of measuring, her blood pressure would strongly rise. Although she wanted to test herself to see if she could do it this time and maintain a normal blood pressure, she approached iVitality very skeptical.

Something similar happened this time, as her blood pressure results jumped up and down in the beginning. She ascribed this to the feeling of 'being tracked' by using iVitality. This calmed somewhat only after she 'surrendered' to it, as she forced herself to finish the trial period of the study. She finished measuring her blood pressure on a daily basis, but described being happy that it was over at the end of the month.

2) The second participant used to be a medical general practitioner. From this background, he had no specific expectations related to measuring his own blood pressure as he did not think anything special would result. For e-health applications he saw possibilities in continuous monitoring of patients when finding the right dose of medication, especially with elderly people.

At the end the participant described iVitality as being very user friendly, but could not keep him motivated for continuous measuring. He slacked on measuring his blood pressure towards the end, but did relate continuous monitoring once more to specific target audiences who are at risk of hypertension or take medicines. While he did not use the blood pressure function all the way to the end, he was very enthusiastic about the questions as the right combination of effort and raising awareness of topics such as alcohol or sleep.

3) The third participant's motivation came mainly from her curiosity for e-health as a topic. Her expectations focused on the app being easy to use. She considered herself as healthy and had no concrete expectations towards her blood pressure of health. A final remark that she made was that she is not the kind of person who goes for a full medical check every year.

At the end of the month, the participant described two things, 'being done' with measuring, and a positive confirmation of the possibilities of e-health applications. She described iVitality as a fantastic application, ideal for people who need it for medical reasons. However, as she is healthy herself, and her blood pressure values always stayed within normal boundaries, measuring felt like a waste of time. She connected this again to the full medical check towards which she is very critical; "als het goed is, dan vind ik het zonde van mijn tijd."

4) Participant number four is a management consultant in the healthcare industry who works on project basis, in alternating periods of quiet and busyness. He mentioned expectations of a certain fun-factor, but more importantly insight into his own blood pressure. He explained his blood pressure is usually somewhat high, and further related high blood pressure to how you deal with work and personal life. In relation to e-health apps he viewed their potential impact in terms of 'patient empowerment'.

As expected, iVitality could provide the participant insights into his own blood pressure. Not only did it turn out to be better than expected, but the insight also revealed a relation between work-stress and blood pressure as the graph revealed a pattern in weekdays and weekends. This insight made him more conscious of tensions, and this awareness actually influenced his behavior. "Dat je zegt 'ik wind me nu op over dingen, en dat heeft weerslag op mijn bloeddruk.' Maar eigenlijk is dat niet nodig, als je je niet druk maakt is er niets aan de hand. En dat vind ik wel erg goed, dat opent wat mij betreft wel een wereld aan mogelijkheden, veel breder dan dit alleen." He thus continued to relate his own experience to the general theme of e-health. In addition the interview touched on patient empowerment again, for which he stated that insights are the starting point of empowerment.

5) Participant number five was the only one of the group who had to measure his blood pressure for medical reasons. He had a CVA in 2003, and was since forced to measure his blood pressure twice a day; to monitor blood pressure levels for risk aversion, and to find the right dose of medication. Since the CVA he was very ill and he was reminded of that every day by having to measure his blood pressure: "Eigenlijk is het helemaal niet leuk om zo met jezelf bezig te zijn, met meten enzo… aanvankelijk had ik er ook wel moeite mee dat ik een ziek iemand was … Bloeddruk meten symboliseerde dat." In 2004, he built his own mobile app to register his blood pressure. This turned his life around; creating this app gave him back a sense of control and power over his own situation.

After a period of about four years he had managed to reduce his blood pressure to an acceptable level, and measuring became boring. "En bovendien, op een gegeven moment wil je ook niet meer ziek zijn." A feeling of treatment and belonging to a risk group always stuck to measuring his blood pressure, which is why he stopped measuring completely. Since last summer he had also stopped taken blood pressure medicines while on holiday. Now he explained that he should

start measuring again, and probably check his medication, which is why he participated in iVitality.

With iVitality, the participant started measuring his blood pressure again regularly and started taking his medicines again. The iVitality app is far simpler than the one he once created, and does not have that feeling of power or control. However, this was not a problem, but rather a good thing. “meer dan aan het begin, wil ik er ook eigenlijk zo weinig mogelijk nog mee te maken hebben… nu wil ik er niet zoveel meer mee te maken hebben liever. Dat is eigenlijk een nieuw gevoel dat er bij komt. Dus die controle is wat minder belangrijk. Ik zou liever willen dat het een beetje uit mijn leven verdwijnt.” iVitality has less feedback and less options, “daar staat tegenover dat ik het ook een minder prominente plaats wíl geven in mijn leven… Het is anders dan 10 jaar geleden, toen wilde ik er echt iets aan doen, nu niet.”

And iVitality allowed exactly that, “met die iVitality kun je dingen heel routinematig afhandelen… Zo simpel gaat het… met deze metingen leef je een volstrekt normaal leven. Je bent niet ziek.” iVitality’s extreme simplicity detached it from all association to treatment or being at risk, “dat komt door het routinematige… dat heeft niks meer met ziek zijn te maken.”

6) Participant six, a consultant in the healthcare industry, had strong views on the possibilities of e-health applications. In terms of technical capabilities, almost anything is possible, however we still have to get used to using these kids of technologies in the health context. He elaborated this view with e-health applications providing insight, making people aware of certain aspects of health, and even evoking user action with respect to how they deal with their own health. However, he was somewhat doubtful if he was the right target audience, since he is young, healthy, and has never had any trouble with his blood pressure.

For the trial period, participant six had faithfully finished measuring his blood pressure daily. In the end interview, he extended on his view of e-health applications. He mentioned two main purposes: prevention and coaching. Prevention could be applied for monitoring specific target groups (an additional group he mentioned was pregnant women). Coaching could be used to stimulate people to change their behavior, based on different forms of feedback. These two uses could reduce healthcare costs by replacing part of our traditional healthcare. However, in translating these ideas to iVitality he could not relate any of these things with his own experience. He did not personally experience any insights, awareness, or coaching, due to lack of feedback or any medical motivation.

7) Participant seven, also a consultant in the healthcare industry did not describe any concrete vision of e-health applications. He approached iVitality somewhat skeptical, because he did not have an active conception of blood pressure in his personal picture of health. This he explained with an example of weight as being much easier to work on: “als je te dik wordt weet je wat je er aan kan doen. Ik kan mijn bloeddruk wel gaan meten, maar… ik heb te weinig kennis van zaken om te weten wat ik doe met de uitkomst. Dus waarom zou ik het meten dan?”

At the end of the month, the participant did elaborate more on a vision of e-health applications. As possible effects of e-health applications he mentioned

influencing lifestyle, awareness, preventive use, gathering information, enabling monitoring over distance, digital consults, and responding to an acute crisis such as a malfunctioning pacemaker. However, this all could not be connected to his personal experience using iVitality. In addition he completely stopped measuring after two weeks. He related this to lack of feedback and the resulting inability to interpret the measured data, "dat is meteen waarom het bij mij nooit meer werd dan meedoen aan het onderzoek… het is in ieder geval niet mijn instrument geworden voor mijn gezondheid."

8) Participant eight joined because he wanted to personally experience the use of an e-health application, since he dealt with them professionally as a healthcare consultant. He elaborated an impressive vision on digital technology in healthcare practices. A main problem lies with healthcare providers who have trouble accepting that such technologies will impact and change the way they are used to doing things. When handing over some tasks to a technology, many healthcare professionals experience this as a loss of control. However, a technology such as iVitality can be seen as many limited contacts with a healthcare professional. Each of these 'contact' is not nearly as rich as a face-to-face consult; but those face-to-face contacts that you do have can have more value with such extensive blood pressure data. "Ik hoor behandelaren zeggen: 'nu ik die technologie heb, in wezen breek ik mijn spreekkamer open, en krijg veel meer momenten waarop ik contact kan hebben, via die technologie, met mijn client.'… je hebt wel meer en andere contactmomenten, die ook weer maken dat op het moment dat je wél elkaar live ziet, dat die contactmomenten weer rijker zijn qua waarde. Dus men ziet wel het potentiëel, maar moet nog erg wennen aan de veranderingen die dit met zich meebrengt."

At the end, this participant admitted that he didn't measure with regular frequency during the second half of the period, and that it was hard to give this a place in his daily routine. He did not experience any change e.g. in his views of his own blood pressure, because of using iVitality. But he did explicate that he found iVitality a great application for people who have a particular reason to monitor their blood pressure.

Several things are notable in these results. The first is that two participants, number 4 and 5, have been impacted by iVitality unlike the others and also unlike appropriation theory in IS accounts for. With participants number 2, 6 and 7, there was an orientation towards the technology as presented, and this did not really change after one month. For participants 1, 3, and 7, iVitality had a distinct other meaning than just an e-health application that focuses on blood pressure. How we can read these results in terms of the theories will be discussed in the next section.

5.5 Analysis of the results

Most participants viewed iVitality as a very interesting technology, a model for the future of e-health. However, most participants also viewed themselves as not belonging to the target group for an application that focuses on blood pressure. Some very practical feedback from the participants can be found in their vision of e-health applications and how they relate that to iVitality. The use of e-health applications can be found mainly in prevention and coaching. However, these can

only be applied to very specific target groups, in this case people with some risk of high blood pressure. More general, prevention can be applied for risk groups such as chronically ill or pregnant women by monitoring certain crucial health values. Coaching can be added by having the application interpret and respond to the measures. This is basically a form of feedback which was found to be somewhat missing in iVitality. Feedback was also explicitly mentioned by several participants as a crucial aspect of keeping participants motivated. This could be in the form of a written message after a blood pressure measure (e.g. "that is well within normal bounds," or "this is a somewhat high value"), or information about blood pressure or the topic of the questions asked. In addition, as participant eight explicated, an important aspect of e-health applications is appropriation of the application by healthcare providers, who have to integrate the new technology into their existing healthcare practice.

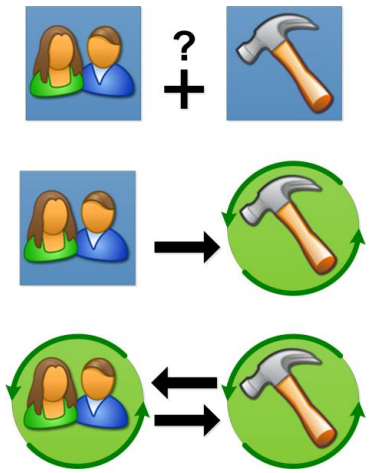


Figure 5-4: Theoretical framework, following chapter 4

With respect to the more detailed analysis, the internal validity will first be addressed. Internal validity essentially revolves around the question: "would someone else have come to the same conclusions, given the empirical data?" This section focuses on three results, corresponding to the three models of the human-technology relations in the theoretical framework, shown here in Figure 5-4: the first being that of static interaction between two separate entities; the second being that of a dynamic view of technology, technology changes meaning during use; the third being that of co-constitution, use of the technology changes both the technology and the person. The first model is the one underlying user acceptance theory in IS literature. The second model is the one underlying appropriation models in IS literature. The third model is the one underlying the structurational model of technology. With respect to each of the three models, the question is asked how much it covers in relation to the empirical data. If the first model runs out of 'explanatory power' so to speak, the analysis moves to the next one.

1) User acceptance: static interaction with technology

User acceptance theory applies to all participants, however only covers a limited part of iVitality use. Looking back at who 'accepted' iVitality, this can be said to be participants number 4 and 5. The others all slacked measuring halfway during the trial, or finished daily measures till the end of the trial 'because they participated in a research'. In terms of user acceptance theory, this can be addressed in terms of motivation: participants number 4 and 5 were the only ones with a medical motivation to participate. Participant number 4 because he feared being at risk of high blood pressure, and participant number 5 had to measure because of the CVA. The others just wanted to get a taste of what e-health technology is like. If you were to look strictly at the UTAUT model, Figure 2-2, this can probably be accounted for in terms of 'Performance Expectance'. The

participants who did not have a medical motivation did not perceive the technology as being useful for them personally since they did not belong to the target group. Another aspect that was mentioned by multiple participants was a lack of feedback, which could be interpreted as limited 'Facilitating Conditions'.

However, as mentioned before, user acceptance models have a rather limited scope. Only for three of the participants this theory is enough to cover how they interacted with iVitality. For the others, the meaning of the iVitality technology was transformed. This is something not addressed in the user acceptance theory. For this aspect, we move to appropriation models. The participants that can be described in terms of user acceptance were:

P#3: measuring something while there is nothing wrong is a waste of time.

P#6: use of iVitality strengthened view of e-health, but he was not in target group and unable to relate his personal experience with iVitality to this generic view of e-health.

P#7: he was not in target group, and missing feedback to allow further interpretation of the measured data.

2) Appropriation: transformation of the technology

So far, three of the participants have been 'dropped', as their cases require little more explanation that what is offered in user acceptance theory. For the other users however, there was more going on. The 'Technology-as-designed' transformed into a 'Technology-in-use'. Although only two of these truly made iVitality 'their' tool, the focus of this interpretation lies with the transformation of meaning of the technology. For participant 1, using iVitality felt like constantly being watched over. This was explained almost as a 'big brother' feeling. Participant number 2 was no longer interested in measuring his blood pressure after the first week. However, the questions kept him interested. He explicitly shifted the technology's focus from blood pressure to the health related questions. Participant number 4 was the only one to make the connection between his personal experience with iVitality and a more general vision of e-health applications. For participant number 5, the focus of iVitality was in its simplicity, mainly as being less complex and easier to integrate with his daily routine than any other alternative. Participant eight focused his vision of e-health on the applications serving as a means of communication between patient and doctor. The application is not so much a monitoring device, but a device that allows for small and a-synchronous moments of contact. This interpretation is an explicitly distinct one from its other definitions.

However, also these models have their limitations. The focus in appropriation models is on the transformation of the technology during use. The impact that use of the technology can have on its user is not covered in these models. This impact is very present in two of these five participants, which will be discussed in mediation theory. The participants whose engagement with iVitality can be covered with appropriation models are:

P#1: iVitality tracking her every move, giving a 'big-brother' feeling.

P#2: not interested in iVitality's blood pressure measures, but shifted focus to the lifestyle questions.

P#8: iVitality as a means of communication rather than monitoring, providing limited but many more and very specific contact moments between doctor and patient.

3) Mediation: co-constitution of user and technology

After having covered six of the participants, there are still two who's appropriation of iVitality displays aspects that can not be described with the theoretical construct of user acceptance or technology appropriation models. The way they have appropriated iVitality had a specific impact on their lives and on how they view blood pressure that falls outside the scope of any theories discussed so far. This impact can be addressed in terms of mediation. Te use and appropriation of iVitality mediates how they relate to the world around them, to blood pressure, and to their own lives. In these two cases, iVitality becomes a co-constituting medium.

In the case of participant number 4, the direct impact of using iVitality was an insight into his blood pressure, and knowledge on his blood pressure being better than expected. But then, this insight transformed his view of blood pressure and unmistakably made him aware of blood pressure's relation to (work related) stress. This new view of personal health in turn transformed the meaning he ascribed to iVitality, as a means to influence his own behavior, and this in turn "opening a world of possibilities." The case of participant number 4 shows clearly a reciprocal relationship of using technology and resulting change of both the user and the technology.

For participant number 5, measuring of his blood pressure had always remained somehow connected to being ill, being in treatment, and being at risk. However, this aspect completely disappeared with iVitality. Because of its extreme simplicity it allowed seamless integration in the daily routine, while not focusing strongly on the measured values or the health implications of this value. As he stated, with iVitality "you live a perfectly normal life. You are not sick." Appropriation of iVitality has completely changed the way he deals with his condition and the medicines he takes for it. iVitality has allowed him to lose the constant feeling of illness, treatment, and risk.

In both cases, the user appropriates iVitality, and is in turn co-constituted by it. This means that the use of iVitality serves as a medium to approach the world, which in this case means the themes of blood pressure, e-health applications, influence of behavior, and constitution of health or sickness. The participants make part of the technology part of who they are, and become hybrid with iVitality. In the interviews, they are not using the technology, and the technology is not in the direct presence to provide affordances. Instead, iVitality has become part of who they are, which constitutes a *hybrid presence* of participant and appropriated technology (see section 3.5 Appropriation for more on hybrid presence). It is this hybrid presence which mediates how they relate to their own being and the world around them. In case of the 'participant 4 and iVitality'-hybridity, this mediates how he thinks of blood pressure and e-health applications. For the case of the 'participant 5 and iVitality'-hybridity, as a hybrid he is no longer constituted as a sick person.

P#4: strong personal experience of "insight in blood pressure, awareness of stress, and change of behavior", and this experience allowing him to relate iVitality to e-health applications in general.

P#5: using iVitality changed the way he lives with his condition. This technology has turned his life around, removing him from 'being sick'.

In this section, I have tried to show that all IS theories have their value, even though they have very different approaches to the human-technology relation implied. But more important, this analysis strongly implicates that the third human-technology relation does in fact exist. The empirical data suggest that the effect of technology appropriation can reach well beyond only the transformation of that technology. Appropriation can lead to co-constitution, a concept previously not known in IS literature (although implicitly it is part of the structurational model of technology and participatory appropriation). I do not claim that my analysis is completely internally valid. However, I am convinced that anyone else using these empirical data is unable to account for the impact iVitality has on participants 4 and 5 using only theories based on the first or second human-technology relation. As such, this case study delivers empirical validation of the co-constituting relation's existence.

Looking back at the participants, the motivation seems to be a rather determining factor in whether a durable appropriation of iVitality could be accomplished. The only two appropriations were by those participants who had a medical motivation to use iVitality. Starting on the other side, it can be said that the more complex an interaction becomes, the more complex models are required to describe this interaction. In three cases, there was no acceptance, these cases can simply be described with user acceptance. The same is modeled as non-appropriation in the Technology Acceptance Model (see Figure 2-5), the interaction with the technology does not move beyond a static contact. A technology can also be related to, and later discarded, called disappropriation. The important difference is that this way of modeling makes a transformation of meaning compared to the 'Technology-as-designed' explicit. However, in cases of real appropriation of technology, the interaction's complexity goes beyond these models as well. The technology get's a co-constituting influence on the user, which requires new theory that has not been fully developed within IS.

5.6 Conclusion

Section 5.1 stated the goal of this chapter, which is to empirically validate whether a co-constituting interpretation of appropriation exists or not. The case study for this empirical research is iVitality, a digital research platform and e-health application. iVitality uses smartphones to have participants measure their blood pressure at home, the specifications are presented in section 5.2. The next section, 5.3, laid out the main research methods, which are semi-structured interviews with the participants at the beginning and end of the trial. The questions for these interviews were developed using four development interviews to relate the theoretical constructs to the perspective of the participants. The results of these interviews are presented in section 5.4. The results of the eight participants present a wide range of engagements to iVitality. The analysis in section 5.5 showed that aspects of all theories in IS literature are present.

However, in two cases the traditional interpretation of technology appropriation is not sufficient to adequately cover the results of using iVitality. Thus, a new theory, such as mediation, is required to address these cases. The first was able to relate the insights to awareness and influence in behavior, and then connect those personal experiences to a broad vision of iVitality. The second has to measure his blood pressure because of a CVA and blood pressure medication. With iVitality he

could finally measure this in a way that does not constitute him as someone who is ill, in treatment or at risk. In these cases, the participant and iVitality constituted a hybrid presence which mediates intentionality without further direct engagement to the technology.

This chapter shows that in use of technology, there are aspects of user acceptance, technology appropriation, and mediation. Thus, empirical evidence implicates the existence of a co-constituting interpretation of appropriation. An interesting aspect of the analysis presented above is that appropriation does not necessarily correlate to use. Participants 3 and 6 finished the trial measuring on a daily basis, however did not appropriate or really 'accept' the technology. On the other hand, participants 2 and 8 slacked measuring their blood pressure nearing the end of the trial, but were still able to redefine the meaning of iVitality.

In relation to user acceptance theory, some users engage the technology from a certain opinion leading to their acceptance or non-acceptance. However, people who 'accept' the technology enter a complex relation to the technology that goes beyond a mere change of opinion about the technology. The meaning ascribed to the technology changes. This was also witnessed in several participants, who provided a different interpretation of iVitality than the one presented to them in the beginning. In two cases, the relation between user and iVitality became even more complex, as these users integrated the technology into their mode of existence. Appropriation here has the character of hybridization, co-constituting the user.

The final validity issue is that the external validity of the results and conclusions. As this case study investigates the use of an e-health application, the question is whether these results can be generalized outside the domain of e-health. There are two types of results: (1) the results relating to e-health applications specifically, and (2) the results in terms of the interpretation of appropriation.

With respect to the first type of results, those relating to e-health application, I claim no external validity. In summary, these results are the views of iVitality as an e-health application. It can have function as remote monitoring, in prevention and coaching for specific target groups. In addition, feedback is crucial to get and keep users involved. And finally, motivation (in this case a medical motivation) appears to be crucial in which users will accept and appropriate the e-health application. In a different perspective e-health applications can also be interpreted as a means of communication between the doctor and patient, and appropriation of digital technology in healthcare is as much an issue for the healthcare providers as it is for the patients. These results might be applicable outside the domain of e-health applications. But whether or not these results are generalizable beyond e-health is not part of this study.

With respect to the second type of results I address external validity in terms of the theoretical framework and the domain of origin behind the theories to which the theoretical framework refers. This case study serves a clearly defined purpose for our understanding of technology appropriation. As the use of iVitality provides a proof of existence of mediation resulting from technology appropriation within e-health, it thus also validates the existence of mediation through appropriation with relation to technology in general.

Building on these results, the next chapter wraps up the entire study, by placing the conclusions from this chapter in light of the entire study and those of the other chapters. The contribution of this chapter to the study is the empirical validation that technology appropriation can lead to co-constitution of user and technology.

6 Conclusion: co-constitution through appropriation

This study tries to understand and develop the theory to address questions concerning how we are impacted by the use of smartphones and social media. The current theoretical landscape of Information Systems (IS) literature presents an unclear image of how we interact with technologies, and what impact this has exactly. Rogoff (1995) already identified three different interpretations of the concept appropriation, and each of these interpretations is present in IS theories. In order to create some order between the various interpretations of human-technology relations this study bridges IS literature and Philosophy of Technology.

Chapter two provides an overview of IS literature. The first line of research is user acceptance theory, represented by the Universal Theory of Acceptance and Use of Technology (Venkatesh et al., 2003). The second line of research is technology appropriation, represented by Adaptive Structuration Model (Poole, DeSanctis, 1989) and the Technology Appropriation Model (Carroll et al., 2001). The third line of research is socio-technical systems theory, represented by the Structurational Model of Technology (Orlikowski, 1992). The role of this chapter is to identify a gap in relation to this literature.

This gap is the unclear perspective on how humans interact with technology. There is no consensus on what philosophical assumptions are made about humans in these models. This becomes apparent when compared to the three interpretations of appropriation as identified by Rogoff (1995), which fit respectively with (1) user acceptance, (2) technology appropriation, and (3) socio-technical systems. To understand how to assess the human-technology relations underlying these theories, I turn to Philosophy of Technology (PoT) and specifically Mediation Theory.

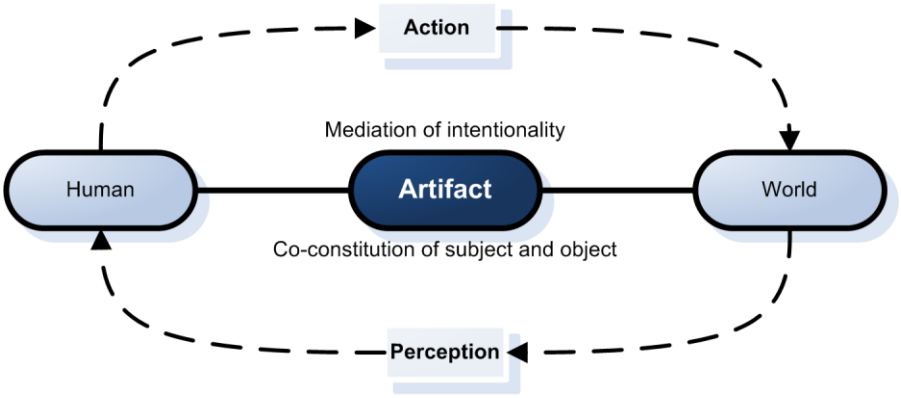


Figure 6-1: Postphenomenological framework, as presented in chapter 3

Chapter three starts with an introduction into mediation theory. The central notion is that technologies we use mediate how we relate to the world (see Figure 6-1). By influencing this relation, they co-constitute who we are as subjects. We are no longer fully autonomous subject separate from the objects around us, but instead become hybrids with the technologies we use. This hybridity is actually not strange to us, think of a carpenter, a musician, a driver, and a programmer.

The next step is to extend this theory to account for the influence felt because of the presence idle technologies, such as the smartphone in your pocket. These idle

technologies have a technological presence that offers us potential uses. These potential uses can be understood as a postphenomenological interpretation of affordances. However, these affordances themselves have to be constituted between a subject and a technology. Which affordances are constituted depends on what technologies the subject has appropriated. The smartphone does not afford anything to someone who has never seen a mobile phone before. Before we can constitute hybridity, we must appropriate the technology. This becomes very visible with every introduction of new technology, people have to learn. But then, this learning is not just acquisition of some knowledge or skill, it is integrating part of the technology into the user's mode of existence. Appropriation of a technology is not some form of acquisition, but rather a process of hybridization.

In turn, this process of appropriation constitutes a hybrid presence between the human and the technology that further mediates intentionality beyond the direct involvement of the technology. As a smartphone user, having mobile internet access becomes part of who you are; this aspect is also present in how you relate to the world around you even when you are not surfing on your smartphone.

Chapter four uses this postphenomenological understanding of technology use to reassess the theories in IS literature. This is summarized in a theoretical framework that consists of three models of the human-technology relation (see Figure 6-2). The three models correspond to the three interpretations of appropriation provided by Rogoff (1995), and consequently also to the different theories in IS literature.

The first model is a static conception of the human-technology relation. Human and technology are two separate entities, and use of technology will have the character of instrumentalism or determinism. Theories that use this human-technology relation as underlying assumption will focus on either opinions of the user or material aspects of the technology. A theory could also focus on both, but what they are is defined independently of the other. A phone is a means of communication, and the user is a subject who can have the desire to make a phone call.

The second model is a somewhat more dynamic conception of the human-technology relation, in which at least the meaning of technology can change. In relation to the previous model, the human subject is still defined independent of the technology. However, the meaning of the technology is defined in relation to its user. Technology appropriation models based on this human-technology relation make this dynamic aspect explicit, by modeling how the meaning of a technology changes in use of that technology. In this case, the user is still a rather autonomous subject who has the desire to make a phone call. But what the phone is, is defined in relation to this user. For a user with the desire to open a beer bottle, the phone may become a beer opener.

The third model of the human-technology relation takes it one step further. Not only is the technology defined in relation to the user. The user is also defined in relation to the technology. Someone who has a phone is constituted as a potential phone user. With respect to appropriation, this means that appropriation is a process that not only transforms the meaning of technology, but also transforms who the user is. To validate whether this third hypothesized human-technology relation actually exists, an empirical research is conducted using the iVitality case study.

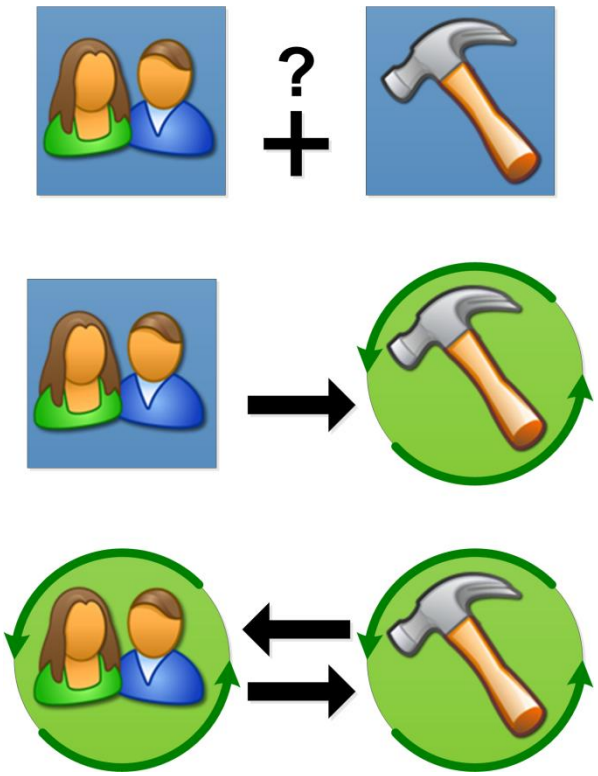


Figure 6-2: Theoretical framework, as developed in chapter 4.

A case study tests the theoretical framework for coherence with empirical evidence. The technology in the case study is iVitality, a digital research platform and e-health application for monitoring blood pressure at home. Eight participants used iVitality for a trial period of one month, and are interviewed before and at the end of the trial period. The questions for the semi-structured interviews are developed with four development interviews, using people who had already used iVitality during development of the application. The results of the interviews show that aspects of all theories are present.

User acceptance theory points to (medical) motivation and feedback as important criteria for acceptance of the technology. However, most of the results fall outside of the limited explanatory scope of user acceptance theory. Using technology appropriation allows to point explicitly at the different meanings people ascribe to iVitality. One participant described a 'big brother'-like feeling of being tracked, another switched focus from blood pressure to the lifestyle questions and a third focused on e-health applications as means of communication between doctor and patient. Still, there were two cases in which the effects of using iVitality go beyond the scope of technology appropriation.

For participant 4, appropriation of iVitality had constituted him as a person with an empowered understanding of blood pressure, awareness of stress, and more control over influencing his own behavior. In addition, he could connect this personal insight to a further understanding of e-health applications in general. For participant 5, measuring his blood pressure and taking medication had been a medical necessity since 2003. However, measuring had always constituted him as a sick person. Until iVitality, which allowed him to live a normal life once more. In a

hybrid presence with iVitality, he was no longer constituted as someone who is sick, in treatment or at risk. These two cases thus validate the existence of a mediating interpretation of appropriation. Appropriation that has the character of hybridization, and that co-constitutes the person appropriating the technology. These two participants constituted a hybrid presence with iVitality that mediated their intentionality since the trial period.

6.1 Contributions

After having laid out the context of IS research in chapter 2, each following chapter provides one of the main contributions of this study. The first three ways this study contributes to IS research and PoT are: (1) development of a postphenomenological interpretation of appropriation and hybrid presence, (2) development of the theoretical framework that explicates the human-technology relations underlying IS theories, and (3) empirical validation of the existence of this new understanding of appropriation. This study as a whole serves as the final contribution (4), to bridge the two domains of Information Systems research and Philosophy of Technology.

1) The first contribution is a further extension of mediation theory. First by adding several existing concepts: technological presence and affordance. Then by developing a postphenomenological interpretation of appropriation, and further by developing the concept of technological presence. Being a smartphone user or a Facebook user co-constitutes you. Not only because the use of the technology mediates intentionality, but also because in appropriation you make part of the technology part of who you are. You become a co-constituted subject: someone who ‘is on Facebook’, and someone who ‘uses a smartphone’. In this form of hybridity, all intentionality is also mediated in some part by the smartphone or social media being a part of you.

This is a contribution to the postphenomenological philosophy of technology. The first step is to explicate a relation between several existing concepts. But the real contribution lies in the further development of the concept of hybrid presence. We relate to the world around us in a very specific way because we are technological subjects. While we are not always actively using all the artifacts we have, the hybrid presence we constitute with them is always there and always influences us.

2) The second contribution is the development of the theoretical framework, explicating the human-technology relations underlying different IS theories. It can serve as a taxonomical tool to analyze IS theory. So far, user acceptance theory seems to stick to a static view of the human-technology relation. The human and the technology in this relation are separately and independently defined, their relation is one of static exchange. Technology appropriation in IS literature uses a dynamic view of technology. The human in the relation is static and defined independently of the technology, while the technology is defined in relation to the user. Participatory appropriation, structuration, and mediation use a more dynamic conception of the human-technology relation. Both the human and the technology are defined in relation to each other. Use of the technology is a reciprocal relation that changes both the user and the technology used.

This is a contribution to the Philosophy of Information Systems. This theoretical framework explicates the philosophical conception of human and technology implied in IS theories. A theory with limited scope might do with a somewhat simpler conception of the human-technology relation, but then also lacks extensive explanatory power. A somewhat more complex theory will explicate that technology will develop different meanings depending on context and user. However, if we look then at the impact such a new technology has on that context and those users, these models also lack explanatory capabilities. Those questions require a further complicated conception of the human-technology relation that also constitutes the user as a dynamic subject that can be co-constituted by technology.

3) The third contribution is the empirical validation that such a co-constituting human-technology relation is coherent with empirical data. At least two of the participants described their experience with iVitality in a way that can not be covered theoretically with technology appropriation theory as currently used in IS literature. Their experiences can only be adequately understood with an interpretation of appropriation as hybridization. With iVitality, they constituted a hybrid presence that made them a different person.

This is a contribution to both Philosophy of Technology and Information Systems. For PoT, this is an empirical validation of a concept that extends mediation theory. For IS research, this is an empirical implication that to understand more complex interaction with technology requires a richer interpretation of appropriation. This is something different from the first two contributions. While the first contribution is a theoretical development of a new concept within the context of mediation, this is an empirical validation that this concept indeed occurs in our engagement to technology. And while the second contribution explicates the different philosophical underpinnings implied by IS theories, this case study indicates that we have good reason to believe a dynamic and reciprocal view of the human-technology relation does in fact exist in how we engage technology, and that theories built on this philosophy have more explanatory power.

4) The final contribution is the goal this study as a whole serves, which is to bridge Information Systems research and Philosophy of Technology. The first connection has now been created with the concept of appropriation. This new interpretation of appropriation allows us to have a richer understanding and appreciation of how a smartphone and Facebook profile can be part of our identity. The smartphone and the Facebook profile co-constitute us as we appropriate them.

The bridge between PoT and IS can be a contribution to both domains. For PoT, IS literature provides a rich empirical base and a strong focus on the process leading up to use of technology. Even more so, information technology is a dominant technology in our society, which has so far received little attention within PoT. For IS, PoT literature can provide a strong theoretical basis for new models and ways to interpret empirical data. To put it stronger, reflection on how we conceive of users and technology has received little attention within IS literature.

Further development of the bridge between Philosophy of Technology and Information Systems research can be explicated as a domain of Philosophy of

Information Systems. This can serve as both a critical reflection for IS research, and further development of the philosophical aspects of information technologies such as the fundamental differences between (virtual or digital) information technologies and the more physical technologies.

6.2 Discussion

There are a number of unrelated issues that I still wish to discuss. This section presents limitations, some discussion, and possible future directions.

Within IS research, there is a tradition called socio-technical systems theory. Due to scope and time constraints I have not been able to get a complete picture of this line of research, what I do know is that the structurational model of technology is a prominent representative of this tradition. As it seems, this model presents a conception of the human-technology relation that is very compatible with a postphenomenological philosophy of technology. Thus, in retrospect, to create a bridge between IS and PoT might have been more efficiently done through connecting mediation theory and the structurational model of technology. However, this approach allowed me to analyze a broad spectrum of IS theories in terms of the human-technology relations underlying these different models. This idea of further investigating socio-technical systems theory now serves as an interesting future direction.

In relation to the previous point, future directions point at further development of this new understanding of appropriation into concrete models, theories, and constructs. This study has remained at a rather abstract level when relating to the concrete construct of for example Adaptive Structuration Theory (and there are many constructs in AST). Thus, further development of the bridge between IS and PoT also requires further translation of what co-constitution means for technology appropriation models. Issues in this area relate to what kind of models can capture the reciprocity of this postphenomenological human-technology relation. Another question concerns the issue Delaney (2010) was working on is how to make the translation of individual mediation and hybridization, to technologies influencing companies. Can we understand e-business in the same way that a programmer is hybrid with his computer skills?

Also related to these issues is the small scale of the empirical research of this study. For a proof of existence, the interview results surpassed my personal expectations. However, any further conclusions, for example related to the actual process of appropriation, are beyond these results. Thus, more empirical research is required for further concretization of the concepts developed and validated in this study.

When setting up the empirical research, this study entered the domain of e-health. While e-health is a full research domain in its own right, no further literature from this domain was consulted. On the one hand this was a limitation due to constraints of time. On the other hand it was a conscious restriction on the scope, as this study aimed to investigate concepts that are not developed within the context of e-health. I do not know if any specific results related to e-health, such as those on motivation and use of e-health applications for prevention and coaching, can be addressed by existent e-health theory. I can not elaborate on the significance of these results and

I do not claim any external validity with respect to these results. Other than that, the presented aspect does point to an interesting future direction. As e-health is itself a bridge-domain between information technology and healthcare, I can say with confidence that the addition of mediation theory can certainly strengthen understanding of the technology involved in this domain.

This study was conducted as an internship at the company Rotterdam Community Solutions (Rotterdam Community Solutions Website). This is the company that created the iVitality application. RCS is a small software development company, with a unique vision on the solutions they develop. This vision revolves around *self-organization* and *communities*, and ultimately the combination of self-organizing communities. Self-organization refers to providing end users the capabilities to organize their own work and life. Using IT, a lot of organization efforts can be outsourced to the users. For example: outsourcing work-planning activities to employees and IT. Within the company, the employees form a community who together perform all work-activities. Providing these employees with the right tools for self-organization asks that these employees take over certain responsibilities that were previously dealt with through hierarchy. This hierarchy is replaced with a community aspect, and employees will take this responsibility and take it seriously. This way, a company can be transformed from a hierarchically controlled organization to a self-organizing community.

RCS is currently involved in the flagship project Rotterdam Open Data (Rotterdam Open Data website). The idea is to turn Rotterdam into an ‘open city’, where all publicly owned data is available and open for reuse by anyone. Sources of data include: the municipality releasing datasets; institutions and companies publishing data; residents generating data with their smartphone; and sensors throughout the city generating live data (e.g. about traffic). The goal is to make Rotterdam a self-organizing community of residents and entrepreneurs. Open data is the first step in providing people with the capabilities for self-organization.

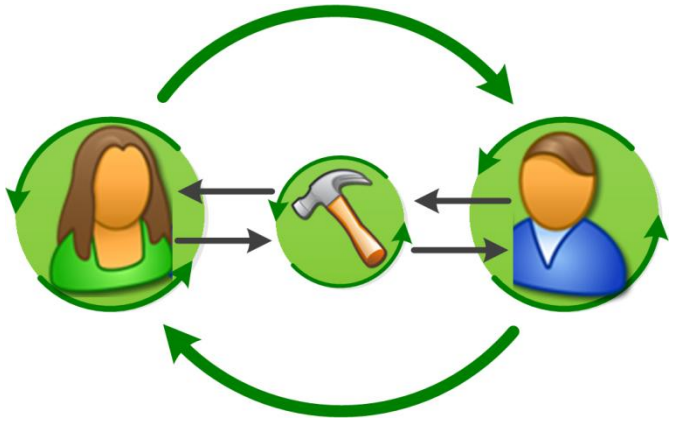


Figure 6-3: The Rotterdam Community Solutions version of a co-constituting human-technology relation

The relation to appropriation lies in viewing self-organization as a hybrid capability. It requires specific technological capabilities, and then requires users to appropriate those capabilities. In turn, the technology and users are co-constituted as ‘self-organizing users’. If done right, these self-organizing users can also be

constituted as a community. On the one side, the community is a result of co-constitution. The users are co-constituted as part of the community. On the other side, the community is a mediating structure that influences perceptions and actions in a very specific way, for example by emphasizing the relation of all those perceptions and action have to other members of the community. In discussion with Aad Nales (company director) and Marc Rijnveld (senior consultant) on the relation between appropriation, self-organization, and communities, a new version of the human-technology relation was drawn by Aad Nales (Figure 6-3). This version is not fundamentally different in terms of the human-technology relation, but it emphasizes the human-technology-human aspect of communities. This figure thus explicates that all technologically mediated actions in turn also impact other participants of a community. On the other hand, a community can also develop a shared meaning of technology, and in turn the technology influences the shared experience of what is means to be part of the community.

When related back to Rotterdam Open Data, the municipality will release a data set. This data set can be interpreted in various ways, and it means different things for different people. One person might suddenly develop a brilliant business concept based on this data set. Having access to this data then co-constitutes him as an entrepreneur. Some time later he release a smartphone app based on this data set. This smartphone app provides a very specific meaning to the data, which in turn changes how other entrepreneurs view this data set. This new meaning of the data set can then again provide new business ideas to those entrepreneurs, who are then in turn co-constituted by the actions of the first entrepreneur.

A final point of discussion I wish to address concerns the origin of the concept appropriation. Within IS literature, it is introduced by Poole and DeSanctis (1989), in the first version of Adaptive Structuration Theory. They reference Bertell Ollman (1971), author on Marxist theory. So far I have not used Ollman's definition in this study, because I wanted to explicitly limit the scope to what appropriation means within the context of IS. But when re-reading Ollman, I was surprised by how limited the interpretation of appropriation within IS really is. It is not so much that what Poole and DeSanctis used is wrong, but is certainly incomplete. Given the mediation theory presented in this study, Ollman allows for a very postphenomenological reading of appropriation:

> "Appropriation, together with perception and orientation, is the third process which occurs when man relates to nature. In its most general sense, 'appropriation' means to utilize constructively, to build by incorporating; the subject, whether stated or implied, is man's essential powers. For Marx, the individual appropriates the nature he perceives and has become oriented to by making it in some way part of himself with whatever effect this has on his senses and future orientation. To 'capture' a sunset, it is not necessary to paint, write or sing about it. It becomes ours in the experiencing of it. The forms and colors we see, the sense of awakening to the beauty that we feel and the growth in sensitivity which accompanies such an event are all indications of our new appropriation. To paint the sunset, or to write or sing about it, if joined by the genuine emotions, would achieve an even higher degree of appropriation, would make this event even more part of us.

> If the appropriation is a significant one, it may increase our appreciation for beauty to such an extent that we now regard the whole of nature in a new way. Nuances of color, light and shape, which were formerly missed, have become striking objects of attention. Orientation, too, is affected as some things assume new or broader meanings depending on which of our fires has been kindled. Our thought and activity in regard to the appropriated entity will also vary accordingly. Though it is an extreme example to which most of our everyday experience can only approximate, it is on this model of appropriating a sunset that 'appropriation' in Marxism can best be understood."
> (Ollman, 1971, p.91)

Using only the first paragraph of this quote may indeed provide for the interpretation that Poole and DeSanctis gave this concept. However, if we then also take into account the second paragraph it becomes clear that there is more to the story. A significant appropriation changes us as it changes how we will perceive and relate to the world around us in future occasions. This is actually a much richer concept than what has been used in IS literature. Similar to the way Rogoff (1995) explicated the personal change involved in participatory appropriation, this concept demands a co-constituting relation between the human subject and the objects and world which he relates to.

6.3 Implications

To understand to use of technology such as smartphones or social media is no trivial matter. This study has discussed IS theories, with a grain of sociocultural literature. Mediation theory was introduced as alternative view of conceptualizing the use of information technology.

An important aspect of this study is the development of a theoretical framework characterizing three views of the human-technology relation and further empirical validation of this framework. A more complex theory on the use of technology provides for a richer explanatory power of this interaction.

However, the theory required really depends on the questions asked. A first question might be to understand why certain user groups use certain apps more than others, or which users take part in which social media. For such a question, theories like user acceptance are very helpful. Further questions might be how the same app is used in different ways, or how the roles of different social media are redefined as photo-service, microblog, or event scheduler. For these questions technology appropriation models will be quite useful.

For further questions concerning how we are in turn influenced by the use of smartphones or social media, for these questions we need a more complex understanding of the human-technology relation. For such a question, an instrumental or phenomenological view of technology is insufficient. To understand and appreciate these aspects requires an interpretation of technology as medium through which we relate to technology. By appropriating the smartphone, we co-constitute ourselves as smartphone users.

References

Carroll, J., Howard, S., Vetere, F., Peck, J., Murphy, J., 2001, Identity, Power and Fragmentation in Cyberspace: Technology Appropriation by Young People. Paper 6 in *Proceedings of the Twelfth Australian Conference on Information Systems*, ACIS 2001, Coffs Harbour, Australia.

Carroll, J., Howard, S., Vetere, F., Peck, J., Murphy, J., 2002, Just what do the youth of today want? Technology appropriation by young people. In *Proceedings of the 35th Hawaii International Conference on System Sciences*, HICSS-35, 8.

Carroll, J., Howard, S., Peck, J., Murphy, J., 2003, From Adoption to Use: The Process of Appropriating a Mobile Phone. *Australasian Journal of Information Systems*, 10(2), pp.38-48.

Davis, F. D., 1989, Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), pp.319-340.

Delaney, P. J., 2010, *A Grounded Theory Study of Technology Appropriation in Anaesthesia*. PhD Thesis, Queensland University of Technology.

DeSanctis, G., Poole, M. S., 1994, Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. *Organization Science*, 5(2), pp.121-147.

Dorrestijn, S., 2011, Technical Mediation and Subjectivation: Tracing and Extending Foucault's Philosophy of Technology. *Philosophy & Technology* 25(2), pp.221-241.

FindIcons website, accessed 02-10-2012: http://findicons.com/

Gibson, J. J., 1986, *The Ecological Approach to Visual Perception*. Hillsdale: Lawrence Erlbaum.

Giddens, A., 1979, *Central Problems in Social Theory*. University of California Press, Berkeley, CA.

Giddens, A., 1984, *The Constitution of Society: Outline of the Theory of Structure*. University of California Press, Berkeley, CA.

Iconaholic website, accessed 02-10-2012: http://iconaholic.com/

Icon King website, accessed 02-10-2012: http://www.icon-king.com/

iPhoneclub website, accessed 15-01-2013: http://www.iphoneclub.nl/172778/apple-store-amsterdam-opent-officieel-zijn-deuren/

iVitality website: accessed 18-01-2013: https://ivitality.nl/home

Kiran, A. H., 2012, Technological Presence: Actuality and Potentiality in Subject Constitution. *Human Studies* 35(1), pp.77-93.

Norman, D. A., Affordance, Conventions, and Design. *Interactions* 6(3), pp.38-43.

Nourhussen, S., Stok, J.-J., 2011, *Bloedmobieltjes, Coltan in Congo*. KIT Publishers, Amsterdam.

Ollman, B., 1971, *Alienation: Marx' Conception of Man in Capitalist Society*. Cambridge University Press.

Orlikowski, W. J., 1992, The Duality of Technology: Rethinking the Concept of Technology in Organizations. *Organization Science*, 3(3), pp.398-427.

Orlikowski, W. J., 2000, Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. *Organization Science*, 11(4), pp.404-428.

Poole, M. S., DeSanctis, G., 1989, Use of Group Decision Support Systems as an Appropriation Process, *Proceedings of the Hawaii International Conference on Information Systems*, Hawaii, pp.149-157.

Procee, H., *Intellectuele passies, Academische vorming voor kenners*. Damon, Budel.

Rogoff, B., 1995, Observing sociocultural activity on three planes: participatory appropriation, guided participation, and apprenticeship. In J. V. Wertsch, P. del Rio, & A. Alvarez (Eds.), *Sociocultural studies of mind*. Cambridge, UK: Cambridge University Press.

Rotterdam Community Solutions website, accessed 19-01-2013: http://www.rotterdam-cs.com/home

Rotterdam Open Data website, accessed 21-01-2013: http://www.rotterdamopendata.nl/home

Wieringa, R. J., 2010, *Design Science Methodology*. Lecture notes with the master's course for Computer Science and Business Information Technology at the University of Twente.

Wikipedia 11M, accessed 14-01-2013: http://en.wikipedia.org/wiki/2004_Madrid_train_bombings

Wikipedia Apple vs Samsung, accessed 14-01-2013: http://en.wikipedia.org/wiki/Apple_Inc._v._Samsung_Electronics_Co.,_Ltd

Wikipedia Criticism of Facebook, accessed 14-01-2013: http://en.wikipedia.org/wiki/Criticism_of_Facebook

Wikipedia Facebookmoord, accessed 14-01-2013: http://nl.wikipedia.org/wiki/Facebookmoord

Wikipedia Foxconn, accessed 14-01-2013: http://en.wikipedia.org/wiki/Foxconn

Wikipedia IED, accessed 14-01-2013: http://en.wikipedia.org/wiki/Improvised_explosive_device#cite_ref-Hunter_39-4

Wikipedia Project X Haren, accessed 14-01-2013: http://nl.wikipedia.org/wiki/Project_X_Haren

Venkatesh, V., Morris, M. G., Davis, G. B., Davis, F. D., 2003, User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly* 27(3), pp.425-478

Verbeek, P.-P., 2000, *De daadkracht der dingen*. Uitgeverij Boom, Amsterdam.

Verbeek, P.-P., 2005, *What Things Do: Philosophical Reflections on Technology, Agency, And Design*. Pennsylvania State University Press.

Appendix A: interview protocol

The interviews are semi-structured, with emphasis on 'semi'. Because follow-up questions are very important, any detour initiated by the interviewee will be drawn upon, so as to have the participant use his own wording in explaining about his experiences and perspective. The image constructed of the participant's perspective and views is based mostly on the way he described these elements, which is favored above 'checking off boxes' related to theoretical constructs that the participant does not really understand. A lot of follow-up questions present themselves in the answers of the interviewee.

In addition, an open question concerning e-health is often answered in very broad and general terms, describing how 'the public' could experience e-health applications. However, I am interested in their personal views. Thus a lot of follow-up questions are required to shift focus from a general perspective to personal experiences.

	Begin interview	**End interview**
Introduction	Can you tell me about your work? What kind of technology do you use in your work?	How was it to use iVitality? What did you think of <function>?
e-health (general)	What do you think of e-health applications?	What do you think of e-health applications?
iVitality (specific)	Can you describe what iVitality is, in your own words? What do you think of iVitality? What are your expectations of iVitality?	How do you now view iVitality? Can you relate you experience with iVitality to your expectations? Can you relate your personal experience with iVitality to e-health as a general topic?
health (general)	Is health a topic that is on your mind? What aspects do you take into account for your personal view of health?	Did you manage to give iVitality a place in your idea of health?
blood pressure (specific)	Do you know what blood pressure is? Can you give me a general description of blood pressure? Is blood pressure an item in your personal view of health?	What is your view of blood pressure? Did using iVitality have any impact on how you view blood pressure?

Example follow-up questions:

- What do you personally think of that?
- Can you relate that to your own experience?
- Can you relate x to y? Example: how do you relate blood pressure to you general view of health?
- You just mentioned <aspect x>, can you elaborate on that? Example: You just mentioned privacy issues in e-health applications, what are the important aspects of privacy for you?
- Bridging between two topics; example: You just mentioned a sports app on your smartphone, what do you think of health apps?