

# Value-Sensitive Design in Hyper-Connected Societies

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**Abstract:** In hyper-connected societies, where the opposite of communication and interaction may unobtrusively change from a human to a bot or another device, underlying services and technologies can easily come into conflict with cultural and social values. In this paper, we discuss how values apply to hyper-connected societies and we elaborate how values could be functionally integrated into platforms that provide and combine both human-to-human, human-to-service and human-to-thing communication and interaction.

**Keywords:** Value-Sensitive Design, Hyper-Connected Society, Internet of Services, Internet of Things, Human-computer Interaction

## 1 Introduction

With the dramatic growth of the web, our lives have been fundamentally changed. Our society is increasingly transforming into a networked society. We now expect “instant online access to information, our contacts and goods and services from everywhere in the world”, we participate in multiple communities—often through multiple online personae—, and we “make new acquaintances and business contacts, find nearby friends, and navigate completely new worlds” through the internet[Er15].

Values have a huge influence of how we human beings undertake communication and interaction between ourselves. These values apply not only in face to face communication and interaction of our society, but also when using information and communication technology to communicate and interact with others. However, our connected society is transforming into a hyper-connected society, where communication is ubiquitous, omnipresent, and communication partners might be humans, services, or things. In the hyper-connected society, we communicate and interact with more and more new actors in our daily lives. New actors, like a variety of different services of the Internet of Services or Internet of Things (IoT) devices, and an increasing amount of avatars and bots, i.e., artificial intelligences. It is thereby often not obvious if we currently communicate with a human or a machine, and sometimes communication and interactions switches from a machine to a human in an unobtrusive manner. For certain humans, communication with non-humans, or the switch from human-machine to human-machine communication might violate with their values.

*Value* is thereby often referred to as the “equivalent monetary worth of a specified sum

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or amount”[Ox10]. However, a more broader meaning of value is “the estimation in which a thing is held according to its real or supposed desirability or utility”, where such “estimation [is] regarded in relation to an individual or group”[Ox10]. The more specific meaning of the term *Value* in the context of this paper, is “the generally accepted or personally held judgement of what is valuable and important in life”[Ox10]. Such values are for instance: *privacy* [Ro04], *ownership* and *property* [LB00] and *autonomy*[Hi91].

In this paper, we want to start the discussion of how values apply to hyper-connected societies, i.e., to communication and interaction between humans, services and things. We will point out pitfalls when designing systems that support hyper-connected societies and elaborate possibilities of how to integrate values into systems to have actual effects on functionality.

## 2 Related Work

Designing information and communication technology in a way that takes values into account, is not a new topic. The so called value-sensitive design (VCD) “is a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner throughout the design process”[FKB08]. The research area of value-sensitive design emerged because values can “seemingly conflict with economic goals and can be difficult to articulate clearly and to translate into meaningful processes and designs”[Fr96]. Besides other notable work in VCD, like [FHN09] and [Ho07], there are also efforts about shifting the focus of HCI towards a value-centered design process[Co04].

The Business Motivation Model (BMM) describes two directives that are similar to how values apply in organizations. These two directives are *Business Rules* and *Business Policies*. A Business Policy “is a Directive that is not directly enforceable whose purpose is to govern or guide the enterprise” and a Business Rule “is a Directive, intended to govern, guide, or influence business behavior, in support of Business Policy that has been formulated in response to an Opportunity, Threat, Strength, or Weakness”[Om15].

## 3 Values in Hyper-Connected Societies

More and more communication and interactions in our networked society are not only human to human anymore. Human to machine and also machine to human interactions are increasing. Borders between human-human and human-machine are thereby often not clear and changing even during an ongoing interaction in an unobtrusive manner. A recent example is Facebook’s personal assistance *M*. Rather than always responding to assistance queries using an artificial intelligence (AI) analyzes of the query, Facebook’s *M* has a team of humans behind the scene. This team can jump in and help out on queries, where AI is not yet well trained. That is, for the user, it is not always clear if

they are talking to the AI or to a human being. Furthermore, during a conversation, the opposite can change from human to AI, or the other way around.

Another example is GitHub, where multiple bots have emerged over the years to take over some repeating tasks, like checking whether a Contributor License Agreements has been signed for incoming pull requests, or like automatically upgrading dependencies and running tests accordingly to ensure that these upgrades do not break the application. Occasionally, this leads to having bots talking to bots.

With technology like the Facebook Messenger Platform<sup>3</sup>, which allows to easily integrate services into Facebook's messenger, it is to be expected that human to machine communication is increasing rapidly in the next couple of years. This makes it even more important to take values into account, when designing such services and integrations.

Current research focuses on taking values during the design process into account. However, we think values should also be integrated into actual operation of systems and as such paving the way for a culture of a hyper-connected society. According to [Fr96], two common issues that concern values are: user autonomy and freedom from bias. They further identified four aspects of systems that can promote or undermine user autonomy: System Capability, System Complexity, Misrepresentation of the System and System Fluidity. The other concern of freedom from bias is about avoiding biased technology, i.e., to avoid to "systematically and unfairly discriminate [...] certain individuals or groups of individuals in favor of others"[Fr96]. Such values can be supported by improving implementation-related parts of the application.

However, in a hyper-connected society, platforms are not monolithic applications anymore, but rather compositions and integrations of many third party services and devices/things. That is, such third party services are provided as is. The influence of the compliance with values is limited to how the integration of such services is done and represented. Furthermore, values are often not dependent on functionality. We therefore propose to differentiate values into *functional values* and *non-functional values*, which are introduced in detail in Section 4.

It is also important that when implementing values into a system, they must not be used to enforce a certain behavior. Because then we are talking about rules and not about values anymore. The difference between rules-oriented and values-oriented culture is how much emphasis is placed upon controlling human thoughts and behavior[JS06]. Rules are more about governing behavior, while values are about guiding behaviors. For a healthy and thriving culture, an optimal blend of both rules and values is necessary[JS06]. While some rules are necessary, other rules that would discriminate a certain user group, may not necessary and are better replace by values. That is, there are always functionalities and especially security related features, that have to be enforced

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<sup>3</sup> <http://messengerplatform.fb.com>

by rule. Values instead are not enforced, but supported, which also enables the coexistence of individuals with different values.

## 4 Functional and Non-functional Values

Values are often not dependent on functionality, but rather on the level of effort that is put into something. For this reason, we propose to differentiate values into *functional values* and *non-functional values*, where both kinds can be implemented as follows.

*Functional Values* are values that provide practicable guidance. That is, functional values can be automated inside a system. However, the functionality that automates guidance of functional values must not be enforced. That is, instead of enforcing a certain functionality, implementations of functional values can provide recommendations of how a technology or software is used. Taking for example a value of *transparency*, and a platform where employees inside an organization can manage their goals. When defining goals, read access to them can be set as either public or private. Since, in this case, transparency is a value and not a rule, both options are still available. However, upon creating a private goal, a dialog may appear asking to reconsider the decision of creating a private instead of public goal.

*Non-Functional Values* are values that are not directly practicable, but still guide and steer decisions and actions of an organization. Such values can be integrated into a system as measurements. These measurements can thereby be about the system itself or about the behavior of the organization that provides the system. Taking for example the value of being responsive to customer inquiries. By measuring response time and whether inquiries are answered at all, the non-functional value of being responsive could be observed. In case the compliance with such a non-functional value is, according to the measurements, not satisfying, further steps can be taken inside an organization.

We are working on integrating functional and non-functional values into goal-oriented composition of apps, services and things based on the SmartComposition[KWG14] approach. In the center of goal-oriented composition is a means and ends structure, which is partially as shown in Fig. 1. In this structure, means are hierarchically broken down into Mission, Strategy, Operation and Task. Respectively, ends are broken down into Intent, Goal, Purpose and Result. Means thereby depict the course of action (COA) that is taken to achieve the desired effects, which in return is described by corresponding ends. All ends have success measurements attached to them. This enables to track their level of accomplishment. Furthermore, it allows to distinguish between both a project's completion (through progress in means) and success (through progress in ends).

Fig. 1 shows, besides the means and ends structure, how functional and non-functional values can be integrated. Functional values serve as guiding force for how activities are actually conducted to achieve desired effects that are described through ends. It is thereby only a guiding force, which recommends and promotes certain behaviors. That

is, it does not enforce a certain behavior. Non-functional values provide the basis for functional values. They are used to govern how things are approached. They are something we want to achieve, but which is not within our direct control. For some non-functional values it is possible to measure them, i.e., measure their compliance. Doing so, could be considered a good practice, because it shows the motivation behind such values and also shows how such a value may cascade to other ends. This, in return, makes an overall organization's vision more visible. The resulting integration of functional values and non-functional values can be—respectively—compared to Business Rules and Business Polices of the Business Motivation Model[Om15].

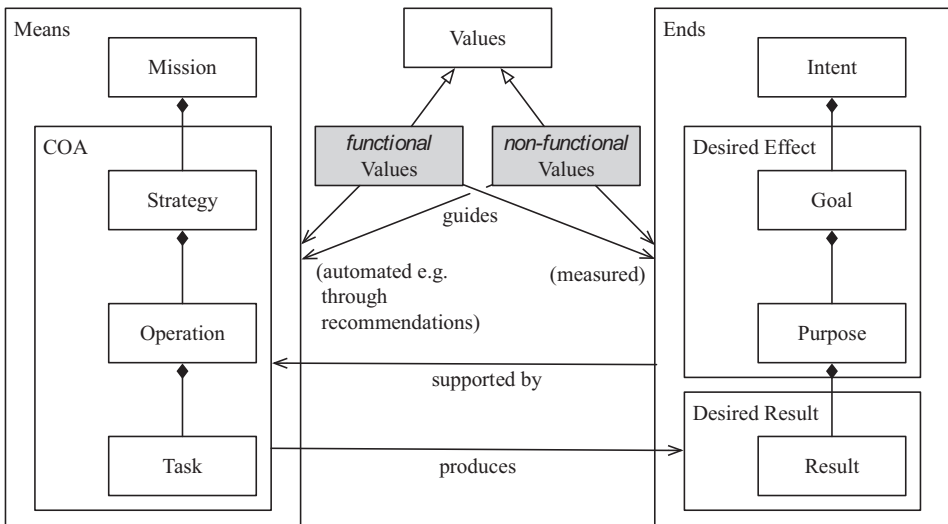


Fig. 1: Integration of Function and Non-function Values on Means and Ends

## 5 Conclusion

Values in hyper-connected societies are an important topic. Especially the increase in human to machine communication poses new challenges in regard of human values. Values are thereby not as easy to actual integrate in systems as rules are, because they are not to be enforced on everyone. We therefore proposed to distinguish between functional and non-functional values and introduced first possible means of implementing values into software platforms.

By integration functional and non-functional values into our model of means and ends, we are able to improve the foundation of a goal-oriented composition. Because doing so, can in the end, enable us to use the values and vision of an organization to derive an appropriate course of action and help to both complete this course of action, but also to achieve the underlying desired effect, i.e., achieve actual success. Building this on top of

SmartComposition, provides this functionality in an end-user friendly way to enable non-technical personae to apply this approach.

Certainly, more thinking is needed for being able integrate all possible values in software platforms in generic way. Also, the impact on human to machine communication to values has to be examined further. Both these challenges will be subject of our future work.

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