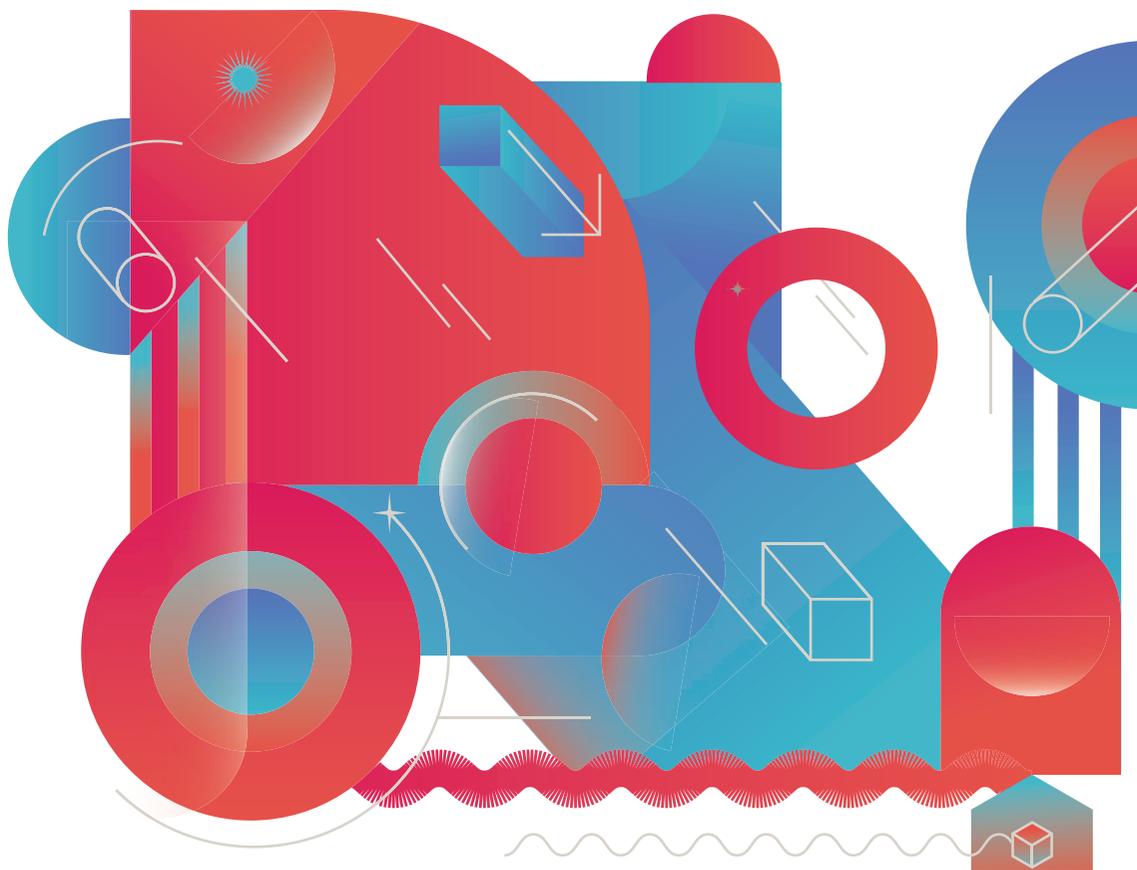


# EMBEDDING INTELLIGENCE

Designery reflections on AI-infused products



edited by Davide Spallazzo, Martina Sciannamè



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Designerly reflections on AI-infused products



edited by Davide Spallazzo, Martina Sciannamè

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## 5. Understanding meaningfulness in AI-infused artefacts

*Marco Ajovalasit*

*Department of Design, Politecnico di Milano*

*Eternal truths will be neither true nor eternal unless they have fresh meaning for every new social situation.*

Franklin D. Roosevelt, 1940

Creating meaningful artefacts translates into creating meaningful experiences for the consumers going beyond the artefact's functional features to reach people intrinsic motivation and their symbolic values. This process would require acquiring an understanding of how people come to understand in their own terms and for their own reasons the meaning attached to the designed artefacts. Despite the advances on the market of AI-infused products, the sophistication of modern technologies of these designed artefacts and the complexity of modern social behaviors would make simplistic to continue to consider the user experience (UX) mostly characterized by the performance of its users or in terms of interaction quality. Relatively little empirical work has instead focused on understanding why designed artefacts are seen as salient choice criteria, that is, understanding the reason why do consumers perceive AI-infused artefacts to be personally relevant for their needs. The understanding of the concept of meaningfulness discussed in this chapter suggests that the consideration of target values and meanings is important as a strategy towards defining the relational role of AI-infused artefacts in the lives of their owners for which artefacts are not simply functional tools, but are also relational mediators which shape the long term aims, objectives and behaviors of an individual or of a group. The research presented in this chapter aims to set the basic considerations regarding the term "meaning" used by commercially active designers and introduces the concept of "meaningfication" for the purpose of designing AI-infused artefacts based on new meanings.

## 5.1 Introduction

Nowadays many everyday products are equipped with some functionality enabled by artificial intelligence (AI) (Follett, 2015). Examples span from mobile devices in the form of activity trackers, mail filters, autocomplete, and social network feed ads to home assistants like Amazon Echo with Alexa, Apple HomePod with Siri, Google Home with Google Assistant that help users to accomplish simple tasks (Sciuto *et al.*, 2018; Spallazzo *et al.*, 2019; Vitali *et al.*, 2019).

Previous research on AI-infused artefacts has predominantly focused on the utilitarian attributes and usability dimensions (Amershi *et al.*, 2019), on the use of conversational agents (Sciuto *et al.*, 2018) and on the tangible form and appearance as well as the interaction modalities (Spallazzo *et al.*, 2019).

While on one hand the advances in the AI domain (Follett, 2015) and the growing uses of AI technologies in human-facing applications provide opportunities for user interface design (Amershi *et al.*, 2019) proposing generally applicable design guidelines for human-AI interaction, on the other hand there are current challenges of how the use of such technology may bring value to their users and how to design them in order to mean something in their users' world and therefore to be meaningful to them.

Although Weiser's (1991) ubiquitous computing vision of embedding information processing and network communication as key components in the design of everyday objects and human environments to make familiar tools and environments do their jobs better and help people in their ordinary activities (Follett, 2015; Kaptelinin and Nardi, 2009) may have existed thirty year ago, the complexity of technology of the algorithmic reasoning (intelligence) and the design of the embedded systems may have overshadowed nearly all the consideration of the user experience and motivation, whether the designed artefact resulted useful to full fill desires, to be enjoyable or meaningful to their users. As noted in Gartner's hype cycle (Blosch and Fenn, 2018) product innovations like, self-driving cars and personal assistants which use AI-infused artefacts, follow "a typical progression of innovation, from overenthusiasm through a period of disillusionment to an eventual understanding of the innovation's relevance and role in a market or domain". The use of such AI-infused designed artefacts is rarely the most important activity

in someone's life, but the artefacts form part of a larger flow of needs, desires and meaningful experiences (Kuniavsky, 2010).

In the context of this exposition, the word “meaningfulness” is described by the definitions found in standard dictionaries of the English language as “the fact of having a serious or important meaning”, and “the quality of having great value or significance”. Significance, as a concept in design, explains how forms assume meaning in the ways they are used, or the roles and meaning assigned to them, often becoming powerful symbols or icons in patterns of habit and ritual. In contrast to the emphasis on efficiency or experience significance has more to do with expression and meaning (Ravasi and Rindova, 2008). Also in this exposition, AI-infused artefacts refer to artefacts that have features harnessing AI capabilities that are directly exposed to the end user (Amershi *et al.*, 2019). AI-infused artefacts leverage computers and machines to mimic the problem-solving and decision-making capabilities of the human mind (IBM Cloud Education, 2010).

The aim of this chapter is to draw attention to the most obvious and influential issues which affect the meaningfulness of a designed artefact and to note the implications for the design of AI-infused products. The objective is to place into perspective the basic considerations regarding the term “meaning” used by commercially active designers. The reflections conclude by introducing a “design for meaning” framework which organizes one possible sequence in which the various considerations might be dealt with, and which provides a tool for identifying key questions which should be answered by commercially active designers. The concept of “meaningfication” is introduced for the purpose of designing AI-infused artefacts based on the new meanings that the AI-infused artefacts are intended to provide or to facilitate for the consumer.

## **5.2 Conceptualising the term “meaning”**

Within market-driven economic systems the commercially active designers must consider the forms of value and meaning which a product, system or service may hold for its customers. It is in fact frequently claimed that the value and meaning of a commercial offering is the actual basis of the business (Verganti, 2009).

Given the importance of “*meaning*” and “*value*” in design it is worth noting the definitions of the concept of two words which are often used interchangeably, with important practical consequences in terms of possible misunderstanding.

According to standard dictionaries of the English language, the word “meaning” can express at least three possible concepts:

- the sense or signification of a word or sentence;
- the significance, purpose or underlying truth of something;
- the motive or intention of something.

The word “value” can express instead:

- the amount of money that can be received for something;
- how useful something is;
- the importance or worth of something for someone.

Neglecting the purely linguistic sense of the word “meaning” and the economic aspect of the word “value”, the questions can be asked of how design artefacts assume a purpose or intention and why they have value to people. According to Baudrillard (1968) he views value as a meaning, that is, people value objects not for what they do, or what they are made of, but for what they signify. According to Richins’ (1994), based on the measurement of the value of physical possessions, “an artefact’s value derives from its meaning within the cultural system”. Meaning should be then considered as the source of value. Both anthropologists and neuroscientists (Diller *et al.* 2005) agree that “meaning is the sense we make of reality. Assigning meaning to experience is how each of us creates the story of our life and its ultimate value and purpose”. In the context of designed artefacts, researchers such as Diller *et al.* (2005) have highlighted a main difference between values and meanings claiming that “values involve preferences; they represent our choices between opposing modes of behavior, and they are shaped not only by ourselves, but also by those around us”. Whereas “meaning provides a framework for assessing what we value, believe, condone, and desire”.

In conceptualizing “meaning”, this exposition doesn’t follow the ontologizing of meaning as it were an entity that could be attached to

objects implying that the meaning would be the same for everyone. It also avoids the representationalism of semiotic discourse for which artefacts would signify something unrelated to its use (Williamson, 1978). The concept of meaning discussed in this exposition is assumed to be “the full set of interactions and experiences associated with a specific spatial-temporal event”. It doesn’t focus on the semiotic studies that concentrate on the artefact itself as the most important site of its meaning, but it focusses on social semiotics that emphasizes the social effects of an artefact’s meaning placing the emphasis on the social modality of meaning-making (Hodge and Kress, 1988). According to Desmet and Hekkert (2007) the experience of meaning involves our ability to assign personality or other expressive characteristics and to assess the personal or symbolic significance of products”. Giving more attention to the ways the meanings of artefacts are made socially is also reported by Theo van Leeuwen:

in social semiotics, the focus has changed from the “sign” to the way people use semiotic “resources” both to produce communicative artefacts and events and to interpret them in the context of specific social situations and practices (van Leeuwen, 2005).

The focus of social semiotics put thus the emphasis firstly on the understanding the social context where the artefact’s meaning is taking place; secondly on the wide range of modes in which meaning is made. “Mode” here is referred to something like the medium of the communicative act in question. Kress (2010) describes key modes as: image, writing, layout, music, gesture, speech, moving image, soundtrack, 3D objects.

The working definition of the word “meaning” that underlies the ideas put forth in this chapter exposition is that of “the sense of purpose that makes a person feel that his/her life is valuable” (e.g., “my car means a lot to me”). As also stated by Verganti (2011, p. 384), “meaning” represents “the profound psychological and cultural reasons people use a product”. “Meaning” thus specifically refers to the “reason why” a designed artefact has value for the person in the operational and social context of its use.

### 5.3 The role of meaning in design practice

In the context of this exposition, the term “designed artefacts” refers to the intentionally designed objects that designers implement through a conscious, goal-oriented activity as opposed to “non-intentional design products” (Brandes *et al.*, 2013) which offer a broad spectrum of potential ulterior uses and types of repurposing driven by the consumers’ motivation to use an object for a purpose other than that for which it was professionally intended.

In the context of designed artefacts (Douglas and Isherwood, 2021), designers typically follow a process that leads from the concept to the designed artefact as shown in Figure 5.1. When using products, however, the consumers participate in the opposite dynamics: they are looking for a particular concept that make sense to them, and on the way they will find artefacts that best match this concept.



*Fig. 5.1 – The designer’s process: from conceptual ideas to meaningfulness of artefacts.*

The idea that design is a manner for making sense of things (Krippendorff, 1989) is frequently discussed in professional circles, and debated in the design literature (Giacomin, 2017; Knudsen and Haase, 2018). For many practicing designers, the activity of design cannot be separated from the intended values and meanings of the artefact which is being designed. As noted by Krippendorff and Butter (2007) “it is a truism that we surround ourselves with objects that we are comfortable with and experience as meaningful. To design artefacts for use by others is to design them to be or to have the chance to become meaningful to these others – not merely in their designers’ terms, but according to these others’ own and often diverse conceptions”.

Sociological research performed by Csikszentmihalyi and Rochberg-Halton (1981) have demonstrated how people construct patterns of meaning from the objects surrounding them. Most research to date

provide an increasing evidence that many products and services evoke meanings and are symbolic stimuli for consumers (Levy, 1959; Holman, 1986, Csikszentmihalyi and Rochberg-Halton's, 1981; Park *et al.*, 1986; Fournier, 1991; Smith and Colgate, 2007; Almquist *et al.*, 2016) and an increasing interest in the process of how new meanings are constructed (Krippendorff and Butter, 2007; Verganti, 2009; Knudsen and Haase, 2018). All these previous studies suggest that although consumers seek functional benefits, underlying this there is a more profound significance composed of deeper meanings and instinctive ways of defining and shaping themselves and the world around them (Ravasi and Rindova, 2008). It further suggests that consumers are likely to select those alternatives in their decision-making that are more useful to their needs, that is, those that have personal relevance for achieving consumers' goals and values.

Adding further sophistication to the analysis of the meaning of designed artefacts, Krippendorff and Butter (2007) have suggested that “key to our conception of meaning is the recognition that humans create their own worlds and distinguish among their artefacts not in physical terms but according to what they mean to them, including how they enter the communications about them. Our concept of meaning involves a second-order understanding of how others come to understand and interact with our designs”.

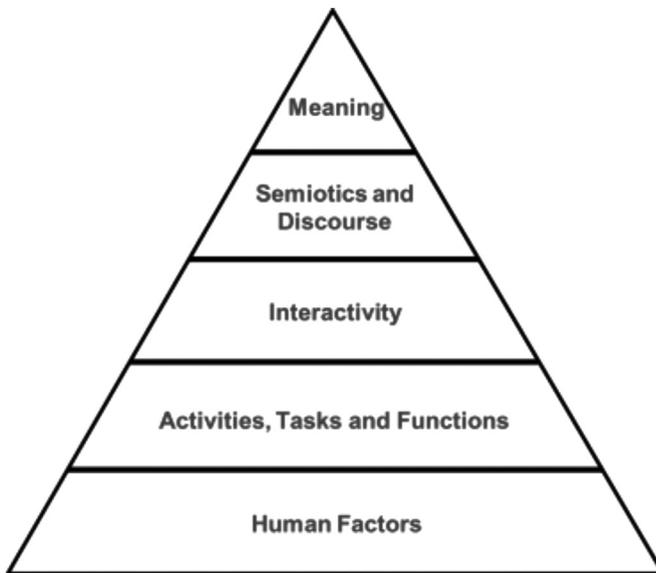
Boradkar (2010) suggested that “design's core mission is to fashion things so that we may have meaningful interactions with the world. Meanings are neither inherent properties of the things themselves, nor are they total fabrications of the human mind; they are suspended in the spaces between us and all that is around us. Meanings emerge and change continuously as people and things travel through their lives, constantly bumping into each other”.

If something or a situation has a meaning for a person this in turn implicates that it would be necessary for a designer to understand what constitute the meanings in his/her life as he/she interprets it in order that the designer could anticipate much about his/her desires and behaviour (Siefkes, 2012).

Key to the conception of meaning by Krippendorff and Butter (2007) is to consider a human centered design approach for which “meanings cannot be separated from how people interact with the technologies that their culture creates and renders meaningful, with

each other, and with how we – for example as designers or researchers – describe, conceptualize, and enact our conceptions of these meanings”. It does seem reasonable to consider human centered design as ways of conceptualizing, designing and evaluating the symbolic meanings involved.

As described by Giacomini (2014), human centered design involves a hierarchy of considerations which places the value or meaning of the product (see Figure 5.2) at the crucial position at the top. Giacomini (2014) has described human centered design as the use of techniques which communicate, interact, empathize and stimulate the people involved, obtaining an understanding of their needs, desires and experiences which often transcends that which the people themselves actually realized.



*Fig. 5.2 – The human centered design pyramid (adapted from Giacomini 2014).*

## **5.4 Meaning is a social, culture-based construct**

The claims of sociologists regarding the constructed nature of meaning and its possible relativity to a given culture at a given point are supported by several studies of the meaning of artefacts. For example,

Dewey (1934) has noted that “every person, as an individual, responds to different aspects of an artwork and experiences it differently; they also give it a meaning in different ways. In a similar vein, it can be assumed that every user experiences products differently”. Extensive research by Csikszentmihalyi and Rochberg-Halton (1981) has shown that meaning can change substantially as a function of age, gender or other demographic descriptors of the people involved. Further, studies such as those of McCracken (1986) and Wallendorf and Arnould (1988) have shown that “the meaning associated with an artefact can change substantially as a function of the general cultural context in which the artefact is emerged”.

Krippendorff and Butter (2007) suggest that “meaning is made collectively across society via culture using language. Desmet and Hekkert (2007) report that at the level of meaning, cognitive processes, like interpretation, memory retrieval, and associations enter into account to be able to recognize metaphors, and as such these cognitive processes depend onto individual and cultural differences.

Ravasi *et al.* (2012) noted that “the cultural perspective on value creation calls for a fundamental rethinking of the system of activities a firm engages in, e.g. how to involve designers in product development, how to manage new types of knowledge stocks...it also draws attention to the fact that the collective construction of the meanings that surround symbols and artefacts makes some of the cultural resources that producers use only partly under their control. Value creation and appropriation in such resources may depend more on skillful use and dynamic updating than on control and protection of intellectual property”.

Battistella *et al.* (2012) have articulated the meaning as a stakeholder dependent property emphasizing the relativistic nature of the construct and highlights the need for commercially active designers to satisfy at least three potentially divergent world views (culturally constitute world, the company business model and the individual customer/ stakeholder).

The fact that people respond socially to artefacts, it opens the door for AI technology to apply for a host of ethnographic research and persuasion dynamics that are collectively described as social influence: the type of influence that arises from social situations (Fogg, 2003).

## **5.5 Meaning is context-based, salient, collective, personalized, and dynamic**

Meaning is perceived uniquely by individual customers; it is conditional or contextual (depending on the individual, situation, or product); it is relative (in comparison to known or imagined alternatives); and it is dynamic (changing within individuals over time and with age).

Decoding meaning from the product to the consumer is likely to be a more reinforcing and ongoing process for personalized objects than it will be for cultural objects (Fournier, 1991). The temporal quality exhibited by many objects with personalized sources of meaning (e.g., the favorite sweatshirt from college, the china that grandmother used, the ring received on wedding day) encourages on-going reflection by the owner/user, resulting in knowledge structures that are more dynamic and evolutionary. The forces that drive the meaning creation process may also differ by source of meaning (collective or personalized). Advertiser-constructed messages may be more dominant in the creation of meaning for objects with a cultural center while empathic responses and the generation of self-referent ties may be more likely to govern the creation of personalized meaning.

Because of these ties with the self, objects with personalized meaning center may enjoy higher levels of enduring involvement, greater salience and evocation potential, and stronger motivations for processing and elaboration.

## **5.6 Towards the need of a design for meaning framework**

In the conceptualization of the meaning, Osgood (1952) suggests that meaning is composed by a “bundle of components” which include both objective and subjective elements, such as experiences, feelings and images. This allows to visualize these components as the basic structural elements of the construct meaning. Friedmann and Lessig, 1986 report that the meaning that products elicit in the consumer’s mind is shown to be a function of the bundle of attributes found in the product, the consumer’s perceptual mode, and the context in which the perceptual process takes place. More specifically, Friedmann (1986)

and Hirschman (1980) have characterized the meaning of an artefact in three dimensions: tangibility, emotionality and commonality.

- Tangibility concerns whether the attribute at the basis of meaning is tangible, in the sense that is objective and verifiable through the senses, instead of being subjective. It reflects if the meaning is located in the object itself or in the mind of the user.
- Emotionality concerns the emotional responses to products and it can range from low to high intensity, going from simple affective reactions to true emotional experiences such as enjoyment and excitement.
- Commonality identifies the degree to which meaning is shared by members of the culture, or if it has a more individualized and personal character. It is linked to the source that is more responsible of the assignment of meaning to the object. For example, it is a cultural source if the meaning is assigned by advertising and shared media opinion. It is a personal source if meaning is created by the user through time, experience and interaction, such as an object received as a gift from a dear friend, your most comfortable pair of shoes, or your favorite toy when you were a child.

Holman (1986) proposes a typology of products that captures the exact nature and character of the emotional experiences beyond the utilitarian/experiential dichotomy to present five categories of products: background props, mediators, enhancers, self-expression and emotional objects.

Fournier (1991) acknowledges that all products contain degrees of both hedonic and utilitarian elements, which allows for the placement of objects along a hedonic/utilitarian continuum. Eight categories of objects are defined based on the nature of the meaning perceived by the consumer: objects of utility, action, appreciation, transition, childhood, ritual enhancement, personal identity, and position and role. Fournier (1991) has further categorized the meaning of objects using the following dimensions: utilitarian, symbolic, emotional, shared, personalized.

In terms of customer values, Park *et al.* (1986) has defined three brand value categories: functional, experiential, symbolic. Smith and Colgate (2007) have defined four categories of value: functional/instrumental, experiential/hedonic, symbolic/expressive and cost/sacrifice.

Creusen and Schoormans (2014) distinguished six roles of product appearance for consumers based on a literature review: aesthetic, symbolic, functional, ergonomic product information, attention drawing and categorization. In a large qualitative study (N = 142) Creusen and Schoormans (2014) tested whether these roles indeed existed in consumers' process of product choice, and whether they were sufficient to describe the way in which product appearance plays a role for consumers. In addition, they gained qualitative insight into these roles. The aesthetic and symbolic appearance roles were far more salient to consumers, and the appearance influenced perceived ergonomic value for one-third of the subjects. The functional role of the appearance was mentioned less by the customers.

Giacomin (2017) has developed a design for meaning framework which was further developed by Ajovalasit and Giacomin (2019) who capture the main forms of meaning of designed artefacts into three primary categories of meaning covering a spectrum from the purely instrumental to the purely symbolic: function, ritual and myth. Giacomin (2017) further suggests that "while the choice of other semantics is of course possible, the categories of function, ritual and myth align closely with three of the four categories of value defined by Smith and Colgate (2007) of functional/instrumental, experiential/hedonic, symbolic/expressive and cost/sacrifice. The categories of function, ritual and myth also align closely with the three brand value types suggested by Park *et al.* (1986) of functional, experiential and symbolic".

Vitali *et al.* (2019) have recently proposed a toolkit that consider three kinds of meaning that are relevant for smart connected products: the meaningful identity of the object as product category, the meaning of the product in relation to its shape and functionality, and in relation to a phigital ecosystem.

Mekler and Hornbæk (2019) have defined a framework of experience of meaning in human-computer interaction which outlines five distinct senses of the experience of meaning: connectedness, purpose, coherence, resonance, and significance. They report that their "framework focuses on the moment-to-moment experience of meaning".

Table 5.1 summarizes the different categories of meaning as found in various frameworks from the literature.

Authors (year)	Hirschman (1980)	Holbrook and Hirschman (1982)	Friedmann (1986)	Friedmann and Lessig (1986)	Park et al. (1986)	Fournier (1991)	Diller et al. (2005)	Smith and Coigate (2007)	Siefkes (2012)	Creusen and Schoormans (2014)	Giacomin (2017)	Vitali et al. (2019)	Mekler and Hornbæk (2019)
Meaning category	tangibility emotionality communality	aesthetic hedonic symbolic	tangibility emotionality communality	heuristics fun elation hedonic pleasure	functional experiential symbolic	utilitarian shared personalised emotional symbolic	accomplishment beauty creation community duty enlightenment freedom harmony justice oneness redemption security truth validation wonder	functional/ instrumental/ experiential/ hedonic symbolic/ expressive cost/sacrifice	function or frame style iconicity or metaphor individual experiences cultural allusions connection to social groups specific contexts	functional ergonomic product information aesthetic symbolic attention drawing categorization	function ritual myth	shape and functionality meaningful identity phygital ecosystem	purpose connectedness coherence resonance significance

Table 5.1 – Categories of meaning of artefacts found in the literature

The work done by the different researchers, as presented in Table 5.1, to attempt framing and categorizing diverse kind of meaning which the artefact is anticipated to provide or facilitate for the customer lead to a series of reflections and implications regarding the need of a framework of design for meaning.

Firstly, most research to date tends to address the topic of product meaning from the product attribute perspective, whereby meaning is tied only to the physical, observable characteristics of the product (Gutman, 1982; Kleine and Kernan, 1988; Reynolds and Olson, 2001). Moreover, current research seems to consider forms of meaning to be fixed taxonomic categories (Park *et al.*, 1986; Fournier, 1991; Smith and Colgate, 2007; Almquist *et al.*, 2016). However, given the complexities and divergences in forming the construct of meaning by the individual consumer's perceptual mode (Dewey, 1934), it can be argued that not all artefacts or actions which hold meaning for people are likely to fall into easily predetermined categories.

In addition, most of the research about meaning performed to date seems to consider the taxonomy to be self-evident, or at least easily identified. Given the complexities of human language and the infinite variations in social constructs, it is not currently obvious what words should be used and what ideas should be raised when working with people to establish the taxonomy and parameters of meaning. Existing research does not suggest how to talk about meaning with people, or how to ensure that the approach, language and concepts adopted do not lead to irreparably biased and misleading conclusions.

If commercially active designers are therefore expected to clarify, decide upon and communicate the meaning which an artefact is anticipated to provide or facilitate for the consumer (Giacomin, 2017), it would be then necessary for the designer to acquire an understanding of how people come to understand the meaning attached to a designed artefact in their own terms and for their own reasons. This is what Krippendorff (2006) refers to as second-order understanding.

## **5.7 The framework of “design for meaning”**

To assist to the limitations of current research approaches, Giacomin (2017) has developed a “design for meaning” framework which provides basic considerations which should be considered if meaning is a funda-

mental characteristic of the product, system or service which is being designed. The framework, shown in Figure 5.3, is based on a systematic review of several key semantics involved in design for meaning literature. The framework of design for meaning is subdivided into two sections in relation to the fundamental consideration of whether the artefact should adhere to an existing technological or societal stereotype or, instead, whether there is the opportunity or the need to define a new stereotype due to technological or societal change. The considerations of ideology, meaning, function, ritual, myth, meaningfication and metaphor constitute the basic checklist of questions to ask and clarifications to achieve.

The concept of “design for meaning” suggests that the three categories of pre-existing meaning of function, ritual and myth can provide a bridge between the global meaning of an artefact and the specific metaphor which is deployed by the designer.

The category of “function” is meant to reflect all those situations in which a physical or informatic use is acting as the focus of attention, with less attention being paid to the psychological or sociological considerations. The category of “ritual” is meant to reflect all those situations in which the meaning of the artefact is closely related to action of a symbolic nature (Rook, 1985). The category of “myth” is meant to reflect all those situations in which the meaning of the artefact is mainly symbolic, thus not necessarily requiring dedicated externally visible activity on the part of the consumer (Barthes, 1973).

Further, each type of meaning is implicitly a word which describes a complete spatial-temporal event. A function or a ritual is not as such if it is not fully performed, and a myth is not a myth if most of the story is not fully known to the person.

When a designer identifies an opportunity, which interconnects several previously unrelated technological and cultural codes, and articulates one or more product, system or service concepts which address the opportunity, the process can be described as one of “meaningfication” which is defined as:

The use of data, design ethnography, real fictions and co-creation for the purpose of designing artefacts based on new meanings which emerge from the interconnection of evolving patterns of technology, experience, personal identity, societal identity, value assignation and consumption (Giacomin, 2017).

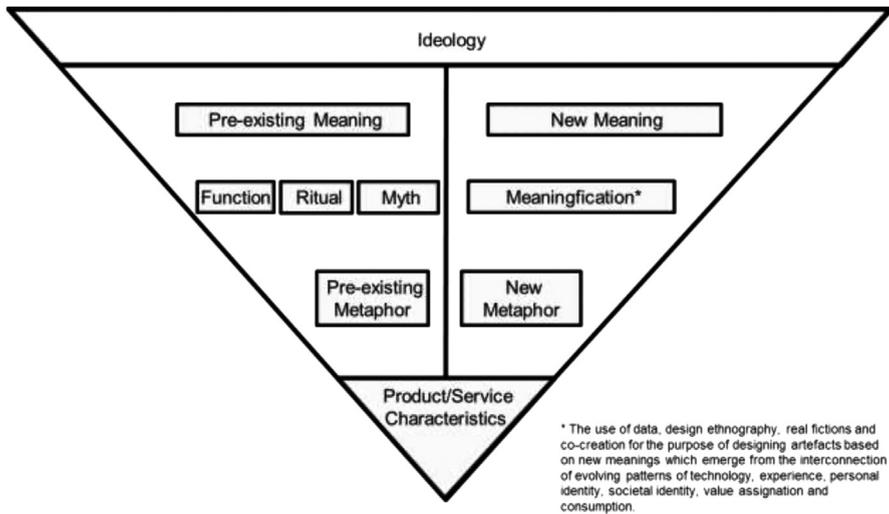


Fig. 5.3 – Framework of design for meaning (adapted from Giacomini, 2017).

The usefulness of the framework has been further explored by Ajovalasit and Giacomini (2019) demonstrating that three categories of pre-existing meaning, “function”, “ritual” and “myth”, are commonly encountered in practice, either occurring individually or be co-present to some degree covering a spectrum from the purely instrumental to the purely symbolic. While it is possible to find designed artefacts of many kinds defined solely in terms of function related to the quality of appropriateness in use, to the performance of specific tasks or to effectively execute them, there are situation for which a meaning stems from a personal evocation of relationship and ritual or that is mainly symbolic which is intrinsic and not dependent upon any specific affordance (Ajovalasit and Giacomini, 2019).

Further research is needed to identify the elements that constitute and define the semantic dimensions and the microstructure of the three categories of meaning to assist the designers in the construction of meaning and the required words and ideas which are adequate to capture the main forms of meaning.

## 5.8 Meaningfication of AI-infused artefacts

The growing uses of AI technologies interfacing with people and their advances of the AI-infused artefacts into the societal domain and everyday activities (Follett, 2015; Amershi *et al.*, 2019) lead to the consideration that a business opportunity can be achieved by exploiting a new technological capability or a new cultural code which Giacomini (2017) defines it as “meaningfication” in which the interconnection of previously unrelated technological and societal codes lead to new ways of thinking by the consumer. Fundamental to the concept of meaningfication is that the “consumer is implicitly invited to think differently about the opportunities and value propositions which are on offer” (Giacomini, 2017). The design implication for AI-infused artefacts is therefore that innovative aspects of such artefacts should be framed with new meanings, or it should be clarified if the meanings of the AI-infused artefacts still align with the pre-existing meanings linked to previous people’s experiences. As observed by Giacomini (2017), “in time the new business opportunities can develop into societally recognized functions, rituals or myths, but start off initially as hybrids involving previously unrelated technological and societal codes”.

AI-infused artefacts can augment people natural interactions that are already happening in the world, recoding them as data or interpreting them as input and taking action (King and Chang, 2016) leading to new meanings for the consumer. Current research deploying the design for meaning approach for AI-infused artefacts has outlined why AI-infused artefacts could be considered as a result of the concept of meaningfication. Vitali *et al.* (2019) for example suggested that “a successful example of design for meaning approach is represented by the Nest learning thermostat<sup>1</sup> (...), that can detect whether a person has left the house and turn down the temperature. They suggested that “through technology the Nest was able to shift the identity/meaning of the thermostat from a static, passive, and hard to personalize element of the house, towards an active and reactive element, that automatically answers to user’s presence and habits. This shift from the pre-existing

1. TheGoogle Nest learning thermostat: [https://store.google.com/gb/product/nest\\_learning\\_thermostat\\_3rd\\_gen?hl=en-GB](https://store.google.com/gb/product/nest_learning_thermostat_3rd_gen?hl=en-GB).

values led to a new vision for the market of thermostats”.

Another example concerns the creation of new visions in the market of Smart TVs. Samsung for example reflects on the role in the room of large, wall-mounted TVs, trying to suggest new meanings. Vitali *et al.* (2019) reported that “Samsung proposes ‘The Frame’ a TV that when switched off becomes a personal piece of art displaying selected high-resolution images from a curated art gallery. In this way, the TV acquires meaning in the room, even when is not switched on. Another innovation is the Samsung Ambient Mode, which lets the TV screen disappear, simulating the texture of the wall on which it is mounted. In these examples the new meanings and visions redefine the architectural role of the TV, trying to anticipate future user wishes”. Vitali *et al.*, (2019) suggested that AI-infused artefacts should have a strong identity that differentiates them from, or relates them to, the pre-existing meanings of their unconnected, “less smart” counterparts. The meaningful identity of the artefact should be considered as a product category.

Other commercial artefacts which are the result of meaningfication include numerous products from the wearables sector (Follett, 2015) which combine the initially unrelated topics of “micro-computer”, “fashion accessory” and “health awareness”. Recent examples of smartshoe, fitness tracker and hearable devices are artefacts of meaningfication which are currently developing into established stereotypes. Bosch Sensortec (2022) for example has developed a revolutionary self-learning motion sensor that adds AI to portable devices: the BHI260AP self-learning AI sensor<sup>2</sup> which enables personalized solutions for every user.

By adding self-learning AI capabilities, Bosch Sensortec’s new movement sensor changes how users interact with their fitness devices from a mere one-way approach and activity tracker to an interactive way of training. For fitness trackers the shift in demand to home-based “trainerless” solutions offers substantial potential to benefit users by accurately informing and assisting them with their solo exercise programs (Kenez *et al.*, 2021). The self-learning AI leads to new ways of thinking for fitness tracking making exercising more automated, personalized, and upgradeable. This makes exercising more motivating

2. The Bosch BHI260AP self-learning AI sensor: [www.bosch-sensortec.com/products/](http://www.bosch-sensortec.com/products/).

and rewarding – whatever a user’s level of fitness or experience (Kenez *et al.*, 2021).

## 5.9 Conclusions

AI-infused artefacts can be regarded as consumer goods which have a significance that goes beyond their utilitarian character and commercial value. This significance rests largely in their ability to carry and communicate meaning for their users.

The fact that people respond socially to AI-infused artefacts has significant implications for intrinsic motivation and persuasion. The design of AI-infused artefact can then leverage the principles of social influence to motivate, persuade and generate meaning (Fogg, 2003).

Common characteristic of AI-infused artefacts is that unlike other artefacts, they have the possibility to persuade and influence people’s attitude and behaviors, or to adapt and learn over time. They may also react differently according to lightning conditions, ambient noise, human accents, and other contexts. Their effect and unpredictability if not designed well may confuse users, dwindles their trust, and may ultimately lead to abandonment of the artefacts for its lack of meaningfulness.

For such AI-infused artefacts, a design for meaning framework based on human centered design approach has been proposed here to help the designer to carefully articulate the intended meaning by either referencing an existing meaning or articulating a new meaning through the process of meaningfication for which “customers are implicitly invited to think differently about the opportunities and value propositions which are on offer” (Giacomin, 2017).

The “design for meaning” framework provides basic considerations and checklist of questions to ask and clarifications to achieve which should be considered if meaning is a fundamental characteristic of the product, system or service which is being designed. The concept of “meaningfication” is not prescriptive in terms of the methodologies to adopt, but it leaves ample room for the deployment of approaches such as real fictions (Dunne, 2008), projective techniques (Soley and Smith, 2008), collaborative organizations (Manzini, 2015) and crowdsourcing (Brabham, 2013). These and other ethnographic approaches typically

used for social science and business research (Khoo-Lattimore *et al.*, 2009; Porr *et al.*, 2011) would help to uncover feelings, beliefs, attitudes and motivations that consumers otherwise find difficult to articulate. They can provide a greater depth of understanding into what people truly think and feel about an artefact.

The reflections made in this chapter suggest that the consideration of target values and meanings that surround artefacts are important as a strategy towards defining the relational role of AI-infused product in the lives of its owners for which artefacts are not simply functional tools, but are also relational mediators which shape the long term aims, objectives and behaviors of an individual or of a group. The meaningfulness factor and whether artefacts are there to motivate people to set and achieve their own goals or develop better habits make AI-infused artefacts one of the most promising frontiers in the use of AI-technology interfacing with people.

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Artificial intelligence is more-or-less covertly entering our lives and houses, embedded into products and services that are acquiring novel roles and agency on users.

Products such as virtual assistants represent the first wave of materialization of artificial intelligence in the domestic realm and beyond. They are new interlocutors in an emerging redefined relationship between humans and computers. They are agents, with miscommunicated or unclear properties, performing actions to reach human-set goals.

They embed capabilities that industrial products never had. They can learn users' preferences and accordingly adapt their responses, but they are also powerful means to shape people's behavior and build new practices and habits. Nevertheless, the way these products are used is not fully exploiting their potential, and frequently they entail poor user experiences, relegating their role to gadgets or toys.

Furthermore, AI-infused products need vast amounts of personal data to work accurately, and the gathering and processing of this data are often obscure to end-users. As well, how, whether, and when it is preferable to implement AI in products and services is still an open debate. This condition raises critical ethical issues about their usage and may dramatically impact users' trust and, ultimately, the quality of user experience.

The design discipline and the Human-Computer Interaction (HCI) field are just beginning to explore the wicked relationship between Design and AI, looking for a definition of its borders, still blurred and ever-changing. The book approaches this issue from a human-centered standpoint, proposing designerly reflections on AI-infused products. It addresses one main guiding question: what are the design implications of embedding intelligence into everyday objects?