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Original Research Article

Indicators of Improving the Relation between Humans and Objects from Heidegger's Ontology of Objects*

Masoumeh Esmaeelzadeh[1] ,Behzad Soleimani[2**]

1. Ph.D. of Art Research, Faculty of Art, Alzahra University, Tehran, Iran.
2. Associate Professor, Faculty of Art, Alzahra University, Tehran, Iran.

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Abstract

Problem statement: The rapid expansion of new technologies has an undeniable impact on human life, affecting the relationship between humans and their surrounding world. Evidence of this can be seen in the criticisms raised by various philosophers regarding the expansion of new technologies and their impact on human life. One of the leading critics in this field is Martin Heidegger, the famous 20th-century German philosopher. Heidegger explains in his critique of technology how the nature of technology has altered the relationship between modern humans and the world around them, casting a shadow of calculative thinking over reflective thinking in today's world. However, he does not propose a clear way to escape this situation. Many philosophers, influenced by Heidegger, have offered solutions based on their areas of study.

Research objective: Therefore, this research aims to identify indicators for improving the relationship between humans and objects from the perspective of thinkers influenced by Heidegger. To achieve this goal, it synthesizes the results of the works of ten reputable philosophers and researchers in this field to identify and interpret the main themes of Heidegger's ontology of objects.

Research method: A qualitative meta-synthesis research method employs three stages: open coding, axial coding, and selective coding. In this way, we synthesize previous research findings to reach a new interpretation in the field under study.

Conclusion: The results of this research show that applying six indicators designing objects based on action, object durability, understanding the existential reality of objects, mutual learning between humans and objects, artistic reflection on objects, and focusing on communication networks can improve human-object relationships and moderate calculative thinking in design.

Keywords: *Philosophy of Technology, Human-Object Relationship, Heidegger's Ontology of Objects, Difference between Thing and Object.*

Introduction

Design is a human capacity to meet needs, give meaning to life, and shape and construct the surrounding environment. A design draws on science and technology, making it a medium for exchanging meaning and establishing communication within a social and cultural context as products, services, or processes. However, looking at the state of products and services designed in the present age, the realization of such goals is not fully observed, and the advancement of technology has brought about numerous issues and consequences that are well-known. Many philosophers and scholars have long expressed their concern about the total dominance of technology over all aspects of human life. Evidence of this concern includes the

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** Corresponding Author: b.soleimani@alzahra.ac.ir, +989121039955

criticisms voiced by various philosophers about the way technology has expanded and its impact on human life. One such critic is Martin Heidegger, the 20th-century German philosopher, who articulated his views and critique in a speech titled "The Question Concerning Technology" (Heidegger, 1977). In this speech, Heidegger explains how the nature of technology has changed the relationship between modern humans and the world around them, casting a shadow of calculative thinking over reflective thinking in today's world. Decades after this speech, many thinkers and philosophers have critiqued this speech and Heidegger's other works related to the discussion of objects and technology. These thinkers, while critiquing his philosophy, have also been influenced by him and have proposed new theories and solutions regarding the existential relationship between humans and objects in various fields. The main question of the present research is: What are the indicators for improving the human-object relationship from the perspective of Heidegger's ontology of objects? By "improving the relationship," we mean enhancing those aspects of the relationship between humans and objects that Heidegger criticized. This research intends to identify the indicators for improving the human-object relationship from the perspective of Heidegger's ontology of objects by reviewing the theories of these thinkers. To this end, we use the qualitative meta-synthesis method to review these theories and create a new theory. Meta-synthesis is a structured method for combining various qualitative studies (theories and critiques of philosophers) in the field under study (Heidegger's philosophy of technology). Therefore, we chose and utilized it to achieve the goals of this research.

Research Background

We can examine the research background of this study in two broad areas: The first domain includes research related to Heidegger's ontology of objects, and the second domain pertains to studies that have explored the human-object relationship in various fields of science, including the philosophy of technology. In this section, we provided a brief review of the most recent studies to clarify the contribution of the present research to this field.

Vilad Peter Glavin (2023) is one of the most recent researchers who, by referring to Heidegger's ontology of objects and analyzing his perspective on things and objects, has examined the impact of human interaction with the material world on creativity. Drawing on Heidegger's ideas, he differentiates between things, objects, and artifacts. Glavin tries to interpret the formation of creativity within the context of how humans interact with the material world. He believes that if we want to understand the relationship between individuals and their material environment, it is impossible without considering how things transform into objects through interaction and ultimately into artifacts (Glaveanu, 2023). He asserts that Heidegger, in his phenomenological approach in the essay "The Thing" (Heidegger, 1971), aimed to encourage us to see things beyond cultural representations and conventional narratives that reduce a thing to an object and enable us to experience their materiality. His research concludes that openness to the countless uses of objects, seeing them as possibilities among many others, can contribute to the emergence of creativity. He argues that to achieve this, we must focus on the essence of things. Engaging with an object as a thing disrupts our perception of what it is or should be, meaning that the path from the object to the artifact for creative work is made possible by viewing them as things (Glaveanu, 2023).

John S. Seberger (2021) also, in his research influenced by Heidegger's ontology of objects, examines the reduction of things to objects in the realm of the "Internet of Things" theory. He argues that things are intermediaries between us and our spaces, transforming spaces into places for living through them. He critically views the Internet of Things, stating that in a world shaped by the Internet of Things, not only are things reduced to objects but also humans are reduced to users, perceiving their world through these objectified things. Relying on Heidegger's ontology, he emphasizes that in a world of thing-like phenomena, through

the reduction of things to objects, everything falls under human control: objects that can be organized, categorized, and manipulated. In other words, when thing-like phenomena are reductively transformed into standard objects for identification, certain aspects of their experience are lost. He concludes that the final significant step towards objectification in the Internet of Things world is the ongoing process of digitizing everything, and this issue has led to reducing the human role to that of a mere user (Seberger, 2021).

Researchers who studied the human-object relationship mostly belong to the field of the philosophy of technology. For example, one of the most recent studies in this field, which historically discusses the relationship between humans and objects (in general, technology), shows that recent trends towards human-centered approaches in design, despite having positive outcomes, have not effectively addressed social, environmental, or even technical issues. Many of them, including user-centered design approaches, require continuous updates to keep pace with new theoretical and methodological advancements (Forlano, 2017). Nigel Thrift is another researcher who has analyzed the human-technology relationship and, as a result, has emphasized the impact of technology on human mentality. His research specifically mentions five social and technical transformations that have had the most significant impact on shaping human mentality (Thrift, 2011). Braidotti, who examined the human-object relationship within the context of posthumanist thought, similarly concludes that science and technology change our understanding of ourselves and our relationships with machines and other species. Additionally, this research analyzes the values and issues that cause such changes in human perception and mentality (Braidotti, 2013). Another study examined the human-object relationship under the use concept and its impact on the relationship between humans and products (objects) arising from different attitudes toward the design process. In this regard, it introduces three general attitudes toward the design process: design-centric, communicative, and user-centric attitudes. The study concludes that the prevailing approach in our time is the user-centric approach, where the type and manner of use are not pre-determined, and the way of use can be made by the user (Vardouli, 2015).

The review of studies in the field of Heidegger's ontology of objects highlights researchers' emphasis on not reducing things to objects_ summarized in Table 1. Researchers in this field, for example, have examined the impact of this reductionism on issues such as creativity or used this concept (the non-reduction of things to objects) to critique various emerging design fields, such as the Internet of Things. Additionally, studies on the human-object relationship have focused on how the relationship has evolved and its trajectory. The present research also aims to describe the relationship between humans and objects based on Heidegger's ontological perspective on objects. However, what distinguishes this study from previous ones is the identification of indicators for improving this relationship. To achieve this goal, the study synthesizes the ideas of thinkers influenced by Heidegger.

Table 1. Summary of concepts and results of research background review. Source: Authors.

References	Concepts and Results Presented
Glaveanu, 2023	Seeing things beyond object-like representations and openness to countless uses of objects as things in the direction facilitating creativity.
Seberger, 2021	Objectification of things and reduction of humans to users in the world of the Internet of Things.
Forlano, 2017	Lack of positive results in recent human-centered approaches and the need to decentralize design approaches from human-centric and pay more attention to the environment and objects.
Vardouli ,2015	Identification and introduction of the user-centric approach as the prevailing approach in contemporary design that reshapes the human-object relationship.
Braidotti, 2013	Changing our understanding of ourselves and our relationships with machines and other species through science and technology, and identifying the issues and values that drive these changes.
Thrift, 2011	Non-neutrality of the human-technology relationship and proving the impact of technology on human mentality.

Theoretical Foundations

The most vital, broad, and complex concept in Heidegger's works is the concept of "Dasein." The literal translation of this word is "being-there", or "existence-there," or "being-in-the-world." Heidegger uses this concept to emphasize that we cannot talk about existence in terms of consciousness separate from the specific spatial, temporal, and contextual condition of an agent (Ahmadi, 2003). Heidegger uses the term "Dasein" to refer to human existence, awareness of his being and actions, and questions about existence. Dasein refers to a human being who chooses a mode of existence through which they contemplate existence and always relate to the world based on a certain understanding of being (Heidegger, 2013). Dasein does not have a purely theoretical relationship with the world; rather, he engages with praxis or action more and before theory. Heidegger's Dasein is not a Cartesian subject that seeks to identify the world as an object. Instead, Heidegger's Dasein is in the world, and he initially understands the world through action (Heidegger, 2010).

Praxis means a natural or psychological endeavor that leads to a result (Saliba, 2014). Aristotle first used it in the meaning of the art of acting for change conditions that an individual faces. He defined praxis as a conscious rational action on a decision, a type of action that is aware of how it is carried out. However, praxis is more than just reflecting on performance; it involves acting towards improving the conditions or situation of individuals and seeking truth within a framework of respect for others (Doosti Irani et al., 2012).

In Heidegger's philosophical system, the relationship between humans and objects is based on action and praxis. It is through action that Dasein gains an initial insight into understanding. He defines the relationship between humans and objects in two general categories: "readiness-to-hand" and "presence-at-hand." In the readiness-to-hand relationship, the individual is aware of the task and the goal but does not pay direct attention to the tool or object that achieves that goal. However, when, for any reason, the tool or object does not work properly and disrupts the system, the individual becomes aware of the presence of that tool or object, and attention is directly focused on it (Heidegger, 2013). Heidegger believes that if we seek to understand something, it is within the readiness-to-hand relationship that we can achieve this understanding, i.e., in the relationship where we engage with something to achieve a goal in acting. In contrast, in the presence-at-hand relationship, where something is present before us as an object, the correct understanding is not obtained. In other words, practical necessities should guide the theoretical examination (Ahmadi, 2003).

According to many of Heidegger's commentators, his critique of the nature of technology is based on describing these two types of relationships and the precedence of praxis over theory. Heidegger believes that modern humans, by focusing on "how" things are and forgetting about existence, reduce things to objects. The reduction of things to objects means that the existence of objects is gradually forgotten, and being is interpreted as something that can have material benefits, be available, and be ready for production. In his speech, "The Question of Technology," his main and fundamental critique of technology is its essence or technological thinking, which signifies the reduction of things to objects and the dominance of calculative thinking over Gelassenheit in modern humans (Ihde, 2004).

Research Methodology

As mentioned earlier, this research aims to identify the indicators for improving the human-object relationship from the perspective of Heidegger's ontology of objects. Therefore, this research is qualitative and practical in terms of its purpose. Since qualitative research aims to gain a natural and deep understanding of social events and phenomena, the synthesis of qualitative research allows the researcher to achieve a broader, deeper, and more comprehensive understanding of that phenomenon (Aguirre & Bolton, 2014). Given that among qualitative methods, meta-synthesis is an effort

to synthesize the findings of qualitative studies to provide a new interpretation of them (Finfgeld, 2006), this method was chosen as the research method for this study. The studies samples of the meta-synthesis method are qualitative studies that the researcher selects based on their research questions (Sandelowski, 2008). Various methods have been proposed for conducting the meta-synthesis method, among which the seven-step model by Sandelowski and Barroso (2006) is the most commonly used. The present study was also conducted according to this model, with the details provided as follows (Sandelowski & Barroso ,2006).

- **Step one: Formulating research questions**

The main research question is as follows: What indicators can improve the relationship between humans and objects from the perspective of Heidegger's ontology of objects?

- **Step two: Systematic search of texts**

For the systematic search of documents, studies that specifically describe, interpret, and critique Heidegger's philosophy of technology and, more broadly, Heidegger's ontology of objects were searched using specific keywords (both in Persian and English) including Heidegger's philosophy of technology, The relationship between humans and objects, Heidegger's ontology of objects, and Heidegger's concept of object and thing; also with a time limit between the years 2000 to 2024 across various databases (Google Scholar, Scopus, Taylor & Francis, ScienceDirect, ACM, DL, SID, etc.). As a result of this search, approximately 78,000 documents were found. Since the searched documents were sorted by relevance to the topic (as such sorting is the default in some databases, such as Google Scholar), only about the first 3,000 documents presented by search engines were deemed relevant to the research goals and questions, based on title review. This number of found documents, regardless of their type or research goals, was entered into the screening stage of the research.

- **Step three: Selection and screening of texts**

At this stage, we reviewed all documents based on criteria such as abstract, research method, and content, screened in four stages according to the criteria in Table 2, and selected the final documents.

The document selection process involved four screening stages: In the first stage, out of 3,157 documents, 346 were screened based on title and type of research. In the second stage, these documents were reviewed based on abstract (field of study and research method), resulting in 88 selected documents. In the third stage, suitable documents were fully reviewed in terms of content (accepted research parameters), resulting in 42 selected documents. In the fourth stage, these 42 documents were screened based on quality, one of the quality criteria being the highest citation among all screened sources. As a result of this final screening stage, 11 documents, including eight articles and three books, were selected as final sources, with their details provided in Table 3.

- **Step four: Extraction of information from the documents**

In this step, we studied the contents of the documents, then extracted the information related to the main research question and secondary questions using note-taking and checklists, as described below.

The secondary research questions are as follows:

Table 2. Criteria for accepting and rejecting documents and scientific references. Source: Authors.

Parameter	Description
Field of study	Philosophy of Technology / Philosophy of Design / Anthropology
Research method	Qualitative
Accepted research parameters	Heidegger's Analysis of 'Tool' / Critique of human-object relationships in Heidegger's view
Type of research	Articles published in reputable research journals / Book chapters
Index	WOS, Scopus, ISC, …

Table 3. Selected studies for research. Source: Authors.

Title	References
What things do: Philosophical reflections on technology, agency, and design	Verbeek, 2005
Don Ihde's philosophy of technology, a response to technological determinism	Kaji, 2013
Focal things and practices.in "Readings in the Philosophy of Technology"	Borgmann, 2004
Democratic Rationalization: Technology, Power, and Freedom. In "Readings in the Philosophy of Technology"	Feenberg, 2009
Examining the Approach of Andrew Feenberg and Martin Heidegger for Overcoming the Dominant Technological Space.	Borumand & Taqavi, 2012
Technology, objects, and things in Heidegger	Harman, 2010
Cognition and Tool Use	Preston, 1998
Bringing Things to Life: Creative Entanglements in a World of Materials	Ingold, 2010
Heidegger on Gaining a Free Relation to Technology. In "Readings in the Philosophy of Technology"	Dreyfus, 2009
Design for Dasein	Wendt, 2015
Is Design Finished? Dematerialization and Changing Things	Tonkinwise, 2004

1. Given Heidegger's critique of technology, what is the relationship between humans and objects in the contemporary era?
2. What solutions does Heidegger propose to improve this relationship?
3. What are the indicators for improving the human-object relationship from the perspective of researchers influenced by Heidegger?

As evident from the secondary research questions, the note-taking in this research was conducted in line with two general topics: First, a description of various thinkers' perspectives on the relationship between humans and objects from Heidegger's perspective, and second, an explanation of the concepts and theories that these thinkers, influenced by Heidegger, have developed regarding the improvement of this relationship.

• Step five: Analysis and synthesis of qualitative findings

This step is the most critical part of the research. In this step, we used open coding, axial coding, and selective coding to analyze the data, identifying and naming the key concepts and categories of the research. As mentioned earlier, one of the main focuses in note-taking and the three coding stages in this research was extracting concepts related to the theories of Heidegger's influenced thinkers in analyzing tools and improving the human-object relationship. In this section, we provided a brief explanation of these theories and concepts.

According to Table 3, the first document used in this research pertains to Peter-Paul Verbeek, a Dutch philosopher in the philosophy of science and technology. In this work, he presents and explains his theory of "material aesthetics." The central theme of this theory is recognizing the mediating role of objects in shaping human relationships, thereby making designers aware of the need to anticipate these mediating roles in design (Verbeek, 2005).

The second document pertains to the explanation of Don Ihde's views, an American philosopher in science and technology. Hossein Kaji, in this work, accurately portrays Ihde's views on Heidegger's ideas. This work states that Ihde believes that Heidegger distinguishes between the relationship humans establish with the world through tools and the relationship they establish without tools. Influenced by Heidegger, Ihde argues that the relationship between humans and technology is not neutral, and its impact is neither necessary nor inevitable. In other words, the human-technology relationship is contingent, and humans can make choices and decisions regarding the effects of technology. Ihde derives this contingency from the concepts of "readiness-to-hand" and "presence-at-hand" that Heidegger discusses in the tool analysis in Being and Time (Kaji, 2013).

The third work pertains to Albert Borgmann, a German-born American philosopher of technology. He follows Heidegger in linking technology in the modern era with our way of being in the world.

According to Borgmann, technology has made everything easily accessible to humans, and humans no longer face hardships in activities such as preparing food or keeping warm. As a result, technology has eliminated activities that used to bring people together from social life. He calls these activities "focal practices" and the objects around which these activities take place "focal things" (Borgmann, 2004).

The latest two works relate to the views of Andrew Feenberg, an American philosopher in the field of technology. His theory concerns the democratization of technology in today's modern world as a solution to Heidegger's critique of technology and its destructive impacts. He believes that we can achieve a new type of technological society that supports a broader range of values. This form of democracy is one of the main values that can be implemented and served in redesigned industrialism (Feenberg, 2009).

The sixth document in Table 3 is related to Graham Harman, an American philosopher and distinguished professor of philosophy in architecture. His work on the metaphysics of objects led to the development of the "object-oriented ontology" approach. He has tried to distance himself from human-centered approaches in design, such as user-centered design, and instead recognize the existence of things alongside the existence of humans. In this regard, he attempts to achieve a correct understanding of things and realize it in design through the "readiness-to-hand" relationship. This type of relationship in cognition is usually overlooked, but for Heidegger, reality has this exact meaning (Harman, 2010).

The seventh document pertains to Tim Ingold, a British anthropologist who, influenced by Heidegger's distinction between things and objects, proposed the theory of "Environment without objects." In this theory, he emphasizes the belief in the liveliness of things and acknowledges their movement and growth. He argues that things move and grow because they are alive, not because they have agency, and designers must recognize this liveliness in design. Things, like humans, are processes in motion, and their agency is that humans cannot fully control them (Ingold, 2010).

The next document pertains to Hubert Dreyfus, an American philosopher and one of the well-known interpreters and commentators. He argues that the great danger of technology in the modern era, from Heidegger's perspective, is the dominance of calculative thinking over Gelassenheit, which may one day be accepted and used as the only way of thinking. Therefore, the danger goes beyond the destruction of nature or culture; it is a limitation in our way of thinking. Dreyfus believes that the common ways in which we are socialized provide an initial understanding of what is considered real, based on how we shaping our actions about in our interaction with things and people. According to Dreyfus, Heidegger's concept of "unconcealment" refers to this understanding, i.e., a pre-understanding that provides a framework for human comprehension of the world (Dreyfus, 1997).

The ninth document pertains to Cameron Tonkinwise, a design researcher from Australia. In his theory of "recovering the sense of movement in things," he presents a concept similar to what previous thinkers, including Ingold in the "Environment without objects" theory, have stated regarding the liveliness of things. Tonkinwise emphasized the fact that being in motion means not being finished things. Being in motion means that what exists aims to continue existing. In a place where the goal of technology is to finish or construct something, "poiesis" means maintaining things in their change, continuing their change, or continuing them through their self-change (Tonkinwise, 2004).

The tenth research pertains to Beth Preston, a philosopher of mind with a strong background in Continental philosophy in general and phenomenology in particular. Her interpretation of Heidegger's tool analysis presents a non-individualistic view of the nature of cognition. Drawing on Heidegger's ideas, she considers understanding culture and grasping supra-individual structures essential for identifying a person's behavior and the functioning of and relationship between humans and tools (Preston, 1998). She further

investigates the topic of tool use and the roots of this concept in Heidegger's thought, concluding that, in Heidegger's view. She concludes that users do not have complete control over the tools they engage with, and the environmental structures control them in many aspects (Ibid.).

The last document pertains to Thomas Wendt, a theorist and researcher in the field of design. He, too, emphasizes the importance of praxis and the practical process in design based on Heidegger's ontology of objects, attempting to explain how understanding and experience are formed in humans. According to him, engaging with objects in and of themselves is important as it gives the user a sense of self-understanding. A person can only act and know through the lens of objects; the same is true for objects: they gain identity through human relationships. This dual relationship between objects and users is highly significant for design. However, it is disregarded by designers in analyzing the design output, attention to which can be a step forward in how humans and objects relate (Wendt, 2015).

These theories are all, in a way, extensions of Heidegger's explanation and interpretation of a "thing" and the dos and don'ts he points out regarding the human-object relationship and improving this relationship. We provided the titles and concepts related to these theories and their connection to Heideggerian concepts in Table 4. These theories form the foundation of the present research in the coding stages and the final result as Heidegger's ontology of object indicators.

- **Step six: Quality control**

Researchers use various strategies to ensure the scientific accuracy of qualitative research, such as self-review by the researcher, participant review techniques, peer review, and detailed descriptions of research conditions (Klassen et al., 2012). In this research, a combination of the mentioned strategies, including self-review by the researcher and peer review, was employed to control the quality of this article.

- **Step seven: Presentation of findings**

In this stage, the findings obtained from the previous steps were summarized and presented as indicators for improving the human-object relationship in the next section.

Findings and Discussion

In this section, we presented the codes extracted from the three stages of coding in the fifth step of the research method in the relevant tables. The first stage of coding is open coding, which, as the name suggests, is carried out openly and without any restrictions. We showed an example of the tables related to the open coding in Table 5. The other tables relating to this stage are not mentioned in this text due to space constraints. Table 5 shows the concepts extracted from the main text of the relevant document, and the codes extracted from it through open coding. Finally,

Table 4. Theories influenced by Heidegger's ontological perspective on humans and objects. Source: Authors.

Philosopher or researcher	Title of theory and concept discussed	Related heideggerian concept
Peter-Paul Verbeek	Material Aesthetics	Relationship of readiness-to-hand and presence-at-hand
Don Ihde	The possible influence of humans and technology on each other	Relationship of readiness-to-hand and presence-at-hand
Albert Borgmann	Focal Things and Practices	Emphasis on Gelassenheit over calculative thinking
Andrew Feenberg	Democratization of Technology	The concept of Gestell
Graham Harman	Object-Oriented Ontology	Analysis of tools
Beth Preston	Non-individualistic View of Cognition	Analysis of tools
Tim Ingold	Environment without Objects	Distinction between thing and object
Hubert Dreyfus	Establishing a Free Relationship with Technology	The concept of Unconcealment
Thomas Wendt	The Importance of Praxis and the Practical Process in Design	Primacy of action over theory
Cameron Tonkinwise	Things in Motion	Distinction between technique and poiesis

Table 5. Concepts and textual evidence related to document 1 from Table 4. Source: Authors.

Concepts and Textual Evidence	Initial Codes
In fulfilling their functions, artifacts do more than function- They shape a relation between human beings and their world. Things mediate the relation between human beings and their world not in a linguistic but in a material way. They fulfill their functions as material objects, and by this functioning, they shape human actions and experiences (Verbeek 2005).	Attention to the role of mediation by things in shaping human experiences and beings and their world relation
Aesthetics should therefore be located in the sensory location of human beings to the world, a relation that is not solely visual but that involves other senses as well. In certain product use, for instance, the sense of touch is at least as important as sight. After some practice, many products can be used without looking, though they could not be used at all without touching (Ibid.).	Pay attention to the practical relationship with products for sensory perception.
I shall make clear that this discussion can be fruitfully supplemented by a perspective in which the relation between humans and products takes center stage, instead of focusing separately on humans (who should act more friendly toward the environment) and things (which should be "cleaner") (Ibid.).	Priority of focusing on the relationship between humans and products in design rather than separately focusing on them
The most relevant issue for durable product development is therefore to devise ways to lengthen this psychological lifetime. How can stronger bonds, that is, be fostered between people and the artifacts around them? Seeking answers to this question calls not only for an instrumental technological solution to environmental issues but also for the generation of what Eternally Yours calls "cultural durability" (Ibid.).	Focus on cultural durability in design to increase the psychological lifetime of products.
Designers, he said, should be guided by the image of objects as plants in a garden; they should see themselves as planting "a garden of objects." Just as do trees and plants, objects have "lives of their own"; they "perform services and require care." Manzini makes a plea for "caring for objects," with the word "caring" bringing with it a new "ecological sensibility" (Ibid.).	Designing to promote a culture of caring for things as if they were growing plants
Businesses could shift their emphasis from simply producing and selling products to establishing and maintaining a relationship with clients. The stronger this relationship, the more extended the survival time of the product around which this relationship takes place is likely to be (Ibid.).	Creating and maintaining relationships with clients to strengthen the human-product relationship
Transparent products break through the technological pattern in which the machinery of devices recedes into the background and involve people with their machinery (Ibid.).	Functional transparency to create a durable relation with products
In order to involve people with products as material things and not only with their meanings or the lifestyles they represent, products must be designed that are more dependent on humans rather than functioning quasi-autonomously. Products that allow human participation in their functioning, or with their repair when they break down, forge a bond between users and themselves as material things rather than simply as suppliers of commodities (Ibid.).	Allowing product users to participate in service provision and creating a reciprocal relation.
The material aesthetics that I have elaborated from the postphenomenological perspective points the way toward different design possibilities when it is applied to culturally durable product development. The most important viewpoint in this connection is the necessity of a materially oriented design approach. If products are to be designed to encourage human attachment, it is necessary to design them so that humans deal with the products themselves and not only with what they do or signify (Ibid.).	Physical involvement with the product to create a bond between the user and the product
The engaging capacity of products invites attachment during the product's use by allowing trusted interaction with it and by involving people in the functioning and aging processes. In both cases a sensorial relation with objects as material artifacts arises, through which people are actually engaged with the very product that is present here and now. This engagement, supported by functionality and significance, amounts to a condition for a durable relation with these things (Ibid.).	Involving people in the processes of function and aging of the product

we extracted 50 initial codes from all documents (11selected documents) in this stage.

In the next step, we categorized the codes in the axial coding stage by establishing conceptual relationships between the codes. We obtained 14 sub-categories in this stage. All the initial codes and sub-categories extracted from them, along with the document number corresponding to each initial code, are displayed in Table 6. Finally, in the selective coding stage, the researcher, considering the nature of these 14 sub-categories and closely examining the relationships between them, reduced the obtained categories and named them within broader categories according to the type of each sub-category. In this final coding stage, we received six main categories, which include: "designing things based on action," "sustainability of things," "understanding the existential reality of things," "mutual learning between humans and things," "artistic reflection on things," and "formation of things within communication networks." The data in Table 7 show the selective coding stage and the final categories obtained as Heideggerian ontological indicators of objects from the perspective of thinkers influenced by him. The following sections will elaborate on each of these.

Table 6. Sub-categories extracted from initial codes. Source: Authors.

Document Number from Table 2	Initial Codes	Sub-categories
1	- Attention to the role of mediation by things in shaping human experiences and beings and their world relation.	Attention to the mediation of things in shaping human relationships
2	- The influence of humans on products and the role of tools and objects in shaping our understanding of ourselves.	
1	- Pay attention to the practical relationship with products for sensory perception.	Primacy of action-based knowledge over theory-based knowledge
2	- The practical relationship with the product precedes the theoretical relationship for true understanding.	
3	- Employing practical activity to activate sensitivities to integrate means.	
10	- Priority of action and the experience of engagement with objects over theorizing for achieving understanding.	
10	- Creating theoretical models through practical outputs to utilize the potential of new final goals that appear only after initiating a relationship with something.	
1	- Priority of focusing on the relationship between humans and products in design rather than separately focusing on them.	Primacy of the relationship between humans, objects, and environmental structures over separate focus on them
7	- Function and use of tools and equipment result from a joint investment between humans and environmental structures.	
6	- The formation of Objects only with other objects and their contextual background.	
8	- Design in the context of understanding the designed issue in relation to the environment and other things.	
3	- Conducting focal practices as patterned and social activities to restore depth and integrity to life.	Investigation into the social background of need formation and use
7	- The need to understand the social context, including pre-existing equipment context, in design.	
10	- Thinking through objects within communication networks or usage context.	
7	- Understanding individual activities through social and cultural roles.	
4	- Reforming technological behavior by referring to the traditional background of use.	
1	- Designing to promote a culture of caring for objects as if they were growing plants.	Functional transparency for caring and creating the ability to change things
11	- Creating the ability to change and repair things over time to enhance durability.	
1	- Functional transparency to create a durable relation with products.	
1	- Creating and maintaining relationships with clients to strengthen the human-product relationship.	Creating and maintaining a durable relationship with the user to preserve things
11	- Actively preserving things through product-centered services to increase product lifespan.	
1	- Allowing product users to participate in service provision and creating a reciprocal relation.	User participation in product function
1	- Physical involvement with the product to create a bond between the user and the product.	
1	- Involving people in the processes of function and aging of the product.	
10	- Priority of meaningfulness of the product over function.	
2	- The emergence of humans through greater practical and physical involvement with the product when achieving the desired function.	
3	- The artwork as the focal point and origin of the world's meaning.	Artistic activities to achieve an existential need and generate meaning
9	- Creating a shared sense of reality and a new understanding of existence through design with art.	
9	- Using daily and marginal activities (things that seem to lack practicality) in the design process.	
6	- Not reducing reality to the existent and questioning the existence of beings.	Redefining reality following the being of things to define their existence
9	- The need to understand common socialization methods to achieve a correct understanding of reality.	
3	- Expanding interpersonal relationships and moving away from purely individual decisions to challenge the dominance of technology.	Expanding relationships to enhance responsibility toward things
5	- Broadening the scope of interests and stakeholders involved in the design process to achieve democratic values.	
4	- Democratic rationalization (rationalization based on responsibility towards the human and natural contexts of technical action) as a way to counter the dominance of technology.	

Rest of Table 6.

Document Number from Table 2	Initial Codes	Sub-categories
6	- The need to understand and maintain real proximity and distance (ready-to-hand relationship) and avoid lack of distance (presence-at-hand relationship).	The priority of focusing on ready-to-hand relationships over presence-at-hand relationships
6	- Achieving a proper relationship with things by refusing to reduce things to objects (objects that we show or reduce things to the causal conditions that brought them into being).	
10	- Placing the design process around the care and maintenance of Dasein with designed objects.	
8	- Joining formation processes in design to achieve the environment without objects.	
8	- Following the fluidity of the process of life in design.	
9	- Designing alongside things instead of controlling them.	
8	- Designing as an ongoing event and participating in the gathering of things instead of presenting a finished object.	Designing as an ongoing event
11	- Designing the sustainability or presence conditions of the object over time alongside designing its features.	
10	- Leveraging the textual nature of using an object (using an object in different ways at different times) by designers.	
11	- Continuity of things through their self-change and not finishing construction.	
8	- Joining forces and material flows and following them rather than reproducing the initial idea.	Understanding human and object existence to redefine initial goals and ideas
9	- Designing beyond achieving mere efficiency and increasing productivity.	
4	- Avoiding dualistic thinking about goals and contextual impacts.	
3	- Reviving the existential view of things and the focal space created by them to understand the nature of technology and overcome technological thinking and reviving focal things.	
10	- Studying the embodied use of the designed object and the inherent diversity that comes with it.	Studying users' methods of personalizing products for cultural durability
1	- Focus on cultural durability in design to increase the psychological lifetime of products.	

- **Designing things based on action**

Design requires understanding. In the Heideggerian ontological perspective, action precedes theory in learning. Using a thing is an action that can lead to this understanding. Therefore, designers should design in the context of use. An example is the user-centric approach, where users are allowed to determine how to use products rather than being passive recipients of the instructions embedded in the design. The thoughts of thinkers such as Verbeek, Ihde, Borgmann, Wendt, Harman, and Ingold have played a key role in formulating this indicator. For example,

Table 7. Categories formulated from extracted sub-categories. Source: Authors.

Sub-categories	Categories
- Primacy of action-based knowledge over theory-based knowledge	Designing things based on action
- The priority of focusing on ready-to-hand relationships over presence-at-hand relationships	
- Expanding relationships to enhance responsibility toward things	Sustainability of things
- Designing as an ongoing event	
- Creating and maintaining a lasting relationship with the user to preserve things	
- User participation in product function	
- Functional transparency for caring and creating the ability to change things	
- Redefining reality following the being of things to define their existence	Understanding the existential reality of things
- Understanding human and object existence to redefine initial goals and ideas	
- Attention to the mediation of products in shaping human relationships	Mutual learning between humans and things
- Studying users' methods of personalizing products for cultural durability	
- Artistic activities to achieve an existential need and generate meaning	Artistic reflection on things
- Investigation into the social background of need formation and use	Focus on communication networks
- Primacy of the relationship between humans, objects, and environmental structures over separate focus on them	

Don Ihde explains that in the function of tools, the readiness-to-hand relationship is a prerequisite for the presence-at-hand relationship by expanding on the concept of praxis in Heidegger (Kaji, 2013). This indicator, influenced by Heidegger's attitude of the priority of action over theory and the priority of the readiness-to-hand relationship over the presence-at-hand relationship, has been expanded upon by his followers, such as Thomas Wendt, who has extended this concept into other fields such as design, making its practical aspect more tangible.

- **Sustainability of things**

Sustainability means being. In Heideggerian ontology, being means preserving change and keeping the possibilities of existence alive. Something that lacks the possibility of change, like a human unaware of his existential possibilities for change, merely exists and neglects his existence. Such a thing is reduced to an object with a limited lifespan, easily discarded. Therefore, the sustainability of things means creating and maintaining the possibility of change in them. The formulation of this indicator specifically draws on the theories of Verbeek, Ihde, Borgmann, Feenberg, Ingold, Wendt, and Tonkinwise. For example, Tonkinwise (2004) refers to this concept in his theory of "things in motion," stating that when we can provide the grounds for a change in things and offer artifacts that allow for repair, upgrade, reconstruction, and personalization, we provide the grounds for being in things, allowing them to age and wear out just like us. This concept in Heidegger's thought is presented in the distinction between technique and poiesis, which his followers have further developed into the concept of sustainability. The interpretation we provide here is more closely aligned with the interpretation given by Heidegger's followers.

- **Understanding the existential reality of things**

Understanding existential reality means recognizing the difference between reality and existence so that knowledge of reality does not reduce to the mere existence of something. In understanding things, hidden realities that perform tasks unnoticed must be seen and placed at the center of attention. One cannot focus on the objectivity of things and separate them from the flows that animate them, reducing them to mere objects. Studying things within the context of use is one of the ways to achieve such an understanding of things. We use the theories of thinkers such as Borgmann, Feenberg, Harman, Ingold, and Dreyfus to formulate this concept. For example, Harman (Wendt, 2015), in developing his theory of "object-oriented ontology," uses the concept of existential understanding, arguing that a thing cannot be reduced to what we show about it or the causal conditions that brought it into being. He uses Heidegger's example of a jug, explaining that a jug, as a vessel, must be created, not that it is a vessel because it was created. In other words, according to him, the external representation of things never reveals their inner and real life to us. Both Heidegger and his followers have interpreted the understanding of existential reality as the non-reduction of reality to existence, and we have also used this interpretation in formulating this indicator.

- **Mutual learning between humans and things**

Humans and objects shape each other reciprocally in their interactions. This relationship happens through things, and just as humans shape things through the actions of "designing" and "creating," human actions and perceptions are also shaped by things. According to Heidegger, learning occurs through the meaning revelations resulting from human experiences in the interaction between Dasein and other humans, as well as in the interaction between Dasein and the environment and objects. We formulate this indicator using the theories of Verbeek, Don Ihde, and Thomas Wendt. For example, Verbeek (2005), in his theory of material aesthetics, influenced by the various relationships Heidegger introduces between humans and objects, presents artifacts as mediators that can influence human relationships with each other and with objects. Verbeek emphasizes that this influence is not one-sided. Both humans and objects are involved in a mutual influence and shaping each other. Heidegger does not directly use such an interpretation

(mutual learning) in his ontology regarding objects; however, his followers have arrived at theories such as mediation and intermediation in the relationship between humans and artifacts through concepts such as "event of appropriation," "being-in-the-world," and so on, from which we have drawn upon to formulate and apply the indicator of mutual learning between humans and things.

- **Artistic reflection on things**

Artistic reflection means contemplation doesn't just look for profitability and productivity; Reflection in which the things become the subjects, in such a way that the existential view of things is revived. Artistic activity, as it stands in opposition to technological action, can counter the dominance of technological thinking and promote "Gelassenheit" over calculative thinking in design. Artistic reflection or "Gelassenheit" can also be achieved through marginal activities (such as walking or observing nature), where increasing productivity is not the sole aim. We formulated this indicator by synthesizing the thoughts of Borgmann, Dreyfus, and especially Heidegger. Both philosophers (Borgmann and Dreyfus) are influenced by Heidegger's thoughts on "Gelassenheit" and calculative thinking in their critique of the nature of technology. For example, Borgmann (2004) presents his theory of focal practices in line with this concept, aiming to reinforce "Gelassenheit" and reduce the dominance of mere productivity-focused and calculative thinking. The interpretation we have utilized in this indicator relies more on Heidegger's thoughts (particularly regarding the role of "Gelassenheit" in confronting the essence of technology); in this context, the thoughts of his followers were used mainly to better interpret the topic.

- **Focus on communication networks**

Just as Dasein finds meaning in relation to other Daseins and things, one cannot understand a thing without considering the flows that shape it. In other words, solely focusing on the objectivity of things separates them from the flows that animate them, reducing them to mere objects. Products are the result of social factors, and from another perspective, they create new social factors that did not exist or at least changed their scale. An example that Verbeek provides regarding the microwave oven is a good example for this indicator. He explains how changing users (men and women) altered the function of this device and how the widespread use of this device introduced new types of food and eating habits in society (Verbeek, 2005). This indicator is the result of synthesizing the thoughts of Verbeek, Borgmann, Feenberg, Harman, Preston, Ingold, and Wendt. Among these thinkers, Beth Preston has specifically focused on this concept. Preston (2013), influenced by Heidegger's tool analysis, developed her non-individualistic view of the nature of cognition, arguing that there is no clear boundary between the body and external equipment. In reality, we deal with a collection of tools and equipment that work together. In other words, the user disappears in a sea of equipment. Heidegger's tool analysis emphasizes seeing objects within the context and background of their formation and use. His followers have also expanded their theories with a similar interpretation in this regard, with the title of this indicator resulting from a combination of foundational concepts in their thoughts, all of which play an equal role in shaping it.

In the final stage of this research, we examined the conceptual relationships between the indicators, the result of which is shown in Fig. 1. The following sections explain these relationships.

- **Designing things based on action**

Designing based on action focuses on the readiness-to-hand state of things_ an existential relationship, and can lead to understanding the existential reality of things. Additionally, designing based on action, by reviving the existential view, creates reflection free from mere productivity, leading to artistic reflection. Action always occurs in an existential relationship with something or someone, which can lead to mutual learning. Again, for this reason, it leads to a focus on communication networks.

• **Understanding the existential reality of things**

Understanding at the existential level leads to an existential relationship. Since an existential relationship is free from mere profitability, it increases attachment to things and, as a result, enhances responsibility towards them, leading to the sustainability of things.

• **Mutual learning between humans and things**

Mutual learning is derived from action through attention to experiences and meaning revelation during an event or action, expanding understanding from the existent to existential knowledge. Additionally, the existential understanding resulting from mutual learning leads to the continuity of the relationship with things and their sustainability.

• **Focus on communication networks**

Attention to communication networks reveals the flows that shape things, including the preconceptions and presuppositions that have shaped the relationship with a thing and changed it over time. When these preconceptions are revealed, an understanding of the existential reality of that thing occurs, going beyond knowledge at the level of existent. Additionally, since such understanding occurs within a communicative context, it also leads to the formation of mutual learning.

• **Artistic reflection on things**

In artistic reflection, things are considered independent of profitability, leading to existential knowledge.

• **Sustainability of things**

We can achieve sustainability through the continuity and change of things. This continuity and change are achieved through action. In other words, without an existential relationship between humans and things and without action, the change that can lead to the preservation and sustainability of things does not occur. Therefore, sustainability is influenced by designing things based on action.

As seen in Fig. 1, the indicator "designing things based on action" has the most influence in shaping other indicators, and it can be considered as having precedence in implementation in a design process. Similarly, "understanding the existential reality of things" receives the most input among the indicators. In other words, the outcome of implementing all these indicators can be summarized in achieving this indicator, i.e., understanding the existential reality of things. However, a more precise examination of this issue requires specific quantitative methods (e.g., Interpretive Structural Modeling), which can be considered a suggestion for continuing this research.

Conclusion

Heidegger uses an ontological perspective in his description of objects, like in his entire philosophy. Therefore, in his description of a thing, the criteria of existential understanding take precedence over ontological criteria. This study attempted to examine the indicators for improving the relationship between humans and objects from Heidegger's perspective

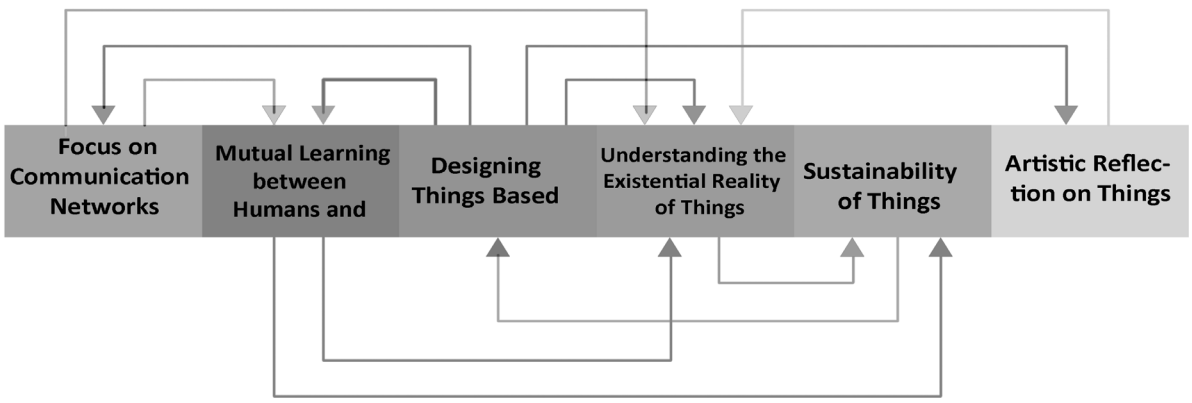

Fig. 1. The influence of Heidegger's ontology of objects indicators on each other. Source: Authors.

by reviewing the theories of thinkers influenced by Heidegger and combining the foundational concepts of these theories to offer a new interpretation. We identified six general indicators in the article: the projection of things based on action, the durability of things, understanding the existential reality of things, mutual learning between humans and things, artistic reflection on things, and focus on communication networks. The results of this research, through these six indicators, demonstrate that the interpretation of thinkers influenced by Heidegger from his ontological engagement with things, emphasizes his focus on action, communication networks, and attention to mutual learning in engaging with things. Through this approach, understanding of things shifts toward existential understanding, and the sustainability of things is introduced as an achievement of this ontological perspective. Thus, these indicators can be considered in modifying calculative thinking and enhancing "Gelassenheit" in the design process.

Furthermore, by explaining the relationship between these indicators, the projection of things based on action was recognized as the indicator with the most influence in shaping other indicators. Similarly, the understanding of the existential reality of things garnered the most input among the indicators and, for this reason, was identified and introduced as the outcome of implementing all these indicators. The review of previous research results in Table 1 clarifies that understanding the difference between a thing and an object and establishing a relationship with the world that does not reduce things to objects will result in understanding the existential reality of things. We can consider an artifact as a "thing" as long as it continues to function in harmony with the different parts of the body. In other words, things are not within our conscious awareness, like a chair that, due to its proper function, exits the user's field of awareness. Things expand human comfort and functional range and withdraw themselves. Only when their function encounters a problem do they enter the realm of awareness and transform into objects. Once the problem is resolved, they return to their previous state. When this cycle of problem-solving and returning is provided in artifacts, a thing remains in its state of being a "thing." However, it seems that in today's technological world, due to the dominance of technology over human thinking, things no longer act in the direction of expanding human action while simultaneously withdrawing from this relationship. From the outset, they are presented not as things but as objects. For example, in some instances, they replace humans (smart cars), and in others, they flaunt themselves instead of withdrawing (the fashion industry). Since designers play a direct role in creating both types of relationships-between humans and things or between humans and objects-awareness of these concepts can provide a new direction for design research and artifact creation.

Conflict of Interest

The authors declare they have no conflicts of interest in conducting this research.

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