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What is the value of design theory?

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ABSTRACT: This paper explores the multifaceted concept of design theories value, challenging traditional views of science and philosophy and proposing a novel framework for evaluation. Through critical analysis, considering design theories like C-K theory, PSI, GDT, and CDP, and insight from the history of science, we establish the need for a new value model of design theories that includes design-related and other general properties such as generativity, robustness, and impact on practice. We adapt a recently developed system value model (SVM) to consider the diverse perspectives of design theory stakeholders. Our framework is tested on the PSI theory, demonstrating its applicability. This paper redefines how we perceive and measure the value of design theories, offering insights that could influence future research and practice in design science.

KEYWORDS: design theory, research methodologies and methods, evaluation

1. Introduction

How do we measure the value of a design theory? Or to be more specific, how do we measure the value of C-K theory (Hatchuel and Weil, 2007), PSI (Reich and Subrahmanian, 2020), GDT (Yoshikawa, 1981; Tomiyama and Yoshikawa, 1986), CPD (Braha & Reich, 2003), or Axiomatic Design (Suh, 1984)? Before trying to answer, we'd have to ask what we mean by the term value. These questions are not mere thought experiments because, as researchers, we want to develop valuable theories.

Let us try to answer simpler questions. What is the value of your refrigerator? What is the value of a cellular phone? If you ask people these questions, you'll get many confused answers. People are not used to thinking about this question, although the ultimate goal of a system (product or service) is to provide value to its stakeholders or owners (Freeman, 2010; Phillips, Freeman, & Wicks, 2003). You can conduct a short survey around you to validate this statement. We have repeatedly asked 'the value question' in various meetings, lectures, research projects, and other occasions to confirm our claim.

When we surveyed the landscape of human knowledge disciplines, we found that the notion of value is quite limited, but its meaning is evolving toward a more holistic encompassing concept (Lavi and Reich, 2024a). To improve our understanding of value, we developed a framework that guides estimating a system value based on a new system value model; we tested its validity in diverse case studies (Lavi and Reich, 2024b). We suggest that an approach like system value could address the initial questions regarding the value of design theories. Nevertheless, on the way to using our system value model, we'll encounter firm positions about evaluating theories or assessing the quality of theories. Such positions are part of the culture and practice of science or philosophy of science. Such positions consider the goodness of a theory and not its value. Goodness could be determined by consistency, validity, ability to explain observations, and insight into manipulating reality. But goodness does not determine value - a good product that adheres to its requirements might not provide value to stakeholders, for example, if the requirements were wrong. Eaton (1921) contends that a theory may have the following properties: beauty, utility, truth, and intellectual interest – curiosity. A theory must have explanatory value, enabling the derivation of true conclusions and intellectual satisfaction; its worth is assessed by two key criteria: primary, completeness; secondary, elegance or simplicity. Eaton concludes that explaining experience is the primary and sufficient value of a theory, truth is not a necessary value.

In developing a new value definition of scientific theories in general and design theories specifically, our research methodology is design. We establish the need for a new measure of theory value (section 2); we recount a recently developed system value model, redesign it to address the need, and demonstrate it (section 3). Section 4 concludes the paper.

2. Background and motivating examples

The term theory refers to different things, including the brand name of a fashion company. A theory is about finding things such as facts, cause and effect relations, and laws describing relationships. We may gather supporting evidence for the theory or contradicting evidence to refute it. Merriam-Webster dictionary proposes several meanings of theory, such as scientifically acceptable principles offered to explain phenomena, the analysis of a set of facts related to one another, etc. (Merriam-Webster, 2024). However, like the perspective on “value”, having widely accepted, clear, and measurable dimensions in physical sciences, while being abstract and subjective in design, so is the perspective on design theory. While some believe that since design itself is a practice, it is artificial to enforce upon it a theory (Hooker, 2004), others argue that design theories are not only viable but should have a distinct structure (Jones & Gregor, 2007). A review of the work of the Design Theory SIG of the Design Society on design theory discusses precisely what design theory is and its three core foundations: generativity (see section 2.4), splitting condition (e.g., use of multidisciplinary knowledge), and social spaces (e.g., exemplified by PSI) (Hatchuel et al., 2018). Nevertheless, in the context of this paper, we can view theory much more broadly as a method, prescriptive process or even personal or local theories such as organizational routines. Each of these rests on assumptions, rooted in experience and culture, and its objective is to support professionals in solving challenges. As none of them can be considered always better than others (Reich, 2010), we need some measure to select among them for different purposes - theory value could serve this purpose. We want to understand the space of theory value by considering the history of science and design theory examples. These examples suggest that a simple value measure is insufficient to describe the multiplicity of perspectives and manifestations of value.

2.1. General science view of theory’s value

Two and a half millennia ago in the Aegean region, a crisis arose concerning the explanatory value of the prevailing theoretical framework. At that time, mythological explanation was the accepted model for understanding various natural and human phenomena. In the eighth century BCE, this myth-based worldview offered intriguing answers to questions about the creation of the world, the seasons, the cycle of life, and more. The Greek word for myth, mythos, means “story,” and whenever the Greeks faced the need to explain a natural occurrence or a form of human behaviour, they developed a new myth. Each new myth included a narrative background, a chronological development, and reasons that seemed justified and coherent to human minds. By the sixth century BCE, however, myth no longer satisfied the intellectual needs of thinkers like Thales and the members of the Miletus school. Thales and his colleagues sensed that mythology’s explanatory value had diminished. They felt there were too many myths and that individual stories devised to solve particular problems – without being part of a broader, non-arbitrary system devoid of human motives – could not explain the universal nature of the world.

This intellectual shift explains why Thales’ philosophical proposition that “all is water” had greater importance and influence than his geometric theorem. For the first time, Thales offered an objective explanation independent of human perspective. He distinguished between various phenomena - stones, olive trees, sheep - and the underlying essence that he believed was fundamental to them all. Above all, he identified what appeared to him to be the material and unchanging origin of all things: the arche. Furthermore, Thales’ philosophical principle promised the existence of universal regularities akin to those he found in mathematics (Kirk, et. al. 1983).

If we set aside the spread of monotheistic religion throughout Europe during the Middle Ages – and the way it forced science to adapt to the claim of a single God – we can proceed to the modern era beginning with the emergence of new theory in Western culture in the mid-sixteenth century, demanding a radical change in thought. This was, of course, the heliocentric model proposed by Copernicus as an alternative to Ptolemy’s geocentric model (Copernicus, 1543). Copernicus’ heliocentric theory ignited an intellectual shockwave, intensifying the secular movement of the era (Kuhn, 1957; Koestler, 1959).

Popular accounts of the Copernican Revolution often portray Ptolemy's geocentric model as flawed – failing to reconcile its underlying mathematical regularities with empirical observations – and suggest that a more accurate model was needed. However, these accounts do not seem to reflect historical reality fully. Copernicus was not motivated by the supposed inaccuracies of the Ptolemaic model. The heliocentric theory offered less practical utility and less accurate predictive power than Ptolemy's refined, observation-based geocentric system. Ptolemy's model, polished over two millennia, accounted for complex motions such as variable angular velocities and even retrograde movements of planets through the concept of epicycles (Ptolemy, c.150 CE; Copernicus, 1543; Kuhn, 1957).

Comparing this to Copernicus, who insisted on perfectly circular orbits around the Sun, shows that, at first, heliocentrism did not surpass Ptolemy's model in explanatory power. Copernicus himself resorted to epicycles to reconcile observations with his theory. Only later, with Kepler's introduction of elliptical orbits, did the heliocentric model gain the explanatory strength it is known for today (Kepler, 1609; Kepler, 1619; Kuhn, 1957).

Koestler (1959) describes Copernicus and his followers as moving almost in a dream state, lacking rigorous scientific reasons to champion the heliocentric model – other than the quest for truth, and perhaps an aesthetic sense of harmony. The only apparent motive driving Copernicus to write and publish his work was the desire for truth, even if that truth did not align neatly with observations. He died shortly after publication, leaving his book as an intellectual testament.

Perhaps the novelty of Copernicus' theory – the break from long-held conventions and the challenge to the Earth's centrality – sparked curiosity and interest. The heliocentric model was revolutionary from both human and religious standpoints. This realization not only challenged religious orthodoxy but also illustrated how the value of a theory may depend on its historical, social, and cultural context.

Before we discuss the value of engineering theories, let us consider the twentieth-century scientific revolution, i.e., the dispute between Einstein and Bohr over the completeness of quantum theory, which followed the revolution launched by the theory of relativity (Einstein, Podolsky & Rosen, 1935; Bohr, 1935).

In 1935, Einstein, Podolsky, and Rosen (EPR) (1935) published a paper claiming quantum mechanics was incomplete. According to EPR, a complete theory must represent every element of nature. They argued that quantum mechanics' statistical descriptions were epistemological tools compensating for limited knowledge, not ontological facts. EPR proposed a thought experiment to determine a system's state indirectly without interference, concluding quantum theory was incomplete.

Six months later, Bohr (1935) responded, arguing EPR's completeness criterion was "ambiguous" and their setup actually demonstrated quantum theory's completeness. Bohr showed that even indirect measurement imposes logical determinations on a system. Subsequent research supported Bohr's position, teaching us that in certain domains, scientific theory cannot be separated from human observers who interact with and influence the reality they investigate (Jammer, 1974).

The relativity revolution further transformed physics. Newton's Principia (1687) established absolute time and space. Einstein (1905) challenged this, based on the Michelson-Morley experiment and Maxwell's electromagnetism (Michelson & Morley, 1887; Maxwell, 1865). If light speed is constant and physics laws identical in all inertial frames, absolute space and time cannot exist, fundamentally limiting human cognition.

Einstein's work gained wide acceptance only after Eddington's 1919 observations during a solar eclipse (Eddington, 1920) – which confirmed the gravitational deflection of starlight predicted by Einstein. Newton's Principia was not discarded; its practical value endures. We still use its principles to build structures and send spacecraft to the Moon. This teaches us that while the truth of a theory matters, it is not the sole determinant of its importance. Sometimes, even when a theory is known to be incomplete or not universally true, we continue to employ it because of its practical utility (Kuhn, 1962).

The twentieth century saw the philosophy of science flourish. Thinkers like Thomas Kuhn (1962) and Karl Popper (1959, 1963) offered frameworks for understanding scientific progress and developed conceptual tools to assess the value of scientific theories. However, the technological revolution of the twenty-first century now compels us to consider the value of engineering theories. Technology influences how we communicate, travel, understand ourselves, form relationships, and conduct countless essential aspects of our lives. Therefore, the value of engineering theories is significant not only for professionals but for humanity as a whole.

The history of science demonstrates the use of diverse criteria to value theories: truth, practicality, a conceptual shift towards better models, objectivity level, adherence to evidence, or even the appeal of the theory description. The evaluation of theories has been subjective, and culturally and socially dependent.

The tools developed for evaluating scientific theories may prove valuable in assessing engineering theories, though this transfer presents both opportunities and challenges. The historical examples we've examined – from the shift from mythology to Thales' objective arche, through the Copernican Revolution's emphasis on truth over utility, to the quantum-relativistic revolution's acknowledgment of observer involvement – reveal how evaluation criteria have evolved. These examples demonstrate that theories can be valued based on truth, practical utility, conceptual coherence, objectivity, evidential support, aesthetic appeal, or contextual relevance. Borrowing these evaluative frameworks offers engineering a rich philosophical foundation and established methodological approaches. However, we must acknowledge the limitations of this transfer. Scientific theories primarily seek explanation and prediction, while engineering theories aim for intervention and transformation. The standards of falsifiability, empirical adequacy, or theoretical parsimony that guide scientific evaluation may not fully capture the pragmatic, ethical, and societal dimensions central to engineering theory assessment.

As our technological capacity grows, the frameworks we use to evaluate engineering theories must reflect both the lessons from scientific history and the unique goals of engineering practice. This requires developing new evaluative dimensions that consider sustainability, accessibility, social justice, and long-term consequences – concerns that traditionally fall outside standard scientific theory assessment. By developing sophisticated evaluative tools, we can better navigate technological development, anticipate its consequences, and harness its potential to address humanity's most pressing challenges. Understanding this dynamic relationship between theory evaluation and technological progress becomes increasingly crucial as technology reshapes every aspect of human existence. The challenge ahead lies not in simply adopting scientific standards wholesale, but in thoughtfully adapting and extending them to meet the unique demands of our technological age.

2.2. Example valuation of design theories: the value of GDT vs. CDP

GDT and CDP are design theories built on mathematical topology, albeit different types. General Design Theory (GDT) is a mathematical design theory, developed by Yoshikawa (1981), and extended by Tomiyama and Yoshikawa (1986) that has been cited extensively in the design literature. It was critically analyzed from mathematical and other perspectives (Reich, 1995).

Coupled Design Process CDP is a design theory developed by Braha and Reich (2003), built on co-evolving topological closure spaces. CPD was proven to be more general than GDT. Consequently, its scientific value should be more than GDT. Furthermore, GDT's value to practitioners is limited. It has no derived practical tools or methods and does not correspond to real design beyond catalogue-based design. In contrast, CDP can be used to model and interpret real processes. Nevertheless, it seems that the general value of CDP is lower than that of GDT. For example, GDT is much more known and cited than CDP and GDT's developers derived significant recognition from it.

GDT is more valuable than CPD as far as investment in research, public value, and researchers' benefits. In contrast, CPD is more valuable due to its general validity and generality over GDT. The value of theories to different stakeholders could be unrelated to their scientific value.

2.3. Design-specific value measures: generativity and robustness

One approach to comparing design theories is to rely on design-specific measures not considered in science. One design-theoretical perspective suggests that a critical function of creativity or design theory is its ability to generate new objects. Consequently, we can measure the generativity of theories and use them to compare between theories (Hatchuel et al., 2011; 2013) - a more generative theory will have higher value. We can also compare theories concerning their robustness (Hatchuel et al., 2011) or potentially design new design-specific properties important for design for contributing to theory's value (e.g., encourage or support inclusion and teamwork).

3. The value of a theory

We have seen that common perspectives of theory value do not correspond to different measures of value exhibited in design research and the history of science. Different properties characterize theories and contribute to their value, and new properties could be developed (e.g., generativity). We need better models of theory value. This section presents such a model based on the recently developed Systems Value Model (SVM) and the Value-Oriented Design Framework (VODF) (Lavi and Reich, 2024a, b). SVM is a holistic, multi-domain, and practical SVM that integrates socio-technical and multi-disciplinary considerations into value analysis. It is designed to support alternative evaluation and stakeholder perspective exploration throughout the system design process.

VODF is a general and field-agnostic value-oriented design framework that encompasses SVM, a value-oriented requirements analysis method, and several complementary methodologies. By incorporating multi-disciplinary socio-technical factors into development processes, VODF highlights aspects that are often overlooked in engineering and managerial discussions, ensuring a more comprehensive assessment of decisions. It considers both direct and indirect stakeholders, revealing the broader implications of design choices.

3.1. Redesigning the system value model into a theory value model

The value of a design theory is elusive. Is a design theory valuable only when it serves efficient design methods leading to successful results, or is it valuable even when it is false and not being used? What does impact the value of a design theory? We believe that the general SVM provides a solid foundation for a design TVM; we adapt the specific indicators by using various ranking methods employed in an academic environment. For example, journal guidelines for publishing scientific work include the following criteria: integrity of the scholarly record, diversity, equity, and inclusion in publishing (Sage Journals, 2024); originality, correctness, novelty, importance, and clarity of the article, along with maintaining and strengthening a journal's reputation in the scientific community (ACM, 2024); quality, appropriateness for the journal, impact on the field, and depth of the discussion insights (IEEE TMI, 2024). Common factors considered in selecting best paper awards include theoretical or practical relevance, scientific rigor in terms of hypotheses, operationalization, data sources, analysis and validity/reliability, and potential contribution to theory or practice (CINET, 2024).

Building on these sources and others, and the background on the value of a theory presented in Section 2, we refine the general SVM proposed by Lavi & Reich (2024b) and validate its suitability for evaluating design theories. The primary objective of TVM is to facilitate a comprehensive and systematic evaluation of a design theory's value for all relevant stakeholders. Similar to SVM, TVM assesses the value of a theory from the perspectives of three distinct, yet complementary, stakeholder groups. First, the customers include those who utilize the theory for structuring design methods, conducting further research, or for second-tier stakeholders who apply methods derived from the theory. Second, the society encompasses both the global society, which may be positively or negatively affected by the theory's development, application, and impact, and the specific academic community within the relevant research domain. Lastly, the enterprise group in TVM refers to the entities involved in the theory's creation and dissemination, such as the theory's developers, the research institutions funding and owning this intellectual property, and the academic journals or research societies that publish and advance the theory. Notably, as the evaluation factors for a system and a theory differ, certain indicators of value were modified when adapting SVM into TVM.

3.2. Example – the value of PSI theory

To illustrate the application of TVM, we have selected the PSI theory due to its versatility, broad applicability, and intuitive comprehensibility. The authors of this study conducted the analysis, possessing extensive familiarity with both TVM and PSI, ensuring a well-informed and rigorous evaluation. However, it is important to acknowledge that while the utilization of TVM ensures a structured and comprehensive analysis, the specific evaluation scores remain inherently subjective. A more objective assessment could likely be achieved through analysis conducted by a larger and more diverse focus group, thereby reducing individual biases and enhancing the reliability of the evaluation.

3.2.1. Problem formulation

The goal of PSI is to serve as a theoretical scaffold to describe and analyze complex design scenarios (Reich & Subrahmanian, 2020). The core values of PSI are capturing design complexity, simplicity, and usefulness to stakeholders. PSI value should be informed by this goal and values.

3.2.2. Stakeholders and context

Employing reflexive practice (Reich, 2017) and based on the PSI analysis of a design theory stakeholders and context, we find PSI spaces as described in Figure 1. The problem space of the stakeholders relates to what they can accomplish with PSI, the social space defines precisely which group from the respective stakeholder type is engaged in the particular use of the PSI, and the institutional space specifies how they would be using PSI to address the 'what' question.

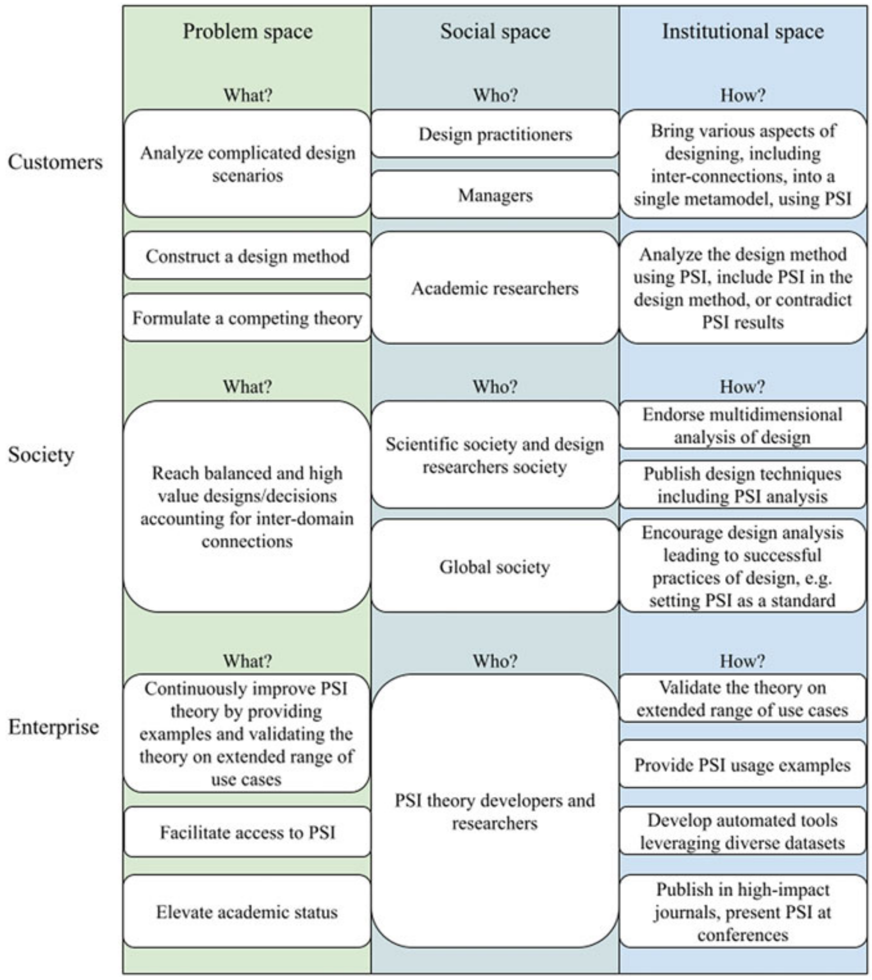

Figure 1. PSI analysis of PSI theory

3.2.3. PSI theory value model

Table 1 presents the evaluation of the PSI design theory with the SVM. The relevance of a specific value element in the evaluation of PSI is indicated by a binary classification, where 0 denotes irrelevance and 1 signifies relevance. To provide a comprehensive representation of the TVM, both relevant and irrelevant elements are included in the analysis. The evaluation score for each value element is assigned within a scale ranging from -2 to 2, allowing for a nuanced assessment of its impact. The value of the PSI theory is significantly positive. It does not have any negative value elements, as it poses no harm to any stakeholder. The financial value elements for both the customer and the enterprise diverge the most from the original SVM definition. However, given the academic world's connection to finance-related topics like funding, these elements can be appropriately interpreted. The value analysis of PSI considers both its current level of adoption in practical and theoretical domains, as well as its future potential.

3.2.4. Discussion

The PSI theory achieved a high-value score of 37 on a scale ranging from a minimum of -60 to a maximum of 60, assuming all value elements are considered relevant. This score reflects a strong overall evaluation. It is not surprising that PSI obtains good value as SVM and subsequently, TVM embeds some PSI principles such as diversity and inclusion. Nevertheless, as noted, some TVM aspects are not covered well or straightforwardly by PSI.

Our TVM creates improvement opportunities. In Table 1, points valued as 1 and not 2 or marked as irrelevant could become the focus of future work, whether by devising a way to make them relevant in the context of PSI, by improving PSI, or by combining it with other theories that complement it. For example, accountability is relevant to PSI, but the value is 0. Can we increase the value to 1 or even 2? Suppose PSI is used in a project context to model the operation (e.g., the Dreamliner project, Reich & Subrahmanian, 2025). We could assign people to the reflection layer, and they will be responsible for identifying misalignments in the project operation and proposing alignment activities. In a case of failure, their activities related to misalignments could be revisited to determine whether they are accountable, or it is somebody else's responsibility. Similarly, in the analysis, revenues are irrelevant but perhaps running workshops and consulting for organizations can generate wealth for the researchers.

A clear additional value in using value analysis of a theory lies in the ability to determine whether a particular enhancement to the theory provides significant added value compared to the effort it would require. A negligible added value may render the activity ineffective. Rather than determining which theory has more value in general, TVM allows one to pinpoint which value elements are covered by a theory, in line with Reich (2010). This can help stakeholders use different theories, providing different value elements to diverse stakeholders. This aligns with the need for an ecology of design theories (Hatchuel et al., 2018). PSI can be combined with C-K theory (Klasing Chen et al., 2018), graph theory (Bekius and Meijer, 2018) or others, but in general, combining theories may not be trivial.

Table 1. TVM of the PSI design theory

Value beneficiary	Value cluster	Value element	Analysis of PSI design theory	Relevance	Evaluation
Customer	Emotional value	Correlation with customer values	PSI analysis of a design method or situation advances understanding of the motivations and underlying principles of the participating parties, enabling them to find inclusive and adapted solutions coherent with their values. Moreover, PSI does not enforce a solution that might oppose the customer values but gives scaffolds enabling design solutions that consider them.	1	2
		Wellbeing	PSI is elegantly formulated, sparking intellectual curiosity about the relationship between stakeholders and PSI spaces and between the spaces themselves. It can also contribute to self-satisfaction, based on a better understanding of the problem.	1	2
		Sentimental value	Although using PSI could become a habit, as it is an operational theory, it is less related to sentimental value.	0	0
	Operational value	Applicability	PSI has been applied to multiple design cases and embedded in several design methods, producing valuable insights and contributing to practice.	1	2
		Efficiency	Deep understanding of the interrelations and motivations of stakeholders significantly contributes to efficient processes and successful results.	1	2
		Reliability	PSI, being well formulated and generalized theory applied across various case studies, has demonstrated reliability and validity. However, since there is no definitive way to ensure the correctness of PSI analysis execution, its results may be partially unreliable if improperly utilized.	1	1
		Life quality	PSI application reveals insights that can potentially improve the user's life quality, such as reducing effort and achieving successful outcomes more efficiently, enabling a better work-life balance.	1	1
	Economic value	Financial profit	A better understanding of the situation and the insights brought by PSI could lead to a better financial state.	1	1
	Social value	Public image	Utilizing a well-known theory to analyze design problems or develop new methods based on PSI may improve the chances of research articles being accepted by high-impact journals and as a result, contribute to the customer's academic image.	1	1
		Alliances formation	Multiple researchers employing PSI can collaborate and use a common language. PSI can be used to model and guide such alliance formation.	1	2

(*Continued*)

Table 1. Continued.

Value beneficiary	Value cluster	Value element	Analysis of PSI design theory	Relevance	Evaluation
Society	Collective wellbeing	Social wealth	If PSI becomes common knowledge and is utilized in multiple situations, it will improve society's ability to cooperate.	1	1
		Life quality	A better understanding of interrelations and stakeholders might improve work-life balance and many other aspects of life quality. However, the global society is still not aware enough of the theory.	1	1
		Equality	PSI does not eliminate bias, as the analysis is conducted by people with prior opinions. However, employing a structured analysis by diverse stakeholders and conducting constant reflection might minimize prejudice and lead to better comprehension of motivations and behavior.	1	1
		Accountability	PSI is not expected to substantially impact accountability.	1	0
	Ecological value	Environmental assets preservation	PSI is not expected to substantially affect this element, except while used in environmental issues.	0	0
		Sustainability support	PSI is not expected to substantially affect this element, except while used in environmental issues.	0	0
	Economic value	Produced fixed assets	PSI is not expected to substantially affect this element.	0	0
		Intellectual property assets	PSI might affect this element while utilized as a foundation for novel design methods or helping to generate contexts conducive to creativity and innovation.	1	1
		Community productivity	Employing PSI will lead to more effectiveness and better utilization of resources.	1	2
		Financial capital	PSI is not expected to substantially affect this element.	1	0
Enterprise	Human capital	Employee retention and recruitment	The popularity of PSI, its contribution to successful outcomes, and the intellectual curiosity it inspires attract researchers and foster collaboration.	1	2
		Employees development	Employing and validating PSI in various scenarios contributes to the development of the employees involved especially due to its reflective pillar.	1	2
	Structural capital	Methods and tools	PSI is being used in various methods developed by the researchers' group.	1	2
		Intellectual property	PSI is the intellectual property of the researcher and the institution.	1	2
	Relational value	Reputation	Wide-spread usage and citations of the PSI contribute to the researchers' reputation.	1	1
		Relational networks	The common language of PSI creates collaborations and mutual understanding.	1	1
		Customer relations	When PSI is utilized by other researchers or designers, relations can be created with the theory developers and researchers.	1	2
	Financial value	Scholarly economic impact	As academic institutions are typically non-profit organizations, this element might initially appear irrelevant. However, a well-established or widely recognized theory can enhance a university's ability to secure research funding, expand a journal's readership and subscription base, directly influencing its financial sustainability and revenue generation.	1	0
		Research investment potential	PSI theory penetration and academic acknowledgment can affect funding opportunities for theory stakeholders. This element represents the external perception of the theory's economic impact on enterprise stakeholders, analogous to the stock market value of business entities.	1	1
		Academic influence share	This value element is similar to market share for a business. Widespread use and recognition of PSI could establish it as the leading tool for situational, organizational, and design analysis.	1	1
Total					37

4. Summary

Analyzing the positions of academic disciplines and the public about theories in general, we uncover different perspectives about what we may consider the value of a theory. We further observe anomalies in the way we perceive different design theories. Historical review also points to deviations from the common perception of theory's value. These observations and the needs of design theories to address broader concerns than scientific theories such as ethics and sustainability demand moving away from the perception of a theory as an ideal esteemed object that seeks to uncover the truth to a system (of claims, laws, hypotheses, etc.) designed to adhere to some value requirements.

To design a theory value model, we took an existing system value model (SVM) developed to evaluate systems in general, considered a theory as a variant of a system, and following observations from our review of theory value in science and design, adapted the SVM to a theory value model (TVM). We used this model in a reflexive practice, to evaluate the value of PSI theory and found its value to be high. The analysis supports focused theory improvements and combining theories for addressing challenges.

We intend to continue developing TVM and use it to evaluate different design theories and other research contributions. This will position TVM as an important scientific instrument for evaluating theories and scientific progress. Together with PSI and other tools for documenting and analyzing design research (Reich & Subrahmanian, 2022; Shaked & Reich, 2020), we can provide guidance towards better and valued design science.

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