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Domain-Independent Design Theory and Methodology to Boost the Adoption of Design Methods

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Abstract. Since its inception, research on design methods has encompassed a number of objectives and fields. In this fragmentary and evolving landscape, a reflection was apparently needed on the chance to provide a general framework and understand the progress (if any) towards a unified and domain-independent design theory and methodology. The issue was discussed by the authors, among the others, during a workshop organized by the Society of Design and Process Science. The paper reports the most important points that emerged in the debate, which was kicked off by panellists' talks providing different perspectives on domain-independent design and the adoption of design methods by industry and practitioners. The discussion highlighted the relevance of design education, individual factors, as well as the role of designers in nowadays' changing world. A major take-away from the workshop is the forecast that, in the foreseeable future, a shared design knowledge will be developed, but this will be juxtaposed by peculiar and bespoke design practices.

Keywords: Universal design, industry, design methods, design education, design domains

1. Introduction

Design methodology research has experienced rapid development over the last six decades, with some focused on products; some on functions; some on affordances; some others on users; yet others on product environment (Zeng, 2020). Researchers have studied these methodologies from architecture, mechanical engineering, environmental engineering, software engineering, arts, management, and medicine. We may find design methodologies for requirements gathering and modelling, ideation, conceptual design, configuration, and detailed design. However, very few design methodologies coming out of research labs have found their way into the industrial product lifecycle.

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This issue formed the basis of a workshop entitled 'Domain-Independent Design Theory and Methodology', which was held at the 25th Anniversary Conference of the Society of Design and Process Science. Its broad aim was to look into the criteria and develop a common ground for a domain-independent design theory and methodology. This paper will set out the content of the discussion and outline an emergent point of consensus reached by contributors. We begin by briefly sketching out the core issue at stake: the meaning of methods and methodology in the context of the industry.

2. Methods and industry

A simple definition of a design practitioner's role is that they are responsible for creating technically and aesthetically appropriate products, services, and systems. Alongside this, one might also posit a responsibility to act as agents of innovation and improvement. Design is, after all, inherently focused on changing the world surrounding us and making things better, e.g., (Irwin, 2015).

Beyond questions of individual talent, many would argue that to be successful, practitioners must refer to a robust theoretical and methodological knowledge base – in particular, a suite of design methods, despite not being well identified (see e.g., Green & Bonollo, 2005; Reich, 2017). The general value of design methods has received some attention in recent years. Methods are said to be especially effective when it comes to saving time and money (Marion & Meyer, 2011) in that they can prevent product failures. Equally, according to Jagtap et al. (2014), they may support the management of complex problems and the development of innovative products; in doing so, they help companies maintain a competitive advantage. They have also been shown to be essential in coping with sustainability targets (Rossi et al., 2016).

However, despite these apparent advantages, the industry has been slow to adopt any form of design methods at scale (e.g., Gericke et al., 2016; Schønheyder & Nordby, 2018). Indeed, when it comes to demonstrating the successful application of methods, it is of anecdotal evidence that the literature predominantly offers preliminary case studies with little evidence of more generalizable results. It would appear that critical gaps remain concerning the investigation of the enablers of a successful introduction, implementation and long-term adoption. In seeking to problematize this area, some scholars have focused on the *barriers* to adoption, which identifies some issues often raised by the industry.

- Misalignment between the academic and industrial perspectives, which leads to a lack of trust towards academic research (Bacciotti et al., 2016).
- Methods should be structured as flexible guidelines — flexibility and customizability are must-be attributes for design methods (Matschewsky et al., 2015).
- Industries require practical process models where a well-structured and defined procedure enables the design process workflow to be smoother so as to prevent errors and waste of resources (Graner & Mißler-Behr, 2013).

In summary, preference is given to flexible methods and tools that provide an immediate result in solving everyday (design) problems upon the completion of a structured and repeatable procedure. One might think that flexibility and adoptability should be properties of general-purpose methods, likely featured by a larger theoretical basis, which might nevertheless conflict with the claim of practicality and immediateness of outcomes. How (and whether) the most popular design methods have been able to target generalization and flexibility contextually is another open issue. In this respect, some knowledge can be extracted by looking at those studies that have gathered information about adopted design methods. Here, the most appropriate contribution, albeit not recent, is the research conducted by Graner & Mißler-Behr (2012). The outcomes show that a predominant share of methods do not

deal with the development of products but rather address management activities and the acquisition of critical information. Among the specific methods, many popular methods involve the integration of customer (requirements) in the product development process, the finalization of designs through computerized tools, non-systematic aids to push creativity. Otherwise said, the presented landscape (if still reliable after the remarkable changes that have taken place in the industry in the last decade) shows that neither practitioners' demands for flexibility and customizability nor academicians' claims for enabling impacting and lasting changes are clearly identifiable in those design methods that are actually adopted.

The apparent contradiction between adoptability and generalizability was foregrounded as the starting point for the 'Domain Independent Design Theory and Methodology' workshop discussion. The following section documents the specific, individual stances expressed by the chairs and panellists of the workshop. It is worth noting that the discussion was not restricted to the issue of academia-industry transfer of methods. However, it encompassed a number of viewpoints in virtue of the various speakers' expertise and background. The speakers were indeed given a chance to elaborate also on

- the significance and effectiveness of attempts towards universal design methods;
- the generalizability of approaches coming from specific design domains;
- commonalities and differences of designing across multiple domains;
- learning and the role of education in light of the different perspectives and requirements of researchers and practitioners, and educators, who are supposedly the most prone to value general-scope design methods because of their audience;
- the implications of students' positive and negative experiences;
- the existence of one or more design methods adoption models, and, accordingly, the dynamics and phenomena applying in particular industrial and design domains;
- communication, terminology and clarity issues.

3. Viewpoints and stances

The expressed statements are reported in the following subsections, ordered alphabetically based on the chair's or panellist's surname. It is worth clarifying that the excerpts provided in the following subsections are a summary of the speakers' talks, including the main points they have raised; however, additional topics have been dealt with too. In addition, a discussion followed the talks during the workshop, whose primary considerations and outcomes are reported in the discussion.

3.1. Yuri Borgianni

At the company level, the mission of designers should be intended as the planning and the creation of machines, devices and products that are (purchased to) satisfy needs. All these "artificial" deliverables of industrial and design processes are expected to contribute to innovation, as they are able to impact on people by improving their well-being, making their life easier or simply making them happy. Entrepreneurs and marketers often emphasize their innovation capabilities and their care for humans and our increasingly fragile living environment. It follows, logically, that design activities should be at the cornerstone of industries, especially those that deem themselves innovative — by the way, it is hard to hear someone being proud of their obsolete practices and products. Once it is established that companies are the core beneficiaries of designing, at least with regard to engineering, product and industrial design, one awaits to find tons of literature reporting industries' pleasantness of adopting more and more effective and creative design methods, which have resulted in game changers.

Perhaps, scientific publications are not the best outlets to provide information about these triumphs, as somebody might not be willing to favor competitors while revealing their keys to success. However, the fact is that the literature is so bare of those kinds of outstanding results that legitimate protection of sensible information is not sufficient to explain the perceived failure of introducing design methods in industry on a large scale. This happens while all the design methodologists would love to present the successful adoption of their proposals as the undeniable demonstration of their usefulness and efficacy. Unfortunately, many proposals just pass the test of a preliminary case study. What are the keys to overcome this deadlock? Which information, needs and viewpoints should be expected in order to accelerate the adoption of the design methods we are all so proud of?

A famous quote from Henri Ford reads "If I had asked my customers what they wanted they would have said a faster horse." This is often used by advocates of proactive design methods against the practice of listening to the voice-of-the-customer (Borgianni et al., 2018). If industrialists are to be considered the recipients of design methods, the same circumstances of the request for a faster horse might apply. When trying to address industry needs in terms of designing new successful and creative products, academicians are likely tempted to provide something that enables practitioners to do the same things better and more rapidly. Technologies, new challenges and a number of turmoil situations, where the Covid-19 pandemic is just the last one of a long list, are maybe the opportunity for a paradigm shift. By the way, designers should not lack instruments for rethinking things and changing the chain of delivered values (Borgianni et al., 2012). The failure to exploit this opportunity can represent a further reason of mistrust between industrialists and academicians, especially those developing design methods. Actually, there is much uncertainty and poor rigor in the definition of what "design methods" actually are. While a shared definition does not exist yet, some acknowledgement is attributed to the Lindemman's (2009) "planned, rule-based procedure prescribing the way in which certain activities are to be performed in order to achieve a certain goal." This leads to the point that everybody has a different conception of a design method, in contrast to not only tangible objects (a wheel, a gear, an electric circuit), but also abstract things (the law of gravity). Design researchers do not speak the same language; it would be daring to believe that the communication with other subjects is clear and straightforward as regards these topics. It is therefore challenging to identify situations where design methods are used. However, whatever the meaning, those are surely used, perhaps unconsciously and unwittingly. This is what leads Borgianni to conclude that industrialists use design methods on a daily basis but they do not know that — that is why they think they do not need better design methods. But this does not mean that academia should convince their audience of the utility of design methods and that improved design methods are actually what best supports the transition to the industry and products we all figure out because of the persuasiveness of digital technologies. At least not before the definition and the reach of design methods are not agreed.

3.2. Brian Dixon

Dixon argued that if a universal design methodology were to be pursued, it should be with a view to opening up the scope for applying design beyond its existing, excepted domains, as well as articulating its value to more general audiences as others have famously done in the context of business and management (e.g., Brown, 2008; Kolko, 2015; Verganti, 2009). He proposed that there could two potentially useful routes for its establishment. First, one might work to develop a special, formal logic which represents the process and may act as guide within it as, others have done (e.g., Zeng, 2015; Zeng & Cheng, 1991; Gero & Kannengiesser, 2004). Second, aligning with the work of the American pragmatist philosophers (in particular John Dewey), he argued there was also the possibility that a phenomenology of the design process (i.e., how it practiced and experienced in direct terms) might be formalized and generalized within a model or set of models. He argued that this route might enhance

the likelihood that those who themselves practice and experience design, as well as design educators, will attend what is being proposed, removing a potential barrier to its adoption.

Dixon suggested that Dewey would form a source point here. With specific reference to the Deweyan 'theory of inquiry', he outlined how, for the late pragmatist, logic is best understood as the generalized historical outcome of prior successful inquiries. In taking this stance, Dixon noted that how it becomes possible to 'see' how logic works 'in practice' within inquiries (here understood as a process of seeking an answer to a question that arises in a doubtful situation). Dixon then went on to highlight the links between Dewey's theory and the work of Schön (1983), who emphasized the importance reflection in the context of such inquiries and Dorst (2015), who emphasized the importance of working to 'frame' one's actions. For Dixon, the Dewey-Schön-Dorst lineage was found to offer a series of insights which might help shape a *phenomenologically-grounded* universal design methodology, which ground the concepts of context, recursive action, problem definition, expertise and non-expertise in 'lived' terms. Terms which practitioners would likely find accessible and, as such, compelling.

3.3. Stephen Ekwaro-Osire

One of the aspirations of pursuing a 'Domain-Independent Design Theory and Methodology' is to receive large acceptance and adoption, particularly in industry. There has been already discussions of the barriers that existing in adoption of already existing design methodologies (Graner & Mißler-Behr, 2013, Matschewsky et al., 2015, Bacciotti et al., 2016). At this juncture, it may be a research worthy exercise to hypothesize and cast design methods as innovations or technologies that are destined to be adopted by industry (or other domain users). There is limited literature on applying extant user acceptance models on design methodologies; however, it is important to understand, explain, and predict design methodology acceptance. The result of such systematic research may increase the potency of a 'Domain-Independent Design Theory and Methodology' once constructed.

Davies (1989) developed the technology acceptance model (TAM) basing it on the technology's perceived ease of use and its perceived usefulness. Though TAM was originally proposed to predict information technology acceptance and usage on the job, it was extended to explain the use of, for example, social media, information systems, online-learning, and virtual reality. TAM was extended to include a subjective norm as an additional predictor of intention in the case of mandatory settings (Venkatesh and Davis, 2000). TAM explains technology acceptance and usage based the technology attributes and contextual factors. Recently, Chillakanti, Ekwaro-Osire, and Ertas (2021) also extended TAM and its use led to the design of a tool to evaluate technology platforms for use in transdisciplinary research projects.

Venkatesh et al. (2003) constructed the Unified Theory of Acceptance and Use of Technology (UTAUT) model to explain about 70% of the variance in behavioral intention and usage behavior. UTAUT was a major departure from TAM since it included four moderators, namely, gender, age, experience, and voluntariness. Despite the major advantages UTAUT had over TAM, Dwivedi et al. (2019) observed that it was not applicable in all contexts, in particular since the "individual" engaged in the behavior was missing in the model. Thus, they extended UTAUT including the aspect of "attitude" in the acceptance of new technologies by individuals. Some observations made on extended UTAUT, that may be of pertinent for design methodologies, were that managers should (Dwivedi et al., 2019):

- shape the attitudes of individuals for influencing behaviors and intentions,
- manage use of innovations by enhancing the ease of use and usefulness,
- provide training to users in-house so that they are more inclined to use the new technologies, and
- positive feedback by organizing forums for sharing best use practices.

To improve the explanatory models of TAM and UTAUT based on multiple linear regression, Alwabel and Zeng (2021) recently proposed a predictive model comprised of thirty seven constructs that are used to predict the end user's acceptance of a technology. Particularly, this is a data-driven model of technology acceptance that uses machine learning to predict the end users' acceptance of a technology. This method allowed the inclusion of design-related determinants of technology acceptance. Over this machine learning approach allowed the formulation of a complex model of technology acceptance.

In summary is it critical to apply the latest predictive models (e.g., Alwabel and Zeng (2021)) in order to understand, explain, and predict the current design methodologies acceptance for use in industry (and other domains). The wealth of information and knowledge gained will be useful in the design, construction, and implementation of a 'Domain-Independent Design Theory and Methodology.'

3.4. Oscar Nespoli

Experts know more than they can say (Schön, 1983). Much of the knowledge that is gained by practitioners is so-called first-person knowledge; knowledge that is gained through enskilment in tackling tough messy situations in authentic practice settings. This type of information and knowledge Boisot (1995) characterizes as uncoded and abstract knowledge. This is in contrast to knowledge that is generalizable, codable, and shareable – so-called third person knowledge – knowledge that is separable from the knower and discovered through research.

So is this uncoded, abstract knowledge gained by practitioners domain-independent, or domain-specific? Is the knowledge specific to their area of expertise or business of concern? How do we know if it is difficult to code and to share (diffuse)? Do practitioners rely on this uncoded knowledge rather than acquiring coded knowledge offered by academics? If so why?

We contrast this view with an important set of axioms offered by Gero (1990):

1) All designs can be represented in a uniform way.
2) All designing can be represented in a uniform way.

Gero (2014) claims that the foundations of designing are in fact independent of the designer, their situation, and what is being designed. The F-B-S ontology represents a framework for design knowledge and includes design issues, and processes of designing. While not claiming to be a domain independent methodology, the ontology is very useful in abstracting designs and the act of designing to be commensurable between tasks and activities. It is applicable to acts of designing by both practitioners and academics is of use in trying to uncover whether or not domain-independent methods or adoption thereof exist in design tasks (Hurst et al., 2019).

3.5. Thomas T.H. Wan

Healthcare delivery systems are evolving with advances in health information technology (HIT) development and its applications to coordinated or guided care for chronic conditions. The system design features show how artificial intelligence applications in health care may reflect the public interest in optimizing care coordination and communication between providers and patients. Wan offers a practical evaluation and assessment of relevant theoretical frameworks and appropriate methodologies to guide causal inquires and formalize a multi-criteria optimization of a logical model applicable for achieving the system's performance in efficiency and effectiveness. Based on the scientific literature, Wan specifies important theoretical constructs and research methods that are discipline-free and well-integrated into the HIT evaluation.

A systems perspective enables investigators to formulate a causal and dynamic model of health outcomes research that specifies the logical flow of causal sequences of multiple components of a health system, such as the logic model

- structure
- design & process
- organizational performance
- outcomes.

Further conceptualization of the system components facilitates the formulation of theoretical constructs (i.e., the integrity of structure, efficiency of design and process, organizational performance, and patient care outcomes) for empirical studies of the causal relationships of health care system components. The structural integrity of an intervention enhances the design and execution of program changes, and, in turn, targets the efficient and effective performance of a health care organization. Ultimately, patients and providers will benefit from the transformation of the health system. With the causal specifications made in the system analysis, the direct and indirect causal effects of each system component on performance and patient care outcomes could be identified and estimated statistically. A variety of multivariate modeling approaches have been detailed in Wan's (2002) Evidence-Based Health Care Management.

Causal thinking plays a pivotal role in shaping the scientific inquiry of answering the why, what, and how to design and implement decision support systems for optimizing organizational performance. Scientists should keep in mind the medical ecology with which researchers are fully relying on scientific evidence identified from the knowledge basis of scientific literature, past investigative experiences, and recent observations of benefits accumulated from the impacts of health care innovation as they pursue academic excellence and excel in the maximizing practice utility of predictive modeling, design and process. By holding the contextual factors constant, investigators are capable to target specific causal sequences and then find an optimal (efficient and effective) solution to the problem under consideration. Thus, the use of discipline-free analytical approaches to the solutions of societal problems could offer highly generalizable and parsimonious results to guide the design and implementation of social and health interventions.

There are multiple analytical approaches to specify and identify potential determinants of the performance of health care organizations. For instance, the typology of analytics for data science without being restricted to experimental design could include:

1) individual unit analysis,
2) ecological analysis,
3) mixture of individual and ecological analysis,
4) longitudinal analysis with growth curve modeling,
5) discrete event simulation, and
6) generalized estimation equation with multi-year outcomes.

Experimental design has various forms that may include a classic randomized controlled experiment, complex factorial experiment with multiple interventions and their interaction effects, and quasi-experiment without randomization (Wan, 1995). Scientists often try to overcome the challenge of adhering to stringent rules of experimental analysis. Thus, when we perform evaluation research, we often rely on the design of non-experimental design and perform rigorous statistical analysis such as the propensity score matching and analysis for handling potential confounders. The result is that we could generate useful information to disentangle the causal mystery involved with multiple and complex determinants of health care outcomes and performance. Furthermore, we pay a great deal of attention to replication studies, avoidance of selection bias, and sensitivity analysis as a data scientist to guide further advancement of discipline-free predictive analytics (Wan, 2018).

As concluding remarks, Wan states that the interplay between conceptualization and operationalization is the essence of scientific inquiry. Causal analysis requires the integrative approach to theory construction and validation without the disciplinary or domain specific restriction. The Society of Design and Process Science has been uniquely positioned to take the charge of analyzing voluminously and complex digital data in health care or medicine. With the collaborative effort of scientists from a variety of disciplines, we are venturing into a new world of artificial intelligence applications and big-data-to-knowledge pursuit. We wish that in the next twenty-five years we will be able to realize the dream of our founders and predecessors in building a solid transdisciplinary science of social change and improvement.

3.6. Yong Zeng

Design does not only happen to engineering, but also happen to education, health, social activities, and our everyday life. As an action, design follows a general postulate as specified in (Nguyen & Zeng, 2012): design creativity is related to designer's mental stress through an inverse U-shaped curve. Obviously, only when designer's mental stress is at a medium level, will the designer be creative and productive.

When it comes to barriers in applying a design methodology, Zeng noted that in design, especially new product design, the problem is open-ended, where design problem, design knowledge, and design solutions are interdependently evolving due to the recursive logic of design (Zeng & Cheng, 1991). As an action, design follows another postulate specified in (Nguyen & Zeng, 2012): design reasoning follows a nonlinear dynamics which may become chaotic due to the recursive logic of design.

Various design methodology and methods have been proposed to resolve the recursive coupling between design problem, design knowledge and design solutions. Therefore, applying a design methodology indeed includes two types of workload: the first is the workload triggered by the given design task whereas the second is the extra workload needed to learn and follow a structured design method/methodology, considering that the nonlinear design process implies the flexibility, randomness, and complexity. This contradiction leads to four kinds of implementation barriers: emotion barrier arisen from the uncertainty of design, logic barrier arisen from the structure of design methods and designer's natural design process, knowledge barriers arisen from the identification and application of the right design knowledge to the current design problem, and the resource barrier arisen from the unpredictable design tasks due to its open-ended nature (Yang et al., 2021).

Zeng went on to discuss the features of a natural design process model. Design activity aims to change an existing situation, which is the present environment, to the desired one by creating a new artefact (Simon, 2019). This environment change process is shown in Fig. 1, where the current environment state E_{i+1} is determined by its previous environment state E_i (Zeng, 2004).

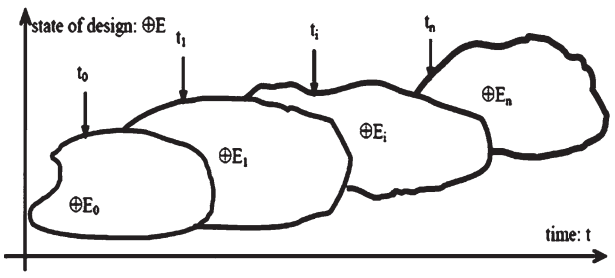

Fig. 1. Environment change design process (Zeng, 2004).

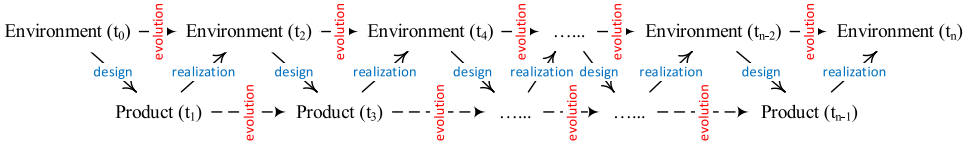

Fig. 2. Design process: evolution of environment (Zeng, 2020).

Figure 1 can be further transformed into Fig. 2, which shows that a new or a new part of a product can be first generated out of the current environment in the design process. The newly generated product immediately changes the original environment by becoming a part of the proceeding design environment. This process continues until the designer is satisfied. Product evolution occurs alongside environment evolution.

In summary, an implementable design methodology must satisfy the following criteria (Zeng, 2015):

(1) Can fit into and lead the natural design process that evolves the environment shown in Fig. 2;
(2) Can moderate the designer's mental stress during the design process;
(3) Can decouple the recursive coupling among design problem, design knowledge, and design solutions; and
(4) Can identify the right knowledge for an identified design problem.

4. Discussions and implications

Despite the heterogeneity of the presented viewpoints, all the above contributions stress elements that are shared across design and designing. Although the emerged considerations are insufficient to evaluate the possibility of founding domain-independent design methods, some factors can be considered universal. Such commonalities include theoretical aspects, characteristics of the design process, difficulties, challenges, and opportunities. Through the expert talks, the workshop attendees, and possibly the paper's readers, can realize that shared aspects of design and designers extend well beyond the recalled Gero's FBS framework, plainly recognized as an important attempt to establish a common ground for design as a science. However, the identification of determinants and invariants in design was far from easy. Someone even claimed that the study of common design aspects is penitential as variants and circumstances might emerge at any time that jeopardize initial assumptions, as the scope of design is expanding and the digital technologies provide new opportunities on a daily basis.

Based on the workshop's premises and objectives, it is of no surprise that the role of (professional) designers and design researchers has been largely discussed. The participants soon realized that a subdivision between who designs and who studies design is poorly useful, if not obsolete nowadays. The fact that the two roles might become more and more blended is of anecdotal evidence. Alongside this, the audience agreed that the major responsibilities lie in people entrusted to teach design, which will shape the approach of future designers. Therefore, design educators, if possibly distinguishable from designers and scholars, play a key role and must be considered in the foundation of domain-independent design, and, especially, in the future adoption of design methods. In this context, the possible overcoming of skepticism towards design methods can be favored by at least two circumstances.

(1) The boundaries between educators, designers and scholars are increasingly blurred;
(2) Design, education and research involve learning to a large extent, which goes hand in hand with the transformation of companies into learning organizations.

Nevertheless, this does not alleviate the communication issues raised in the summarized talks. A shared design vocabulary is not currently available, which might be caused by domain dependence. The interpretation of design concepts, meanings and terms is uneven across disciplines, schools and cultures. Design educators and researchers can happen to argue, for instance, on what are constraints, requirements, specifications, criteria, needs, wishes, and goals. Design language emerged as a fundamental barrier to universal design. As well, lack of clarity is a further barrier to reaching out companies, which expect and long for simple and clear approaches. This redirected the audience to the conflict highlighted in the introduction, namely the dichotomy between generalizability and ease application.

It is therefore likely that the final decision on methods' adoption, possibly monitored through the models described by Ekwaro-Osire, will depend on what future designers will be and are currently primed with. Designers are supposed to use, introduce and promote methods and approaches that empower them (up to a balanced level of mental stress, as suggested by Zeng), along with giving them the possibility to make changes and adaptations. The issue is how to transmit potentially good methods in design education, as we are all aware that any failure could be fatal, as no second chance is normally given in a frenzy society. This exacerbates the importance of sharing experiences on the use of design methods, and establish channels beyond the scientific outlets normally used for scientific divulgation. The current situation is penalizing by at least two point of views.

(1) Mere experimentation of known design methods is hardly published because original methodological aspects are expected beyond the presence of a case study.
(2) A shared outlet is not identifiable as authoritative, well-recognized journals having "design methods" in the title do not even exist to represent a reference in this domain.

These latter considerations are obviously food for thought for the whole design community, and especially for the Society of Design and Process Science (Tanik et al., 2021), which has overseen the organization of the workshop on which the paper is grounded.

5. Conclusion

The paper reports the main points emerged during a workshop entitled 'Domain Independent Design Theory and Methodology'. The written reports of six speakers and panelists are included in the paper, which are considered as a contribution per se in the definition of those elements that are shared across design domains and in relation to problems encountered in the diffusion of potentially domain-independent design methods and approaches. The authors attempt to stress below the main takeaway of the discussion and highlight some aspects that were initially unpredicted.

Despite the call for the development of a universal theory of design and domain-independent methods, some aspects suggest that peculiarities and domains of application should play a major role, at least in the design practice and markedly at the industrial level. The actual possibilities of moving forward with the foundation of domain-independent design rely on the future developments of education and the background of design teachers. In line with this interpretation, design processes might well share the whys and the whats, but the whos and the hows might be kept conveniently separated: a shared design knowledge and a peculiar design practice. We believe that these open issues are to be tackled. The authors' expectation and hope is to foster a discussion on these topics beyond the organizers and the speakers of the mentioned workshop.

A major mission of the SDPS is to nurture the healthy formation and growth of a design ecosystem, in which design practices, education, and research interact with and support each other. This ecosystem will eventually lead to a new discipline of design.

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