Design Situations and Methodological Innovation in Interaction Design

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Abstract
This juried alt.chi paper argues that philosophy can seed HCI innovations. Recent developments in ontology open up novel methodological opportunities. Alain Badiou's situational ontology breaks an apparent impasse between essentialism and relationalism. For Badiou, the essence of any entity is a multiplicity formed from what is counted-as-one, but its parts bring potentials for change. These can exploited through the concept of design situations that contain infinite opportunities for designing as connecting. Far from being a barren abstraction, this opens up new spaces for demonstrable practical methodological innovation in Interaction Design.

Keywords
Design Situations, Situational Ontology, Designing as Connecting, Interaction Design and Evaluation Approaches (IDEAs).

ACM Classification Keywords
H.1.2. User/Machine Systems.

General Terms
Design, Human Factors, Theory

One Place for Philosophy in HCI

Philosophy's attention to vocabularies, concepts and arguments can improve understandings in ways that can reduce, and even overcome, the practical impact of substantial dilemmas. For example, HCI researchers and practitioners may worry whether they (or others) have discovered *all* user needs or requirements, found *all* usability problems *in* a design, or accounted for *all* relevant aspects *of* a usage context. Doubts here cannot be overcome by evidence or experience: neither can tell us what 'all' could mean in each context. Confident use of the word 'all' requires *closures* [6] that, if absent, makes such doubts insurmountable. Closures can be either physical (e.g., all of the cake), mathematical (e.g., all prime numbers) or institutional (e.g., all teams in a league). None of these can apply to the above HCI uses of 'all', and it is thus *impractical* to ask most questions containing the word 'all' in HCI.

The impossibility of closures in most practical design settings reveals the value of critical philosophical reflection. However, bigger problems require more complex analyses. This paper considers the problem of scope for design and evaluation methods, and the innovative opportunities that these create for Interaction Design and Evaluation approaches (IDEAs). It is argued that existing IDEAs, considered as a whole, are narrow in scope. We also need broader spectrum IDEAs that can better span the complexity of realistic design situations. One place for philosophy in HCI arises from its support for analyses here.

The Potential for Method Innovation in HCI

Potential method innovations in HCI can arise from any underexplored plausible opportunities. Exploratory opportunities arise from combining meta-principles for designing [3] with different combinations of types of design choice. Meta-principles relate to the qualities of choices made when designing, which depend on the options that could be chosen. Firstly, the meta-principle of *receptiveness* [3] requires a diverse range of options to be available for consideration. Next, *expressivity* [3] requires that available options are appropriately communicated to design stakeholders. Thirdly, *credibility* [3] requires that options are realistic and constitute genuine choices.

Designing involves more than choosing options from one type of menu (e.g., design features). Each type of design menu adds a category of design choice. From [8], there are four such categories, requiring choices of means, ends, beneficiaries and evaluations.

Formally, an IDEA can range in support for one meta-principle for one category of design choice, to supporting several meta-principles for several categories of design choice. Most existing IDEAs have the simplest scopes, e.g., personas support *expressivity* about *beneficiaries*. Narrative or plan based IDEAs such as scenarios or task analyses support *expressivity* of envisaged usage that relates *means* (i.e., design features) to *ends* (e.g., user goals). Opportunities for innovation arise where existing IDEAs as a whole do not provide adequate support for some combinations of meta-principles and choice categories.

A Conceptual Space for Method Scopes

An IDEA can be analysed as supporting one or more meta-principles for designing *applied to* one or more categories of design choice. The extent of the conceptual space here depends on (i) meta-principles and (ii) abstract categories of design choice. These may

or may not be orthogonal, since a meta-principle may be specific to one or more choice categories. If so, then the potential conceptual space is reduced by ruling out impossible combinations of meta-principle and choice category. The first three meta-principles apply to any category, since they are qualities that we would want to hold for any strong design option, i.e., that it is receptively sourced, well expressed and well grounded.

Once we consider more than one category of design choice, we need to consider how choices for one category *relate to* choices for another. Choices require co-ordination, and cannot necessarily be made independently of each other. Where dependencies necessarily exist between design choice categories, then the first three meta-principles also apply to any *connection* between design choices. Meta-principles express qualities that we would want to hold for any strong co-ordination of design choices, i.e., that it is receptively sourced, well expressed and well grounded. More concretely, we would expect a task description to compose *means* (i.e., use of system features) so that they can *credibly* achieve *ends* (i.e., user goals). Such tasks should be *expressed well* enough for stakeholders to understand them, e.g., through an envisionment scenario or some form of experience prototyping.

To form a conceptual space for method scopes, one set of tactics is thus to:

1. Decide on a set of meta-principles that express desired qualities for design choices
2. Decide on a set of categories of design choices that distinguish between ontologically distinct decisions that could be made when designing
3. Iterate through 1. and 2., adding meta-principles that apply to specific categories of design choice or combinations thereof. Associated meta-principles give *functions* to IDEAs, e.g., to improve communication, validity or ideation.
4. Stop once there are no further compelling iterative possibilities.
5. Scope existing IDEAs by meta-principles and (connections between) design choice categories that they support.
6. Brainstorm on potential innovative IDEAs to fill identified gaps in existing frameworks

We have started the first step above, by introducing three meta-principles of receptiveness, expressivity and credibility. A possible second step would be to accept Heskett's four categories of design choice [8], as in [3], but instead these are explicitly derived here instead, via the concept of a *design situation*, which refers to the combination of (i) an explicitly committed to set of design choice categories with (ii) an explicitly committed to set of co-ordinating connections between categories. Additional design choice categories extend the scope of IDEAs.

A complete IDEAs framework for a design situation would have to provide methodological support for forming both menus of options for each design choice category, and also menus of options for each type of co-ordinating connection. The simplest design situation thus requires the simplest IDEAs framework.

Pure Craft: The Illusory Simplest Situation

The simplest imaginable design situation has only one design choice category: the *feature*. This must be so,

because in *design*, the artefact must exist in some form of conceptualisation and/or realisation. So, if there is to be only one category of design choice, then it must be the choice of things to do with *the design*.

In such a minimal design situation, there are only designers-makers who craft artefacts in a reflective dialogue with their materials. However, such a romantic design situation requires decontextualisation that is doomed to fail. Designer-makers and their materials cannot be isolated from social, cultural, technological and other historical aspects of their milieux. Either they construct themselves romantically as lone genii with privileged access to the truth through their craft, or their agents do. Worse still, when such conceits are swallowed whole, designer-makers can be demonized for these fictions, around which cultures can form to resist them as truths. HCI is one such culture.

In HCI folk lore, 'designers' never think about people, only about inventiveness, both technical (engineers) and aesthetic (creatives). They focus wholly on artefacts, and never on people. *We* (in HCI) are human-centred, while *they* (geeks and stylists) are not.

Although perhaps implicit and subconscious, all design must refer to things *beyond* the artefact. Thus the appeal of a harmonious, spacious and balanced visual design needs a human visual system to create such appeal. Similarly, for a product's capabilities to be powerful, compelling or valuable, there must be people to desire these capabilities.

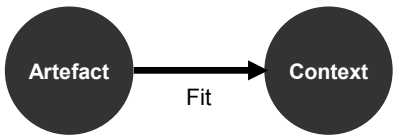

Figure 1: A *True* Minimal Design Situation

Context and the Fitting Artefact

All designing takes place in, and gives rise to, human contexts of regarding, usage, ownership, consumption and other relations to things. What distinguishes HCI from longer established craft design practices is the surfacing of context as a design choice category. What may be implicit for a designer-maker must be explicit for *bona fide* human-centred practitioners.

There are thus two design choice categories in Human-Centred Interaction Design: (i) choices of form and content for the interactive artifact, and (ii) choices about intended human usage contexts (Figure 1). With only two categories of design choice (circles), there can be only one co-ordinating connection between them. It is referred to as *fit*: a well designed interactive artifact will fit its intended context of use.

Human-centred HCI readers will be comfortable with this analysis, and prefer design situations focused on fitting artefacts to contexts over ones focused on inventive crafting of artefacts. However, in choosing the more complex design situation, we risk ignoring a millennia old problem in ontology (philosophical analysis of the nature of being).

Two Competing Ontologies

> thingness has only been invented by us owing to the requirements of logic, thus with the aim of defining, communication (to bind together the multiplicity of relationships, properties, activities).
> [9, III 558]

Until the nineteenth century, many western ontologies were *essentialist*. Being was understood to comprise entities with necessary properties that gave rise to contingent properties when one entity interacted with another (e.g., light on an object gives rise to its colour). The *illusory* simplest design situation uses an essentialist ontology. However, it proved hard to argue successfully for any necessary essential properties. Most could be shown to be contingent, leaving little, if anything at all, to constitute the essence of an object. With relativity in physics seeing off most rationalist essences of objects, *relational* ontologies became more credible, i.e.: *relations spawn objects, beings and acts, not vice versa* [12, p.107]. The *true* minimal design situation uses a relational ontology

However, there has to be some substance to an object to let relations occur: one cannot relate nothing to nothing, and still create contingencies as a result. While it is hard to isolate the essences of objects, it is equally hard to believe that there is no substance prior to relations. For design to be influential, artefacts must have qualities that can shape usage and outcomes.

There is more to ontology than essentialism and relationism (e.g., role of time in Hegel and Heidegger), and thus the above risks introducing a false closure. An attempt to avoid these false oppositions, as in Badiou's situational ontology ([1], below) may thus be a better basis for scoping out a conceptua space for IDEAs.

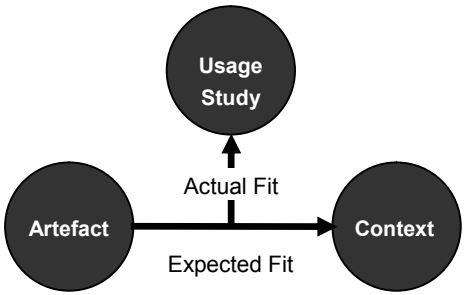

Figure 2: A Credible Design Situation

Evaluation is a Design Choice Category

Fit is a relation between an artefact and its context. We cannot determine such fit from either the artefact or its context in isolation. Ontological dilemmas again arise. Fit is inherently relational, but a relation cannot add anything beyond related objects. How then, is fit determined in HCI? Given a specification of the artefact, and a description of its intended context of use, can we determine fit? The answer would be yes, except that we cannot have a full enough description of a usage context to determine fit analytically: "one does not know what one needs to know about a user until one sees the user in person" [7]. As a result, Gould and Lewis [7] advocated two design principles in addition to *early focus on users and tasks* (i.e., usage contexts). These were *empirical measurement* and *iterative design*. The latter depends on the former: disappointing measurements require changes to the design. However the 'true' minimal design situation does not make such evaluation explicit.

Designing evaluations clearly introduces a third category of design choice. We need empirical *observation* of usage, but perhaps not *measurement*. While fit is a relation between artefacts and usage contexts, we do have to choose to *see* fit. The third choice category is thus choice of *usage studies*.

Figure 2 illustrates this credible design situation. What is studied in a user study is neither the artefact nor the usage context, but the fit of the former to the latter, hence there is a connection to a connection, rather than a connection between choice classes. This adds a new form of complexity to design situations. Choices of different categories need to be co-ordinated with each other *and with other co-ordinations*.

A Design Situation with a Focus

We have thus established the need for two of Heskett's four categories of design choice [8], i.e. *means* (artefacts) and *evaluations* (usage studies). However,

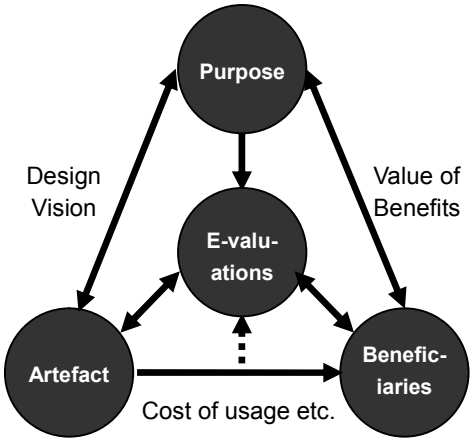

Figure 3: A Focused Design Situation

the other two categories of *ends* and *beneficiaries* remain fused within usage contexts. The question thus arises as to whether the now orthodox HCI understanding of context as everything beyond the artefact and the evaluation is apt.

Heskett's final two categories are ontologically distinct. HCI has limited itself by not distinguishing between *people*, potential beneficiaries in a real world, from *purpose*, intended benefits in designers' minds. Designing succeeds when design purpose strongly connects with the motives of intended beneficiaries. While the latter motives are part of usage contexts (albeit much ignored in HCI in favour of the minutiae of concrete activity), design purpose is quite distinct. We cannot speak of a design's intent succeeding without such a distinction: the intention is ontologically separate from the intended beneficiaries. The two (purpose and beneficiaries) must of course be logically connectable, but this does not fuse them into one category of design choice. Identifying beneficiaries and expressing purpose are distinct acts made in different contexts. Appropriation is clear evidence of this, since a design may not meet its designer-intended purpose, but still be of benefit for different reasons (in which case *ends* discovered for *means* reside in the same context, but *intended* ends do not). The good luck of appropriation can thus save ill-conceived designs.

Letting go of context as a first order design choice category is a challenge for HCI. As a further example, consider the human-centred endeavour of designing for *me*, the author. No-one can sensibly design for *all* of me. I am, amongst many other things, a husband, a father, a brother, an uncle, a son, a neighbour, an art lover, a wine and beer buff, and a cyclist. Not only can no-one design for *all* of me, no-one *should even try to* However, you can design for *some of me*, and a key function of design purpose is to decide what this *some* will be. Such purpose is clearly distinct from, though hopefully connectible to, a design's usage contexts.

Purpose is much better understood in mainstream design disciplines. The design educator and commentator, the late Norman Potter asked "What is good design?" and answered: "The 'goodness' or 'rightness' of a design cannot be easily estimated outside of a knowledge of its purpose" ([10], p.45). Without a clear sense of purpose, usage studies are not evaluations at all. To e-valu-ate requires a focus on the intended value of a design, i.e., its purpose.

Figure 3 shows how choices of purpose can focus design situations on *worth*, as the net benefits that arise when the value of realised benefits justifies costs of usage, ownership, maintenance and other resources.

Steps 3 to 4: Iterative Additions

We appear to have enough categories of design choice to proceed, having established that each of Heskett's origins of design outcomes [8] is necessary. This does not establish them as sufficient, but it will be seen below that we have enough potential for method innovation already (plus of course, no closure to establish sufficiency may be available). We can now iterate Step 1 by considering whether any design choice category or combination needs further meta-principles.

Choosing beneficiaries involves ethical choices that are not foregrounded by the meta-principles of receptiveness or credibility. A fourth meta-principle of *inclusiveness* thus subsumes receptiveness and

credibility for options for and choices of beneficiaries. This emphasises the ethical nature of inclusion, which requires more than the creative openness of receptiveness and rationalised evidencing for credibility.

Evaluations as a design choice category are also distinctive, since they tend to undo other choice categories. Evaluations commit design teams to following through if designs are not delivering on their intended purpose. Evaluations thus cannot be planned or acted on in isolation from other design choices. Evaluation measures and targets must be closely related to design purpose [2]. Understandings of poor evaluation results must be related to existing co-ordinated choices. Where existing unchosen options cannot resolve problems revealed through evaluation, then existing receptiveness must be extended to find workable solutions. An extra fifth meta-principle here is required to span this nexus of evaluability, understandability and responsiveness. This meta-principle of *improvability* cannot be associated with a single design choice category, but must instead apply to connections between artefacts, evaluations and purpose, and perhaps beneficiaries too.

Improvability can only apply to all four choice categories if a project team are committed to all of them. Different design situations may commit to fewer, and thus a sixth meta-principle is required to cover explicit *committedness* to specific categories and specific connections between them.

This completes the second iteration of Step 1, and with no further compelling iterative opportunities, we will stop and move through Step 4. Note that while [3] derived the six meta-principles on the assumption that the account of design choice categories in [8] was correct, no such assumption has been made above. Instead, each design choice category has been argued for. Three meta-principles potentially apply to any design choice category (receptiveness, expressivity, credibility), while three apply either to a specific category (inclusiveness to beneficiaries) or to a flexible combination of categories and interconnections (improvability and committedness, thus improving on both of their characterisations in [3]).

Splitting purpose off from context to leave beneficiaries is not guided by a need to prove [8] correct. A separate argument for the necessity of purpose and the insufficiency of fit to context was made in [2], as well as in other defences of as value-centred design.

Step 5: Scoping IDEAs

We have already observed that existing IDEAs tend to only support choices for one design category, e.g., personas (beneficiaries), guidelines (artefacts), or user testing (evaluations). Given that *design purpose* is not well recognised as a key design choice category in HCI, it is not surprising that there are few IDEAs to support receptiveness to, and credibility of, options for purpose. However, having identified this gap, ways to fill it have quickly emerged. IDEAs such as sentence completion [5] and field research [4] have been successfully used to identify desirable benefits and undesirable costs.

The novel concept of richly *connected design situations* exposes the rarity in HCI of IDEAs that connect between design choice categories. Existing connecting IDEAs in HCI mostly link artefacts (*means*) to *ends*. Task specification and scenario are long established IDEAs here. However, *goals* in tasks and scenarios are

too often what a system lets someone achieve (e.g., hire a van on the web) rather than what people actually want to achieve (e.g., hire a van with costs that make the transport of some item(s) worthwhile). In this sense, such IDEAs barely escape the space of artefact features.

For Step 6, we could explore opportunities for new IDEAs by better supporting meta-principles for specific design choice categories, or by better supporting meta-principles for connecting between categories. However, until recently, these two sets of IDEAs may have been ontologically opposed. Addressing a choice category in isolation risks slipping into essentialist ontologies (as has been clear with design guidelines), whereas addressing connections moves us into relational ontologies that discount the impact of what gets related through co-ordinating connections.

Interlude 2: Badiou's Situational Ontology

We could take a pragmatic approach and ignore such perhaps false ontological dilemmas, and would do except for recent developments pioneered by Alain Badiou [1,8]. His *situational ontology* [1] is a response to postmodernist ontologies that marginalize the object in favour of the relation. However, it is motivated by long standing and fundamental issues in philosophy, and not by the needs of design theory. We thus do not need to make full use of Badiou's ontological apparatus.

Badiou accepts Nietzsche's position quoted above [9] that "thingness has only been invented to bind together … multiplicity", claiming that "the One is not" ("*L'un n'est pas*" [1]), but rather than develop this into a postmodern relational ontology, he instead introduces a construct whereby a multiplicity can *count-as-one*. This operation of *counting-as-one* structures a situation, distinguishing the elements that belong to it from those that do not. Design situations have been structured above by arguing for categories of design choice: {artefacts, beneficiaries, evaluations, purposes}.

The *state* of a situation is its meta-structure, a structure that arises out of structure, which brings with it *potential for change*. The structure of a situation is a *set*, but the structure of the state of a situation is a *power set*, i.e., the set of all subsets within a set. For the set {a,b,c}, the power set is {{},{a}, {b}, {c}, {a,b}, {a,c}, {b,c}, {a,b,c}}, i.e., every subset of {a,b,c}, including the empty set. Badiou refers to these subsets as *parts* of their underlying set.

The *state of a design situation* is thus *all of its parts*. We can thus think of a complete development framework as one comprising IDEAs that cover all parts of a design situation. Thus, abbreviating the structure of a focused design situation {artifact features, beneficiaries, evaluations, purposes} using variables, i.e., {a,b,e,p}, we would require IDEAs to support choices and connections thus: {{},{a},{b}, {e}, {p}, {a,b}, {a,e}, {a,p}, {b,e}, {b,p}, {e,p}, {a,b,e}, {a,b,p}, {a,e,p}, {b,e,p}, {a,b,e,p}}.

Badiou's project is vastly wider than ours here, but a common concern for resolving ontological dilemmas offers design a perspective that spans single categories of design choices (as the singleton subsets {a},{b}, {e} and {p}), and also the connections between them. Rather than lapse into essentialism through a focus on a single design choice category, such basic IDEAs can instead expose a potential for change within a design situation through a design choice ('event') that radically

reconfigures a current design. Moreover, more complex IDEAs that co-ordinate design choices across categories bring further potential for design changes without denying the possible effectiveness of simpler IDEAs.

Co-ordinating connections require refinement of Badiou's parts, which are *proto-relations*. Unlike relations, subsets are not ordered. In ordering them, we generate sets of relations. We use tuple notations for relations, i.e, <a,b> means *a* and then *b*. So, for the subset {a,p} the relations are the two tuples <a,p> and <p,a>, which could respectively be connections from artefacts to purposes (i.e., means-end chains) or vice-versa (indexing features by design purpose).

Further complexity arises from connecting a relation to a choice category. The dotted arrow in Figure 3 represents the relation <<a,p>,e>. Similarly, for the most complex IDEAs that simultaneously cover all four categories of design choice, relations can be partitioned in several ways into origins and targets.

Step 6: The Potential for Innovative IDEAs

Such observations can guide the adaptation of existing IDEAs and the refinement of novel ones. We have already noted the adaptation of field research [5] and sentence completion [4] to create novel IDEAs that connect from beneficiaries to purpose. Similarly, we can extend personas from an IDEA for receptiveness, credibility and expressiveness for beneficiaries, to an IDEA that also connects beneficiaries to purpose. This requires a persona's skeleton to include specific information on (un)bearable costs, and strongly motivating benefits. Such skeletons may already exist in specific design practices. The value of the conceptual space developed here is to highlight a systematic need for them. So too will scenarios with outcomes anchored in design purpose (i.e., happy endings) be better at connecting artefacts and purpose. Where such practices are largely implicit, inconsistent and undocumented, it helps to surface them into the scope of useful IDEAs.

A relational structure over design situations also supports brain storming on potential IDEAs that have currently not been well explored within HCI, e.g., some binary relations suggest new possible IDEAs:

- <p,a> design purpose led feature brainstorming
- <p,b>: (new) market identification
- <p,e>: element measurement strategies that derive evaluation targets from design purpose
- <b,a>: acceptable features/costs for beneficiaries (e.g., cultural preferences)
- <b,e>: identification of participant resources and/or screening criteria for user testing
- <e,p>: identification of achieved worth

The above examples span adaptations of existing IDEAs within HCI, classification of novel ones, and speculative possibilities for ones yet to be developed. Together, they suggest how to prime novel IDEAs. It turns out that most innovative worth-centred IDEAs connect between design choice categories (e.g., worth maps (<a,p>) and user experience frames (<<a,b>,p>) [4]. However, the analysis of Badiou's situational ontology indicates that these only scratch the surface of potential IDEAs for designing as connecting. As well as the six example binary relations for IDEAs above, there are six further possible binary relations (in a reversed direction), and dozens of possible ternary and

quaternary relations (recall that the proto-relation {a,b,e} can generate the relations <<a,b>,e>, <e,<a,b>>, <<b,e>,a>, <a,<b,e>>, <<a,e>,b> and <b,<a,e>>, where pairs are either connections or origins/targets. The ability to connect to a connection (similar to Badiou's infinitely computing the power set of power sets) creates a theoretically infinite space for IDEA structures. We are highly unlikely to need this, and this is why design situations require *committedness* on which choice categories and co-ordinating connections are in play.

In simple terms, connecting between design choice categories, and between connections too, coupled with a focus on one or more meta-principles for designing, opens up an immense unexplored IDEAs space.

Conclusions

An analysis of design situations has indicated that artefact features comprise the only category of design choice of which we can be sure, but never certain. We can be sure that artefact features will always be part of a design situation, but we can never be certain that we have chosen the right ones. This reflects tensions between essentialist and relational ontologies. On the one hand, artefacts must be essential (in more than one sense). On the other, they must be related to their contexts of usage, ownership, consumption etc. in order to establish their effective qualities and the outcomes that can be achieved via them. This tension has made it difficult to focus when developing IDEAs frameworks, as it has proved hard to find a balance between making choices and connecting between them.

Although the development of this new conceptual space for design situations has been quite technical, it nevertheless steers HCI towards the real complexities of designing. It maps out a space that both includes existing simple IDEAs and complements them with more powerful IDEAs for designing as connecting. The combination of meta-principles for designing and design choice categories is thus both powerful and valuable, pointing towards new futures for HCI methodologies. Space limits have severely limited concrete examples above, but interested readers can explore for themselves how to extend existing HCI IDEAs to make more connections, and how to devise new ones to explore a wide range of design connections.

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