
When and Why Feelings and Impressions Matter in Interaction Design

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Abstract

The 'Third Wave' of Human-Computer Interaction research extends beyond cognition and usage contexts to many aspects of user experience, including emotions, feelings, values and motivating worth. Design representations need to evolve, as existing task specification approaches are too limited. This paper motivates and presents User Experience Frames (UEFs), a representational resource for envisaging user experiences. UEFs support *designing as connecting*, which looks beyond crafting or conceptualising artefacts to a wide range of interdependent connections between designs, usage, outcomes, evaluations and beneficiaries. UEFs expose relationships between design qualities and unfolding user experiences. They connect the design qualities and emotional responses that are in focus for Kansei engineering, but extend beyond first impressions to the motivations that guide human choices.

Keywords

Kansei Engineering, User Experience Frames, Designing as Connecting, Craft-Axiological Connections, Worth.

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Riding HCI's Third Wave

Human-Computer Interaction (HCI), a broad field spanning research and practice, is currently witnessing a rapid expansion of concerns in its 'Third Wave' [4], from a focus on cognition and/or social contexts to many aspects of user experience, including emotions, feelings, values, aversions and overall worth [8, 9]. However, there is a danger of becoming overly focused on the novel aspects of Third Wave HCI, at the expense of established concerns. It is thus important to understand when and why feelings and impressions matter in interaction design. The role of feelings here is more complex and dynamic than in product perceptions and purchase decisions, as modelled in approaches such as Kansei Engineering [27, 35].

It is important that design and evaluation approaches keep up with the expansion of HCI concerns without losing sight of established foci. In this paper, I extend existing forms of task description into User Experience Frames (UEFs). UEFs take a holistic approach to representing user experiences for Interaction Design. UEFs were developed to simplify worth maps [15]. Both worth maps and UEFs support *designing as connecting* [11], which looks beyond designs and usage to a broader range of interdependent connections between designs, usage, outcomes, evaluations and beneficiaries. UEFs express relationships between the qualities of designs, as indicated by designers' hopes and users' impressions, and the expected unfolding of user experiences (UXs), which will hopefully culminate in worthwhile outcomes.

Kansei Engineering and Interactive User Experiences
UEFs forge connections between design qualities and emotional responses (the focus of Kansei engineering)

on the one hand, and the motivating worth that guides human behaviour and choice (the focus of worth-centred development [11, 13] on the other. Connections are thus not only formed between feelings and product attributes, but also into the dynamics of unfolding user experiences and the motives driving them on (or bring them to a premature end).

This paper places Kansei Engineering in the broader context of Third Wave HCI. As an Engineering Design approach, Kansei Engineering can still provide an integrated set of resources for making quantitative grounded associations between product attributes and user perceptions ('kansei') of qualities and characteristics. However, Interaction Design has to extend this focus on consumer perceptions beyond fleeting first impressions to the dynamic evolution of feelings and beliefs within the context of interactive user experiences. Such feelings and beliefs need to be associated with the (de)motivators that valorise product qualities within specific usage contexts. The balance of motivators and demotivators associated with a product or service determines its *worth*, that is, a relationship between benefits and costs that must be sufficiently positive to motivate purchase, extended usage, recommendations and user appropriations.

The main argument of this paper is thus not that Kansei Engineering is outdated or outmoded, but that, where project teams prefer, it can be integrated within a wider worth-centred framework of design and evaluation approaches. One worth-centred resource (UEFs) are used to illustrate this re-positioning of Kansei Engineering within the broader Interaction Design context of HCI's Third Wave.

Kansei Engineering has roots in Aesthetic Theory [27]. The Japanese word *kansei* is said to be difficult to translate into English, but it can be thought of as the "structure of emotions which exists beneath human behaviors" [27]. Each person has a kansei that shapes their propensity to respond to an object. Kansei is contrasted with *chisei*, which "works to increase the knowledge or understanding, which is matured by verbal descriptions of logical facts" [27]. Clearly, "both Chisei and Kansei have the same level of power to stimulate human behaviours" [27]. With its roots in European Enlightenment Aesthetic Theory, Kansei Engineering has inherited a longstanding Western separation of rationality and emotionality, with the latter often seen as problematic, resulting in irrational behaviours with adverse consequences. However, there has been substantial progress in Affective Psychology in the 20th Century, as evidenced in recent text books (e.g., [30]. We now have a more balanced view of emotions, and understand them as being essential to human behaviour, alerting us to factors relevant to our goals and supporting evaluation of situations. Visions of wholly rational superhumans who never succumb to their emotions are now seen not only as a fantasy, but wholly as unrealistic [7].

We now have a more holistic view of feelings, which also has roots in Aesthetic Theory. Dewey, in his *Art and Experience*, argued that "there is no such thing in perception as seeing or hearing plus emotion. The perceived object or scene is emotionally pervaded throughout" [17]. Such holistic contexts for emotions and feelings are now standard, with Oatley, Keltner and Jenkins initially treating emotions as "multi-component responses to challenges or opportunities that are important to an individual's goals, particularly social

ones" [30, p.29]. By maintaining the separation of *chisei* and *kansei*, Kansei Engineering may obstruct a balanced consideration of the multiple components of feelings, which, like attitudes in social psychology [31], have cognitive, affective and conative aspects (*conation* refers to the propensity to specific actions).

The separation of *chisei* and *kansei* also fails to take advantage of contemporary understandings of affective phenomena that relate them to *time courses*, e.g., from subsecond facial and voice cues and physiological changes, through minutes of self-reported *emotions*, days and weeks of *moods*, months and years of emotional *disorders* and lifetimes of personality *traits* [30, p.30]. Unlike some 'irrational' subconscious characterizations of emotions, *kansei* actually go beyond the subsecond visceral reactions associated with changes in facial expressions, vocal intonation and physiological changes (associated physiologically with the limbic system and the paleomammalian amygdala within the human forebrain [30]). The emphasis on self-reported feelings through *kansei words* clearly extends emotion beyond subsecond time courses, which will inevitably involve cognitions associated with *chisei*. Krippendorff has criticized Kansei Engineering for repeating the 'epistemological mistake of aesthetic theory' [26, p.159] that divorces the reported characters of artefacts from the cultural contexts and the language associated with them. In this sense, a rigid separation of cognition and affect (or *chisei* and *kansei*) loses the benefits of holistic approaches to experience such as Dewey's aesthetic theory [17].

Despite these concerns, we need to recognize Kansei Engineering as a valuable contribution to design methods, especially in settings where its empirical

quantitative bases are appreciated by key stakeholders. As one of the earliest comprehensive approaches to 'affective engineering', Kansei Engineering has become well established in some large manufacturing organizations, and continues to support successful product innovations and adaptations [16,35].

Kansei Engineering cannot be transferred unchanged to Interaction Design. It must instead be placed within a broader context. Although directly and immediately sensed qualities are important to purchase decisions, they are not enough to support pleasant and worthwhile user interactions with digital products and services. Kansei Engineering success stories such as the Mazda Miata [35] depend on the immediate appeal of a sports car and similar manufactured artefacts. However, the value of such immediate compelling sensual appeal varies across design disciplines. It clearly has a limited role in the design of products and services that have substantial intangible elements that only materialize at specific customer *touch points*. For Interaction Design, we thus need to place Kansei Engineering in a broader context, where its relevance and relative value can be assessed within a broader framework of design and evaluation approaches.

The Elements of User Experience (UX)

A broader view of User Experience (UX) requires us to reflect on what such a view should comprise. Existing approaches to the elements, processes and threads of UX need to be combined, and perhaps extended, to be truly holistic. In isolation, existing technocentric and human-centric elements are an inadequate basis for spanning all elements of UX.

Technocentric Elements

Garrett organizes *the* elements of UX into five *planes* [18]. Four are similar to long standing concepts in interactive systems architecture going back two decades (e.g., the Arch/Slinky Model [21]). Garrett's *Surface* and *Skeleton* planes correspond to the *physical* and *logical interaction* layers of interactive systems in the Arch/Slinky (A/S) Model. *Structure* elements correspond to the *A/S dialog* layer, and *Scope* elements to the *A/S functional core* (adaptor). Such claimed elements of UX may not actually be experienced by users. They are software design constructs that support an architectural separation of concerns, but we cannot assume that users will be aware of such expert technical distinctions.

Garrett arranges his planes in a vertical stack with his *Surface* plane on top and his *Strategy* plane at the bottom, making the latter foundational. Layers depend on those below them (and thus higher planes are lower level in terms of system abstractions). From a technical standpoint, Garrett's highest stacked plane (surface) is the *lowest level* in terms of design abstractions. It is very concrete. Conversely, the *lowest* plane has the highest level of abstraction, and only this *Strategy* plane has any overtly human focus to it. This incorporates "not only what the people running the [web] site want to get out of it but what the users want to get out of the site" [18, p.23]. Such desires, (business) goals, motives, wants or (user) needs are clearly human elements of UX. Garrett decomposes his *Strategy* plane into user needs and site objectives, and similarly decomposes, for example, his *Structure* plane into interaction design and information architecture. When combined with the decompositions of his other three planes, Garrett claims that his "component

elements" can "fit together to create the whole user experience" [18, p.31]. It is not clear how such an almost wholly technocentric view of human experience could ever be adequate.

Human-Centred Processes and Threads

In contrast to Garrett, McCarthy and Wright's *Technology as Experience* (a Dewey-inspired title), implicitly rejects the idea that resolving business and user needs only "depends on a conceptual integration of information design, information architecture and interface design" [28, p.10]. In contrast, they replace Garrett's almost wholly technical approach to UX with a wholly human one. They propose six overlapping *processes of sense making* (anticipating, connecting, interpreting, reflecting, appropriating, recounting [28, p.124]) alongside *four threads of experience* (sensual, emotional, compositional, spatio-temporal [28, p.80]). Their six processes are temporal constructs, whereas the four threads appear to be structural, but unlike Garrett's planes, there is no systematic relationship between the higher order threads (compositional, spatio-temporal) and the lower order ones (sensual, emotional). It is not clear how experience can be composed except in spatio-temporal terms, leaving little, if any, residual scope for the compositional thread.

As psychologists, McCarthy and Wright's omission of any cognitive thread is surprising, especially as an 'emotional' thread cannot, unlike feelings, be understood to subsume any beliefs or knowledge. There is thus both overlap and omission in McCarthy and Wright's threads, which cannot be wholly attributed to their "reading of the pragmatist literature" [28, p.80].

These omissions extend to their exclusion of all design elements from UX.

Everything-Centred Elements

There are two necessary responses to technical and human extremes. The first is that both provide elements of the user's experience of an interactive product or service. On the one hand, there has to be something to interact with (Garrett's planes), and on the other there has to be someone to interact with it (McCarthy and Wright's processes of sense making). Interaction, by definition, requires two parties, thus making it inadequate to 'centre' exclusively or predominantly on either the technical or the human. A user's attention will shift between aspects of the system, their conscious experience, and their multi-faceted evolving goals. UX representations must be equally heterogeneous, and privilege no elements of experience at the expense of others.

The second response is to recognise that Garrett and McCarthy and Wright may provide many required elements of UX. McCarthy and Wright's romantic occlusion of cognition has already been noted (does this indicate former cognitive psychologists 'on the rebound?') A further major oversight lies in Garrett's Strategy plane, which splits simply into user needs and site objectives. The latter hides the complex interaction of multiple stakeholder agendas, which can lead to several competing sets of site objectives. The former (user needs) has further echoes of the romantic individual with needs conceptualized independently of the social contexts within which almost all higher order needs are constructed (in contrast to lower order needs that are determined by our bodies' physiology).

Restoring technical and cognitive elements to a consideration of UX is straightforward, especially if we combine *use cases* [6] and *cognitive task descriptions* [e.g., 5] as our starting point, i.e., we start with technical task descriptions, insert cognitive steps, but then add several further necessary design and human elements.

Use cases are rarely expressed below the level of Garrett's Scope plane (i.e., *above* the Scope plane in his stack!). They thus fail to capture the surface materiality of interaction. Also, their instrumental bias allows little if any consideration of user perceived qualities, which Kansei Engineering has shown to be important for product success. We thus need design elements other than the *features* (expressed at some level of abstraction) that predominate in instrumental design approaches. We need to give separate consideration to the *materials* that underpin features, as well as the *qualities* that arise from both materials and features. The *design elements* of UX are thus *materials, features and qualities*. In contrast, Garrett's planes are a software designer's elaborate architecture of a system. As users may not be able to work out this architecture from their usage experience, Garrett's planes cannot be regarded as primary elements of *users' experiences*.

Similarly, McCarthy and Wright's processes and threads are essentially different views of the same thing (i.e., just as Garrett's planes are different abstraction levels within a design architecture). The 'same thing' here is human rather than technical, i.e., the 'felt life' of a user's experience of interaction with a digital product or service. As already noted, this overly simple focus on feelings needs to be complemented by not only the

design elements of UX, but also by cognitive human elements. It makes no sense to go from one extreme to another. i.e., from the the emaciated logical cognitive world of Newell, Shaw and Simon's slim line *General Problem Solver* [29] to the romantic affective world of Geert's 'felt life' [19]. However, these two human experience elements of feelings and cognition are not enough. UX descriptions must also consider the *motives* that drive interactions (or end them abortively).

McCarthy and Wright are held back from any sustained focus on human motivation by their acceptance of Dewey's perspective on action that "there can be no separation of means and ends in a world where people are always already engaged, rather people create goals and the means to achieve those goals in the midst of their engagement with the world" [28, p.17]. However, McCarthy and Wright are comfortable with using other 'separated out' abstract concepts such as space and time, here under the influence of Bakhtin. Kant [25] would be a much better source of influences here. For Kant space and time are universally essential forms of thought, and not just useful constructs for literary narrative analyses. A hyphen in 'spatio-temporal thread' is not enough to unify the two concepts, anymore than naming a 'means-end' thread would make means and ends inseparable.

We thus need to complete the elements of UX with considerations of human motivation that recognize the interplay of drives and aversions and the resulting balance of *worth*, which will be positive when benefits (satisfying drivers) outweigh costs (dissatisfying aversions). Roto has thus argued that "discussion about the scopes of usability, acceptance, and UX should be broadened to include the scope of worth-centered

design” [34, p.3]. To do this, we have to bring motives and aversions into focus, regardless of any circumstances under which ‘means’ and ‘ends’ are (in)separable. Such motives put the ‘happy’ in ‘happy endings’, which should be the default end point when designers envisage user experiences.

The Need for Happy Endings

Human activity is guided by motivators and demotivators. This does not require a fixed set of Aristotelian final causes [3] as in the Rokeach Value Survey [33]). Instead, we should recall the position within Activity Theory [24] that an *object* (or *objective*) can become a goal, and vice-versa, i.e., ends can become means, and means can become ends (e.g., as for an accountant who grows from using spreadsheet macros as means to ends to programming them as an intrinsically satisfying activity). This may have been behind Dewey’s concern over separability, i.e., that goals (re-)form during engaged experience, but Activity Theory has long given HCI ways of dealing with this without insisting on the inseparability of means and ends. Indeed, Activity Theory depends on the separation of the ends of long term object(ive)s from the means of conscious tactical instrumental goals and practical unconscious operations.

Most importantly however, *designing without purpose* leaves us with *no apt means of evaluating*, and few bases for making rational choices or grounding design objectives in real social settings. Thus Dewey’s perspective on action, even if true, is no use to designers. We need to settle on interaction design objectives, which thus must become ‘ends’, i.e., the happy endings of successful user interactions. Good design should result in good outcomes, and these are a

vital element of user experience, if not its dominant element. It is thus vital that design teams develop a clear shared understanding of design purpose (i.e., the ‘ends’ of design), and keep this very separate from consideration of the ‘means’ of design (i.e., the design elements that enable interactive UXs).

What are Happy Endings, and What are Not?

Kansei Engineering tends to treat positive user perceptions as ends in themselves, when they are clearly only means to an end. They are a step in the story, and not its happy ending. In most applications of Kansei Engineering, this end is sales, i.e., consumers will buy positively perceived products and services. However, this does not make kansei words invariably *valenced*, i.e., inherently positive or negative. For example, we may think that ‘simplicity’ will always be positive, and indeed it may be for users and interaction designers, but not for marketing roles who feel the need to complete a tick list of ‘must have’ features. Also, sponsors or commissioning roles often feel the need to demonstrate value for money through rich feature sets. Alternatively, what is a positive quality in one context (e.g., austerity in a fine wine), may be a defect in another (e.g., austerity in the architecture of a children’s nursery). Put more simply, “one man’s meat is another man’s poison”. What is a positive quality for one human group may be a defect for another. The idea of a database of kansei words with fixed positive or negative valences thus divorces the perceived characters of artefacts from the cultural contexts and the language associated with them, as Krippendorff has argued [26].

Product qualities may be positive or negative in different purchase and usage contexts, and *neutral* in

others. This three valued approach to motivators is very important, and reflects Herzberg's [23] positive *motivators* and negative *hygiene* factors. Hygiene factors are dissatisfiers (e.g., low pay), but removing them does not automatically result in satisfaction. Instead, the recipient of a pay rise may simply become *undisatisfied*. Similarly, the absence of recognition in the workplace may mean that an employee worker is *not satisfied*, but it may not make them dissatisfied. Thus product or service qualities may have neither a positive nor negative valence in some contexts: they will not matter either way.

We have two key facts to bear in mind when considering both design qualities and interaction outcomes. Firstly, we cannot fix the valence (positive or negative) of qualities or outcomes independently of interaction contexts. The same applies to outcomes, which are happy or unhappy endings according to the overall balance of worth. Satisfying some positive values alone does not constitute a happy ending. Instead, outcomes need to be worthwhile, i.e., with positive consequences outweighing negative ones. Secondly, we cannot fix what will be 'instrumental' and what will be 'terminal' (as in the Rokeach Value Survey [33]) independently of usage contexts. In Activity Theory terms, *goals* would be instrumental and *objects* would be terminal, but human growth and development can lead to the instrumental becoming terminal and vice-versa.

What makes an ending happy or otherwise is due to a complex interaction of personal, social and other contextual circumstances. The scope of these interactions can be captured by the L-ERG-IKK acronym (pronounced 'allergic', for those allergic to theory!)

[13]. This short hand for complex circumstances comprises:

- L-** The *Locales* [20] that constitute a physical *space* as a set of overlapping socio-cultural *places*.
- ERG-** *Existence, Relatedness and Growth* [2], psychological categories for individual motivations.
- IKK** *Institutions, Kin and Kind* [13], sociological categories that distinguish between the different 'missions' of organizations, families and communities and their impacts on human social relationships.

Together, specific instances of the above form *worth webs* [13] that bring specific (de)motivators into play in specific settings, determining how qualities, feelings and outcomes are valenced (i.e., as good, bad or indifferent).

Summary

The elements of user experience comprise design and human elements that interact to create and maintain feelings and beliefs, as well as enabling actions within digital environments and in the social and physical world. Ultimately, closure points are reached which are understood by all fully engaged human actors to constitute an 'ending' that can be judged to be worthwhile, of little or no significance, or damaging. To represent user experience, we thus need to show how design elements (materials, features and qualities) interact with human behaviours and experience in specific socio-digital settings. Depending on the

context, we may be primarily concerned with the unfolding of feelings and beliefs, but generally, our main evaluative focus will be on *outcomes*, that is, whether an interaction leads to something worthwhile, even with moments of challenge and discomfort, or absence of fun or sensual pleasures.

Feelings and impressions thus matter in Interaction Design when they drive worthwhile user experiences forward and head off adverse ones, and also when they bring them to an unsatisfactory premature end. Designers thus need to expose and assess the likely unfolding of user experiences in envisaged interactions. User Experience Frames (UEFs) are a representation for interaction design and evaluation that can support this, letting designers indicate which feelings are expected to arise and when during an interaction, and how these feelings will then shape the course of subsequent interaction. UEFs are one design approach from an evolving framework for *worth-centred development* (WCD, [13]). They evolved to simplify the existing WCD approach of *worth mapping* [11], which are described after first introducing the WCD framework of design and evaluation approaches.

Approaches within a Worth-Centred Framework

Development frameworks should combine approaches that support the complete process from the fuzzy front end of design to installation/manufacturing and subsequent use, ongoing evaluation and maintenance. The extent to which a framework's approaches can be integrated depends on the organising principles that guide selection, adaptation and evolution. The WCD framework that forms the background to this paper is

based on a *craft-axiological* restriction of six *meta-principles* for designing [13].

Craft-axiological restrictions limit design choices to both specific *craft materials* and specific *value systems*. WCD is currently only restrained for Interaction Design, where the craft materials are interactive digital technologies and people. People are as much a part of the materials as technologies in Interaction Design, since there simply can be no interaction without people, whose characteristics shape the resulting interaction no less, and perhaps more, than the design elements that comprise the technical materials. The raw materials for any Interaction Design are thus *sociodigital* [13]. These craft bases overlap strongly with those for product and service design, with the former often having no digital element, and the latter requiring much more *in use* from the people in the process than a manufactured artefact.

Axiology studies the nature of value and value judgments. Kansei Engineering tends to treat qualities and values as the same, i.e., positive qualities are also positive values. WCD's axiology is broader, since the concept of *worth* subsumes qualities, value and values in both their positive and negative manifestations [13]. This is a much wider scope than both the intrinsically valenced (positive or negative) qualities of Kansei Engineering, and also the wider philosophy of *Design as the Creation of Value* [13].

Craft-axiological restraints apply to all four categories of design choice (means, ends, beneficiaries and evaluations [13]). Craft restrictions apply to *design means*. The axiological breath of *worth* minimises restraints over design purpose (ends), design

beneficiaries and design evaluations. The purpose of any design should be expressed as a set of worthwhile outcomes, taking costs into account as well as benefits (value). The costs and benefits which interact to produce worth must be relevant to specific beneficiaries in specific worth webs. Our primary focus in HCI should thus not be solely on human activity, but on values and aversions as they are inscribed in people, places and things. Human activities need to be understood as endeavouring to avoid the adverse and to achieve the valuable, such that the benefits of achieved ends outweigh the costs of the means. Similarly, evaluation should focus on achieved worth relative to design purpose, and not on measures that may be irrelevant to the real costs and benefits in an envisaged design setting [10]. Worth provides direct support for *designing as connecting* [11], as it provides a clear basis for connections between design choices (e.g., between ends and evaluations, beneficiaries and ends, and evaluations and beneficiaries).

WCD's craft-axiological restraints are a minimal set of initial constraints for a development framework. With these in place, progressive instantiation can develop a set of design and evaluation approaches, guided by *meta-principles* [13]. However, the approaches within a framework cannot fully instantiate meta-principles into *principles*, i.e., rules or codes of design practice. That is only possible within specific project or design team contexts. A framework of approaches thus seeks to maximise support for meta-principles while minimising adverse constraints that undermine project team effectiveness.

WCD approaches currently collectively support six meta-principles: receptiveness, expressivity,

inclusiveness, credibility, improvability and committedness [13]. Briefly, *receptiveness* is indicated by openness to alternative design means and ends (i.e., user values), beneficiaries, and approaches to evaluation [14]. *Expressivity* is assessed in terms of how well design approaches in use can communicate design options and choices. *Inclusiveness* is indicated by the range of human roles that are explicitly designed for, and the modes of benefit and harm for both included beneficiaries and others who can be impacted by a design (e.g., accessibility issues arise from impacts on people with impairments). *Credibility* is assessed in terms of the feasibility or groundedness of a design choice. *Improvability* is assessed as the capability for evaluating designs, understanding discovered usage problems, and responding to these with design iterations (all design choices can be iterated, not only choices of means: improvability requires *total iteration potential* [13]). *Committedness* is the extent to which a project team has made explicit their commitment to design means, design ends, intended beneficiaries and evaluations. Each design and evaluation approach in the WCD framework can partially instantiate one or more of these six meta-principles.

The use of the word 'approach' here is deliberate, in preference to 'techniques' or 'methods', since these attribute more certainty and regularity to development practices than can ever be the case. If we accept, as we should, that people in design roles are no less human than the users for whom we design, then we should not expect them to dance to the tune of the method designer or technique inventor. Instead, we should expect design roles, as with any other human, to mold

and bend the diverse loosely integrated resources of a development approach to their own purposes.

We should expect design roles to appropriate, to adapt, to modify, to extend, to compress, to edit, to reconfigure and to contextualize, and in so doing, affirm their humanity as creative, free, interpretative restless souls who seek to do the best they can, developing their skills and advancing their achievements, rather than passively following the algorithmic instructions of experts. This introduces further challenges in keeping support for Interaction Design up to date. Not only must affective and axiological considerations be added to the mix, but at the same time we need to relax any expectations that any one can develop methods and techniques that guarantee successful outcomes in design or evaluation.

Worth Maps and UEFs need to be understood as *resources* that project teams must configure for specific uses in specific contexts. Designing can rarely be algorithmic and procedural. It is a creative heuristic endeavour where the apparent benefits of standards, consistency, absolute repeatability and rigid procedures are generally outweighed by the costs of design failure and wasteful ineffective design activities. If we are designing for people, here design project teams, then we must design for people, and not machines or slaves.

UEFs and Worth Maps: Two WCD Approaches

Worth mapping is a WCD approach that connects means to ends [11]. As an *approach*, it combines a *set of resources*, in this case: a representation *format* (worth maps); the *philosophy* of designing as connecting; the *concepts* of means-end chains, aversion blocks, design element categories (materials, features, qualities) human element categories (UXs, outcomes), and worth; and a set of *practices* that configure and combine the other resources.

Worth maps are directed graphs ('boxes and arrows') that show how design means are expected to combine to achieve design ends. Elements in a worth map correspond to design means or design ends. Design means comprise design elements (materials, features, qualities) and user experiences. Together, these means should combine to produce worthwhile outcomes, which are the fifth element category in worth maps. Simpler forms of worth map are possible, with a single composite design element category ('product attributes'), user experience elements, and worthwhile outcome elements [14]. However, to illustrate the use of UEFs with worth maps, we need to retain separate categories of materials, features and qualities.

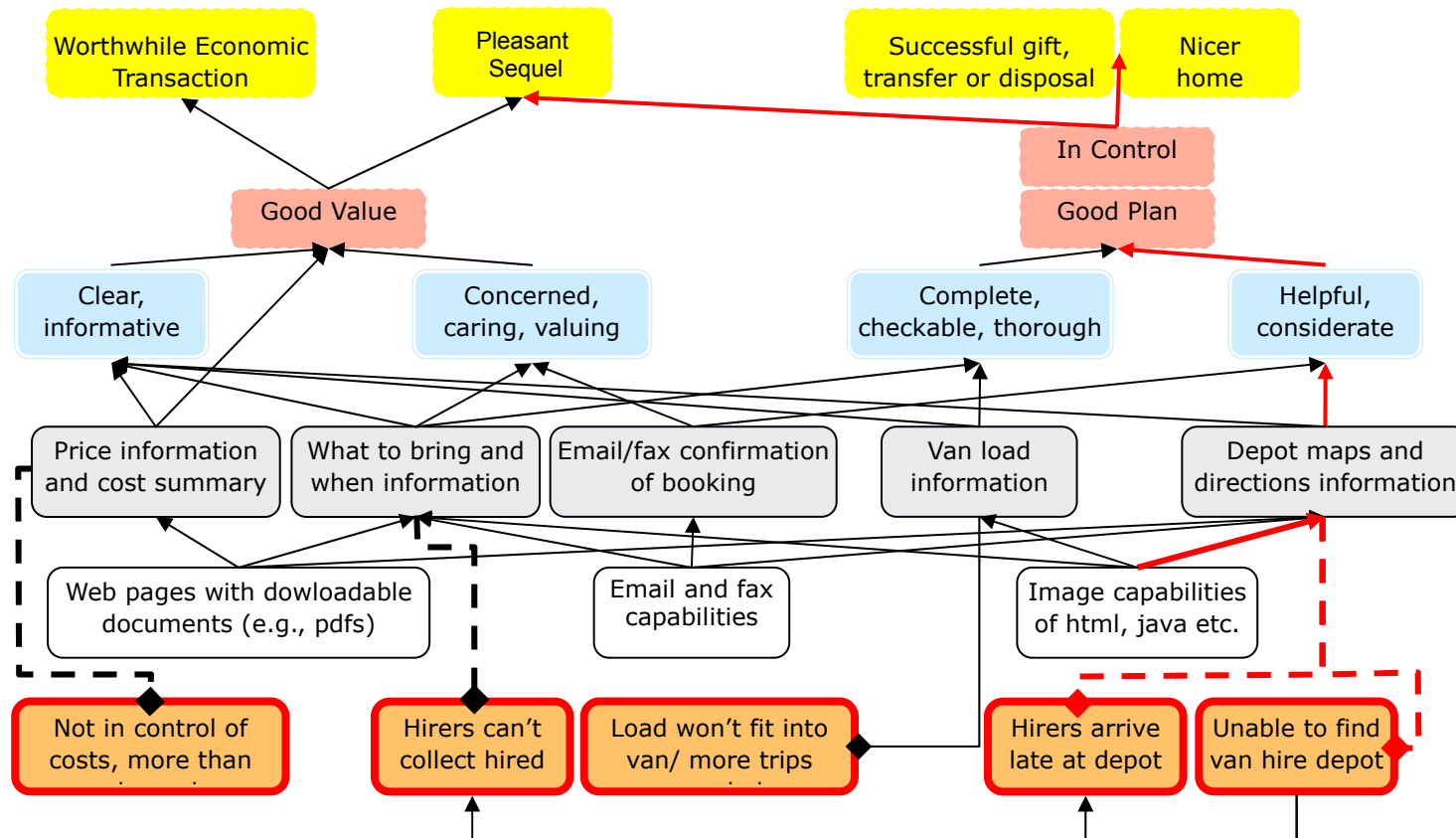


figure 1. Worth Map for Hypothetical Van Hire Site.

Means-end chains (MECs) are represented in worth maps as paths of arrows from materials and/or features to worthwhile outcomes, via features, qualities and user experiences. Figure 1 shows a worth map for a van hire web site, mostly from a customer perspective. The map is populated by design elements (materials, features, qualities) and value elements (user experiences,

outcomes). Element colours are: yellow for worthwhile outcomes, pink for user experiences, light blue for qualities, grey for features, white for materials, and red edged for adverse outcomes. Other negative elements (defects, adverse experiences) are omitted for simplicity. Closely adjacent elements (no arrow links) are (non-exclusive) alternatives (horizontally adjacent)

or sequenced (vertically adjacent). Outcomes are ends. All other elements are means.

An example MEC is highlighted in red in Figure 1. It indicates an imaginary project team's hope that they can make use of image capabilities for webpages (*materials*, white) to implement features that support directions to the van hire depot with maps and related content (*feature*, grey). The expectation is that these features will be perceived as helpful and considerate (*qualities*, blue). This is where Kansei Engineering stops, with its assumption that the 'kansei' of hopefully many individuals will lead them to associate kansei words such as 'helpful' and 'considerate' with the product attributes that provide directions to the van hire depot. Again, Krippendorff [26] is critical of the decontextualisation of kansei words, and the implicit assumption that product attributes can be designed to elicit the same affective responses from the same people all of the time. While a well designed 'directions' web page may indeed produce immediate feelings of helpfulness and consideration, such feelings have limited value if they do not translate into worthwhile outcomes. When booking a van for hire, such outcomes include: making a worthwhile economic transaction; having a pleasant sequel after completing a van hire (i.e., not left so frustrated and exhausted that it ruins the rest of your day); successfully transferring something as a gift, purchase, sale or disposal, and/or improving one's home (by removal of something old or bringing in something new). Such worthwhile outcomes are indicated by the yellow elements at the top of Figure 1. The two right hand elements are complementary, with 'nicer home' potentially resulting from a 'successful gift, transfer or disposal'.

User Experiences are the bridge between design elements and worthwhile outcomes. There are two main envisaged experiences for the van hire web-site. One develops and maintains the feeling that the booked van hire is good value, the other develops the feeling that a good plan is falling into place for collecting the van, transporting some goods, and then returning the van to the depot. The 'goodness' of the plan will be revealed by how 'in control' the hirer feels once they collect, use and return a van.

This example means-end chain includes a 'good plan' UX (pink element). Carrying out this plan should result in a later UX of being in control throughout the whole episode of hired van usage. This UX is vertically above 'good plan' to indicate a typical time delay in on-line service purchases (e.g., flight, theatre or theme park tickets, airport car parking bookings). Purchasers buy and/or book services that will be consumed at a later date, requiring the web UX to be build confidence and trust, since the quality of the purchased service will not be known until later.

Positive means-end chains indicate the expectations of a project team that design elements will enable positive UXs that result in worthwhile outcomes. Such outcomes will not only be worthwhile because of *achieved value*, but also because of *acceptable costs*. The dashed red lines ending with diamonds in Figure 1 are *aversion blocks*, which indicate the expectation that web site features will avoid the adverse costs of being unable to find, or arriving late at, a van hire depot, which could destroy the worth of an intended economic transaction and/or result in an unpleasant sequel of a ruined day (perhaps longer). Adverse outcome elements are shown in orange with red edges.

UX elements greatly simplify worth maps in comparison to their predecessors, Worth/Aversion Maps (W/AMs, [10]), which retained the overall structure of the Hierarchical Value Maps on which they were based. These used a complex system of functional and psychosocial usage consequences that have now been incorporated into *User Experience Frames* (UEFs). Their key benefit is that, when combined with a worth map, they indicate when and why feelings and impressions should matter. Worth maps shows associations between materials/features and qualities that are systematically investigated in Kansei Engineering (which can thus still be used to strengthen the credibility of such associations). UEFs extend initial static impressions into the dynamic unfolding of a UX, where feelings about an artefact give way to feelings about experiences, which depend at least as much on what users do as on how a system responds and what users sense or believe as a result.

Use Cases and Cognitive Task Specifications

UEFs can be thought of as extensions of Use Cases and Cognitive Task specifications, which are now briefly reviewed.

- Claimant submits claim with substantiating data.
- Insurance company verifies claimant owns a valid policy
- Insurance company assigns agent to examine case
- Agent verifies all details are within policy guidelines
- Insurance company pays claimant

figure 2. Get paid for car accident use case [1, p.166].

Use cases [6] can be expressed in theory within any of Garrett's planes of user experience, but the tendency is to express them using constructs that would logically belong to Garrett's Strategy or Scope planes, even if such constructs are not included by Garrett for these planes. Figure 2 shows a use case from [1], which is presented as a business use case with a strategic goal, and thus is more appropriate for Garrett's Strategy than his Scope plane. It essentially indicates the responsibilities of key stakeholders in an insurance claim transaction. It is too abstract to express intended UXs. Even so, it illustrates the sequential one dimensional nature of many use cases. This is Cockburn's preferred style, although he does cover alternatives, including two column tables [6].

Cockburn [6] provides examples of use cases at the level of abstraction of Garrett's Scope plane. Table 1 shows an excerpt from an e-commerce transaction. The abstraction level is still very high, making it difficult to introduce any cognitive analysis. Even so, it would be straightforward to refine this use case to a sufficient level of detail to be able to see where knowledge, beliefs and feelings would come into play during the shaping of a user experience.

The two column format of Table 1 can be readily extended to add additional columns. In the first decade of HCI research, there was a sustained effort on specifying the human cognitive operations associated with each step in an interaction. Casner [5] used this approach to identify hard cognitive operations in decision support and replace these logical operators with simpler perceptual ones. Figure 3 shows an annotated task description for an airline flight search task. Cognitive operations appear in brackets after each

task step (Scope plane abstraction level). These could also be placed in a parallel column to the corresponding task step. However, this would provide only a limited basis for expressing and assessing an envisaged UX.

20. Shopper will select a product model	21. System will determine standard product model options, and then present the first question about determining major product options.
22. While questions exist to determine Product Option recommendations	24. System will prompt with questions that vary based on previous answers to determine the Shopper's needs and interests related to major product options, along with pertinent information such as production information, features & benefits, comparison information, and pricing.
23. Shopper will answer questions	
25. Shopper answers last question	26. At the last question about major product option desires, the system will present the selected model and selected options for Shopper validation.
27. Shopper reviews their product selection, determines they like it, and chooses to add the product selection to their shopping cart.	28. System will add product selection and storyboard information (navigation and answers) to the shopping cart.
	29. The system presents a view of the shopping cart and all of the product selections within it.

table 1. e-commerce transaction use case excerpt [6, p.95].

The representation in Figure 3 is adequate for Casner's purpose, since it allows identification of difficult logical operations (e.g., subtraction, greaterthan), supporting system redesigns that replace these with simpler

perceptual operations through the use of appropriate graphical visualisations alongside text and numbers.

- findFlightWithOrigin (search)
- findDestination (lookup)
- landsInDestinationCity? (verify)
- available? (verify)
- determineDeparture (lookup)
- determineArrival (lookup)
- computeLayover (subtraction)
- connecting? (greaterthan)
- layoverLessThanX? (lessthan)
- determineCost (lookup)
- addCosts (addition)
- costLessThanX? (lessthan)
- findSeat (search)
- emptySeat (verify)
- findSeatNumber (lookup)

figure 3. Cognitive Analysis of Flight Search Task [5, p.127].

Although neither single and two column use cases, nor a two column version of Casner's cognitive task specifications are an adequate basis for assessing user experiences, they provide a basis for extensions that do.

User Experience Frames (UEFs)

A UEF is a tabular representation that uses columns to separate different aspects of a UX. Project teams need to decide on which column types are needed to express and analyse their envisaged UXs, but it is likely that they will all borrow both of the two columns (user actions, system action/responses) that are common in basic tabular use cases. If required, a further column

could be added for cognitive operations to support analyses similar to those of Casner, but in practice a much higher level of abstraction is more appropriate for UXs. For example, a *beliefs* column can be used to indicate how users form beliefs about system capabilities, task status and any other aspects of UX.

The key point here is that UX must involve some form of cognition, however out of favour this is in some HCI circles. However, this need not translate into the sorts of cognitive operations that sit comfortably within the traditions of Newell, Shaw and Simon's *General Problem Solver* [29].

This gives three initial column types (user actions, system responses, user beliefs), but where appropriate, a column type may have two instances, e.g., to separate browsing user actions from searching user actions (Figure 4 and [15]). UEFs are a flexible tabular resource that can be adapted for different design and research purposes.

The starting point for UEFs is thus 'first wave' HCI with its cognitively enhanced task descriptions. 'Second Wave' columns can be added to reflect HCI's turn to the social [32], for example, a column that expresses *social interactions* between co-present users and observers (e.g., for group use of a table top interface [15]).

Lastly, 'Third wave' HCI columns can be added to express a user's (or group of users') *feelings* as they emerge and are shaped during interaction. Also, for ubicomp applications, there may be associated actions in the *physical* world (e.g., retrieving a physical object to be used as part of a ubicomp interaction). While this might be considered as 'social' and placed in a social

interactions column, the needs of a project team may be better met by adding a separate column to capture specific 'off-system' actions in addition to 'off-system' utterances and other social interactions.

Column types for UEF table thus include:

- Feelings (sensual, emotional, interpretative, evaluative)
- Beliefs (about user/system capabilities)
- User Actions (via system features)
- System Responses (from features)
- Social Interactions (in the world)
- Physical Actions (in the world)

Again, a UEF can contain more than one instance of a column type (as in Figure 4), as long as the table format remains manageable. Table 2 shows a UEF for the 'Good Plan' UX element in Figure 1. The rightmost column combines social and physical actions into a single 'Acts in the World' column. Numbers in brackets are used in conjunction with Figure 5.

Two dashed horizontal lines in Table 2 indicate space saving breaks in the experience for firstly, what co-users Harry and Sally do and see when they find the right van, and secondly, how they check details and complete the transaction. A dotted arrow is used to show a temporal thread from the top to the bottom of the table as Harry and Sally book a van on the imaginary lovelyvan.com. To save space, Table 2 often has several UX elements on one row, which complicates placement of dotted arrows (and may make it hard to draw threads as required). Such problems can be avoided by spreading elements across several rows.

Feelings	Beliefs	User Action	System Response	Acts in the World
(1) Worth a try		Open lovelyvan.com		
			Display home page	
	(2) Can find prices and availability			
Not a good place to start		Enter Post Code	Show depots map	Sally persuades Harry
	Nearest depot is on ring road	Sally sees nearest depot		
		Select depot on ring road	Display depot and van info	
(3) That's cool				
	Can find right van	Select appropriate van	Display book this van page	
		(4) Book and pay for van		Sally checks details
		(5) Save and print confirmation page	Display and email confirmation	
Feels great, all well planned	Booked right van for right time period			
		(6) Read email, follow link to info pdf	Display pdf	
That looks very smart		Print info, and instructions pdf		Staple and pin up info and instructions
(7) Looking forward to getting van	Have all necessary details			

table 2. UEF for Good Plan for Van Hire UEF

Table 2 is deliberately 'rough and ready'. Readers will no doubt have issues about the credibility and coherence of the unfolding experience implied by the arrow. If so, then therein lies some of the value of UEFs, i.e., that they can in a very compact space open up a wide range of UX related design issues for discussion. This is the case even when, as here, segments of the UX are missing.

There are examples of McCarthy and Wright's processes of sense making in Table 2. Harry and Sally have positive *anticipations* about lovelyvan.com from what friends have previously *recounted* about it. Harry and Sally *connect* with the web site, forming evaluative *interpretations* of their progress as they proceed, with varying degrees of evaluative *reflection*. In a small act of printing out and pinning up instructions for van collection and return, they *appropriate* by physically integrating a print out into their domestic space. The lack of linear causal relationships between different forms of sense making is clear. UEF structure helps to foreground the interleaving here, with narrative UX arrows weaving between columns

While associations between design elements in worth maps can represent the Kansei Engineering world of consumer perceptions of products and services, UEFs show how interaction goes beyond first impressions. UEFs can show when and why feelings and impressions matter in the contexts of specific UXs at specific points in the interaction. Harry and Sally would not have even visited lovelyvan.com if friends had not created feelings of worth about the site. Such product expectations clearly precede the perceptions measured by Kansei Engineering, and are formed by advertising and marketing as well as product recommendations, but

even so, those who recommend a product or service tend to form their expectations directly.

Of the six example feelings in Table 2, only two ("That's cool", 3 in Table 2; and "That looks very smart") are direct responses to web site design elements (for details see next section). Two are due to anticipation: from friends first (1 in Table 2), and cumulatively from their own UX at the end of the interaction (7 in Table 2). A fourth feeling is due to social interaction, where Sally persuades Harry that looking for prices and availability is *not a good* place to start (note the negative valence here). The fifth feeling follows reflection on the whole UX: this feeling constitutes the envisaged 'happy ending' ("Feels great, all well planned"). However, as the web site interaction does not complete the service consumption, the interaction actually ends with positive feelings about the forthcoming van hire.

Kansei Engineering focuses on feelings during product encounters, perhaps indirectly via advertising. It tends to assume that consumer perceptions remain stably associated with product attributes, and ignores feelings that have different origins, such as Sally's feelings about browsing tactics, and feelings about the quality of the interaction and its consequences for the actual van hire. Such feelings are neither static nor stable. Both the content and the strength of feelings can change beyond the initial encounter or experience. Tractinsky *et al.* [36] showed how initial perceptions of beauty and usability could change as a result of interaction. Hassenzahl and Sandweg [22] showed how strength of feelings diminishes from initial reporting during interaction through subsequent closure points during and after the UX.

UEFs can thus place feelings in context, showing when and why they are expected to arise. They support the meta-principle of *expressivity* here, as well as *receptiveness*, through providing opportunities for project teams to discuss their shared expectations for UXs with their designs. However, UEFs provide little support for the meta-principle of *credibility* beyond exposing issues and identifying research questions for user studies and evaluations. UEFs are a design representation, not a scientific one.

This points to an alternative answer to the implicit question in the title of this paper. Feelings and impressions matter in Interaction Design because we do *not* have strong theories of how they operate. What matters is thus, not just how we express UXs using representations such as UEFs, to expose designers' expectations as triggers for discussion, but also how we can know whether feelings will form as expected and thereafter orient and reassure users.

An advantage of Newell, Shaw and Simon's *General Problem Solver* [29] and the whole paradigm of Cognitive Modelling that it spawned, is its theoretical bases in logic and discrete mathematics. This allows computational models to generate predictions of user behaviour that can then be empirically tested. Progress has been admittedly slow over half a century, but there have been successes, albeit local and limited. In contrast, we are only just beginning to start to reason about the detailed origins and impacts of feelings during user interactions. UEFs have value in letting designers explore this space informally, based on their intuitions and experience, without having to wait for the science to develop that could increase credibility in UEF authoring and analyses.

An Extended UEF Format

As a design resource, UEFs are meant to be adapted and appropriated. When used in live design contexts, ease and speed of use will be very important. When used in research contexts, more elaborate formats can be used. Figure 4 shows an extended format developed during a research visit to Microsoft Research Cambridge. It shows several abstract scenarios for reliving (shared) experiences with an envisaged Family Archive system [15]. Colour coded arrows, with annotations in the footer of the table, indicate the narrative structure of several potential UXs, using common column types and shared content. The bottoms of some columns include relevant design elements. This is to allow the influence of qualities (and related materials) to be checked against feelings and beliefs, and the role of features against beliefs and user and system actions. The design elements to be added at the bottom of UX columns can be identified from the corresponding worth map, where there will be associations between UX elements and specific features and qualities. Note that Table 2 does not include either of the associated feelings for the UX from Figure 1. This oversight is picked up through the use of a *Worth Delivery Scenario* in the next section.

The extended format adds a header and footer to the column structure used in Table 2. The header gathers all the worthwhile outcomes that could potentially be a 'happy ending' for a UX. The header can also be used to associate the worthwhile outcomes with specific stakeholders, since the worth of any outcome is relative to the beneficiary.

Stakeholder associations support the meta-principle of *inclusiveness*, and let UX elements in worth maps be

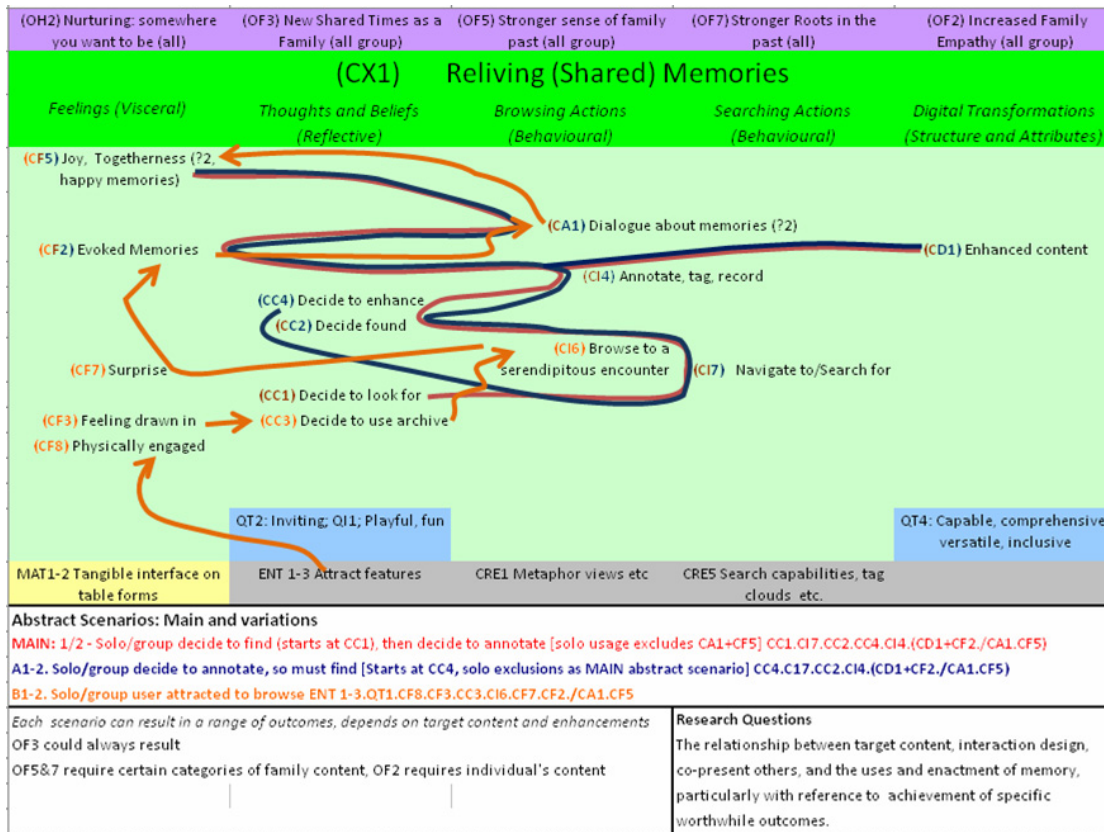


figure 4. Extended UEF format [15]

annotated with corresponding stakeholder related symbols, such as a traffic light or graphical scale indicating stakeholder impact in terms of the degree and valence (positive/negative worth) of interaction outcomes. This extends worth maps to covering the connections between beneficiaries and ends, and not just design means and ends.

Connections between evaluations and both means (costs) and ends (benefits) can also be made by relating worth map elements to measurement and/or inspection strategies (Element Measurement Strategies: EMS, [12]).

This illustrates the coherence and synergies that arise between design and evaluation approaches when guided by a WCD framework with specific craft-axiological constraints and meta-principles that guide *designing as connecting*. Extended UEFs and EMSs expand the connections that can be represented by, or indexed via, worth maps. This improves support for *expressivity*, including a worth map's ability to express *committedness*, that is, the extent of a project team's coverage and confidence in their design choices across all four choice categories of means, ends, beneficiaries, evaluations, and across the multiple connections between these.

Figure 4's alternative format also uses extensive footers to relate feelings to qualities and beliefs to features, and to state the preconditions for a range of narrative arrows that may overlay a single UEF. There are colour coded arrows in Figure 4, each covering two variations). The footer also notes the conditions under which different worthwhile outcomes would arise. Lastly, UEF footers can be used to keep track of issues and research questions that require attention during evaluations or in further user research.

Figure 4 has been included to stress the exploratory, open and embryonic nature of UEFs and related WCD resources and integrating approaches. For resources that support approaches, any expectation of a method or technique is misplaced. Algorithmic guidance on use

of WCD approaches is neither intended nor planned. Design is a creative activity that cannot be programmed through the use of rigid methodologies. Instead, project teams must develop the expertise that improves their judgement, tactics and fluency when choosing, combining and adapting approaches. However, for approaches within a WCD framework, project teams do benefit from the synergies that arising from its six guiding meta-principles. As one last example in this paper, a third WCD approach will be briefly introduced to show how concrete envisionment scenarios can be used to improve the credibility of abstract scenario narratives over UEFs.

Worth Delivery Scenarios

The abstract scenarios represented by arrows in UEFs can be further tested for credibility through the use of *Worth Delivery Scenarios* (WoDS), a third WCD approach covered in this paper. A WoDS is an envisionment scenario that sets out how a project team envisages that a design will be used. A WoDS focuses on the outcome of a scenario, and illustrates how a UX can build up via system use into a happy ending. Figure 5 shows a worth delivery scenario for the narrative arrow over Table 2.

The paragraph numbers in Figure 5 correspond to the numbers in Table 2. Little of the structure of Paragraphs 4 and 5 is reflected in Table 2, as indicated by the dashed horizontal lines that indicate missing steps.

WoDSs can, and should, be developed in parallel with UEFs, selecting specific abstract scenarios for detailed consideration. It should be clear from the extent of detail in Figure 5 (just over 1000 words), when

compared to Table 2, that WoDS authoring is more laborious than drawing abstract scenario arrows over UEFs. Thus a range of abstract scenarios can be expressed far more quickly than a single concrete WoDS corresponding to one of them. WoDS should thus be selectively developed to explore and resolve issues that arise for specific abstract scenarios.

For example, the absence in the feelings column of Table 2 of the worth map qualities "complete, checkable, thorough" and "helpful, considerate" from Figure 1 has already been noted. The use of the bottom of columns in Figure 4 to keep track of relevant materials, features and qualities should help to avoid such oversights when constructing UEFs and mapping out abstract scenarios. Both missing qualities are explicit in Paragraph 5 (both *italicised*: "*that's so helpful*" and "*details are so complete and thorough, and laid out in a format that makes them easy to check*"). With these and other detail in place, the UEF could be completed by adding the missing steps, ensuring that the role of specific design qualities from a worth map is made clear in a feelings column.

1. Sally saw a classified advert in the Carlisle paper and agreed to buy a *chaise longue* after visiting the owner to have a look and check its measurements (206 x 107 x 84cm,). She and her husband Harry now need to go and pay for and collect it, so they visit www.lovelyvan.com, the web site of a national van hire franchise. They have seen a press campaign for the company, and friends in London have used it and recommended it.
2. Sally lets Harry drive their PC. He finds a prices and availability link, but Sally asks him to check depot locations. There's no point in checking on prices and availability if the nearest depot isn't close enough. There's a clear area on the home page for finding your nearest depot. Harry types in their post code. A map appears in the large blank space below showing nearby depot locations with an information list below. Sally points to the nearest depot on the ring road. Harry clicks on it. The map changes to a local one for the depot, with address and phone details, and driving directions.
3. "Cool!" exclaims Harry (there's a cute animation as the map and info change). Another animated transition places a circle of vans in the blank area to the left. Next to each van there's an example load and below that, there's the van's load space dimensions. Sally immediately spots the van with a settee next to it. "That should do" she says. "Hang on," says Harry "Let's check the small print. OK, load space dimensions 240 long by 170 wide by 140cm high. Something 206 x 107 x 84cm will fit in easily, and there'll be enough room down one side to manoeuvre it from inside the van. So, we want a medium panel van".
4. Harry clicks on an obvious red "Book Me" button over the right edge of the van photo (no fancy animations this time). The other vans disappear and a calendar appears in between the medium panel van and the depot details. It clearly indicates that there are medium panel vans available for the coming weekend. Below the calendar is a clear informative statement on hire periods, prices and depot opening times. Vans can be hired for up to 24 hours, or for short four hour hires. The local depot is open from 8AM to 8PM over the weekend. Harry notices a 'hire planner' button below the information and moves the mouse to click it. "Hang on" says Sally, let's see how much it is first." "I can see," says Harry "it will be £44 for four hours". "The chaise longue was only £100" said Sally "that hardly seems worth it". "A new one's over £500," said Harry "and you said it was as good as new. I can take some things to the recycling centre on my way back". "In four hours?" asked Sally. "Maybe not, let's see" said Harry and he clicks on a chunky 'hire planner' button. A simple spin box appears with 2 in it, labelled 'Number of drops/pick ups'. Harry clicks this up to 3: "let's see, there, here, recycling, yes, that's 3". He clicks on OK and text boxes pop up one by one to the right of the spin box. At either end is the depot's post code in a non-editable text box, with the OK button moved to the right as well, but disabled. "That's smart" says Harry "I just need to fill in the seller and recycling centre post codes and ours". He sees a link to UK post code look up, clicks on it. A web-site opens in a new window and Harry gets the two post codes that he needs
5. Harry types in each post code into a blank text box, and presses the OK button once it is enabled. Three more spin boxes appear below the post code ones labelled 'time needed at each drop off/pick up' with default editable times of 20 minutes in each. There's an OK button at the end again, and Harry presses it: "If we're quick, 20 at each will be enough". A summary of the route comes up 'From the van depot to ... From ... to your location. From your location to ... to the 12van depot. It's all clearly laid out, with a time estimate for each leg for the date and time, and a total time based on these legs and the time at each drop off/pick up. Below this is a very obvious clear statement that while lovelyvan have done their best they can to be accurate, they cannot guarantee time estimates. Sally is really impressed "*that's so helpful*" she cries out. The total estimated time is three hours. "That's enough leeway for us" says Harry "especially if we have everything clear for getting the chaise longue in and the recycling stuff is stacked up ready to go". Harry selects a date and a time period, and navigates to the booking details and payment page, where Sally helps him with credit card and checking all details, which she does quickly as *the details are so complete and thorough, and laid out in a format that makes them easy to check*. Harry saves and prints the booking confirmation page.
6. Within minutes Harry has an email from lovelyvan. It's a well laid out html message with a link to an on-line pdf as an alternative layout. Harry follows the link to the pdf out of curiosity. "That looks very smart" says Sally. The document contains details of the hire, the depot and directions to it, the documents that drivers need to bring, instructions on what to do at the depot, time estimates for these activities, and a map with the route between drop offs. There's legal information at the end, but this is clear and well set out, and written in a reassuringly straightforward tone. Harry prints the pdf off, staples it, and pins it to the cork board near the PC. The print out even looks good when pinned up.
7. "I'm really looking forward to getting the chaise longue now" said Sally. "I'll be glad to get the stuff to the recycling too" said Harry "really easy".

figure 5. Worth Delivery Scenario for Good Plan UX

One reviewer has recently commented how a WoDS can read like an advert. Intended as a rebuke, I actually take this as a complement. The WCD framework has adapted some approaches from advertising and marketing, moving their use from late in development at release to manufacturing and product launch to much earlier, to the 'fuzzy front end' of design. While advertising and marketing can and do misrepresent product benefits, this is not possible during the fuzzy front end of design, since there is not yet any product or service to misrepresent. Instead, a project team can express their hopes through worth maps, UEFs and WoDSs. In so doing, they can set themselves very demanding design challenges that can have clear and credible tests through the use of EMSs for evaluations [12].

Any false or unachievable hopes on the part of a project team will be rapidly disabused during evaluations, inspections and critiques. The language and content of Figure 5 is thus appropriate, and we should not be distracted by feelings about the integrity of some advertising and marketing. Having told stories about rich and satisfying UXs with happy endings, project teams set themselves the demanding challenges of delivering them.

While scientific or engineering approaches (e.g., Kansei) can provide some support for the meta-principles of receptiveness, credibility and improvability, currently much must depend on the capabilities of a project team. However, the hope is that the WCD framework of approaches does open up new possibilities for project teams, letting them develop new skills and perspectives, and improving the structure of their experience of designing, helping them to learn

more quickly and deeply, and thus approach future design challenges with increased capability and competence.

Conclusions

Worth Maps, UEFs and WoDSs take Interaction Design beyond the tasks of first wave HCI, and expand the usage contexts of second wave HCI by identifying how a project team believes when and why feelings and impressions will matter in their envisaged interactions. They also take affective product design beyond the static first impressions of Kansei Engineering into dynamic evolving UXs, where the value of a feeling lies, not only in how it draws attention to important features and qualities and triggers user evaluations, but also in it can 'fuel' interaction through cumulative impacts on users' confidence, trust, enjoyment and engagement. Such value is inherently dynamic, and often transient. It is thus important to place the feelings and impressions of UXs in the wider context of achieved worth.

Recalling Oatley, Keltner and Jenkins's opening position on emotions as "multi-component responses to challenges or opportunities that are important to an individual's goals, particularly social ones" [30, p.29], UEFs support the required multi-component expression and analyses within the context of a user's goals, including social ones. However, such goals should not be conceived as the single dominant task goal of Newman, Shaw and Simon [29], and their apostles in cognitive modelling [e.g., 5], but as multiple concurrent overlapping goals, all of which may need to be attended to at once, some driving interaction onto specific ends, others driving it away from potentially adverse outcomes. Feelings and impressions matter because

throughout interaction they can guide users' attention and evaluations. Our experience as experience designers remains limited however. We are still pioneers in moving beyond the static perceptions (as studied in Kansei Engineering) to the dynamic orientations and evaluations of interactive user experiences. Design and evaluation representations are a key resource here, which can only be developed and evolve through use. It is thus only through extensive future uses of an evolving WCD framework that the worth of WCD approaches can be credibly demonstrated. Such uses have to be bold and confident, proceeding in the face of uncertainties over how resources for design and evaluation approaches need to be chosen, combined, adapted and configured for specific projects. There are no guarantees here, only opportunities. Hopefully, the WCD approaches presented above and elsewhere already have sufficient apparent worth to warrant exploratory use by innovative project teams. While initial experiences are not wholly positive [14, 15], they are encouraging.

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