

Aesthetics and Experience-Centered Design

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The aesthetics of human-computer interaction and interaction design are conceptualized in terms of a pragmatic account of human experience. We elaborate this account through a framework for aesthetic experience built around three themes: (1) a holistic approach wherein the person with feelings, emotions, and thoughts is the focus of design; (2) a constructivist stance in which self is seen as continuously engaged and constituted in making sense of experience; and (3) a dialogical ontology in which self, others, and technology are constructed as multiple centers of value. We use this framework to critically reflect on research into the aesthetics of interaction and to suggest sensibilities for designing aesthetic interaction. Finally, a digital jewellery case study is described to demonstrate a design approach that is open to the perspectives presented in the framework and to consider how the framework and sensibilities are reflected in engagement with participants and approach to design.

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1. INTRODUCTION

In their paper “Aesthetic Interaction,” Graves Petersen et al. [2004] point to a growing interest in the aesthetics of interactive systems design. They suggest that this is a response to the need for alternative frames of reference in interactive systems design and alternative ways of understanding the relationships and interactions between humans and new digital technologies. Leaning on the pragmatist aesthetics of Dewey [1934] and Shusterman [2000], Graves Petersen et al. [2004] develop a framework for understanding aesthetics as an additional complementary perspective on user-centered design. Following Shusterman, for example, they make a distinction between analytical and pragmatic aesthetics. Broadly speaking, an analytical approach to aesthetics focuses on the artifact and the value of its perceivable attributes independent of any socio-historical context, and independent of the viewer or user. This kind of approach, Petersen et al. [2004] point out, is common in design approaches which emphasize appearance, look, and feel, and the idea that interfaces can be designed to be seductive and alluring irrespective of their context of use, culture, history, or user.

In contrast, pragmatism sees aesthetics as a particular kind of experience that emerges in the interplay between user, context, culture, and history, and should not be seen exclusively as a feature of either the artifact or viewer. Rather, it emerges in the construction of relations between artifact and viewer, subject and object, user and tool. Pragmatism also regards aesthetic experience as something that is not limited to the theater or gallery. While these latter institutionalize and frame objects as works of art and therefore signal the need for an aesthetic appreciation, they are neither necessary nor sufficient for aesthetic experience. On the contrary, aesthetic experience can be the stuff of our everyday lives as lived and felt. But while aesthetic experience is continuous with the everyday of our felt lives, it also has a special quality. Wright and McCarthy [2004] capture this special quality thus:

In aesthetic experience, the lively integration of means and ends, meaning and movement, involving all our sensory and intellectual faculties is emotionally satisfying and fulfilling. Each act relates meaningfully to the total action and is felt by the experienter to have a unity or a wholeness that is fulfilling [p. 58].

The emphasis on felt life is important in the pragmatic approach. Shusterman [2000] argues that the work of art and design is to give expression in an integrated way to both bodily and intellectual aspects of experience. Similarly, Dewey [1934] argues that sensation and emotion make the cement that holds experience together, and that values relate to human needs, fears, desires, hopes, and expectations through which we have the potential to be surprised, provoked, and transformed. In short then, the particular quality that marks out aesthetic experience is that it is creative, enlivening, and expressive, and involves the senses and values in inclusive and fulfilling activity that is considered worth engaging in for its own sake.

In their application of pragmatist aesthetics, Graves Petersen et al. [2004] focus on using it as way of conceptualizing embodied interaction, gestural input, emotional expression, and tangible interfaces that are playful and

serendipitous. By extending Bødker and Kammersgaard's [1984] four-element model to include aesthetics as a perspective on interaction, they offer two main points that distinguish the aesthetic perspective:

First aesthetic interaction aims for creating involvement, experience, surprise and serendipity in interaction when using interactive systems . . . Second, aesthetic interaction promotes bodily experiences as well as complex symbolic representations when interacting with systems [Graves Petersen et al. 2004, p. 274].

We agree with Graves Petersen et al. [2004] in this regard and have also shown that pragmatist aesthetics provides a firm foundation from which to explore concepts such as playfulness, surprise and enchantment [McCarthy and Wright 2003; McCarthy et al. 2006] and to think about the body as a site of interaction [Wallace and Dearden 2004]. But we also feel that the implications of this approach go deeper into HCI theory and practice than just an attention to new modes of interaction and new design ideals. In particular, a pragmatist aesthetic allows us to critically reflect on interaction design as a practice. It also facilitates the development of new tools and techniques, and new ways of understanding design processes focussed on human experience and the aesthetics of interaction.

In the next section, we offer an account of experience and interaction that we hope will productively extend the Petersen et al. [2004] analysis. Our framework has been published elsewhere [Wright and McCarthy 2004; McCarthy et al. 2005; Wallace and Dearden 2004] but we will summarize it here in order to lay the foundations for the third section in which we describe a case study wherein the design approach and practices are responsive to the perspective presented in the framework. The case study, which involves the creation of digital jewelry, places felt life, sense-making, and values at the center of design processes and practices.

2. DIGITAL TECHNOLOGIES AND USER EXPERIENCE

Etymologically, “experience” stands for an orientation toward life as lived and felt in all its particulars. It tries to accommodate both the intensity of a moment of awe and the journey that is a lifetime. These origins suggest the aesthetic potential in all experience. Dewey describes experience as including:

“*[W]hat* men do and suffer, *what* they strive for, love, believe and endure, and also *how* men act and are acted upon, the ways in which they do and suffer, desire and enjoy, see, believe, imagine—in short, processes of experiencing. . . . It is ‘double barrelled’ in that it recognizes in its primary integrity no division between act and material, subject and object, but contains them both in an unanalyzed totality [Dewey 1925, pp. 10, 11].

In emphasizing the unanalyzed totality of act and material in the kind of involved “doing” that he describes, Dewey plays up the aesthetic aspect of experience. In fact, part of his agenda in promoting the importance of experience in the early days of human and social sciences was to ensure an orientation to life as lived by whole beings involved in their worlds, which was for him an inevitably aesthetic orientation. Drawing on Dewey, our account of aesthetic

experience for use in understanding people's interactions and relations with technology [McCarthy and Wright 2004] can be characterized by three themes, described as follows.

- A holistic approach* to experience wherein the intellectual, sensual, and emotional stand as equal partners in experience.
- Continuous engagement and sense-making* wherein the self is always already engaged in experience and brings to each situation a history of personal and cultural meanings and anticipated futures that complete the experience through acts of sense-making.
- A relational or dialogical approach* wherein self, object, and setting are actively constructed as multiple centers of value with multiple perspectives and voices and where an action, utterance, or thing is designed and produced but can never be finalized since the experience of it is always completed in dialog with those other centers of value.

We expand on each of these themes next.

2.1 A Holistic Approach

Many approaches recognize the need to consider not only the cognitive, intellectual, or rational, but also the emotional and sensual as important aspects of our experience. Graves Petersen et al. [2004] talk of mind *and* body. Dourish [2001] uses the term *embodied action* to capture the simultaneously physical and social site of interaction. Norman [2002], following Boorstin [1990], identifies visceral, behavioral, and reflective levels of design. Pragmatism focuses on the interplay of these constituents of the totality of a person acting, sensing, thinking, feeling, and meaning making in a setting, including his/her perception and sensation of his/her own actions. Seeing experience as the dynamic inter-relationship between people and environment, or as the continually changing texture of relationships, effectively focuses enquiry on person and environment as a whole, or, as Dewey put it, as “an unanalyzed totality” [Dewey 1925]. We have tried to capture this holism by conceptualizing experience as a braid made up of four intertwining threads: the sensual, the emotional, the compositional, and the spatio-temporal.

2.1.1 The Sensual Thread. The sensual thread of experience is concerned with our sensory, bodily engagement with a situation, which orients us to the concrete, palpable, and visceral character of experience, the things that are grasped prereflectively, for example, the look and feel of a mobile phone, the atmosphere of dread and menace at the start of a shoot ‘em-up game, and the sense of warmth and welcome when we walk into a friend’s house on a wintry day. Attention to the sensual thread reminds us that we are embodied in the world through our senses. Aesthetic experience emerges out of the engagement of the whole embodied person in a situation.

2.1.2 The Emotional Thread. The emotional thread refers to judgments that ascribe to other people and things an importance with respect to our (or their) needs and desires. For example, our own frustration, desire, anger, joy, or

satisfaction is always directed at another person or thing. We can reflect on our own emotions but we can also relate to other people's emotions. Empathizing with a character in a movie is an obvious example, but we might also empathize with the artist or designer who creates an artifact even though that person is not materially present in the situation.

Making a distinction between the sensual and emotional threads in an experience serves to highlight the interplay between them. We can, for example, gain a sense of satisfaction or achievement through the exercise of control over sensations such as attraction, fear, or anxiety. Although I might get an immediate thrill from buying the most beautiful mobile phone in the shop, it may cut against my commitment to not being seduced by surface features and advertising. My decision not to buy the most beautiful phone and instead to buy a plainer one that is half the price but just as good may leave me with a strong feeling of self-satisfaction. Here the sensual and emotional threads interact to shape a satisfactory outcome to the experience.

2.1.3 *The Spatio-Temporal Thread.* Experience is always located in a time and place. Space and time pervade our language of experience. We talk about "needing space" to settle an emotional conflict and of "giving people time." In making sense of the spatio-temporal aspect of an experience we might distinguish between public and private space, we may recognize comfort zones and boundaries between self and other, or between present and future. Such constructions affect experiential outcomes such as willingness to linger or to revisit places or our willingness to engage in exchange of information, services, or goods. The humanist geographer Tuan [1977] distinguishes space from place by reference to personal and shared meanings. He describes how distance and direction are defined in relation to the body and he considers the ways in which people form emotional and sensual attachments to home, neighborhood, and nation. The spatio-temporal thread reminds us that experiences are particular. They relate to a particular person in a particular situation at a particular time. No two experiences are identical. Seeing the same movie in the same cinema for a second time is a different experience.

2.1.4 *The Compositional Thread.* The compositional thread is concerned with the narrative structure of an experience, how we make sense of the relationships between the parts and the wholes of an encounter. In an unfolding interaction it refers to "the who," "the what," and "the how," of the experience, what might happen, what could happen, and what does happen, the consequences and causes. Control and agency are important aspects to the compositional thread. In Internet shopping, the choices that are laid out for us can lead us in a coherent way through "the shop" or can lead us down blind alleys. We may or may not experience a sense of control over events, depending on how well the site is designed. In an aesthetic experience the compositional thread has a particular sense of unity in which the parts come together to give a sense of cumulation in which one part shapes and is shaped by the meanings of other parts, tensions emerge and are resolved, and there is a sense of culmination or consummation that gives unity to the whole.

2.2 Continuous Engagement and Sense Making

Experience is constituted by continuous engagement with the world through acts of sense-making at many levels. It is continuous in that we can never be outside of experience, and active in that it is an engagement of a concerned, feeling, self acting with and through materials and tools. Meaning is constructed out of dynamic interplay between the compositional, sensual, emotional, and spatio-temporal threads. It is constituted by experiences with particular qualities, be they satisfying, enchanting, disappointing, or frustrating. We have found it helpful to think of sense-making in terms of six processes.

2.2.1 *Anticipating.* When we encounter a situation, our experience is always shaped by what has gone before. For example, when experiencing a well-known brand online for the first time, we do not come unprejudiced to the experience. On the basis of our sense of that brand offline, we bring with us all sorts of expectations, possibilities, and ways of making sense of the encounter. In anticipation, we may be apprehensive or excited. We may expect the experience to offer certain possibilities for action or outcome and it may raise questions to be resolved. We will also anticipate the temporal and spatial character of the experience. Anticipation is not *just* prior to an encounter, rather it continues into the encounter and is continually revised during the encounter. The relation between our continually revised anticipation and the actuality of the encounter shapes the quality of that experience. The same encounter can be pleasantly surprising or disappointing, depending on our expectations, and different expectations give different shades of meaning to the encounter. We talk about adjusting our expectations to avoid disappointment.

2.2.2 *Connecting.* Following Shusterman [2000], we make a distinction between the immediate, prelinguistic sense of a situation and our linguistically mediated reflection upon it. *Connecting* is our term for this immediate sense of a situation. In the moment of encounter, the material components impact us in a nonreflective way and generate a prelinguistic response. For example, when we walk into a room or enter a Web site we may get an immediate feeling of calmness or tension. This has been referred to as “the emotional climate,” but it is more visceral and sensory than that. This immediate prereflective engagement shapes how we later come to interpret what is going on.

2.2.3 *Interpreting.* By *interpreting*, we mean the process of finding narrative in the encounter, the agents and action possibilities, what has happened and what is likely to happen and how this relates to our desires, hopes, and fears and our previous experiences. We may sense the thrill of excitement or the anxiety of not knowing how to proceed. On the basis of our anticipation we may feel frustration or disappointment at thwarted expectations, or we may regret being in this situation and have a desire to remove ourselves from it. On the basis of our interpretation falling short of our anticipation we may reflect on our expectations and alter them to be more in line with the new situation.

2.2.4 *Reflecting.* As well as interpreting the narrative structure of an encounter, we may also make judgements about the experience as it unfolds and

place value on it. Through reflection on the unfolding experience we judge that no progress is being made. We may come to this conclusion because we sense that we are bored or anxious, or just because we cannot make any narrative sense of the encounter. In addition to reflecting in an experience, we also reflect on an experience after it has run its course. This often takes the form of an inner dialog with oneself. It is a form of inner recounting that takes us beyond the immediate experience to consider it in the context of other experiences.

2.2.5 *Recounting.* Like reflecting, recounting takes us beyond the immediate experience to consider it in the context of other people's experiences. It is where the personal, social, and cultural meet. It can take many forms including speaking and writing. In preparation for recounting an experience to others, we edit it, highlighting points of relevance to the particular others who are the subject of our recounting. When we put the "experience into circulation" [Turner 1986], we savor it again, and also judge the response of others, in terms of what it tells us about them and what they have learned about us. In this way we find new possibilities and new meanings in the experience.

2.2.6 *Appropriating.* A key part of sense-making is relating an experience to previous and future experiences. In appropriating an experience we make it our own. We relate it to our sense of self, our personal history, and our hoped-for future. We may change our sense of self as a consequence of the experience, or we may simply see this experience as "just another one of those." After our first experience of online grocery shopping, we may be concerned about how we reconcile online shopping there with our commitment to the corner shop. We may be concerned about what our neighbors will think when the grocery van turns up and what this is saying about us to others. Likewise, living with a mobile phone may begin as an experience of enchanting new possibilities of always being in touch with loved ones, but it might also become yet another concession to an undesirable future in which the distinction between work and home is even more blurred.

3. A DIALOGICAL VIEW OF EXPERIENCE

A fundamental pragmatist premise that emerges from continuous engagement is that making sense of an encounter is as much about what the person brings to the experience as it is about what s(he) encounters there. Take the everyday experience of watching a movie. A person watching a movie for a second time may have different feelings about it and understand it differently the second time. Moreover, two people's experiences of the same movie will have some commonalities but there will also be differences because they bring different experiences to the movie. This involves not only different experiences of past films, but also different experiences of the day they have just had. For example, the quality of one person's felt experience of the film after a bad day in the office or in anticipation of a difficult day tomorrow may be entirely different to that of another person's after a relaxing day at home. Note how an expectation of a future experience intrudes into the present one. But how we experience the movie isn't only about what we bring to it. The movie also brings something to

us. It may temporarily dispel our troubles or allow us see them in a different light. We can be totally engrossed by the narrative and spectacle, and we may empathize with the characters. The movie also gives us a new experience, a new story that we can reflect on and recount to others. As noted before, when we recount our experiences to others (or when other people's experiences are recounted to us), the connection between the individual, the social, and the cultural is made. This connection in turn affects how we reflect on and interpret our experiences. It changes the sense we make of them. It allows us to see how other people might be expecting us to experience the movie, which may or may not be how we actually experience it.

Our movie example highlights the dialogical character of aesthetic experience, in which self and others, technology and setting, are creatively constructed as multiple centers of value, emotions, and feelings and the experience is completed simultaneously by self and others, not determined solely by one or the other. Consequently, a dialogical relation involves at least two centers of meaning or two consciousnesses. In a dialogical account, the meaning of an action, utterance, expression, or artifact is open because its interaction with the other makes its meaning contingent. For example, an utterance, once uttered, remains open to parody, sarcasm, agreement, disagreement, or disgust from another. The other brings something to an interaction and responds to the act, utterance, or artifact in a way that is informed by his/her own unique position in the world. Since each other is unique, the meaning of the act utterance or artifact is multiperspectival, open to change and ultimately unfinalizable.

However, a multiperspectival understanding of meaning does not imply that a dialog is a "dialogue of the deaf" with neither side comprehending the terms of reference of the other. On the contrary, because we can see what is uniquely our contribution, what is uniquely that of the other, and what is shared between us, we can make sense of the other in relation to ourselves and vice versa. Being able simultaneously to see something from one's own perspective and, at least to some extent, from that of another is an essential foundation for dialog. In the previous movie example, if someone tells us that a movie is great and that we'll enjoy it, when we don't, we learn something about the other person, about how they see us, about ourselves, about how we see them, and about the movie. This is the essence of a dialogical relation based on centers of value.

We can see how with a dialogical lens, recounting experience becomes not simply an act of reporting but rather an act of coconstruction of meaning. This dialogic understanding of self-other relations is foundational to a proper understanding of co-experience [Battarbee and Koskinen 2005]: the ability to not only share experiences but to coconstruct them. A dialogical lens is also valuable in understanding how a shared culture shapes all of our sense-making. Geertz [1973] talks of culture as commonsense, literally ways of understanding the world that are not only shared but also known to be shared. Such common sense is one of the resources we bring to an encounter. Our personal histories, values, desires, and sensibilities are others. Throughout our life we are enculturated into various literacies. Film literacy, knowing how film is intended

to be read in our culture, is one example. So when we watch that Hollywood movie, our film literacy allows us to imagine what the filmmaker intended. But our experience of the film does not stop there. While we can use this literacy to guess how the maker intended us to read the film, and indeed how others do read it, we ourselves may find the film clichéd, formulaic, or condescending because of our personal experiences with these movies and the way we have appropriated the genre. The gap between culturally received ways of making sense of a situation and how we choose to appropriate it is a dialogical one, a relation between self and community. Our commonsense understanding and our personal response coexist and their relation helps define our experience of the film.

The framework outlined in this section provides a language and a set of conceptual resources for analyzing human experience with technology as primarily aesthetic, founded in the interplay between language, sensation, and emotion, and constituted by processes of sense-making. Our position is that it gives a rich view of experience that can be used in a variety of ways in understanding people's relations with technology, and in both understanding and influencing interaction design. However, it would be a mistake to understand it as something like an engineering specification or a checklist of aspects of experience to be looked after in design, and it would be a mistake to use it in such mechanistic ways. McCarthy and Wright [2004] used this conceptual approach to analyze experience of a range of technologies, as well as experiences ranging from procedure following in an aircraft cockpit to ambulance dispatch and Internet shopping. Wallace and Dearden have also used the framework to analyze, explore, and critique wearable technology and contemporary jewelry [Wallace and Dearden 2005]. But the pragmatist foundations of the framework also offer potential to explore and appropriate new approaches to the practice of interaction design and related construals of the nature of relationships between designers, participants, users/clients, and artifacts, placing a rich conceptualization of experience at the center of the process of design and making. This is described in the next section.

4. PRAGMATIST AESTHETICS IN EXPERIENCE-CENTERED DESIGN

As we have argued earlier, experience is a rich concept and there are many varieties of experience for which one might seek to design, including curiosity, frustration, anger, joy, enchantment, and sadness. But, as we have also argued earlier, experience is as much about what individuals bring to the interaction as it is about what the designer leaves there. This means it is not always possible to engineer aesthetic experience, or even to control the user experience in any strong way [Wright and McCarthy 2005]. What designers can do is provide resources through which users structure their experiences. That is not to say that engagement between designer and user is unnecessary. On the contrary, good experience-centered design requires designers to engage with the users and their culture in rich ways in order that they can understand how the user makes sense of technology in his/her life. Empathy is at the heart of this approach to experience-centered design. It is the aesthetic equivalent of the

engineering principle “know thy user” (see also Black [1998], Mattelmäki and Battarbee [2002], Batterbee and Koskinen [2004], and Wright and McCarthy [2008]).

We have explored enchantment as one variety of experience with technology that seems to be central to aesthetic experience [McCarthy et al. 2005; NiChonchúir and McCarthy 2008]. Enchantment relates to experiences such as being charmed and delighted, and carries with it connotations of being bewitched by magic and of being caught up and carried away. Interactive systems designed to enchant should offer the potential for the unexpected, giving the chance of new discoveries and new ways of being and seeing. The greater the opportunity they offer, the greater the *depth* of the experience and the longer enchantment may last.

But how do we confer depth to an experience through design? We cannot engineer enchantment nor does it seem sensible to talk of principles or guidelines for designing enchanting experiences [Sengers et al. 2008]. Such approaches sound too formulaic, too removed from the particulars of felt life. Instead we have argued that it might be useful to think about the kinds of *sensibilities* that underpin an empathic design process. We have used the term “sensibilities” because it points up the sensual and emotional aspects of the relationship between designer, user, and artifact. Sensibilities are embodied in people as ways of knowing, seeing, and acting. They are not external representations or rules to follow blindly. Dotted lines can be drawn between elements of the framework for aesthetic experience described in the previous section and the sensibilities that will be outlined here; dotted because they are not produced by systematically translating elements of the framework into sensibilities but rather result from using the framework to think about designing for enchantment. Briefly, the sensibilities for enchantment involve a design orientation toward the following.

- (1) *The Specific Sensuousness of Each Particular Thing.* Enchantment requires a close and intimate engagement with the particular object at a particular place and time, absorbing its specific appearance, texture, sound, and so on.
- (2) *The Whole Person with Desires, Feelings, and Anxieties.* Enchantment engages the whole intellectual, emotional, and sensual person, acknowledging and recognizing his/her anxieties and aspirations without reducing them.
- (3) *A Sense of Being-in-Play.* Enchantment is playful, engaging with each object as both means and ends, and exploring its qualities and possible descriptions. Jokes and games can be playful in this sense, but the sense of being-in-play that we are describing here also includes the idea of familiar categories and values being challenged, juxtaposed, or seen in a different light. For example, cell phones put into the play the idea of an *intimate* conversation in a *public* place.
- (4) *Paradox, Openness, and Ambiguity.* Enchantment involves paradox and ambiguity, putting “being” in play in an open world. This contributes to creating the depth in a system or object that allows it to contain within it the possibility for complex, layered interpretations even the kind of interpretation, that surprises the person interpreting.

- (5) *The Transformational Character of Experience.* Enchantment is at home with change, transformation, and openness or unfinalizability. Encountering change in what appears to be stable can be enchanting, as can crossings between what we tend to think of as naturally mutually exclusive categories, such as human and machine. As well as providing primary sites for enchantment, transformation is also an outcome of enchantment, with person and object changed by the experience.

Among other things, lines can be drawn from the sensual and spatio-temporal threads to the sensuousness sensibility, from the holistic theme to the sensibility to the whole person, from the dialogical theme's treatment of unfinalizability and openness to the remaining sensibilities. Although it is important to make these links clear here, it is equally important to make clear that they are not in any way strong ties of determining links. The same themes might produce quite different sensibilities in another design context. Our caution here about making strong associations between framework themes and sensibilities is due to wariness about inappropriate generalization from one particular design case to others.

In response to recent debates in HCI about beauty and interaction, Wallace and Press [2004] develop the sensibilities further in the context of analysis of craft practice and digital design and making. They explore the relationship between enchantment, empathy, and intuition by arguing that beauty has a critical role to play in facilitating our experience of digital complexity, but to regard beauty as a "stylistic after-thought" is flawed strategy. Rather, beauty is a form of enchantment (a relation between user/viewer and artifact) and is the key to personally meaningful engagements with digital technology. However, beauty and enchantment cannot be added as a "layer" to the functionality of the digital, rather it has to be at the heart of the process of conception and making:

Beauty, in our view, is not found by design, rather it is discovered through craft, in the fullest sense of the term. Beauty is in the making of it, through engagement with material and process and through craft's sensibility and sensitivities. Craft finds beauty, and design puts that beauty to work [Wallace and Press 2004, p. 4].

Enchantment is a result of an empathic engagement between maker and user and between maker and materials in the process of making, and this is at the heart of what is termed craft practice [Dormer 1997; McCullough 1998]. Craft practice orients us to the particular sensuousness of a thing and its uniqueness (sensibility 1). This offers a great opportunity, when combined with a strong empathic relationship between maker and user for constructing technologies of deep personal significance (sensibility 2). For Wallace and Press [2004], empathy is about relationships with people and also with materials and processes. The aim is to understand experiences of personal significance in people's lives and to present fragments of it back to them. But this process of reflection is mediated by an empathic understanding of materials, and hence it is not a literal reflection. It is a dialogical reflection; experiences of significance to one individual are understood through the eyes and hands of another and returned to them. This mediation creates the possibility for both familiarity and ambiguity

(sensibilities 3 and 4). In so doing, it not only transforms these experiences, but also transforms pre-existing conceptions, both of the digital and of jewelry (sensibility 4).

5. CASE STUDY: DIGITAL JEWELRY AND EXPERIENCE-CENTERED DESIGN

Having described our general approach to experience-centered design and to designing for enchantment in particular, in this section we will describe a case study undertaken by one of us (Wallace) to illustrate one way in which elements of an approach, suggested by the aforesaid framework and sensibilities, can be played out in practice. Wallace is a contemporary jeweler exploring the potential to integrate digital technologies with jewelry through practice-centered research [Wallace 2007]. Her approach marries the connective potentialities of digital technologies with the perspective from contemporary jewelry that the body is something intrinsic to self-identity, valued as a special site for objects and as an emotionally intimate place. As such, Wallace seeks to develop digital jewelry that extends the rich emotional and human-relational contexts of jewelry objects through atypical uses of digital technologies. Moreover, this digital jewelry should also reframe more general current expectations of digital technologies, by presenting a richer characterization of digital potentialities.

We focus in this case study on the design and production of a piece of Wallace's digital jewelry. The form and digital potential of the piece were creative responses to personally meaningful stories, objects, relationships, and events that were shared with Wallace by a participant (Ana).

While technology groups such as Nike, IBM, and IDEO have begun to consider and explore the concept of digital jewelry, the majority of emerging concepts and prototypes privilege, amongst other things, the digital aesthetic over the jewelry aesthetic [Wallace and Dearden 2005]. We argue that if the aim is to engage more fully with the aesthetics of interaction, the concept of "wearable computer" and even computer "user" may be unhelpful ways to frame the design space. "Wearable computer" emphasizes the computer and suggests that the body is simply a convenient location. The expectations of such a thing will rest on existing ideas of computers. Our goal is to make objects that have a meaningful place in people's lives, and if we wish to make things that have such an aesthetic context, then "jewelry" rather than "wearable computer" offers a context upon which we can build. Likewise, the notion of "user" leads to an emphasis throughout the design process on functionality; the user interacts with an object because it enables or carries out a certain function. In contrast, the "wearer" is engaged in a more body-centric and personal relationship with the object. For a contemporary jeweler, the body is (among other things) a symbolic location; the site of self and center for intimate objects that connects the wearer to other experiences and people. A jewelry object may be an extension of the wearer, and wearing jewelry close to or on the body relates the wearer to it in an intimate, sensual, and emotional way. This is often combined with a personal significance or a history associated with the object. This intimate and

constant relationship with the wearer cannot simply be defined in terms of *use* or even *wearability*.

In her practice Wallace engages directly with individuals in order to gain insight into, and inspirational fragments from, their personal histories, biographies, and life experiences. These take the form of narratives about interactions, relationships, places, events, and memories of significance and value. The process involves each individual responding to a set of object-based stimuli that involve action, play, reflection, and imagination in order to answer questions, tell stories, and create images. The approach is similar to the cultural probes work of Gaver et al. [1999] but is also informed by the Bartels and Lindmark Vrijman [2002] KPZ-02 jewellery project. A key feature of Wallace's approach is that the objects are not just a form of response, but are used as resources for conversations between herself and the participants (see also Mattelmäki and Battarbee [2002]). It is a very dialogical process in which she catches a glimpse of someone else's perspective, values, and selfhood. Through this empathic engagement she gains a sense of the felt life of that person. Not only meanings and personal significances emerge out of this encounter, but also aesthetic values and material fragments, including objects that have come to be of importance to an individual.

Through the iterative nature of Wallace's creative practice she seeks to engage with the puzzle presented to her by the materials that emerge from the probe process and her conversations with participants. Wallace connects aspects of these interactions that resonate with her. The process, familiar to many qualitative data analysts (Charmaz [2006], for example) is one of immersion in the materials over time and attention to the nonobvious things as well as the more striking. The immersive process of rereading and relooking through the responses enables an empathic engagement that in turn enables connections and threads of meanings to be made between responses and groupings of materials into themes or shared fragments. Often, these are understandings arising from what she feels she shares with the participants or ways in which she can empathize with them. The process is very dialogical in that Wallace finds some threads that are familiar to her from her own experiences. As the creative response progresses, she might make a book of images that reflect how she feels she relates to the participant's responses. In this way she allows for a tacit response and builds in her own feelings toward them. This may appear to be simply a process of building up an aesthetic vocabulary, but it is much more than this. It is an emotional and empathic response to the participant.

We have previously emphasized the empathic relation between maker and participant. But equally important is the relationship between maker and the emerging artifact. Through an empathic understanding of the expressive potential of the materials (both digital and physical), the emerging artifact can become a medium of expression for the developing idea. Wallace begins to give the ideas a form, both in terms of the physical and interactional aspects of the piece. Intellectually this is a process of learning rather than simply a process of representing. Learning takes place as Wallace develops the idea through making 3D models. These models also offer a focus for talking about the piece



Fig. 1. Blossom.

with peers and team members, where the process involves Wallace justifying the ideas for the piece, which in itself can develop the ideas further. Misunderstandings can also be valuable, revealing new interpretations, the discussion of which can clarify the design concept. During these dialogs and throughout the process, Wallace thinks about the individual for whom she is making, trying to see the piece from their point of view: Would this interaction idea or aesthetic interest enchant or fit with them?

During this process Wallace talks to the participants in a general way about her intention for the piece, but often they will not see it until it is finished, whereupon they will be invited to live with the piece for a period of time. How the participant interprets the objects and how they wear, interact with, and appropriate it is left open to them. During the final stage, the participant is asked to reflect on his/her interpretations, appropriations, and feelings towards the piece, using a range of techniques including photograph-taking, drawing, diary-keeping, and verbal reflection. The process concludes with Wallace discussing these reflections and recountings with the individual to explore further details of the participant's experiences and feelings towards the piece and interaction scope.

5.1 The Blossom Project

Blossom (see Figure 1) is the name of a digital jewelry piece made specifically for a participant in Wallace's research, named Ana (fictional name). Ana is a UK citizen who grew up in the UK but whose family is Greek Cypriot. Blossom is a handworn piece, made from wood, glass, silver, and vintage postage stamps. The piece is not meant to be *worn* in a traditional sense and does not center on ideas of adornment, but is made to be worn by cradling the glass dome within

the cupped hand as a contemplative form of digital jewelry object. This manner of bringing a jewelry object and the body together creates an engagement that is intimate and purposeful: The piece is not something that can be ignored when worn; it is cupped or cradled in the hand and encapsulates a form that can be viewed inside the dome like a world within a snowglobe, a message in a bottle, or something precious within a glass case. The piece has many different tactile qualities and visual aesthetics. These qualities are made to intrigue and they relate particularly to the sensual thread of experience where the bodily engagement reminds us that we are embodied in the world.

The piece was made to embody the idea of connections to human relationships and to place, a feature resembling the status of much jewelry, traditional and contemporary. The form and digital potential of the piece refer to Ana's love of nature, precious relationships with her two grandmothers, and connections to family and family land in Cyprus. These themes emerged from Wallace's conversations with Ana about her responses to the stimulus pack. Ana described her relationships with her grandmothers as *nourishing* and Wallace has attempted to extend this idea into the piece.

The jewelry object resides with Ana in London, and is connected to a rain sensor planted on Ana's family land in Cyprus. At the heart of the jewelry piece is a structure holding vintage Cypriot postage stamps. The stamps date from the years when Ana's grandmothers lived in Cyprus and have been sent on letters from Cyprus to the UK. Printed on the reverse of the stamps is a photograph taken by Ana of a Greek icon, given to her by one of her grandmothers. The authenticity of the stamps is of great importance, partly because of a physical connection that it represented to both geographies. The postage stamps inside the glass dome are initially closed like the petals of a flower. But they are attached to a mechanism which can be actuated when a signal is received from the rain sensor. This happens once the rain sensor on Ana's family land in Cyprus registers a predetermined quantity of rain, which may take months, or even years. When the signal is received the mechanism is activated, slowly opening the postage stamps like petals of a flower blossoming. This would happen only *once*, after which the petals would remain open.

Wallace's hope was that through its form, material, and interaction potential, the object would capture something of the poignancy of what Ana had shared with her and offer a reflection that was meaningful to Ana. In literal terms the jewelry piece may act as a memory trigger to Ana's past relationships and as a connection to a specific place as the events of nature in one geographical location influence the internal physical form of the jewelry object in another. In more abstract terms the piece may symbolize the connection that still exists between Ana and her (now dead) grandmothers and between the countries (UK and Cyprus) that both symbolise home for Ana. The piece makes tangible the influences that one location can have on the other as a way to represent the nourishing influences that both Ana's grandmother and Cypriot culture and place have had on her.

The digital is something that is anticipated over a prolonged and indeterminate period of time. This is both an uncommon mode of interaction for a digital object and also one that is not in the user's control. As such, the digital

spans a prolonged period of time at once both awaiting the digital event and also representing a connection to a rain sensor on family land that displays no physical demonstration for a long period of time, but that nevertheless is digitally *connected*. These aspects, like others we could describe about the piece, offer a multilayered reading of the piece and represent a multilayered engagement with both participant and object by a designer. By considering life as *felt*, Wallace was able to create a digital artifact that attended to the sensual, bodily engagement between wearer and jewelery object, the vital, and in this case nurturing, emotional relationships Ana has with other people, the wide spatio-temporal range of experience that Ana was drawing on to describe what was central in her sense of personal meaningfulness, and the compositional, narrative structure of the parts and wholes that make up these meanings.

By engaging with both Ana and the creative process as a form of dialog Wallace was able to make a digital artifact that remains open for Ana to interpret and that remains part of a dialog. The piece is not totally open; it does reflect aspects of what inspired it, but by avoiding a deterministic casting of functionality or role for the piece it is open enough to give multiple ways to make sense of it. This unfinalizability and ambiguity is a valuable characteristic in the reframing of what is possible to create in digital interactions.

When Ana was presented with the piece, a series of conversations ensued which helped us to understand how Ana made sense of the piece and how this related to Wallace's own expectations and hopes for it. Ana's responses to the piece were complex and a nuanced set of meanings and inter-related issues emerged from the dialog. Here we shall focus on two areas: firstly Ana's feelings about the piece in terms of personal and emotional significance and secondly, her feelings about the integration of digital technologies and jewelery objects.

For Ana, the piece resonated with the idea of planting a family tree. The use of organic materials in the piece also had immediate significance for her, echoing her love of nature. But beyond this immediate and literal connection, Ana's engagement with the piece was rooted in the deeper meanings she attributed to the aesthetics of the interaction. Her main attribution of significance was how these physical qualities and the single blossoming of the piece contributed to a metaphor of the fleeting nature of life and the emotional "rooting" of family land. The following quotes from transcripts of the conversations illustrate this.

I just thought it was very poignant and yeah it was just life affirming in that it was about the sort of preciousness of life for me ... (Ana interview transcript, lines 120–121).

[W]hen it blossomed, it kind of upset me that it was only the once, and I thought 'oh my god!' (laughs) but ... if it wasn't only once then that would defeat the object ... for me anyway ... I mean that was a kind of crucial point for me, when I started blubbing (laughs) when it said it 'only blossoms once' and I was just like 'oh!', 'yeah!' and it, I sort of *got it*, that it was sort of, represented life really and that, erm, you only live it once ... (Ana interview transcript, lines 155–161).

I think you've touched on something (laughs), quite, yeah, big really ... 'planted on family land' ... a kind of permanence to it and a rooting for me ... which links to strong emotional family ties ... (Ana interview transcript, lines 207–214).

[M]y longing really to have somewhere that I can call home and I guess when my house, our old house in *(Cyprus) got sold I felt very uprooted and very insecure in a way ... I think that's kind of what my Mum's house in Cyprus represents now because it's like on family land ... a kind of rooting ... and a kind of permanence ... stability ... (Ana interview transcript, lines 318–321).

As the preceding quotes show, the personal significances of the piece for Ana, relate to her longing for permanence and ideas of the sacredness of emotions. She easily appropriated the idea of the piece into her personal story. She was also comfortable the idea of digital jewellery. She reacted to the single blossoming of the jewellery object in an emotional way and found the transience of the digital functionality to be poignant and necessary.

Ana's response to the integration of the jewellery and digital technology was equally rich and interesting. When talking about Blossom Ana began to describe its "function" and then stated that "function" was not the right term, as it related to a household appliance, which was something very different from the jewellery piece for her.

Function isn't quite the right word because it makes it sound a bit, dunno ... well it's not like a household appliance (laughs) in the sense that it helps you clean the dishes or anything like that ... I suppose its purpose to me is that it reminds you of the smaller things in life and erm, it's like it could help you to just take stock and stop and look at things ... (Ana interview transcript, lines 280–287).

Ana's description suggests that digital devices imply a function based on task and utility for her, rather than something with emotional resonance. She used the phrase "smaller things in life" to denote those that were personally meaningful. The suggestion was that current digital devices lack intimacy and positive emotional significance and that there was a perceived poignancy in the digital jewellery piece, something that she didn't associate with existing digital devices.

5.2 Conclusions about the Blossom Project

Blossom is a design project that had a life, energy, and narrative of its own. That said, the design process was not cut off from the world outside the design project. For example, it was clearly influenced by contemporary discourses on jewellery, the human body, intimacy, and identity. It was also influenced by Wallace's commitment to an understanding of digital jewellery as experience, not just function, and her attention to the details and particulars of experience in her work with participants such as Ana. In attending to these particulars, some aspects of the framework of aesthetic experience and the design sensibilities described proved useful in different ways at different times. Sometimes they suggested particular design decisions and actions. Other times they facilitated the kind of sense-making a designer has to do, in reflecting on the participant and her stories and on the emerging jewellery designed in part as a response to Ana's experiences. Other times again they helped in the intellectual work

of at one stage imagining and at another reflecting on Ana's experience with Blossom. Finally, they helped inform the designer's critical reflective practice through which one project and the practices in it lead to other and perhaps subtly changed practices.

Now, for example, it seems that Blossom involves a playful ambiguity of function. The piece focuses on time, shared places, and the emotional value of these. The digital connection to another place contributes to a metaphor of feelings of closeness to another person and to another locality. It is also sensually rich and resonant in its material features. Through its "one off" blossoming and its link to the family land in Cyprus it also relates to the idea of uniqueness and nonrepeatability. In terms of ongoing design practice this sense of nonrepeatability transforms our way of viewing objects with digital capabilities by emphasizing the fleeting quality of many of our experiences and the lasting quality of many of our feelings for other people. It uses digital technologies to harness the ephemeral characteristics of a flower blossoming, rather than for the more common uses of digital technologies of repeatability and immediacy. Beyond the individual context, aesthetics, fragility, or value of this object, there are more general principles at work here. The piece and conceptual thinking behind it present propositions for developing ideas of the digital that go beyond the development of digital jewelery. Whether we wear jewelery or not, we all know what it means to find our experiences meaningful in a personal way. What this case study highlights is that if we approach the design of the digital by focusing on opportunities for making meaningful interaction and experience, there is the possibility to develop a different texture, pace, and richness to the digital.

6. CONCLUSION

In this article we have argued that a broadening of attention to include the aesthetics of interaction requires a commensurate broadening and deepening of our approach to conceptualizing the user in human-computer interaction. In particular, we have argued that we need to place felt life and human experience at the center of our theorizing and analysis. Like Graves Petersen et al., we have found pragmatist aesthetics particularly suitable to the analysis of the aesthetics of interaction as part of a broader concern with a deep understanding of experience. Pragmatist aesthetics starts with attention to the relation between user and artifact and a recognition of the fact that the user brings as much to the interaction as the designer leaves there. The pragmatist attention to meaning and sense-making as a constructive process, and the acknowledgement that this process concerns not just the cognitive but the sensual and emotional threads of experience situated in time and place, provides a rich foundation for the analysis of human-computer interaction as aesthetic engagement.

But putting aesthetic experience at the center of our theorizing about human-computer interaction is not just about how we analyze and evaluate people's interaction with technology; it affects the way we approach the design and making of digital artifacts. Our digital jewelery work, which has brought together software developers, electronics engineers, and contemporary jewelers, has provided a fertile ground for reflection on the process of interaction design

and the way digital artifacts are framed within traditional HCI practice. The case study we have presented in this article gives an illustration of a crafts-based approach with its emphasis on making as a form of aesthetic engagement with wearer and artifact. Its concern for the relations between materiality, interaction, and personal meaning sits well with pragmatist aesthetics. Empathy between maker and wearer and between maker and materials is highly resonant with a concern for felt life. The design case study shows how beauty emerges as a consequence of the sensibilities toward felt life within the design process, rather than as something that can be added on as an additional layer to the functional artifact. In our case study work, the aim has been to elevate digital artifacts out of the realm of functional “gadget” into the realm of object with personal significance and uniqueness. This has been achieved through empathic engagement between maker and wearer and by the maker interpreting and reflecting personal significances in the form and function of the artifacts. This is just one example of how designers can engage with felt life; it is not the only way.

As we hope our case study illustrates, our approach to aesthetic interaction does not imply that what is needed is some alternative methodology to user-centered design. Rather it suggests a different sensibility towards it, a different way of relating to familiar precepts such as *know the user*, *iterative design*, and *user involvement*. It requires us to see these familiar things in terms of felt life, empathy, and the aesthetics of everyday experience. User needs and requirements are not the focus of our enquiry. Rather the focus is an understanding of individuals, their concerns, desires, aspirations, values, and experiences. The relation between designer and “user” is not an objective one in which the designer stands outside of the user’s situation. Instead, it is one in which the designer and user are in mutually influencing, empathic dialog [Black 1998; Mattelmäki and Battarbee 2003; Wright and McCarthy 2008, 2004].

Prototyping in the broadest sense has always been an important part of user-centered design. In experience-centered approaches, prototyping can serve to give designers some sense of the felt life of the users for whom they are designing. This is the case with the experience prototyping approach of Buchenau and Suri [2000]. In our approach, prototyping gives material form to an idea. It is a form of emotional expression. It serves to put aesthetic experiences into circulation, as an opportunity to recount them and, through this process, change and strengthen its meaning. The voice of the participant is present throughout this process.

If the key to good usability engineering is evaluation, then the key to good aesthetic interaction design is understanding how the user makes sense of the artifact and his/her interactions with it at emotional, sensual, and intellectual levels. This suggests that the focus should be on how an artifact is appropriated into someone’s life and how this is shaped by his/her prior expectations, how his/her activities change to accommodate the technology, and how s(he) changes the technology to assimilate it into his/her world. The emphasis is on meaning in use: how his/her talk about technology changes, possibly even how the artifact ceases to become a topic of conversation is a valuable source of data. One of the implications of this approach is that it takes place in situ and is

orientated towards longer-term processes of change. Various forms of interpretive phenomenological analysis are proving useful empirical techniques in this regard [NíChonchúir and McCarthy 2008; Light 2008]. Others are exploring documentary film making as a form of evaluation [Raijmakers et al. 2006].

A pragmatic approach to aesthetic interaction provides us with a number of valuable tools to help develop a research agenda for the HCI of the new millennium. It provides us with a philosophical framework that does not seek to reduce and to compartmentalize cognition, emotion, and affect; rather, it encourages us to explore the interplay between them. Likewise it does not see aesthetic experience as separate from our everyday experience, but as continuous with it and as emerging from the interaction between subject and object. This makes it easier to conceptualize aesthetics of interaction as an ontological category. Dewey's pragmatics, for example, has influenced thinking and practice in politics, visual arts, literature, and science. For human-computer interaction research in particular, the pragmatic conception of human experience provides a much richer concept of "the human" in human-computer interaction than have traditional human sciences. But pragmatism is a philosophy that extends into a practice and also provides different ways of conceptualizing design and making [Fallman 2003]. Our case study illustrates how a pragmatist understanding of felt life can be used within a process of design and making, both as a way of understanding and talking about this process, but also as a way of seeing within this process that allows designers and makers to put empathy, felt life, and human experience at the center of the design process.

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