

CUT, SLICE, PEAL AND COOK

EXPLORING THE ROLE OF ARTIFACTS IN FOOD INTERACTION DESIGN

NAUSHIN MALIK
INFORMATICS
UMEÅ CENTER FOR GENDER STUDIES
UMEÅ UNIVERSITY
SWEDEN
NAUSHIN.MALIK@INFORMATIK.UMU.SE

ANNA CROON FORS
INFORMATICS
UMEÅ CENTER FOR GENDER STUDIES
UMEÅ UNIVERSITY
SWEDEN
ACROON@INFORMATIK.UMU.SE

ABSTRACT

Digital interactive devices pervade everyday life, introducing new forms and meanings beyond desktop computers. Motivated by design theory and emerging ideas of material agency we regard digital artifacts as a design material and HCI research as an emerging design field. In this paper we employ a methodological approach, *artifact approach*, with the aim to explore material qualities of engagement in digital design. We report on a study of engagement in different cookware. In our study, we identify three principles, *purpose*, *character* and *intention*. These principles support the framing of artifact characteristics as well as the types of engagements that particular artifacts afford. The contribution of our work is a modest attempt to describe how qualities of artifacts can be analyzed beyond user-centered and functional approaches. We conclude the paper by suggesting a tentative framework for artifact analysis of engagement.

INTRODUCTION

As computational technology becomes more and more tangible it pervades everyday life in various forms such as wearable sensors, programmable materials and interactive textiles. Given the complexities tangible

digital materials convey substantial research effort is presently developing in both HCI and other related fields. But as computational technology no longer is constrained to particular types of digital devices, digital materials need to be considered *as a material for design* (Zimmerman et. al 2007, Heekyoung & Stolterman 2011 and Stolterman & Janlert 2014).

Accordingly, it seems as if design oriented approaches are called upon in order to explore how to combine physical and digital qualities, what constitutes compositional qualities, and what potential alternative strategies can be yielded. In our study we have examined artifacts made for cooking food and analyzed how well these artifacts contributes to different kinds of engagement. In this context the notion of artifacts simply mean human-made objects, that is, objects that are imagined, designed, developed and produced by humans.

The artifact approach that we have employed in our study can roughly be understood as a way to develop a repertoire of potential qualities in existing artifacts. We like to think that repertoires like the one's offered by our study expand the scope of design in HCI and make us attend to design things differently (Nelson & Stolterman 2012; Bindern et al. 2011, Haraway 2007, Barad 2003). The artifact approach employed in this paper is as such an approach to establish and frame a number of artifacts and systematically reason and imagine about their properties and qualities. The reason for doing this is thus to develop a repertoire of potential qualities that any new design can be given.

The paper begins with a description of artifact approach where we briefly explains why we think such an approach might be rewarding for HCI in its' emerging design orientation. Thereafter we provide a brief analysis of the concept of engagement, contrasting traditional held views within HCI with features that we find intrinsic to a digital material as design materials. Next, we detail the data and method employed for this particular study, describing what artifacts we have

studied and how we have distinguished particular engagement qualities, their relationships and tradeoffs. We conclude the paper by suggesting a tentative framework for future analyses of engagement through artifacts.

ARTEFACT APPROACH & ANALYSIS

The field of HCI is today already familiar with approaches aimed at exploring the role of artifacts, what they convey, represent and signify in different situations and contexts. But so far, the most dominating view is to regard digital artifacts, as *tools* available to facilitate human skills. Roughly, such a view does not attribute any agency to the tool, but focuses on the tool's capacities to perform the way people want them to. As such agency is placed with users, who craft materials according to their desire and anticipated actions.

The artifact approach and related material knowledge is however quite well established in other design fields such as for instance architecture, art and archeology. In architecture, for instance, analyses and studies of buildings and their intrinsic qualities (shape, walls, windows, doors, lighting etc.) are quite common. Such studies are often conducted in order to enhance the architect's ability to evaluate and judge qualities of form and character (Goldberger 2011). Similarly, the fields of art and archeology also study artifacts based on their physical and functional properties trying to learn about what such properties conveys.

Our motivation for using an artifact approach in this study is based on contemporary developments of physical and digital qualities in everyday life. We think that this development indicates almost unlimited and undefined design potentials. We think that these new complex compositions of physical and digital qualities and characteristics will significantly affect how digital artifacts are designed and experienced. As such we argue that we need to experience and analyze a wide range of artifacts in order to broadening our repertoire and material knowledge in interaction design.

The artifact approach is an approach that is based on the understanding that every artifact is designed with some intention. The intentional characteristic of artifacts is not only important to consider in an actual design process, but can also be studied in order improve the designer's ability to make judgments. By examining previously designed artifacts and queering about the nature of intention it is, according to this approach, possible to dwell upon how certain compositions of properties, material qualities and functions unfolds.

Analyzing artifacts can thus provide us with an alternative approach to evaluate intention, character and purpose in order to develop judgmental abilities. We like to think that we through existing designs can explore and provide opportunities for materials to *talk back* and as such open up for reflexive conversations with designed things (Schøn 1983).

In this study we are using the artifact approach in order to analyze cookware. We like to explore how different properties and functionalities in the artifacts that we studied influence people's possible engagements. The overall idea of employing this approach is thus not to develop a final comprehensive description of the artifact analysis approach, but to explore what could be gained in terms aiming for a more artifact oriented analysis of digital materials.

TARGETING ENGAGEMENT BEYOND THE TOOL AND USER VIEW

For this study we also chose engagement as a focal concern. In the field of HCI *engagement* is normally understood as a temporary or sustained and emotional involvement between particular users and artifacts in a given situation (Caroll & Lewis 2013, McCarthy & Wright 2004).

As HCI also moved from usability to user experience the concept of engagement also gained importance and focus. This has among other things resulted in increased examinations of the nature of interactions between artifacts, humans, and environments detailing out aspects of engagement as a quality interaction. Thus, so far, engagement is considered to be an aspect of user experience (Sutcliffe 2009) and as such relational in its' character. That is, engagement is a quality of the interaction between a user and an artifact (and the environment/context).

As such HCI research targeting engagement has examined this relational process and its' various phases like start, continuity, end and re-engagement (Sidner et al. 2005, O'Brien & Toms 2008). The factors that are considered important for engaging experiences are for instance aesthetics (Jennings 2000) first impression (Quesenbery 2003) interest, curiosity (Chapman 1997) and/or particular goals (Said 2004). The continuity and/or sustainability of interaction based on how engaging the interaction is as such related to how well users maintain interest during the interaction. It can for instance be, by keeping the interaction challenging (Czsiszentmihalyi 2008), informative (Skelly et al. 1994) and/or pleasurable (Douglas & Haragon 2000). The reasons for disengagement are often explained by the same factors. User stops interacting with the artifact when lost interest, challenge and pleasure in the interaction (O'Brien & Toms 2008).

As our study aims at moving the analysis beyond traditional tool and user views, we also experienced a need to advance a different frame of engagement. According to Borgmann (1995, p.16ff) if we are concerned to revive engagement, we must try to recover the depth of design and constitute a common memory of practices of engagement. He writes "Things that invite engagement are distinguished not only by the wealth of their experiential properties but also by the disclosing power of those properties." (ibid, p. 19) .

Supported by Borgmann (ibid.) and other scholars we formulated three thoughts on engagement that might improve an examination of what digital materials do in everyday life. Common for the three thoughts is that engagement is advanced as a unifying characteristic for artifact's quality for the world to be present in its own right.

FIRST THOUGHT: ARTIFACTS BEYOND SERVICE
Instead of considering technological artifacts as tools, Verbeek (2005) proposes that the *mediating* role of artifacts is considered. Physical input and display devices that are connected, for instance, can enable mediated perception of happenings that may be distant in time and/or space. The character of particular digital material configuration determines the precise ways in which activities are made visible.

If, now digital materials, have such capabilities there is of course a great risk for misconceptions regarding the relationship between humans and artifacts. What determines who, when? Despite such risks most new roles that have emerged have actually improved the status (power) of artifacts, by reducing some burden from humans. Providing a detachment from the things that demand attention and care. The sense of human mastery is still perhaps still there. But, the difference is that now one has a device that can do stuff in/for which he/she does not have interest/time.

With this role of digital materials in mind, design efforts have so far had a strong focus on make dealings between humans and devices easy and convenient for. Recently, emotional comfort is added on top of this because just *ease* and *convenience* are not enough?! Or as Suchman (2006) writes: "The litmus test of a good agent is the agent's capacity to be autonomous, on the one hand, and just what we want, on the other. We want to be surprised by our machine servants, in sum, but not displeased".

No doubt, advancement in this direction has sorted out many issues and constraints such as speed, efficiency, perfection, accuracy, stress and panic and many others like these. But with other, more complex challenges like sustainability, climate change, pollution, health etc. it seems as if we also need to rectify people's behavior with the help of a new layer of digital materials and artifacts. Materials that will guide people in selecting best (fresh, bacteria and chemical free, full of nutrition) food, remind people that it's time to eat or not to eat and what to eat or not to eat, or motivate them to stop wasting food or sharing leftover with less privileged one.

Its not that we are against such new layers of complexity but we believe that instead of just introducing artifacts and counter artifacts we should rethink about the role of digital materials altogether. As noted by Haraway (2007) "*technologies are not mediations, something in between us and another bit of the world. Rather, technologies are organs, full*

partners." perhaps such a stance considering artifacts to be full partners can support a view beyond 'at your service'?

We believe such change in perception might open up for new insights for design. In rethinking artifacts as full partners we might reconsider the replacement of people with artifact in every day activities. Designers might instead carefully balance activities between people and artifact in order to get best from both of them. Most importantly it makes designer realize that agency becomes inscribed into artifacts due to the assumptions regarding the relationship between artifacts and use that designer's have.

SECOND THOUGHT: COMPOSITION BEFORE INTERACTION

Our second thought consider how to attend to artifacts as full partners instead of tools that we can pick up and discard at our convenience. If artifacts are considered full partners, we, as designers have to be careful when we design such partnerships. It is also important to explore possible ways for engagements. We like to think these considerations as part of a *composition*, rather than focusing on interactions. The idea is to elaborate and sketch possible compositional outcomes.

Thinking about *composition* thus invites us to a more responsible attitude when attending to details of artifacts. Such *attention* is also within a compositional attitude different from normally observing and attending to a design situation. It is, as describe by Nelson and Stolterman (2012), an unbiased, complete and uncompromising *noticing to details and patterns of connection*. It is an attitude in which invisible connections, relationships, and interdependencies are allowed to surface rather than detaching, separating or restricting such connections from other. It is an attitude that attends to and respect diversity as well as aim for creating balance by keeping tensions alive.

Focusing on *composition*, with the intention of keeping connections and interdependencies alive, can build a way towards alternatives.

THIRD THOUGHT: CARE INSTEAD OF COMFORT

Our third thought raises the question regarding which *values and concerns* should be the focus of design for everyday life. In focusing on engagement with full partners we thought it needed to move beyond instrumental values when considering what matters of concerns to attend to.

Supported by feminist thinking we were able to envision *care* as an outcome of human-artifact *composition*. Care in general sense fosters strong attachment and commitment with others and forces one to get involve in practical doings. It ensures continuity in relationships irrespective of all troubles and/or incompatible interest involved. However, feminist thinking has improved this general concept of care by pointing out those "tasks that make living better in interdependence, but which are

often considered petty and unimportant, however vital they are for livable relations” (Puig de Bellacasa 2011). For instance, cooking, now as we know is considered as unnecessary engagement that keeps one away from other more important tasks. However, for her “domestic labors are labors of care ... productive doings that support livable relationalities” (ibid, p. x).

This perspective of *care* also avoids application of universal norms to all situations and contexts. Every situation needs different type of caring, as care for one might be dangerous for other. So proper care involves curiosity about others, about their needs and this knowledge can build a strong and close relationship between them. More importantly, it ensures one that these activities of *care* are not small but the sites of *world making* (Haraway 2007).

DATA AND METHODS

We began our analysis by expanding our understanding of the notion of engagement as described above. We also selected five traditional artifacts that are commonly part of everyday cooking. These selected artifacts are *knife, pot, kettle, toaster and oven*. We also explored the more advanced and digital forms of these artifacts, i.e. artifacts that aspire to accomplish similar task in preparing meals but also had some additional qualities added to them. Overall, we examined around 40 artifacts that at the time of our study, were either available commercially, soon to be launched, or mentioned as future concept designs. For each artifact, we collected photograph, specifications and descriptions from manufacturers, retailers and/or designers’ websites.

For each artifact in the collection, we identified three aspects: *purpose, character* and *intention* and developed a table of characteristics for all of them (an example can be found in Figure 1).

- **Purpose:** represents the basic function for which artifact is created. For instance knife is to cut food or kettle is to boil water.
- **Character:** is used as a qualifier of attributes, where attribute is to be understood in a very wide sense as including many kinds of specification of an object (Janlert & Stolterman 1997). In our analysis we divided the overall characteristics into three traits; main material used, manufacturing technology used and other interpretative properties like complexity, cognitive handling, shape and style.
- **Intention:** represents the possible aim of the artifact as it might have been intended. It represents an elaboration of the anticipated whole of the artifact, the intention.

Purpose	Character	Intention
Cut Vegetable	<ul style="list-style-type: none"> • Manual • Simple: understandable, human dependent, • Sharpness, water resistant 	<p>Allows the preparation of various kind of food material according to the individual preferences.</p> <p>(Craft and skill)</p>
Cut Vegetable	<ul style="list-style-type: none"> • Mechanical • Complex: space, capacity, cognitive handling • Aesthetic, convenience 	<p>Provide perfectly chopped, sliced or diced vegetable in swift motion without any mess.</p> <p>(Quick, easy and perfect form)</p>
Cut Vegetable	<ul style="list-style-type: none"> • Digital • Complex: visual and cognitive handling, safety measures, external dependency • Visual and audio appropriation 	<p>Provide basic information on freshness, bacteria infection and nutrients at a glance.</p> <p>(Quick and perfect judgment)</p>

Figure 1: Example of analysis of knives in accordance with purpose, character and intention

After we detailed out the characteristics, intentions and purposes for the collected artifacts, we went through the schemas in more details in order to group artifacts with similar characteristics, purposes and intentions together. We ended up with three groups representing the artifacts we have in our collection. These groups are:

- *Basic*, representing all artifacts that are manual, simple and intended to work for skill and craftsmanship with respect to cooking and food preparation activities.
- *Modern*, representing those artifacts that are using modern technology (most of the time electricity and manufacturing techniques sprung out of other designs), devising complex design and intended to quick, easy and perfect forms of commodities.
- *Smart*, representing those artifacts that are interactive, responsive and intended to work independently and/or to guide in making ‘informed’ choices.

Basic	Modern	Smart
 Iron Kettle	 E-Kettle	 I-Kettle
 Griddle Pan	 Toaster	 Scan Toaster
 Dutch Oven Pot	 Crock Pot	 Smart Crock Pot
 Knife	 Chopper	 Smart Knife

Figure 2. Basic, Modern and Smart artifacts

Finally, we analyzed the contribution of each group of artifacts with respect to the three thoughts expanding our understanding of engagement beyond tool and user view (see previous section) considering engagement to matters of *concern*, *composition* and *care*. This part of our analysis is further detailed in the next section.

ANALYSIS

According to our analysis, each group of artifacts reveals different aspects of engagement and lead to different relationships with the environment. Details of how we so far understand the different aspects for the analyzed artifacts are provided below.

BASIC ARTIFACTS: DESIGNING FOR ACTIVITY

Almost all artifacts in Basic group are traditional cooking tools that have been used for a long time when making food. Of the distinguishing attributes of such artifacts are *simplicity* and *openness*. According to our analysis Basic artifacts are simple in form and seldom demands extra effort for understanding features and functionalities. Also, Basic artifacts are quite flexible and open to be used in a way people want and prefer. For instance, knives are traditionally very simple in shape and design, affording almost anyone how to hold and cut. Basic artifacts can also often be used in multiple ways like slicing, chopping, and dicing. These features were found in all Basic artifacts that we analyzed, such as knives, pots, kettles, ovens in their traditional design. There are some variations in Basic artifacts with time either in material like iron, aluminum, ceramic etc., or in shape or size. However, these variations do not have any significant influence on the contribution of and character of interaction in terms of engagement.

Focusing on engagement qualities of interacting with Basic artifacts we find them to be designed with the intention to keep people involved with and attentive to how food should be handled and prepared instead of just picking a meal and eat it to fulfill their need. This makes us realize that intensity and effectiveness of an artifact's qualities has a unique bond with the level of the user's skill. An individual with more advanced skill can perform better outcomes of the interaction. In this way, an individual spend time and put effort on the means, which in this case is a close working relation with food material, in order to accomplish the end that is 'ready to eat' food. Consequently, one may have engaged more in activity than anything else while using basic artifacts as compared to modern and smart artifacts.

In sum, we find that Basic artifacts are attended to in cooking activities with a specific nearness to food preparation such as cutting, slicing peeling etc. We have therefore tentatively concluded such interaction qualities as *activity engagement*.

MODERN ARTIFACTS: DESIGNING FOR INTERACTION

In contrast to Basic artifacts we found a group of artifacts that reveal quite divergent qualities that we refer to as Modern artifacts. We found this group of artifacts to be designed with the intention to interaction with the artifact as well as with food. We also found these artifacts to be designed to make cooking an activity that is *easy*, *effortless*, *carefree* and *effective*. Modern artifacts aim to achieve perfect outcomes at the same time promising less attention and care with food preparation. For instance, in order to get perfect dices of vegetable from a chopper in almost no time and with fraction of effort, vegetables should not be bigger than a certain size or not in odd shapes.

Modern artifacts reveal a rather complex form with hidden mechanism and functions. Consequently, for smooth working these artifacts demand special attention and knowledge about the inner (hidden) workings. For instance, a bread maker requires correct placement of its parts as well as exact quantity and type of ingredients. In this way, Modern artifacts demands that people are involved with putting together parts of artifacts according with an intended procedure before the artifact can function in a proper way. As such there is also assumed that there is a correct and incorrect way of dealing with the artifact. Now in presence of such demands, we label the character of engagement, *interaction engagement*.

But since Modern artifact also seems to intend a particular (pre-planned) outcome of the engagement, we also find that these artifacts reveal characterizations of commodity engagement as well. That is, because the output produced these artifacts usually produces an outcome that is perfect in size and shape. It provides an

easy way of maintaining a certain standard in prepared meal that leads to a different sense of achievement. Accordingly the prepared food is considered to be a product, commodity and output of a standardized process.

With Modern artifacts the nature of cooking activities changes. A preparation of meal is, compared with Basic artifacts, more like a supervision and coordination task than a process of skill, technique and attention. As such the relationship between Modern artifacts and the activity engagement is quite low as compared to interaction and commodity engagement. Similarly, less need of traditional cooking skills are needed while using these

Modern artifacts also decrease demands to connect and interaction with other people. Since preparation of food is understood to be a standardized procedure, there is no point to learn personalized tips and tricks from others. For example, the ability of Rotimakers to provide traditional Indian bread in one minute at dining table makes the activity of preparing bread collectively invisible.

SMART ARTIFACTS: DESIGNING FOR INDEPENDENCE

Smart artifacts are being introduced in the domain of cooking with three different qualities that are adding a difference between them and their predecessors. These qualities are *connect-ability*, *response-ability* and *independency*. Smart artifacts are designed with the intention to establish a connection with other artifacts/networks. With these artifacts the engagement is with other things, in order to fetch/deliver required information, report their progress and perform their task independently. For example, iKettle works independently by boiling water on a scheduled time, uses connect-ability to inform another device about current status. Smart Knife uses these interaction qualities differently. The Smart Knife does not work independently but it uses connect-ability to bring nutrition value of food being cut by it. Similarly, Scan Toaster also uses connect-ability in order to fetch interesting information from social media or news sites and displays on bread. Depending on the task at hand, presence and usage of these properties varies from artifact to artifact.

With these distinct properties and their various combinations, Smart artifacts have quite unique ways of contributing in to the qualities of engagement. Smart artifacts, are intended to work *independently* with abilities to *connect* and *respond* to other artifacts in a network. Engagement is therefore in our analysis understood as a *commodity engagement*, since the outcome of interaction is intended to provide ready to eat food with minimum effort. In this way, Smart artifacts free humans from the exertions of making food.

As such Smart artifacts make people very distant from activity engagement, food preparations and making.

Some Smart artifacts seem to intend the need for new and often detailed related information. In most cases this information is either to guide people in making better and more informed choices or to intended to provide instance information when needed. However, whatever the information flow, we consider this characterization to divert attention from activity and/or food to that particular information. In this way, information in these situations should also be treated as outcome of Smart artifacts. Therefore, involvement in outcome instead of activity or food itself is also another sort of *commodity engagement*.

Overall it seems that Smart artifacts are intending to replace human either physically by reducing the need of their presence on site or virtually by reducing the need of their attention for food while it is being prepared or cooked.

DISCUSSION

We entered this study with a vague assumption that different cookware are designed with different qualities of engagement in mind. Based on our analysis we also find that almost all Modern and Smart artifacts analyzed are intended to provide ease, perfection and less time consuming ways of preparing meals. That is, these artifacts seem to intend that other qualities then activity engagement are desired.

Our analysis also suggest that the activity engagement afforded by Basic artifacts allow people to actually touch, feel, see and pay attention to food, process and other people around them.

According to our study, the move from Basic artifacts to Smart artifacts is, as such, reshaping the quality of engagement. So what should be the next move of designers in order to select a better way forward? As noted by Stolterman (2008) design is about intentionally shaping a desired reality. Based on our artifact analysis we have experienced that the analyze of previously intentions cannot be reduced to exact and precise procedure. Yet, we find that through an artifact analysis as the one we have attempted to describe in this paper, designers can be prepared for careful and responsible judgments based on existing designs.

Based on this study, we are also proposing a framework for the analysis of engagement through artifact. The framework distinguishes and defines:

- *Activity Engagement*: the engagement with the activity of making food by connecting means with end.

- *Interaction Engagement*: the engagement due to interaction with artifacts used in making food.
- *Commodity Engagement*: the engagement with the product produced by artifact without actually getting involved in the whole process. This engagement involves consumption of ready to eat food items.

Based on this framework we can continue to analyze engagement in presence of any artifact based on its own characteristics and abilities. Subsequently, it would guide us in envisioning future role of artifacts characteristics beyond conventional tool and user views.

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