How Performing an Activity Makes Meaning

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ABSTRACT

The analysis of tasks and workflows is a longstanding tradition in Human-Computer Interaction (HCI). In many cases, it provides a crucial basis for the usable design of interactive systems. However, established tools almost exclusively focus on task content and structure, thereby ignoring the more "experiential" aspects of task performance. To fill this gap, we combined Hierarchical Task Analysis (HTA) with the analysis of subjective accounts of meaning. Our explorative study (N=4) suggests that objective descriptions resulting from HTA and subjective experience of one and the same activity differ. People tend to subsume experientially unimportant sequences or even ignore these within their subjective experience. Furthermore, people are able to name experientially important sequences and to relate these to feelings and thoughts (i.e., meaning). In the future, more refined versions of our approach may support practitioners with the design of meaningful interaction and activities.

KEYWORDS

Workflow analysis; Hierarchical task analysis (HTA); Experiential qualities; Experience Design; Interaction design; Meaning.

Table 1: Overview of Paul's HTA and his subjective representation of preparing coffee.

HTA focus	Experiential focus	
Sub-goals (number of task elements)	Experiential sub-goals	Meaningful elements and meaning associated
1. heating-up (3)	1. preparation	
2. cleaning (13)		
3. refilling water/beans if necessary (4)		
4. preparing cup (6)		selection of the right cup → special cup expressing appreciation of good coffee
5. pouring hot water into cup (5)	2. pouring hot water into cup	
6. milling (7)	3. milling	ripple and smell of ground coffee falling into jar → direct contact with material, experiencing its quality
7. preparing the portafilter (17)	4. preparing the portafilter	Tampering coffee with pushing-turning move → bringing in own expertise, estimating pressure and filling quantity
8. storing of remaining coffee (3)		
9. pulling an espresso shot (7)	5. pulling an espresso shot	Observing espresso pouring from machine → bringing in own expertise, control duration, viscosity
10. appraisal (5)	6. appraisal	Looking at coffee and crema → final acceptance
11. consumption (4)	7. drinking coffee	

1 INTRODUCTION

Technology is virtually inseparable from the activities and routines, we use them for (see i.a. [6]). Consequently, the analysis of tasks and workflows is a longstanding tradition in Human-Computer Interaction (HCI). A prime example is Hierarchical Task Analysis (HTA) [7], a common method to analyze workflows in HCI. HTA describes tasks through goals, which are further decomposed into sub-goals and the operations necessary to achieve the sub-goals (i.e., task elements). The purpose of HTA is to meticulously understand the structure of tasks to base according information architectures and task flows of interactive systems on this understanding. While understanding the objective structures of tasks is certainly important, approaches, such as Experience Design [2] or Slow Design [1] emphasize the relevance of experiential qualities. They urge HCI researchers and practitioners to not only ensure efficient task fulfillment, but to provide meaningful experiential outcomes through activity. Unfortunately, HTA and similar methods of task analysis are of limited help here. As Grosse-Hering et al. [1] pointed out in a meaning-oriented analysis for designing a "slow" way of juicing: "Slow Design is not just about optimizing the product in terms of convenience; rather, the 'right moment' in the 'process of use' should be enriched by increasing the user's experience, joy and fun." While they insisted on the importance of understanding activity from a perspective of "meaningful moments", their actual approach to analysis remained vague. Thus, while there is an apparent need to systematically analyze activity with regard to the elements crucial for establishing a particular meaning, there are no structured methods available to date to do so.

In this paper, we present an explorative study (N=4) about how to perform an analysis to trace particular elements of an activity (e.g., sub-goals, operations) to particular meanings.

2 STUDY DESIGN AND PROCEDURE

For the present explorative study, we focused on practices of preparing coffee as model domain. We chose coffee-making for a number of reasons (see also [3]): First, it is a common routine at least in our immediate cultural surrounding. This makes it is easy to identify participants, who find the activity enjoyable and meaningful – a precondition for our study approach. Second, the activity is neither too long nor too complex, which makes an explorative study reasonable for the participants and more manageable for the investigators. Third, it is an activity with a substantial heterogeneity, potentially involving a wide variety of different materials (e.g., coffee makers, grinders).

We recruited four participants by word-of-mouth recommendation, explicitly searching for individuals who experience their way of preparing coffee as especially enjoyable and fulfilling (one female, Age: 27, 30, 33, 35). All sessions were conducted individually at the participants' homes with their own materials. No compensation was provided for participation.

After a short introduction, the participants were asked to prepare a coffee in the way that provides the most positivity (i.e., most enjoyable, most meaningful, "feels right"). Subsequently, participants prepared a further coffee in the same way, however, this time commenting action,

Table 2: Overview of Laura's HTA and her subjective representation of preparing coffee.

HTA focus	Experiential focus	
Sub-goals (number of task elements)	Experiential sub-goals	Meaningful elements and meaning associated
1. cleaning (18)	1. preparation	
2. pre-heating water (4)	2. heating water	filling up to level 1 → exact right amount to cook 8 cups of coffee
3. milling (3)	3. milling	machine setting 12 → exact right amount to cook 8 cupsof coffee
4. waiting for hot water/ground coffee (1)		
5. preparing the right cup(s) (4)	4. preparing the cups	choosing right cup(s) → favorite cup(s), matching size to distribute coffee completly
6. cleaning the pot (9)	5. preparing coffee cooker, everything wet	
7. filling in water (4)		
8. turning on stove (3)		
9. assembling the coffee cooker (3)		assembling the coffee cooker → handling the fragile apparatus, applying know how
10. pouring in ground coffee (13)	6. pouring in ground coffee	knocking on lit, pouring in ground coffee → cast off ground coffee from lit, direct contact with material
11. waiting for the water to cook (1)	7. waiting for the water to cook	waiting for the water to cook → awareness, thrill of anticipation
12. finishing (4)	8. finishing	sound of sucking the coffee into the pod → start signal "coffee is ready!"
13. disassembling the coffee cooker (5)	9. disassembling the coffee cooker and botteling coffee	
14. bottling coffee into thermos bottle (10)		
15. pouring the coffee into the cup(s) (7)	10. pouring coffee	distribute coffee to cup(s) → start into the day

thoughts and feelings (i.e., thinking aloud). Moreover, we instructed them to pause for a moment as soon as they finished a meaningful unit of the activity, to label it and to pose for a photo representing it. We used this information (label, picture) to create a representation of participants' experience of preparing coffee. Based on this collection, we further asked participants to identify all units that seemed crucial to meaning and enjoyment for them. Both instances of preparing coffee were filmed from an elevated viewpoint. Finally, participants were debriefed and thanked for their participation.

Subsequent to the sessions, we used the principles of HTA [7] to structure the participants' individual activities (based on the videos). This provided objective and quite typical descriptions of relevant sub-units of the coffee preparing activity, e.g., heating-up, cleaning, refilling water/beans. These descriptions were then compared with the participants' subjective representation of their practice in terms of structure and meaning.

3 FINDINGS

In the following we briefly describe the four participants' individual ways of preparing coffee based on the HTA and our additional meaning-based analysis.

Artisanal preparation (P1). Paul (33) preferred coffee Americano (i.e., espresso diluted with hot water). To prepare coffee, he used a Rancilio Silvia portafilter espresso machine and a Demoka Minimoka electric coffee mill (fig. 1). Both machines were placed next to another in a central place in the kitchen, close to the sink. Paul's way of making coffee consisted of 74 single task elements, grouped into 11 sub-goals, ranging from *heating up the espresso machine* to *coffee consumption* (table 1 left). From an experiential perspective, Paul distinguished only seven experiential sub-goals. Most strikingly, the various sub-goals to be fulfilled before the actual coffee-making (4 sub-goals with 26 task elements), were subsumed under a single "preparation". In addition, the sub-goal *storing of remaining coffee* played no part in his subjective representation of coffee-making. Of all sub-goals and elements, he marked five as crucial for creating meaning (table 1 rightmost column). For example, when milling he watched the ground coffee falling into the jar. Through this he felt in contact with the material and appraised its quality based on smell and the way the powder poured into the jar. Both, tampering the coffee and observing the espresso flowing out of the machine were important, because these were moments of being in control of the process and the outcome. Using the right pressure given the amount of ground coffee and controlling the duration of the espresso extraction had a direct impact on the quality of the coffee.

All in all, Paul enjoyed feeling competent and focused, when carefully observing, smelling, and getting in direct contact with the materials (i.e., coffee powder), thereby assessing their quality and subtly adjusting preparation and, thus, the quality of the resulting coffee.

Ceremonial preparation (P2). Laura (27) called herself a coffee addict who needed at least half a liter of coffee to manage to get up. She and her boyfriend took turns at this morning "duty" using a Bodum PEBO vacuum coffee maker and an electronic coffee grinder from the 1970ies (fig. 2). Laura's way of preparing coffee included 91 task elements, divided into 15 sub-goals, starting from *cleaning* to *pouring the coffee into the cups* (table 2 left column). Laura experienced coffee-

Table 3: Overview of Michael′s HTA and his subjective representation of preparing coffee.

HTA focus	Experiential focus	
Sub-goals (number of task elements)	Experiential sub-goals	Meaningful elements and meaning associated
1. milling (3)	1. milling coffee	→ exact amount of ground coffee needed, nothing is wasted
2. fetching the machine (4)	2. preparing the espresso maker	
3. cleaning machine (34)		
4. cleaning the filter (20)	3. "puffing" the coffee grounds from the filter	"puffing" the coffee grounds from the filter → keeping it as fertilizer for his garden
5. filling machine with water (5)	4. filling machine with water	fresh water → best materials for fresh coffee
6. filling machine with ground coffee (12)	5. filling machine with coffee	→ direct contact with material, exact depletion of ground coffee
7. drying one's hands (3)		
8. reassembling coffee mill (4)		
9. assembling the machine (5)		
10. placing machine on the stove (3)		
11. activating stove (5)	6. exactly adjusting the flame of the gas stove to the espresso maker	→ getting the most out of the heating output
12. waiting (1)		
13. turning off the stove (3)		
14. picking up machine (3)		
15. preparing cup (4)	7. preparing cup	selection of the right cup → special cup expressing appreciation of good coffee
16. pouring the coffee into the cup (2)	8. serving coffee	→ awareness, thrill of anticipation, consumption
17. put away machine (3)		
18. drinking coffee (2)		

making as being structured into 10 experiential sub-goals, out of which eight became marked as meaningful. Since she continued with her further morning preparations (e.g., showering) while *waiting for hot water/ground coffee*, she ignored this sequence in her experiential representation. Furthermore, she subsumed four sub-goals dealing with preparation (e.g., *cleaning the pot*) as "everything wet". Laura marked eight out of all sub-goals and elements as meaningful (table 2 rightmost column). For example, there were "parameters" that fitted nicely into each other – filling up to level one of the boiler equaled the calibration mark of the coffee maker for eight cups and machine setting 12 of the coffee grinder resulted exactly in the amount of ground coffee needed. Furthermore, this serving of coffee was sufficient enough to fill up two small cups (for Laura and her boyfriend or one big cup in case Laura was alone) and their thermos bottle (again, fixed "scale units"). For Laura, this matching felt like "a pretty good flow" and gave her a feeling of security. Experiencing eight of ten experiential sub-goals as meaningful supported the feeling of security and turned her routine of making coffee into a ritual.

Sustainable preparation (P3). Michael (30) prepared his morning coffee using an electric coffee grinder (Braun Aromatic KMM2) and a stovetop espresso maker (fig. 3). Michael's procedure of coffee preparation consisted of 116 task elements, grouped into 18 sub-goals which ranged from *milling* to *drinking coffee* (table 3 left column). The large quantity of sub-goals was explained by Michael's incremental way of preparation and changing sites of activities (i.e., stove, sink, countertop). Subjectively, Michael experienced his practice as structured into eight experiential sub-goals. Five out of eight sub-goals were meaningful for his experience (table 3 rightmost column). In contrast to the participants above, Michael did not only subsume sub-goals into broader experiential sub-goals (e.g., *preparing the espresso maker* comprised *fetching the machine, cleaning the machine* and *cleaning the filter*) he also highlighted single task elements and interactions by explicitly labeling them as experiential sub-goals (e.g., *"puffing" the coffee grounds from the filter* or *exactly adjusting the flame of the gas stove to the espresso maker*). The meaning he related to these interactions was concerned with efficiency but focused on sustainability and "getting the most out of this valuable material". In summary, it can be stated that Michael enjoyed the manual way of preparation and especially indulged in the direct contact with the material but also in some of his "special" interactions (e.g., *"puffing" the coffee grounds from the filter*).

The proof of love (P4). Tom (35) lived with his girlfriend and since the time they moved in together, he prepared a morning coffee for both of them. This followed a daily pattern: Tom was an early riser and got out of bed before his girlfriend woke up. With an electric version of a stovetop espresso maker (fig. 4), he prepared a coffee in the way his girlfriend likes it best. Then, he took along the two cups of coffee, returned to the bedroom and woke up his girlfriend tenderly so they could sit in bed together while drinking coffee. Tom's way of making coffee included 172 task elements, subdivided into 19 sub-goals which ranged from *situate coffee container* to *pouring coffee into the cups* (table 4 left column). From an experiential perspective, Tom's coffee brewing was more inclusive because it started with *sneaking to the kitchen without waking up girlfriend* and ended with *drinking coffee in bed together*. In sum, Tom distinguished 14 experiential sub-goals. He subsumed several experiential sub-goals directly related to the actual preparation of the coffee into broader units (e.g., *preparations* included *preparing the material, disassembling the machine, cleaning*

Figure 1: Paul´s equipment - Rancilio Silvia espresso machine; grinder Demoka Minimoka.

Figure 2: Laura's equipment - Bodum PEBO vacuum coffee maker (l.); Krups Coffina L (r.).

Figure 3: Michael's equipment – stove top espresso maker (l.); Braun Aromatic KMM2 (r.).

Figure 4: Tom's equipment – electric version of a stovetop espresso maker.

the machine, *cleaning the filter* and *preparing the lower part of the machine*). Beyond that, Tom included experiential sub-goals concerned with meaning making solely (e.g., *sneaking to the kitchen without waking up girlfriend* that is important to actually wake her up by the smell of the coffee). Of all sub-goals and elements, he marked 11 as meaningful for his experience (table 4 rightmost column). These were allotted equally to elements supporting Tom's experience of performing a proof of love (e.g., *choosing two equal cups* declaring "we are a couple") and his feelings of competence (e.g., expertise of knowing the right amount of ground coffee, water and milk to prepare a good coffee).

All in all, Tom enjoyed both sides of his way of making coffee – his competence in preparing a delicious coffee and all the little details and efforts he performed to make it a "gift" to his girlfriend.

4 SUMMARY AND CONCLUSION

We asked four individuals, who enjoy coffee-making, to demonstrate the particular way, they perform this activity. In addition to traditional task analysis (i.e., HTA), we explored an approach to get a detailed understanding of how enjoyment and meaning is made when performing the activity. The four cases revealed a wide variety of procedures and meanings in a presumably mundane activity. This variety is a result of the intertwining of available tools and materials and the fulfillment of particular psychological needs, which provide meaning to the activity (e.g. "caring for your loved ones" – relatedness or "manufacturing a high-quality coffee" - competence) [2]. The present study suggests that an objective description of an activity is not necessarily congruent with an experiential representation of the same activity. Meaningless, yet necessary task elements, are often subsumed into single units (e.g., preparation includes switching on the machine, opening, emptying and cleaning the machine, etc.). Meaning is mainly made through particular sub-goals, and sometimes even through particular interactions (e.g., when Paul experiences competence the moment tampering the coffee powder through pushing and turning the portafilter). Thus from the perspective of meaning and enjoyment, activities are rather perceived a string of particular moments, which then in sum provide meaning. These moments are heavily influenced by the particular design of the tools and materials involved. For example, the way Paul professionally checks the quality of the coffee powder coming from the grinder through the way it smells and ripples into the container, is foremost made possible through the fact that the container is open and the powder is visible. In this sense, a particular attribute of the material involved provided opportunities for meaningful interactions. If taken up by the individual, these opportunities create positive moments, which in turn shapes the meaning of an activity. In fact, modern views on the relationship between technology and humans understand it as mutually constituting each other (e.g., practice theory, [5]). In other words, while we use tools to fulfill goals the very same tools provide us with opportunities to experience meaning.

We found our participants to be well aware of the moments that make coffee making especially meaningful to them. A central challenge in future applications might be the participants' expres-

Table 4: Overview of Tom's HTA and his subjective representation of preparing coffee.

HTA focus	Experiential focus	
Sub-goals (number of task elements)	Experiential sub-goals	Meaningful elements and meaning associated
	1. sneaking to the kitchen without waking up gf	→ basic requirement to wake gf by the smell of the coffee later
1. situating coffee container (4)	2. choosing right sort of coffee	"right" sort of coffee → gf's favourite sort of coffee
2. preparing the material (8)	3. preparations	
3. disassembling the machine (7)		
4. cleaning the machine (19)		
5. cleaning the filter (21)		
6. preparing lower part of machine (19)	4. equiping machine with water	→ expertise of knowing the right amount of water
7. cleaning one's hands (10)	5. further preparations	
8. heating water (2)		
9. filling filter with ground coffee (13)	6. equiping machine with ground coffee	→ expertise of knowing the right amount of ground coffee
10. assembling the machine (6)	7. powering up the machine	pressing power switch → handover job to machine
11. preparing the cups (6)	8. choosing the right cups	choosing two equal cups → "we are a couple"
12. fetching milk (5)	9. pouring the right amount of milk into the cups	→ expertise of knowing the right amount of milk
13. pouring milk into the cups (6)		
14. microvawing milk (12)	10. heating up the milk	
15. storing away milk (6)		
16. storing away coffee container (3)		
17. Waiting for coffee (6)	11. watching coffee gush out	"final countdown" → thrill of anticipation, awareness
18. stiring the coffee (8)	12. swirling coffee	special technique to stir the coffee → homogenous coffee
19. pouring coffee into cups (11)	13. pouring coffee into cups alternately	→ distribute coffee equally among the cups
	14. drinking coffee in bed together	placing cup next to girlfriend → "christmas tree moment"

sivness and ability to reflect on their feelings related to single steps of interaction. While in the present study participants had no difficulties to express their feelings this might be more problematic in other samples and other domains. In these cases, the interviewer should help the interviewee by asking directing questions and guiding the thinking aloud process.

Although, we chose coffee making as a relatively simple and well-defined interaction, we see our approach as promising for diverse contexts and activities, also in more complex domains beyond coffee making. To better understand this experiential perspective of an activity alongside more traditional perspectives focusing on objective content and structure offers great opportunities for design and HCI. One example is meaningful automation [1,4].

Analyses such as the present provide opportunities to automate, but at the same time to not "design away" meaning. Instead of answering the question of "machines-are-better-at/(hu)mans are better at" to determine, which parts of activities become automated, one may rather ask which parts of an activity have to be retained or even highlighted to provide desired meaning. In the case of Paul, for instance, preparation could have been easily taken over by automation, while adjusting the quality of the coffee by feeling and smelling the powder must remain an actionable sub-goal to maintain meaning.

All in all, our approach to the detailed study of how meaning is created through interaction conceptualized as supplementing objective descriptions of task structures worthwhile. In future, we will collect more examples of detailed analyses from various contexts and further elaborate strategies for analysis as well as tools to represent activities from the perspective of meaning to make these insights actionable for interaction design.

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