

What Explains Differences in Users' Inclination to Appropriate Technology for Unconventional Purposes? A Preliminary Analysis

Antti Salovaara^a, Sacha Helfenstein^b, Mikael Wahlström^a, Antti Oulasvirta^a

^aHelsinki Institute for Information technology
Helsinki University of Technology and University of Helsinki
P.O.Box 9800, 02015 TKK, Finland
{antti.salovaara,mikael.wahlstrom,antti.oulasvirta}@hiit.fi

^bAgora Human Technology Center
University of Jyväskylä
P.O. Box 35, 40014 Jyväskylä, Finland
sacha.helfenstein@jyu.fi

ABSTRACT

It is common to state that inventions of new purposes of use arise in social interaction with other technology users. Social aspects of appropriation have subsequently received a lot more attention than individual users' characteristics in appropriation research. To remedy this imbalance, this paper presents a preliminary analysis of a web survey that charted aspects of digital camera use and individuals' photography orientations and used them as predictors of digital camera appropriation. Gender, technology understanding and exchange of ideas with others proved tentatively the best predictors of appropriation.

Keywords

Appropriation, web survey, user characteristics.

ACM Classification Keywords

H.1.2 [Models And Principles] User/Machine Systems – human factors.

1. INTRODUCTION

During the past two decades, it has been increasingly recognized that information systems, like any tools, are not only used for purposes specifically designed for them, but that they are appropriated for purposes that can surprise their designers. The inventions of new purposes of use are called *appropriations*. The reasons for appropriations are both social and individual. The social processes contributing to appropriations have already attracted enthusiastic attention in the research community. The question who decides how technology should be used (e.g., at a workplace) has been addressed in science and technology studies [1] and management studies [5]. Another often-studied topic has been how appropriations are promoted and adopted by certain people at a workplace [3, 4].

However, an individual user's role in the invention process has been a lot less studied topic. In particular, research on the role of cognitive processes and individual user's characteristics has been almost non-existent. In the few studies available it has been found that users with a learning-centered work orientation

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have been found more willing to learn new uses of technology even when it can be hard, than users with a performance-centered orientation who are willing to learn only if learning is easy [2]. In addition to the learning vs. performance orientation, in a mobile phone context, evidence has been found that users can also be segmented into different kinds of adopters whose inventions of use are different [7]. Cyclical perception-action models of appropriation processes have also been presented [6].

However, these studies have ignored the question *what individual characteristics are important for appropriation*. This paper addresses this question by focusing on one easily appropriable technology – digital cameras. In addition to compact and single-lens reflex (SLR) cameras, also mobile phones are nowadays often equipped with cameras that have a reasonable picture quality. The versatility to take photos with these technologies has provided a fruitful basis for ingenious uses, eight of which have been used as a measure of appropriation in this paper. The goal of this study was to identify user characteristics that could statistically predict such uses.

2. RESEARCH APPROACH AND MODEL

The research approach described in this paper is different from many of the previous studies on appropriation. Compared to the sociologically oriented studies in which the focus has been on charting the complexity of the phenomenon and aiming at a holistic picture, the approach here is focused, narrowly defined and aims for measurable results. Appropriation is here interpreted as *an invention of a new purpose of use, previously unknown to the user*.

2.1 Antecedent Factors of Appropriation

No theory has been presented that would attempt to list the possible antecedent individual user's characteristics that contribute to appropriation. Therefore, for the purpose of this study, a set of *tentative* antecedent constructs related to digital camera use were generated by researchers. These were:

- Setting up personal *Goals* for one's photography activities (e.g., personal projects or directions of improvement).
- *Reflection* of one's practices by evaluating one's shots.
- Having a comprehensive and correct *Mental Model* of how a camera works and what its functions are.
- *Curiosity* of trying new ways of photography.
- Taking photos spontaneously and in *Ad Hoc* ways, in a spur of action, without always thinking before acting.

- Having a broad understanding of the surrounding technology *Ecology*; e.g. how photos can be edited or used in other media.
- *Awareness* that a digital camera is an easily appropriable tool and thus a potentially useful in many situations.
- *Social Construction*: learning new ways of use from others through teaching, observation or exchange of ideas. The purpose of this construct was to evaluate the importance of some of the previously studied factors of appropriation.

Because the constructs were not drawn from existing theories, the nature of this study was exploratory and proto-theoretical. It was also conceptually organized in a top-down manner. Each construct was divided into sub-constructs, and phrased as a statement that could be answered on a Likert scale (1=totally disagree, 5=totally agree). For instance the Mental Model construct was represented of the following sub-constructs:

- Learning camera's functions comprehensively ("I have familiarized myself with more or less all the functions in my camera or cameras").
- Understanding cause and effect ("I know how to tune the camera settings to capture photos with good quality").
- Knowing the good and bad aspects of one's cameras ("I know which are the most important strengths and weaknesses of my camera or cameras").

All in all, 35 Likert scale statements were generated to represent the eight constructs. The constructs and their wordings were improved iteratively by organizing two pilot studies. On the other hand, it was admitted that the set of constructs could not be complete, leaving a possibility that another set of constructs could be a better predictor of appropriation.

2.2 Measuring Appropriation

To evaluate the tentatively postulated antecedent constructs, a measure was needed for appropriation. To start with, the following eight uses were defined as signs of appropriation:

1. *Mirror*: pointing the camera toward oneself, in order to see e.g. how one's face looks like.
2. *Map*: taking a photo of a map, and using that photo as a replacement of a paper map.
3. *Note-taking device*: using the camera for note-taking when the content is very visual, e.g. when shopping clothes.
4. *Scanner*: storing printouts and texts as images with a camera.
5. *Memory card*: plugging the camera into a computer like an USB memory stick (does not work with all models equally).
6. *Lamp*: exploiting the camera as a light source.
7. *Instructing device*: using a sequence of photos to provide step-by-step instructions.
8. *Periscope*: inspecting places that are otherwise inaccessible to human vision.

This list of uses was also researcher-generated. During the two pilot studies, respondents were asked to provide their own suggestions for unconventional uses. However, the suggestions received could be subsumed in already listed uses, or their meanings were conceptually unclear. In the final questionnaire, the set of uses was fixed to the eight uses listed above, to gather a homogenous dataset of answers.

The questions in the web survey about each appropriation were tree-structured. The starting question addressed the respondent's familiarity of using any digital camera in the given way (e.g., as a mirror). The scale ranged from 1="this use has never occurred to me before" and 2="I have know that this is possible, but I have never done so" to 6="This is one of my established uses for a digital camera". Later questions addressed the accuracy of the memory of the first time when the use was learned, and the actual person who did the invention in the situation.

From this eightfold set of tree-structured answers the measure for individual's appropriation was calculated using the familiarity variable. For each of the eight uses, two new dichotomized variables were created, one having value "0" if the respondent replied with an answer coded as 1 (see the values above), and "1" otherwise, the other having a value "0" if the respondent replied with an answer coded as 1-2, and "1" otherwise. Thus, one variable expressed whether a user was familiar with an appropriation or not, the other whether he or she had ever used it or not. Summing these binary variables over the eight uses yielded measures for the overall degree of appropriation (Total Degree of Appropriation Familiarity and Total Degree of Appropriation Employment), respectively, both ranging 0-8. The use of two measures was deemed important since the purely imagined use (i.e., answer coded as 2) was a common choice in the data, gathering on average 21% of all the familiarity answers. It was important to know whether its exclusion from the appropriation degree would change the results considerably.

3. THE STUDY

The Likert scale statements about the antecedent constructs as well as the tree-structured questions about different appropriations were part of a web survey in Finland between November 2008 and January 2009. The survey contained also other items, the most important ones from the point of this study being the demographic details (gender, age, education among others), camera use experience (expressed as years of film, digital and phone camera use) and camera use frequency (asked separately for each type of camera, ranging from daily to terminated use). Each respondent was also asked to assess whether she or he considered herself or himself as a beginner, novice, snapshot taker, amateur, expert/professional, or other kind of actor in photography. The questionnaire could be answered anonymously. Two pilot studies were organized before the actual survey.

Due to the mundaneness of a digital camera as a consumer technology, reaching a high number of responses was deemed more important than a strict probability sample of respondents. Invitations to participate were distributed to authors' social circles, camera-related web forums, and camera clubs. By buying keyword-based advertisements from a large Finnish search company, the survey was also visible at different pages in the web. Respondents could also invite their friends by providing their email addresses. These addresses were not archived in the database. A raffle of fifteen 20 EUR gift coupons was arranged between those respondents who had completed the survey.

The survey reached N=2388 of complete answers from digital camera and/or phone camera users. The distribution of values in the self-reported expertise variable shows that the recruitment from camera clubs resulted in high number of answers from amateurs: novice (8.7%), snapshot taker (36.2%), amateur (47.9%), expert/professional (5.5%) and other (1.7%). Genders were equally represented in the data (males 53.3%).

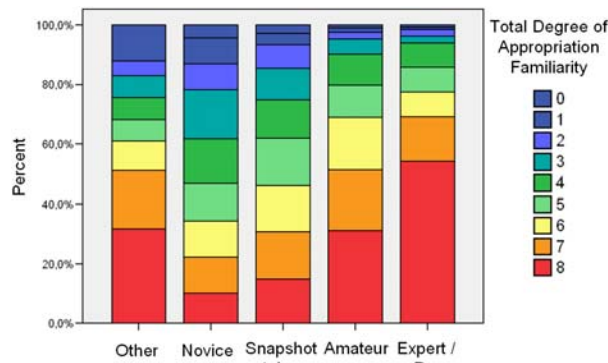


Figure 1. Distribution of how many of unconventional uses the respondents were familiar with, plotted separately by the different photography expertise levels.

3.1 Are Appropriations Invented Alone?

Two questions precede an analysis of individual users' characteristics: 1) whether the eight unconventional uses are rare enough to be informative of appropriation, and 2) whether they are learned individually and not only from others). In light of the data, the answer is clearly "yes" to both questions. Regarding the first question, as visible in Figure 1, the variance of values of Total Degree of Appropriation Familiarity is large, meaning that people exhibit appropriation to different extents.

To answer the second question, on average 54% of the respondents familiar with a use could remember the moment of learning "very well" or "partly". Among these people, inventing the use alone, without a help of others, was the most common context of invention (39%), learning from others being the next (21%). Appropriation by an individual is therefore common enough to warrant a study of its antecedent factors.

3.2 Scope of Analysis in This Paper

In the following analysis, the focus has been limited to snapshot takers only (N=). By this decision, the results are less susceptible to a possibility that active photographing turns out to be the underlying reason for appropriation. Such a biased result is less probable in a snapshot taker data. Due to this scope, the results are preliminary and will be extended in future work.

4. RESULTS

The reliability and validity of the antecedent constructs were evaluated for discriminant validity and internal consistency. For discriminant validity, a confirmatory factor analysis for the Likert statements was carried out. Based on the results, some of the initial constructs were combined into larger ones, and *Awareness* was dropped because of poor factor loadings. These changes yielded the following constructs for the actual analysis:

- Setting up personal *Goals* (unchanged).
- *Social construction* (one item dropped).
- *Technological knowledge* (Mental Model and Technology Ecology combined).
- *Exploration and learning*: (Curiosity with parts of Reflection and Ad Hoc photography style added): Users scoring high on this dimension display increased motivation to actively discover best use practices and learn from experiences.

- *Self-concept* (items in Reflection construct related to one's tendency to analyze oneself as a photographer): Users scoring high on this dimension display an increased sense of self-criticism regarding their photography and camera use skills.

To evaluate internal consistency of the constructs, Cronbach's alpha coefficients were calculated, attaining values between .76 (goals) and .89 (technological knowledge), which was interpreted as a strong support for the synthesized scales

4.1 How Appropriators and Non-Appropriators Differ

For each of the eight appropriations, analysis was carried out to see how users that (a) were familiar with an appropriation (i.e., whose dichotomized familiarity value was 1 or above) or (b) had ever employed an appropriation (i.e., familiarity value was 2 or above) differed from users that were not familiar (i.e., whose value was 0) or had never employed an appropriation (i.e., values 0-1), respectively. The intention was to reveal those basic user characteristics that can potentially distinguish appropriators from non-appropriators. U-tests, t-tests, and Chi-Square tests were used to assess the differences between those groups.

The analysis provided an overall proof that appropriators can be set apart from non-appropriators in basically all construct dimensions. In addition, people that were familiar with the eight uses also displayed differences regarding age, gender, as well as camera use history duration and use frequencies. In general, appropriators (i.e., those familiar with and using appropriations) had higher mean scores in all constructs, except Self-concept, which was associated to appropriation only for the Instructing device, Periscope, and Memory card use purposes.

Appropriation, as measured by familiarity level, was generally more common among men, except for the Mirror and the Lamp appropriations, both of which seem more general purpose or more valuable to women as well. Also, familiarity was on average more wide-spread among younger users.; however, not always in terms of the actual employment into use. In fact, users familiar with the Instructor appropriation proved on average older than others. Finally, appropriators seemed to be on average more active digital and phone camera users, and also had longer experiences with using digital camera devices.

4.2 Basic User Characteristics and Constructs as Predictors of Appropriation

In order to test for a statistical significance of user characteristics as predictors of the total degrees of appropriation (regarding both familiarity and employment), hierarchical, stepwise multivariate regression analyses were used. The purpose was to identify user characteristics that can well explain the overall variability in appropriation among users.

In a first block, the fundamental person variables (gender and age) were entered as regressors, followed by the five improved constructs (i.e., Goals, Social construction, Technological knowledge, Exploration and learning, and Self-concept), and finally by the remaining basic user characteristics (durations and frequencies of use for film, digital, and phone cameras). The research interest was to find out 1) which predictors are yielded as significant, and 2) how substantially each of the three regressor blocks increases the strength of the prediction model.

Since the analysis presented in the previous section had shown that basically all user characteristics were related to one or another appropriation, a decision was made to enter all variables

into the initial regression model specification. For the Total Degree of Appropriation Familiarity, SPSS developed through hierarchical stepwise regression a prediction model in five steps. The resulting predictors were given as gender, age, Technological knowledge, Social construction, and frequency of phone camera use. Calculating the regression with these predictors only, yielded a model with $R^2 = .24$, $F(5,691) = 44.02$, $p < .001$, with gender ($b = .23$, $t(691) = 6.49$, $p < .001$), and Representation ($b = .22$, $t(691) = 5.79$, $p < .001$) the greatest predictors.

Although the prediction model improved significantly (statistically speaking) with the addition of each of the three groups of user characteristics (i.e., person variables, constructs, use parameters), Technological knowledge and Social construction constructs (R^2 Change = $.11$, $F(2,692) = 47.78$, $p < .001$) had a substantial and clearly stronger effect on advancing the model strength than for instance use frequency (R^2 Change = $.02$, $F(1,691) = 19.14$, $p < .001$). And, when compared to gender and age in separate regression models, Technological knowledge $R^2 = .18$ and Social construction ($R^2 = .11$) proved better predictors of users' Total Degree of Appropriation Familiarity.

For the Total Degree of Appropriation Employment, on the other hand, the regression analysis yielded a prediction model including gender, representation, social construction, phone camera use frequency, and duration of digital camera use history. The resulting model is described with $R^2 = .26$, $F(5,671) = 47.65$, $p = .000$, with representation as the strongest predictor, $b = .24$, $t(671) = 6.42$, $p < .001$. Again, a substantial predictive relevance was attested for the construct scales of Technological knowledge and social construction. In fact, the regression model strength appeared primarily attributable to these two constructs, R^2 Change = $.14$, $F(2,673) = 58.82$, $p < .001$, when compared to the model including gender, R^2 Change = $.08$, and use frequency and duration history, R^2 Change = $.05$.

5. DISCUSSION

The regression analyses point towards a tentative conclusion that Technological knowledge and Social construction are important factors contributing to appropriation, at least in a digital camera use context. That is, to generalize, acquiring a good understanding of how digital devices work, which functions they have, and on the other hand, exchanging ideas about their use with others, seem to be aspects that should be particularly

supported when attempting to design easily appropriable technologies.

Many questions remain for future work, however. Why Exploration and learning was not rendered as significant predictor warrants future research, as well as whether the findings hold also among the more experienced users such as those who considered themselves amateurs or professionals.

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