# EXTRINSIC MOTIVATION AND USER PERFORMANCE

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Among daily computer users who are proficient, some are flexible at accomplishing unfamiliar tasks on their own and others have difficulty. We hypothesize that extrinsically motivated users have difficulty with unfamiliar computer tasks and skill transfers, whereas intrinsically motivated daily users accomplish unfamiliar tasks readily. Nine extrinsically motivated users and seven intrinsic users were directed and observed with qualitative ethnographic methods using a think-aloud-type verbal protocol. The observations were coded based on a rubric. The coding was checked with two additional raters, and inter-rater reliability was greater than 90%. The data were then statistically analyzed. Findings show that extrinsically motivated users in all age groups and competence levels have weak productivity when faced with unfamiliar tasks or software, while intrinsically motivated users have few difficulties. This work draws attention to an underrepresented group of competent but extrinsically motivated computer users who become unproductive when operating in unfamiliar conditions. The data suggest that researchers should control for motivation style when evaluating user interface designs.

## INTRODUCTION

Why do some daily computer users quickly adapt to new tasks while others stumble or give up? One answer might be a user's experience and confidence. But even given two daily users with similar experience and confidence levels at tasks they know, one might adopt new skills easily and the other has difficulties.

Human-Computer Interaction (HCI) evaluation studies that neglect the complexity of the individual differences inherent in the real user population are likely to provide results that require additional qualification. For instance, selecting from a population that is inherently motivated to use technology ignores the possibility that extrinsically motivated users may struggle to find a way to do the unfamiliar. In a summary of 24 years of HCI research, Barkhuus and Rode (2012) found that over 50% of individuals that participated in HCI research in 2000, and over 48% in 2006 were college students. Students are considerably different from many other user constituencies (Barkhuus & Rode, 2012) due to their computer experience, youth, and general learning attitude.

This study focuses on identifying users' motivation for using computers as predominantly extrinsic or intrinsic, disregarding users with mixed motivation styles. Intrinsic motivation is defined as pursuing activities for their own sake (Ryan & Deci, 2000). According to these authors, intrinsic motivation is correlated with perceived competence, interest, enjoyment, and positive coping. This suggests that intrinsically motivated individuals feel that they can complete the task at hand, are enthused to do so, have the ability to effectively allocate mental and physical resources to the task, and can deal with associated task demand productively. Other authors have linked intrinsic motivation to important cognitive features such as exploration, curiosity, and natural activity (e.g., Oudeyer et al., 2007). Constructs such as creativity, persistence, and improved performance are a result of "authentic" motivation—a highly related construct to intrinsic motivation (Ryan and Deci, 2000). Intrinsic motivation implies the willingness to engage in problem-identification and problem-solving activities, which are associated with productive, if not skilled, performance (e.g., Martens et al., 2004).

On the other hand, extrinsic motivation is defined as doing something purely for results, to get something from the activity (Ryan & Deci, 2000). These authors explained that users with extrinsic motivation perform activities to get a "separable outcome," rather than for the inherent satisfaction of the work itself. In this paper, we focus on the external regulation subcategory of extrinsic motivation, which is defined as an external "perceived locus of causality" (Ryan & Deci, 2000) because it most clearly represents taking action due to external needs or requirements (Guay et al., 2000). In the absence of sufficient extrinsic reward, this focus on external results— when compared to the internal inquisitiveness of the intrinsically motivated — may reduce the extent to which extrinsically motivated individuals are willing to invest effort in finding solutions to problems.

Accordingly, in this study we hypothesize those proficient daily users who are predominantly extrinsically motivated to use computers will struggle to adapt to unfamiliar tasks in familiar software, or to familiar tasks in unfamiliar software. In contrast, we anticipate that proficient daily users who are intrinsically motivated will not have difficulty adapting to these changed conditions.

## METHOD

The procedure included both quantitative and qualitative data collection methods, including inventory, observation, interview, and pre- and post-task questionnaires. Demographic data was collected and analyzed, including computer experience as one of the following ranges of years: less than one, 1 to 5, 6 to 15, 16 to 25, or more than 25 years.

**Participants**

After screening for daily computer use, a convenience sample of 66 male and female daily users (age range: 18 - 87 years) completed an informed consent form and a motivation inventory with 32 questions on a 7-point Likert-type scale. The randomly ordered questions were adapted from Ryan and Deci (2000) for interest/enjoyment, perceived choice and perceived competence, and adapted from Guay, Vallerand and Blanchard (2000) for amotivation, external regulation, and identified regulation. All of the questions originally had the general wording, "this activity" which was replaced with "using computers" or the grammatical equivalent in keeping with adaptation instructions by Ryan and Deci (2000) and Shroff and Vogel (2009). The motivation data were screened for normality, homogeneity, and independence to ensure that they met parametric assumptions (Sirkin, 2006) and those that failed to meet these were analyzed non-parametrically.

A grouping variable was used to identify participants that held a predominantly intrinsic or extrinsic motivation style. The interest/enjoyment sub-scale was used to represent the level of intrinsic motivation after confirming that the data were positively correlated with perceived choice factors (Ryan & Deci, 2000). The external regulation sub-scale was used to measure the level of extrinsic motivation.

Extrinsic users were defined as those individuals that scored above neutral for external regulation and less than or equal to neutral for interest/enjoyment. Intrinsic users were defined as those individuals that scored above neutral for interest/enjoyment and less than or equal to neutral for external regulation. Therefore the extrinsic and intrinsic groups were mutually exclusive. Seven intrinsic users and nine extrinsic users were identified using this method. All 16 of these users were further observed (see below).

To determine whether these groups differed on other constructs, non-parametric Mann-Whitney U tests were used to examine differences in age, perceived competence, amotivation, perceived choice, and *digital native* status (a dichotomous variable). We define digital natives as people who began to use computers before age 18.

**Procedure**

The participants classified as extrinsic or intrinsic users were observed during an individualized computer task that was video and audio recorded. The task included customized directions based on the participant's experience and proficiency. Participants were expected to accomplish a series of computer-based tasks (as outlined below) on their own to simulate a typical user facing new tasks or unfamiliar software. Each observation was unique. The time spent on a task and the number and type of tasks varied based on the user's experience and task behavior.

In Phase 1 of the task, each participant completed routine tasks using email and word processing applications with a familiar computer system and software. This was conducted to demonstrate current level of proficiency and to provide a baseline for Phases 2 and 3. In Phase 2, participants were directed to perform an unfamiliar task using the same (i.e. familiar) software and system as used in Phase 1. In Phase 3, participants were directed to complete the routine tasks performed in Phase 1 but using an unfamiliar software and computer system.

Familiar and unfamiliar tasks, systems, and software were dictated by the experience of the participant. Examples of unfamiliar tasks in Phase 2 (depending on experience) include finding email contacts, inserting a table while word processing, or creating an email address list. In Phase 3, Linux Fedora 17 was primarily used as the unfamiliar system and two uncommon webmail services or one uncommon word processing software were used as unfamiliar software depending on experience. Each of these unfamiliar software applications generally fit into accepted design principles for providing the user with feedback, clear affordance, expected menu and button placement, consistency, mouse hover hints, and more.

Ethnographic interview techniques and think-aloud-type verbal protocols (i.e. relatively unstructured/unconstrained, level 1-3 reports; cf. Ericsson & Simon, 1980) were used during directed observation as a way to capture the actions, attitudes, thoughts, and feelings of the participants. The researcher gave occasional prompts to the user to "think aloud" and continue sharing what they were thinking, seeing or doing. This method of verbal reporting was encouraged to maximize the information received from participants during performance on the directed tasks.

**Analysis**

Observations for Phases 2 and 3 were transcribed and then a coding rubric was applied with an ordinal measure of performance that we termed: *stumble*, *fall*, and *persist* — each based on the time to complete a task. A stumble was defined as taking between 20-60 seconds to complete the task. A fall was defined as taking between 1-3 minutes to complete the task, and a persist as more than 3 minutes to complete. The rubric also measured two attitudes: *quit* and *resist*. A quit was defined as any expression of a desire to stop the task after making an attempt (irrespective of whether they actually stopped or completed the task). A resist was defined as any expression of resistance to even try a task direction or refusal to solve a problem (irrespective of whether they actually attempted the task). All codes were counted only once per task. Each task is a small piece of a larger workflow. For example, sending email to a new address list requires finding contacts, creating a list, adding addresses to the list, finding email, composing a new email, addressing the email and sending it. Coding reliability was confirmed using second and third raters before quantitative results were statistically analyzed.

A qualitative emergent theme analysis was conducted on the individuals' behaviors, attitudes, and feelings to identify patterns, themes, and commonalities between participants in an effort to understand their performance.

## RESULTS

### Quantitative

*Motivation inventory.* Data was validated by demonstrating a positive correlation between perceived choice and interest/enjoyment factors, per Ryan and Deci (2000). Both interest/enjoyment and perceived choice met the assumptions for parametric analysis, and a Pearson correlation test showed significant correlation ($r(66) = .602$, $p < .01$ and $r(16) = .815$, $p < .01$).

Of the 66 respondents, 37% were either high in both interest and external regulation or low in both, so they were considered neither predominantly intrinsic nor extrinsic users and were excluded from observations. The remainder, 18% ($n = 12$) met the criteria for being an *extrinsic user*, but only nine of these participants were available to be (and were) observed during the directed task performance. Of the 66 respondents, 45% ($n = 30$) met the criteria for being an *intrinsic user,* seven of which were observed.

The seven observed intrinsic users were aged between 23 to 87 years and the nine extrinsic users were aged 32 to 74 years. Perceived competence ranged from 2.5 to 4.3 (on a 7-point scale) for extrinsic users and from 2.7 to 7.0 for intrinsic users. Two of the nine extrinsic users were digital natives and 4 intrinsic users were digital natives. Mann-Whitney U tests on the two groups revealed no significant differences in age ($p = .396$), being a digital native ($p = .16$), or level of perceived competence ($p = .07$).

*Coded observations*. The observational data (32 hours of video) were initially coded by the lead author as one of five codes (see Table 1) based on the rubric defined in the *Methods* section. A sub-set of the data (30%) were randomly selected and coded by two additional raters, after training was provided by the lead author on definitions of the codes. Inter-rater reliability of the coded transcripts was greater than 95% agreement for all five codes.

| | **Stumble*** | | **Fall*** | | **Persist*** | | **Quit*** | | **Resist** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ex | In | Ex | In | Ex | In | Ex | In | Ex | In |
| Phase 2 | 50 | 11 | 32 | 5 | 9 | 2 | 7 | 1 | 7 | 2 |
| Phase 3 | 41 | 10 | 24 | 6 | 6 | 0 | 2 | 0 | 6 | 0 |
| Both Phases | 91 | 21 | 56 | 11 | 15 | 2 | 9 | 1 | 13 | 2 |
| Percent | 81 | 19 | 84 | 16 | 88 | 12 | 90 | 10 | 87 | 13 |

*Table 1: Frequency of each performance and attitude measure (and percent of total for each code) across all participants by extrinsic (Ex) and intrinsic (In) users and for Phase 2 and 3. Asterisk indicates significant difference between extrinsic and intrinsic for that code.*

Based on the rubric, every fall is preceded by a stumble and every persist is preceded by a stumble and a fall. Mann-Whitney U tests showed a significant difference between intrinsic and extrinsic users for the frequency of stumbles, falls, and persist. Extrinsic users stumbled, fell, and persisted more than intrinsic users in general (Stumble: $U = 5.0$, $p = .004$; Fall: $U = 5.5$, $p = .005$; Persist: $U = 12.5$, $p = .03$). The extent to which intrinsic and extrinsic users stumbled and fell was also significantly different in each phase (Phase 2: $U = 3.5$, $p = .003$ and $U = 4.0$, $p = .003$ respectively; Phase 3: $U = 9.5$ $p = .018$ and $U = 11.0$, p = .02 respectively). Persist was significantly different in Phase 3 but not Phase 2 (Phase 2: p = .13; Phase 3: $U = 14.0$, $p = .02$).

Extrinsic users also demonstrated a quit attitude significantly more frequently than intrinsic users in general ($U = 10.5$, $p = .01$). Quit was significantly different in Phase 2 but not in Phase 3 (Phase 2: $U = 14.5$, $p = .04$; Phase 3: $p = .47$). However, groups did not statistically differ in the extent of resist attitudes displayed in general ($p = .19$), or across phases (Phase 2: $p = .24$; Phase 3: $p = .19$).

A Mann-Whitney U test comparing Phase 2 to Phase 3 for frequency of coded performance and attitude measures showed no significant difference for either extrinsic or intrinsic users between Phase 2 and 3 for the frequency of stumbles (extrinsic: $p = .37$; intrinsic: $p = .78$), falls (extrinsic: $p = .15$; intrinsic: $p = .872$), persists (extrinsic: $p = .74$; intrinsic: $p = .32$), quits (extrinsic: $p = .05$; intrinsic: $p = .32$), or resists (extrinsic: $p = .49$; intrinsic: $p = .32$).

### Qualitative

*Extrinsic Users.* The nine extrinsic users, aged 34 to 74 years, had perceived competence scores between 2.5 and 4.3 on a scale of 1 to 7. Only two were digital natives and both were over 30 years old and working mothers who had higher self-rated competence when asked to compare to all users but lower self-rated competence when asked to compare to just their peers. Three other extrinsic users had lower self-rated competence when asked to compare to all users but higher compared only to their peers. Four extrinsic users had the same self-rated competence when compared to either peers and to all users.

Performance difficulties in this group can be exemplified by the case of a 71-year old extrinsic. She self-rated her competence at 3 (out of 10) compared to all users but self-rated at 6 (out of 10) compared only to peers. She had 16 to 25 years computer experience. She began the observation session in Phase 1 saying that she never did anything on the computer that she had not been taught. Her inexperience with self-learning on computers may be the cause of some of her trouble adapting to unfamiliar computer environments or tasks. The observations indicated her ignorance of common usage patterns such as where to look for commands or to use hover hints.

During one task in Phase 2, she delayed searching via the help function (within the software) or on the internet to look for solutions. Her speech and exclamations indicated surprise and discomfort at being expected to achieve an unfamiliar goal without being taught. Her behavior included randomly drifting her mouse over the screen and clicking things that took her further from the task goal. She misread, misunderstood, or forgot the task instructions and never referred back to them. Her longest persistence lasted 8 minutes during which she anthropomorphized the computer as “you guys” and complained that “they” were being unfair and blocking her.

Seven of the nine extrinsic users each had at least one occurrence of quitting. Some of the quitting was due to frustration, reasonable limit setting, or loss of interest. For example during Phase 2, one extrinsic participant quit looking for “contacts” after two minutes and calmly reported, “I do not know. I give up,” while apologizing for disappointing the

researcher. Another extrinsic quit a task in Phase 2 after 30 seconds and said, “I’m getting frustrated now. I’m DONE with my computer now.” Only two extrinsic users did not quit or resist, and observations indicated they were compliant, “wanting to please,” and willing to follow directions and not resist.

Resisting was demonstrated by four of the nine extrinsic users. One resisted only once, one twice, another three times, and another seven times. There are no similarities in their sub-scale scores for perceived choice, which ranged from 1.6 to 3.1, or their perceived competence which ranged from 2.5 to 4.3. Each of the seven extrinsic users that resisted attempting or completing a task also showed broader questioning behavior in the course of the observation including questioning authority, the status quo, or the purpose of the requested task. For example, the extrinsic user that resisted the most (i.e. 7 times) denied the existence of a way to empty email trash during Phase 2 even after being told it is currently visible on screen. The extrinsic said, "You’re just wrong... there’s no way to empty trash because it’s already trash.”

*Intrinsic Users.* The seven intrinsic users, aged 23 to 87 years, had perceived competence scores between 2.7 to 7.0 on a scale of 1 to 7. Four intrinsic users were digital natives and self-rated themselves as experts when compared to either peers or to all users. The three digital non-natives in the intrinsic group had lower self-rated competence when asked to compare to all users and higher self-rated competence when asked to compare to just their peers. One digital non-native intrinsic self-rated her competence as 3 (out of 10) compared to all users but as 8 (out of 10) compared to peers. Another self-rated his competence as 4 compared to all but as 6 compared to peers, and yet another, self-rated as 5 compared to all and as 9 compared to her peers.

Intrinsic users had very little performance difficulty, for example three intrinsic users had no stumbles, falls, persists, quits, or resists. One intrinsic had 3 stumbles in Phase 2 that turned into two falls, but the stumbles were qualitatively different from stumbles of other participants because instead of guessing she immediately used searching the web to find answers. Performing unfamiliar tasks was so smooth for the intrinsic experts that in Phase 2 one indicated after only two seconds that he felt he was struggling to find a solution, but by five seconds he had the task completed. The coding rubric allows 20 seconds attempting a task before it is considered a stumble.

Only one intrinsic user had any quit or resist behavior. His resist behavior was similar to the extrinsic users who resisted. For example, in Phase 2 he refused to insert a table into a word processing document and instead insisted that using tabs to create columns was an acceptable facsimile of a table. He also demonstrated the only example of intrinsic “quit” behavior, in Phase 2, when he proposed to stop trying to send email to an email group list after trying for 5 minutes, but instead of quitting, he persisted another 9 minutes until he accomplished the task.

*Similar daily users*. Among the 16 participants, there were only two pairs of individuals that had similar experience, perceived competence, and age, but different motivation styles. Comparing those two pairs side by side can illustrate our hypothesis that two proficient daily users, one extrinsic and one intrinsic, might appear equivalent in daily proficiency until faced with change.

Our first comparison is between two digital non-natives, one extrinsic and one intrinsic, with similar perceived competence of 4.3 and 5.1 respectively, and both in their mid 60’s with more than 25 years computer experience. The extrinsic had low interest at 2.6 and the intrinsic had high interest at 5.6. As our group statistics predict, the extrinsic had performance difficulties in Phases 2 and 3 with 10 occurrences of stumbling, 8 falls, 2 persists, 1 quit, and 3 resists compared to the intrinsic who had 3 stumbles and no falls, persists, quits, or resists. In Phase 1, both had confirmable proficiency using computers in their daily lives, but the extrinsic user became ineffective when faced with the unfamiliar.

The second comparison is between two 74 year old men with similar perceived competence (2.7 and 3.0). One had 6-15 years experience and the other had 16-25 years. Both of these participants had some performance difficulties and were persistent at applying partial understanding of computers to limit their problem solving attempts instead of being open minded and trying a variety of solution techniques. The intrinsic user expressed disapproval of changes in computer interface designs and the extrinsic user conveyed resignation to his low competence while never questioning the interface design. They both repeated the same behavior while expecting a different result. The extrinsic user had 14 stumbles, 10 falls, 5 persists, 0 resists, and 2 quits in Phases 2 and 3 but the intrinsic had only 8 stumbles, 6 falls, 2 persists, 2 resists, and 1 quit.

## DISCUSSION

We focus on the difficulties of extrinsic users because they are the ones facing difficulty with unfamiliar computer tasks and skill transfer. All observed participants had confirmable proficiencies and were competent daily users. Extrinsically motivated users appeared no different from any other competent user until faced with the unfamiliar, at which point their performance diverged significantly from that of the intrinsic participants, who adapted to unfamiliar tasks and software. Simple solutions to help extrinsically motivated users are to encourage them to become intrinsic or to limit their exposure to unfamiliar tasks or software. Both of these solutions are impractical because people cannot be forced to be intrinsically motivated and computer interface designs change quickly and users' needs and wants also change.

Extrinsic users seem to eventually adapt to change as necessary, but they also drop proficiencies when interface design changes render those skills obsolete. For example, very few extrinsic users we observed knew how to get to their contacts in Gmail but formerly knew how to use the address book that was commonly part of the interface design 8 years ago. This indicated that they only bother to know what they need to know. With new interface conveniences like suggesting names in the “to” field, none of the extrinsic users bothered learning that the “address book” is now named “contacts” or where it was. They don’t need it and so don’t use it. They know just enough without it.

Each extrinsic user is an individual with an abundance of attitudes, some of which are directly related to performance. Some extrinsics have limited experience or confidence at solving computer problems during unfamiliar tasks. Some extrinsic participants were annoyed to have to bother. Some seemed to have a strong expectation of failure and hated having to try or refused to try.

Some observed attitudes were directly related to interface design and were usually expressed as frustration and complaints. For example, one extrinsic gave a veritable lecture outlining interface flaws. Motivation research indicates that intrinsic motivation includes a sense of control (Martens et al. 2004). Without intrinsic motivation, extrinsics would have less sense of control. Criticizing could be a form of taking control.

Another attitude that the extrinsic participants sometimes expressed was a vague sense of not belonging. For example one extrinsic said that the "geekitude" of the university computer lab was enough to throw him into confusion. Another extrinsic talked about how embarrassed she was to ask for help and implied she felt like an outsider. Ryan and Deci (2000) explain that intrinsic motivation is associated with a sense of relatedness and belonging. Extrinsic users cannot build intrinsic motivation if they feel separated from being "in the know."

Many observed extrinsic participants indicated they thought computer experts have "secret knowledge." For example, one extrinsic explained that clicking the right-hand mouse button is the "secret answer" to most computer usage problems. Specific computer visual and verbal vocabulary can be obscure and result in creating walls and dividing people instead of welcoming them. For example, one extrinsic was proficient but expressed that he did not know anything and that he was an outsider.

Inflexible proficiency is a problem. Some stumbling blocks we observed include not understanding the big picture, not relating patterns from one situation to another, and not understanding vocabulary or icons. These are specific and teachable skills that could help extrinsic users to accomplish unfamiliar tasks but also to feel like they are "in the know" and have relatedness. This could help them become intrinsically motivated.

## CONCLUSION

Extrinsic users exist, and many are functional, effective, independent, daily users. They were 18% of our sample, a sizable proportion. Extrinsic users had over 80% of the performance difficulties in our observations and had significantly more stumble, fall, persist, and quit occurrences than predominantly intrinsically motivated users. These difficulties were not explained by age, perceived competence, or whether they were digital natives. They are hard to distinguish from intrinsic daily users until they are faced with change and become unproductive.

The results of this study provide some tentative insights into how important it is to include extrinsically motivated users in evaluation studies of interface design. Intentionally or unintentionally focusing on a population that is inherently motivated to use technology ignores the possibility that extrinsically motivated users may struggle to find a way to do the unfamiliar. Interface design and evaluation techniques that consider the complexity of the individual differences inherent in the real user population are likely to provide improved results. We recommend evaluating motivation style and ensuring a breadth of motivation styles when selecting design evaluation participants. Extrinsic users can be predicted to have low adaptability with unfamiliar tasks. HCI professionals should try to include extrinsic users in their design plans and in their evaluation studies.

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