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The Calculus of Small Change: An Ethnography of Unlearning

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Technological innovation obsolesces not only earlier technologies, but also the knowledge, skills, and expertise of the users of those technologies. Individual obsolescence is generally written off as the cost of participation in a vibrant capitalist economy, a small price to pay and part of the creative destruction that makes the entire system work. This paper takes a closer look at the individual costs of such obsolescence, through an investigation of the particular class of changes that present themselves subsequent to an individual's adoption decision—updates, upgrades, service packs, redesigns, patches, bug fixes, feature releases, versions, and other putative enhancements crowding into the contemporary technological landscape with increasing frequency. Updates make up a much-neglected but significant proportion of the total number of changes that make their way to those who participate—whether whole-heartedly or with reservations, willingly or as the unsought consequence of their participation in the labor force—in the diffusion of modern technology. Diffused through an existing relationship between company and customer, updates do not fit the general model developed in diffusion theory and highlight the human cost of rapid technological obsolescence. Analysis of findings from usability testing and interviews reveals that the most significant elements of the update experience are, on the one hand, the construction of the adoption decision itself and, on the other, the experience of unlearning one set of routines in favor of a new closely related set. While not all such unlearning and relearning is onerous and labor-intensive, those routines that do not ordinarily rise into consciousness during use of a technology, such as memorized classification schemes and actions that have become incorporated into motor memory, are typically experienced as imposing an extremely high cost. Differentiating between types of unlearning, this paper offers a calculus of the individual costs imposed by different types of changes conveyed in updates, and it does so with two distinct goals. First, such a calculus may inform a technology design practice that is cognizant of high-cost unlearning and minimizes unnecessary penalties to the established user base in the diffusion of small change. Second, the update experience serves to illuminate a fundamental question of positioning that confronts the business ethnographer seeking to maximize his or her value to the corporation.

INTRODUCTION

This paper grows out of some twenty years of observations of people grappling with change—or, as the case may be, unfortunately a little less often, rushing to embrace it post-haste. Received wisdom has it that all change is hard, but such bromide is difficult to reconcile with the full range of responses that different changes provoke in people, whether observed in the lab or in the wild. Similarly, some changes appear to require a great deal of mental effort, while others do not. Given the profligacy with which changes are presented to and visited upon existing customers, account holders, and other

incarnations of people who have adopted a technology at some point in the past,[1] it is unfortunate that user experience professionals are not more knowledgeable about the experience and labor of adaptation for those who are meant to benefit by it, at least in principle. There is a tradition of cost of change studies in software engineering, but it attempts to quantify and reduce the cost of development rather than the costs absorbed by people who may or may not have articulated a desire for a change.[2]

The tradition of diffusion studies does concern itself with the people who do or don't adopt technologies, but it does not satisfactorily address the question of what causes the variation in subjective response or mental effort in those cases where diffusion is accomplished on the initiative of the diffuser rather than the adopter. This is in part due to diffusion theory's long-standing focus on characteristics of adopters and on the context in which the innovation is introduced to and evaluated by them. Everett Rogers notes that "Diffusion researchers in the past tended to regard all innovations as equivalent units from the viewpoint of their analysis" (Rogers, 20xx, p. xx). More recent diffusion studies have begun to look at factors inherent in the innovation itself and have proposed relative advantage, compatibility, complexity, trialability, and observability as significant factors. These go some way towards understanding the experience and labor of adapting to change, but they are still crude and reductionist measures. Moreover, some of the innovation characteristics, especially trialability and observability, are irrelevant to updates, the vast majority of which are not evaluated before adoption. That is to say, the changes described by innovation theory do not cover the full spectrum of changes that have become routine in the normal cycles of technological renewal.

To clarify the distinction between changes that are diffused as described by diffusion theory and changes that are diffused through existing relationships between purveyor and recipient, it is necessary to define a variety of terms related to change. A change presented through a relationship established by a prior adoption decision by the individual may rise to the level of an innovation, in the sense that the change may embody a new idea.[3] It is difficult to draw a clear boundary around the concept of a novel idea, however. It doesn't allow us to distinguish between changes that amount to innovations and changes that fall short of that standard. By Rogers' definition, we might agree that the introduction of video chat in Facebook is a new idea and that a bug fix is not. But does the movement of the browser tabs from a position immediately below the menu and bookmark bars to a new position above the location bar in Firefox 4 amount to a new idea? For the sake of expediency, I offer an addendum to Rogers' definition, making a further distinction based on functionality. If a change offers new or different functionality, as experienced by the person receiving the change, I will treat it as an innovation. If the receiver experiences the change as essentially the same functionality but with different presentation, I will call it an improvement. Improvements would also include technical

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[1] I make every effort to refer to human beings in ways that go beyond their relationship to a technology and the corporation that owns it, to recognize their multiplicity and refractory nature, except when intentionally viewed through the lens of technology purveyors.

[2] See for instance the work of Barry Boehm, who introduced the "cost of change curve" in Software Engineering Economics (1981) and has continued to develop his analysis in more recent work.

[3] Rogers defines innovations in terms of a new idea, where new is defined from the perspective of the person deciding whether or not to adopt the innovation: "If an idea seems new to the individual, it is an innovation" (Rogers, 2003, p. 12).

changes that are apparent to the person receiving them, such as a change in response time. I exclude changes that are not apparent in use, as not relevant to this discussion. By this definition of an innovation as a change involving new functionality, the movement of the browser tabs in Firefox qualifies as an improvement.

Of course, the choice of the label "improvement" is tendentious, in the same way that the label "innovation" is tendentious. It is entirely possible, and perhaps even likely, that all improvements are intended as such, but that doesn't mean that they are improvements by any subjective or objective measurement centered in the receiving individual. The extent to which the method of diffusion itself influences perceptions of the value of what is being diffused is discussed in detail below.

METHODOLOGY

The analysis in this paper derives principally from three usability studies, one ethnographic study, and a series of individual interviews.

- *An ethnography*, consisting of 3 stakeholder interviews and 8 employee interviews, to identify causes of failure of a failed software dissemination project in a corporate context, representing an update of a performance management reporting tool.
- *A usability study* for the WebEx web conferencing and screen sharing tool concerning the usability of video controls, with 17 participants, conducted in February 2011. Participants consisted of 5 expert WebEx users, 6 WebEx users with limited experience, and 6 first-time users who had experience with other web conferencing tools but had not used WebEx before. The different experience levels among participants enabled a comparison between an "update" experience and a "new" experience, in which task completion rates among expert users was below task completion for participants who had little or no experience with WebEx.
- *A usability study* for the WebEx web conferencing and screen sharing tool concerning audio controls, with 15 participants, conducted in January 2011. Participants included 3 expert WebEx users, 5 WebEx users with limited experience, 4 users of other web conferencing tools, and 3 participants who had no experience with web conferencing at all. The study focused on the interaction of connecting to the associated conference call and managing the connection, a conceptually challenging aspect of the overall experience. The usability study contained one aspect, known as "call-back," that was a change to the participants with limited WebEx experience, representing an update experience for them. Both novice and expert users (who had had prior exposure to the feature) used call-back, while the participants with limited WebEx experience avoided it.
- *Individual interviews* with people who had undergone an update experience they perceived in negative terms, conducted in Spring 2011. These include 4 who had updated to Microsoft Office 2007 from an earlier version of Office and spoke about their experience of that update. Additionally, 2 interviews involved the experience of an update of the Android operating system on the smart phone and 1 interview involved the experience of a person updating to a new version of the Firefox browser.

In addition, some examples of UI updates and responses to them are drawn from three online discussions among interaction designers and design anthropologists on the topic of adaptation to UI changes that took place in March 2011. Detailed discussion of findings from the interviews and usability studies is provided below.

SUBJECTIVE EXPERIENCE AND THE CONSTRUCTION OF CHOICE

The standard account of the adoption decision for innovations, known as the "optional innovation decision," portrays the decision as fully controlled and constructed by the individual: "the innovation-decision process is essentially an information-seeking and information-processing activity in which an individual is motivated to reduce uncertainty about the advantages and disadvantages of the innovation" (Rogers, 20xx, p. 14). The decision to adopt or reject the innovation is influenced by others (friends, colleagues, reviewers, etc.), but the choice itself is located within the individual. Diffusion theory recognizes two variations on this basic scheme in which decision-making power is situated differently: the collective innovation decision is made by consensus by a group, and the authority innovation decision is made on behalf of individuals and imposed on them, with or without related penalties for non-compliance. In these variations, the locus of decision-making power is recognized to be different in different scenarios, but the nature of the decision-making activities is not seen to change. There is still an evaluation period in which information seeking and processing precedes the adoption decision.

Updates, on the other hand, present themselves to the decision maker as heavily shaped by his or her prior choices and investments, both in financial terms and in terms of time and effort, as they are propagated, post-adoption, through pre-existing relationships between the purveyor of the update (originator) and the individual receiving it (recipient), rather than through the information channels and social networks by which the innovations of diffusion theorists are introduced. The prior investment of money and time in the product locks the person into place, creating a less than level playing field between originator and recipient at the time an update is pushed. People generally recognize that the investment they have made in an innovation ties them to the product. The larger the investment, the tighter the lock, and the less power remains in the hands of the individual, giving the originator of updates the power to make changes at will, with little risk of causing the customer to abandon the product. In the case of a classical innovation the decision is essentially between adoption (a decision in favor of change) and rejection (a decision in favor of no change). The choice to be made by the individual when presented with an update, however, is between adaptation and abandonment; that is, between acceptance of one change and acceptance of a different (and prima facies larger) change. The choice is heavily weighted in favor of adaptation, driven by inertia. After all, abandonment also involves a change, one which, in the ordinary course of events, is anticipated to be more extensive and may also involve a financial investment. In practice, this means that the decision to accept or reject an update differs from the adoption decision for innovations diffused through a network in the following respects:

- Typically, there is a significant (objective and subjective) curtailment in the freedom to choose an update, as compared to an innovation diffused through standard channels.
- As the choice is curtailed, so often is the support for evaluation activities.

Curtailment of Choice

In some cases, recipients are given no choice to accept or reject the update at all, unless they are willing to discontinue their activities and abandon the device in the instant. All computer users have by now become familiar with interruptions of their work by machine-generated messages that note that updates are ready to install. The choice presented is whether to restart the computer now or later. Similarly, one may find oneself unable to shut down the computer because it is busy installing updates. The user is kindly requested to refrain from interrupting the proceedings upon penalty of potentially dire failure. In the case of cloud applications, the account holder is liable to find him- or herself in receipt of an update at any time, typically without warning. Such an update may be part of a limited experiment, in which only a subset of account holders is involved, without benefit of a consent agreement. In other updates, an element of choice is presented, in the sense that the update has to be initiated by the recipient, who will then typically also need to agree to terms and conditions, heaping insult upon injury. One informant who accepted such a user-initiated update for an OS upgrade for her Android phone described the situation as follows: "I was thinking that they hadn't given me a choice. I just had to do the upgrade." Continued use of her phone appeared to require compliance. Several informants talked about the risk of "getting in trouble" if they declined voluntary updates, driven by a perception of the general fragility of much of the technology they interact with daily.

The feeling of being presented with something that looks like a choice but is in fact stacked to force the individual's hand applies not only to free updates but also to purchased versions of software applications. An independent business consultant described her purchase of Office 2007 as follows: "I felt forced. I knew they weren't going to support the version I had in the future. Also, I was unable to work with files from my clients, who were already on Office 2007." There is widespread recognition among those who participate in modern technology culture that companies deliberately do whatever they can to stack the choices offered to their customers.

Evaluation Limitations

In the case of an innovation as traditionally defined, the adopter will have an opportunity to evaluate its benefits and decide whether the cost and labor of change are justified by the return. By contrast, the presence of some element of choice in the acceptance of updates does not presuppose that the "information-seeking and information-processing activity" Rogers described will be facilitated. Often, there is no information concerning the nature of the improvements contained in the updates at all. With luck, a brief summary will be offered. As one informant explained, "You get used to it. You just do it. You hit the button and hope for the best. You never know what you're going to get." A software engineer noted that any time he started to use a new version of a compiler, he was prepared for lots of changes: "You go to compile your code, and you get error messages. That's how you know they changed something." Several informants noted that the originator of the update may not know either what changes the update will bring. Naturally, this general state of uncertainty reinforces the reluctance many informants express about accepting updates. A person who bought a new laptop computer tried to avoid getting a new operating system at the same time: "I looked for a laptop that was still shipped with XP, but it was already too late. I knew I would have to upgrade a lot of my other software because of compatibility issues. But what really got me is that I had to scrap my printer too….

There were no drivers for it that worked with Vista." Although such unexpected mishaps may also occur in the case of a freely chosen innovation, people report a fundamentally different experience of them.

Inferences

The pervasive feeling of being presented with a choice stacked against individual autonomy infects the way that updates are experienced. A common thread in accounts of update experiences is the imputation of cynical motives on the part of the originator, as well as suspicions of intentional manipulation. It adds up to a common perception among my informants of gross indifference to the experience of the recipient. The young woman who upgraded her Android OS reported that the upgrade "slowed everything down. It was terrible. It's still terrible. And also, they changed how you pull up the apps. I preferred the drag-up menu, because now when you tap it, you still have to drag it up. Google changed it, I figure, because they had to make it look like the upgrade was worth it to me." Something in the overall experience inclines the informant to assume not a poor design choice in the switch from a drag-up menu to a control that requires tapping and then dragging, but rather a ploy to create the appearance of benefit to the end user, sugar-coating to make the medicine go down. The business consultant who felt forced to upgrade to Office 2007 explained that "They can afford to do that. I'm being yanked around by the program. But don't ask me to believe [the new interface] is natural..." Along similar lines, three participants in an online discussion agreed that a recent change to the Inbox on Facebook was highly unwelcome. As one of them exclaimed, "Facebook. Bad! … Try out their 'new messaging'. I defy you to figure out how to send someone a message if they're online (it pulls up the chat window). I have absolutely no idea why they did this, but I'd bet it's to make advertising work better. Facebook needs a new term: it's not UX it's AX, for advertisers' experience." FaceBook users in general are well aware of the fact that revenue comes from advertisers rather than account holders, accompanied by a conviction that advertiser needs trump account holder needs whenever a conflict arises. But the update experience, which propagates unsolicited improvements to the end user, foregrounds that awareness and strongly colors the affective experience. The unwelcome improvement then becomes likely evidence of the favored treatment of advertisers.

A similar perception played an important role in the rejection of a performance management software improvement at a large software company. The evaluations used to be written in Word and were then uploaded into a central repository for tracking purposes. The update involved the implementation of the old form in the enterprise software that the HR organization used. Usability was extremely poor, the majority of users being unable to complete the basic workflow without extensive training. Managers estimated that an evaluation would take three to five times as long to complete. Strikingly, the most pervasive and intensely felt complaint among managers was not about poor usability but rather that the project's inferred intention was "big brother." As one manager said, "This has no value except to make sure that I do the process. It's just big brother." It is worth noting that tracking was a feature of the previous incarnation of the tool, a fact known to interviewees. Another interviewee explained that the project proved a willful disregard on the part HR "for the time pressures we are under. [The new tool] shows that they do not care. That bothers me, especially when we're talking performance." While the fact that the new tool was time-consuming to use was considered problematic, but HR's inferred indifference to that fact was experienced as more significant than the

fact itself. Again, what stands out is the tendency of the hapless (but resentful) recipient to personalize the events, to construct a story about the originator's intentions that highlight the injury they have experienced.

The recipient's leap to a (vividly) imagined indifference and putative cynical motives on the part of the originator is common. It presents as a symptom of the disempowerment which is characteristic of updates and which sets it apart from the experience of a standard innovation diffusion. A recent study (Raita, 2011) shows that priming in the form of positive and negative product reviews influences the satisfaction scores of usability participants for the device they interacted with, though not the completion rates for the tasks presented to them. An update appears to function as a different kind of prime, activating an awareness which remains dormant in the course of evaluating and adopting an innovation diffused in the standard manner.

Adaptation or Abandonment

Whether an update contains an innovation or an improvement doesn't appear to make much difference to the experience of powerlessness. The structure of the update experience foregrounds the cost. What results in this situation is a distinctive pattern in which the user is initially very aware of the frustration of having lost a competency (and sometimes a capability as well) and the labor of re-acquiring it. If frustration rises to intolerable levels, abandonment may ensue, but the price of abandonment is typically high so many individuals soldier on. Once adaptation is complete, the struggle can become difficult to remember and a more balanced evaluation of the product comes to the fore. Here is an example from a person upgrading to Windows 7 and learning to adjust to the new control panel UI: "When I was first exposed to Windows 7 … I had a hard time with functions in the Control Panel. I understood that the additional menu layers were meant to make things like setting up a network and/or printer easier and more user friendly, but for me, it seemed like a lot of fluff. Many of the menu overlays were too prescriptive to me; the options were not always relevant to what I was doing. However, once I was able to personalize Windows 7, I nearly forgot how difficult it was to adjust." What is noteworthy here is that the examples of things the user was trying to do (set up a network, connect a printer) were known operations which the person was able to do easily in the earlier version of Windows to which she was accustomed. It is conceivable that, if it were to be tested with first-time users, the new control panel might perform better than the old one. But that doesn't help an experienced individual who is suddenly performing worse than with the old design.

When the individual decides that the struggle is too painful and abandons the product, a major investment is typically required. This may involve the purchase of an alternative piece of hardware or software and the learning process to recover comparable competency levels to what the person was used to in the old product. What disappears in such a scenario is the frustration of individual obsolescence and the labor of unlearning. A long-time PowerPoint user describes the process as follows, "I'd been using PowerPoint for years, and maybe I wasn't a power user, but I knew how to do what I needed to do. I knew where things were. And then all of a sudden, with the ribbon, I just couldn't do half of what I needed to do. I couldn't find basic functions. So I switched to Keynote. That was a huge relief. I don't know if Keynote is better, really. It was just that I could learn it without being furious all the time." Another informant explains that she could not get used to Office 2007,

being "so mad that … I was not going to see anything as an improvement. I eventually solved the problem by installing older versions of MS Office. Since then, I've traded in my PC for a Mac and have moved even further away from MS Office."

Adopter categories (innovators, early adopters, early majority, late majority, laggards) are not directly relevant to updates, which are pushed indiscriminately to all people with an existing relationship with the originator, regardless of what category they might fall into. However, it is possible that they have an indirect relevance to the update experience. Early or later adopters may have a different response to change in general. They may have different levels of tolerance for the labor of adaptation, a different outlook on the cost of abandonment, and possibly a different degree of adaptability that may smoothe out the process of unlearning. A better understanding as to whether and how the adopter categories apply to post-adoption behaviors falls outside the scope of this paper, but it might throw an interesting light on the decision to adapt or abandon in the face of an update.

THE LABOR OF UNLEARNING

Any update can contain innovations (added functionality or re-conceptualized functionality, which allows the user to do something new or different), improvements (the same functionality, allowing the user to do the same thing but in a different way) or both. To understand the process of adapting to them in more detail, it will be helpful to take a closer look at how the different kinds of changes are likely to affect recipients. Some of these changes are learned right away, whereas others require multiple repetitions for the new interaction to become second nature.

First, it is important to note that some changes (innovations or improvements) will not be fully understood. One participant in an online discussion complained that "up to Photoshop CS3 (from memory) you could Command + click/Alt + click on an item in your design and a contextual menu would pop up listing all your layers with the layer selected for the item you'd clicked on. This was a really quick way to select a layer. This was dropped in CS4 with no alternative provided." Another participant replied immediately with an explanation of how to do it in CS4 and CS5: "If you have the direct-select tool selected, control-click (mac), which I think is Alt-Click on the PC, and the contextual menu should appear. You might wish to check to make sure no control panels have overridden your keyboard shortcuts in PS." It is easy to conclude that something is no longer possible when an accustomed action no longer has the accustomed effect, especially when the functionality is not perceived to be essential to the product. If the new interaction is not immediately apparent, the recipient of the change may not know to look for it in its new hiding place.

Misinterpretations of improved UI based on prior experience are also quite common. In a usability study testing a redesign of the video conferencing UI in WebEx, a prototype was tested that showed a single dynamically switched video stream in the default display. The user was able to access all video streams simultaneously in an alternate display by pressing a button labeled "View Everyone". Participants were shown the default display and were asked, "If you wanted to see everyone in your meeting at once, what would you do?" All participants with limited and no experience with WebEx were able to access the alternate display by clicking the "View Everyone" button. However, of the five WebEx experts, four assumed that the button would allow them to hide the names of the people in the

meeting. Their interpretation was conditioned by prior learning, all of them citing a little-used control in the WebEx interface that allows the user to close a set of small panels, including the panel listing the names of attendees. Since WebEx experts didn't want to hide the names of meeting attendees, they didn't click the button and failed to discover that their interpretation was incorrect. That is, no unlearning took place, at least not in the space of the usability test.

When unlearning does happen, it takes distinct forms, which can be roughly divided into three categories:

- Unlearning associated with a change from memorization to visual interaction flows, which is generally speedy and soon experienced as a welcome reduction in cognitive load.
- Unlearning associated with mental model changes, which is typically accomplished over longer periods of time. These changes can leave a residue of dissatisfaction, in that the new conceptualization may not ever be felt to offer the desired functionality, leaving the user hankering for the pre-update experience.
- Unlearning associated with changes in memorized routines, such as classification schemes, as well as routinized actions stored in motor memory. Such changes are especially frustrating when they are experienced as arbitrary.

Relieving Cognitive Load

It will not come as a surprise that almost all informants list changes that provide a graphical UI in place of a command-line UI as positive. This is generally true for any change that bypasses the need for memorization of any sort. It should be noted, however, that the switch-over can still be slow to complete in cases where the old memorized interaction is provided alongside a new graphical interaction, especially when a fully memorized version takes less time or effort to complete. One informant talked about AutoCAD: "As I remember it, it was a dry looking and powerful DOS based software where you could draw using commands with specific syntax, coordinates, and a sophisticated specific language: I can still remember that it was like an obscure magical trick. Then, version AutoCAD 12 for Windows was released in 1993 and incorporated icons and it was a major change. It's a long history... but it took a while to adapt to the new interface. I kept using the commands instead of having to grab the mouse to select an icon, which took longer for someone well trained in the art of typing commands and coordinates." The experience of switching to a new approach was also cushioned by the fact that both old and new interactions were still supported in this example, allowing the user of the software to determine when and how to make the switch. That is, the resentment that rises in the wake of disempowerment is not activated when both interactions are presented side by side, putting the individual in charge of the decision to adapt or delay adaptation.

Mental Model Unlearning

Mental model improvements, on the other hand, are generally painful to users and take a while to complete even when the individual has a generally positive feeling about the technology. The innovation characteristic of "compatibility" recognized in diffusion studies may in some situations be relevant to this form of unlearning, in the sense that a mental model improvement could be more or less compatible with the mental model of the pre-update experience. An example of an incompatibility

came up, unplanned, in remote usability testing of several variants of the WebEx audio connection interface. The testing was done on the WebEx web conferencing client: the participants connected to meeting using the existing UI and were then shown several variants in prototypes shown via screen sharing. The existing tool showed a "call-back" option that few WebEx customers turn on. When selected, the user enters the number for the phone they wish to use and the system places the call. All the user has to do is pick up and press "1" when prompted. Meeting attendees who are used to the call-back feature rate it highly, as it is much less labor-intensive and error-prone than the "call-in" option, by which users have to dial a phone number, followed by a 9-digit meeting number, followed by an "attendee ID" which may consist of one or two digits. A third option provided is to use the computer for the call.

The call-back option was familiar to the expert participants in the usability test, who generally prefer to use it whenever offered also because it remembers phone numbers used in the past. Usability participants who had no prior exposure to WebEx (7 participants in all) also used it without incident, 5 out of 7 rating the audio experience as "very easy" and 2 out of 7 rating the experience as "easy". Unlike experts and novices, participants with limited WebEx experience went through an "update experience" with the call-back feature, which they had not been exposed to before. Four out of five participants with limited experience reported having difficulties operating the call-back feature:

- 2 participants used the computer for audio, just so they wouldn't have to use the call-back feature.
- 1 participant found the control that enabled her to switch to the call-in feature.
- 1 participant tried to look up the call-in phone number and tried to enter it into the call-back feature. When it didn't work, she asked for help using chat.

Three out of 5 rated the audio experience as "difficult" and one rated it "neutral" and one rated it "easy". The difficulty for these participants was that they were used to having to place the call themselves and had no concept that the system might place the call. Their assumption was that a person, most likely the meeting host, would place the call, which was considered undesirable, especially given the fact that the host was a stranger to them. One participant commented that she decided to use the computer for audio (which she had seen before but had not opted to use), because "I don't know who would conference me in. I didn't want to make you call me. I prefer to do it myself." Using the computer for audio fit the general model of wanting "to do it myself" whereas the call-back feature didn't fit that model. Several participants also cited as a reason for avoiding the call-back that they wanted to place the call right away, while they assumed that a call-back would be unpredictable, based on their assumption that a person would place the call. As one participant put it, "I don't know how long that would take. I was thinking that it could be, like, 10 minutes, maybe? I don't know. I wanted to do it right away, so I tried to see … I found the thing I usually use, where it shows me the number to call and so on." Interestingly, none of the novices tried to avoid the feature.[4] This is not to argue that mental model changes invariably and necessarily cause usability breakdowns. Rather, the example

[4] In separate testing for a mobile device that uses a call-back feature, participants with limited experience made the same assumption that a person in the meeting would call them, but they proceeded anyway. The avoidance behavior is specific to the individual who remembers an alternative interaction.

shows that there are situations in which a mental model change disadvantages the individual with prior experience compared to a novice and that it may spur an avoidance behavior. For unlearning to take place, some affordance for unlearning needs to be present, since avoidance behaviors do not provide an experience that allows the individual to adjust his or her mental model.

An example of a mental model change where unlearning did happen concerns an upgrade to the latest version of the accounting software Quicken (for Mac) from the 2007 version. The informant recalled her experience as difficult: "The areas that represent the biggest challenge for me are not in the UI per se, but rather in the data/navigation concepts (e.g., how the budget and transfers between funds are managed and presented). It is a good product, but I had a lot of headaches making the switch because it was conceptually so different." The unlearning may be less painful but also have less positive results, which was the case with the Facebook messaging system described above. One of the women who complained about Facebook's messaging redesign struggled with the way the new design treats histories of messages. Another wanted to be able to send asynchronous messages to friends who are online rather than being forced into synchronous chat. And the third explained that the feed does not suit her purposes: "While I have grown accustomed to these changes, it has also made me use it less. The feed is somewhat useful, but filters out info from people I haven't 'talked' to in a while, so it's really lost its purpose for me since I use FB primarily to keep up with people I don't often get to talk to."

Unlearning of Routines

Changes in routine present an altogether different type of unlearning, where an established routine must be overwritten by a new one by dint of repetition. An example may be found in the reflections of a person adjusting to the placement of the home button in Firefox 5 in similar terms: "At first, I just couldn't find the home button. I mean, every time I needed it, I had to figure out where it was all over again. I kept looking in the old place for it. Eventually I got used to it being to the right of the URL and now I'm not sure exactly where it used to be. Somewhere on the left." All changes in the placement of frequently used elements require the same kind of unlearning. A special case of positioning changes took place when the Microsoft Office tool suite moved from fixed to dynamic menus, which meant that frequent users could no longer predict the exact placement of any function in a menu. As one person recalled, "At one time, I knew exactly where everything was when I pulled down most of the menus. I didn't have to read to hit what I wanted. And then that didn't work anymore. The items weren't in the same place as before and you could never be sure if it would stay where it landed." In this case, unlearning takes place without a parallel relearning. Another example of improvements that require gradual overwriting of routinized actions include changes in keyboard shortcuts, which are quite common in games but are also occasionally seen in productivity software. One informant complained about the reassignment of drawing shortcuts in PowerPoint to various review functions in Office 2007.

Changes in classification schemes deserve attention in this context also. The most frequently cited example of an improvement that was extremely difficult to adjust—the ribbon in Office 2007—involved multiple reclassifications, which sent many individuals scrambling to find functionality they were very familiar with before. The change was generally well received as an improvement for first-

time users, but it was extremely challenging in that it retired a vast amount of know-how among users of pre-2007 Office applications. One informant described her experience with the new classification scheme inherent in the ribbon as follows, "The grammarian in me objects. Some things you insert into your document, but they're not in the "Insert" page, for instance. I know they can afford to do this. I'm yanked around by the program, but don't ask me to believe that it's natural, the way they do it now." While the classification scheme of the old Office suite was no more "natural" than the new one, it was taken for granted in the older versions while it is experienced as capricious in Office 2007. Another informant also complained about the ribbon: "My frustration with the MS Office ribbon was that I could not find commands that I was used to finding and using intuitively. The placement and bundling/organization of the commands were different and non-intuitive to me. Frankly though, even if they were reorganized in an intuitive manner, it was lost on me. I was so mad that they moved and that I had to spend extra time looking for the commands, that I was not going to see anything as an improvement." She describes very clearly how an acquired skill feels intuitive—that is, it feels like it doesn't require cognitive effort?—whereas the new interaction feels non-intuitive and it stands in stark contrast with the acquired one. It raises the bar for redesigns to a very high level.

CONCLUSION

Findings from the studies analyzed in this paper suggest not only that innovations diffused through existing relationships between purveyors and end users of technology create a different kind of choice for end users, but also that there are design considerations that can positively affect the update experience. These include:

- Designing to optimize user control – This includes enabling the recipient to evaluate the changes and allowing them to move to the improved experience as an autonomous choice, for instance by providing parallel interfaces that support both the old and the new.
- Providing affordances for unlearning – To facilitate mental model changes, affordances for unlearning help the user understand that a given mental model does not fit the functionality provided.
- Avoiding substitutions of one memorized routine for another.

Most of all, these findings suggest that no improvements should be propagated to the established user base unless they have been proven to be true improvements for those who receive them as updates as well as those who encounter them in a first encounter with the product and that the costs of change are manageable to the individual.

However, the update experience raises questions not only for designers but also for ethnographers in industry practice. By the nature of our work, we take the perspective of the individual or groups of individuals. By the nature of the relationship with the business commissioning that work, we would tend to take the perspective of the business. Provided that the interests of both groups are aligned, this dual allegiance can be highly productive and lead to satisfactory outcomes for all parties, ethnographer included. Whenever we can take findings such as the ones I have collected here to a business and argue for a need to be more respectful of the established user base, pointing out specific experiences to avoid and others to pursue, we can feel both useful and virtuous. However, it is difficult

to avoid the thought that the update experience exposes a fundamental conflict of interest between businesses and their customers—profit maximization on the one hand and positive product experiences on the other—and that the business ethnographer is uncomfortably balanced on the fault line. This is not to argue that profit maximization is never reconcilable with positive product experiences and such values as delight, productivity, empowerment, or other individual benefits. But it would be naïve to think that such will invariably be the case. Where does that leave the ethnographer? I would like to propose that this fundamental conflict creates the potential for a productive tension in the ethnographer's practice, exposing the complexity and ambiguity of contemporary life in a manner that can lead to more nuanced analysis. But it will only do so if we are continually aware of being in the middle of a conflict that cannot be resolved.

REFERENCES

Baliga, Ganesh, with John Case, Wolfgang Merkle, Frank Stephan, and Rolf Wiehagen
2008 When Unlearning Helps. *Information and Computation* 206 (5): 694-709.

Boehm, Barry W.
1981 Software Engineering Economics. Upper Saddle River: Prentice Hall.

Boehm, Barry, with Richard Turner
2003 Balancing Agility and Discipline. Boston: Addison Wesley.

Ching, Clarke
2004 The Cost of Change Curve.
http://www.clarkeching.com/2004/02/the_cost_of_cha.html

Fleming, Di, with Grace Lynch
2005 Innovative Learning and Unlearning. *In Proceeding of the 2005 conference on Towards Sustainable and Scalable Educational Innovations Informed by the Learning Sciences: Sharing Good Practices of Research, Experimentation and Innovation.* Chee-Kit Looi, David Jonassen, and Mitsuru Ikeda, eds. Pp. 93-100. Amsterdam: IOS.

Raita, Eeva, with Antti Oulasvirta
2011 Too Good to Be Bad: Favorable Product Expectations Boost Subjective Usability Ratings. *Interacting with Computers* 23: 363-371.

Rogers, Everett
2003 Diffusion of Innovations. 5th ed. New York: Free Press.

Starbuck, William H.

1996 Unlearning Ineffective or Obsolete Technologies. International Journal of Technology Management, 11: 725-737.

Toffler, Alvin
1970 Future Shock. New York: Bantam.

Wimbauer, Stefan, with Nikolaus Klemmer and J. Leo van Hemmen
1994 Universality of Unlearning. Neural Networks 7 (2) 261-270.