

A Human Capital Perspective of Skill Acquisition and Interface Loyalty

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There are many arts among men, the knowledge of which is acquired bit by bit by experience. For it is experience that causeth our life to move forward by the skill we acquire, while want of experience subjects us to the effects of chance.

Plato

To most men experience is like the stern lights of a ship, which illuminates only the track it has passed.

Samuel Taylor Coleridge

It has long been recognized that humans are able to improve task performance as a result of repeated experience with a particular task, and that this type of learning consistently adheres to the Power Law of Practice. However, less attention has been given to the impact that practice, and the acquisition of skill, have on a user's loyalty to a particular software interface. Here, we review the notion of human capital, and discuss specific examples from research into online shopping, in an effort to better understand the role of learning in the development of interface loyalty.

Learning by doing is an essential aspect of human knowledge acquisition. Over time and through experience we acquire the skills we need to survive and thrive in the world. While novel tasks often require a concerted effort, over time, and with practice, many behaviors that were initially very demanding become routine. As a result, the demands of the task are diminished and cognitive resources can be allocated elsewhere. Learning to drive is a good example of this phenomenon. While initially operating an automobile can be quite demanding, with practice many of the required skills become automatic. Similarly, using a computer to type a letter or to shop for a new CD can be intimidating to a novice user. Yet, experienced users find the operation of a word processor or the navigation of an online store to be a relatively simple task. The ability to learn from experience is a fundamental aspect of human existence.

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However, when behavior is automatic and the environment changes, the difficulty of the task and the potential for error can increase dramatically. Driving on the right-hand side of the road, for example, becomes routine very quickly when one learns to drive in North America. As a result, North Americans renting a car in England, where they must drive on the left-hand side of the road, find the task of driving more difficult and tend to avoid it when possible. In this way, learning by doing can result in the development of preferences for behavior to which acquired skills can be applied. Another example can be found in the realm of online shopping. Although some pundits expected the advent of e-commerce to result in a reduction in consumer loyalty and increased information search, the early evidence indicates that online shoppers tend to engage only in very limited amounts of prepurchase information search and to, in fact, be quite loyal to a single site.¹ This type of loyalty has been explained as the result of the development of user skills, which make a site with which a consumer has had some prior experience more useful, even though, given the same experience with another site, the latter would be equally useful [5]. We examine the role of skill acquisition in the development of interface loyalty from a human capital perspective, using some early evidence from investigations of consumer loyalty in online shopping.

The Learning Curve

It is commonly recognized that, in general, practice at a task results in improved performance, and that more practice leads to even more improvement, but at a decreasing rate. In other words, the biggest gains in performance are made early on, and although performance continues to improve, the rate of improvement declines. This pattern of learning, which adheres to the *Power Law of Practice*, is often referred to as a learning curve. It is so ubiquitous in studies of skill acquisition that “current theories of skill acquisition and automaticity treat the Power Law as a benchmark prediction that they must make in order to be taken seriously” [7]. According to the Power Law,

$$(1) \quad T = a + bN^c,$$

where T is the time required to complete the task, a is the asymptote (the limit on performance), b is the difference between the initial and the asymptotic performance, N is the number of exposures to the task (that is, the amount of practice), and the exponent c is the learning rate.

The value of practice is captured by changes in the term T , the time required to complete the task. As the number of exposures to the task increases the time required to complete the task decreases as a power function. For example, the more practice a driver has at parallel parking, the more quickly s/he is able to parallel park; however, while practice increases the speed of performance, the biggest gains are made early on and the magnitude of the increase in performance diminishes with additional practice. Similarly, the more times a shopper buys a book from Amazon.com, the more

¹Johnson, Moe, Fader, Bellman and Lohse [6] find that the average number of online stores searched before a CD is purchased is 1.1, and that 70% of CD and book shoppers are loyal to a single site. Similarly, Brynjolfsson and Smith [3] find that online consumers tend to make purchases from higher-priced vendors even for homogeneous products such as CDs and books.

rapidly s/he is able to buy a book at Amazon—although, again, the rate of improvement decreases over time.

In their classic text, *The Psychology of Human-Computer Interaction*, Card, Moran and Newell illustrate the role played by the Power Law of Practice in understanding user keystroke performance [4]. The Power Law succinctly describes the learning process that a typist goes through. In particular it details the speed with which novice users gain a moderate level of skill, and then continue to improve at a decreasing rate. Because the practice curve is eventually all but flat—it continues to increase at a slow rate and is never completely horizontal—typing performance becomes relatively constant and it is reasonable to refer to experienced users' performance as stable.

These early findings are echoed in recent empirical and experimental studies that have found this exact effect in online shopping. As the number of exposures to a Web site increases, shoppers spend less time at the site [5] and are able to complete tasks more quickly [8]. The observed reductions in time consistently follow a pattern that is very closely approximated by the Power Law (see Figure 1). Not surprisingly, the acquisition of skills related to human interaction with a computer interface appears to be subject to the same type of learning curve as most other cognitive and motor skills (for a review, see [9]).

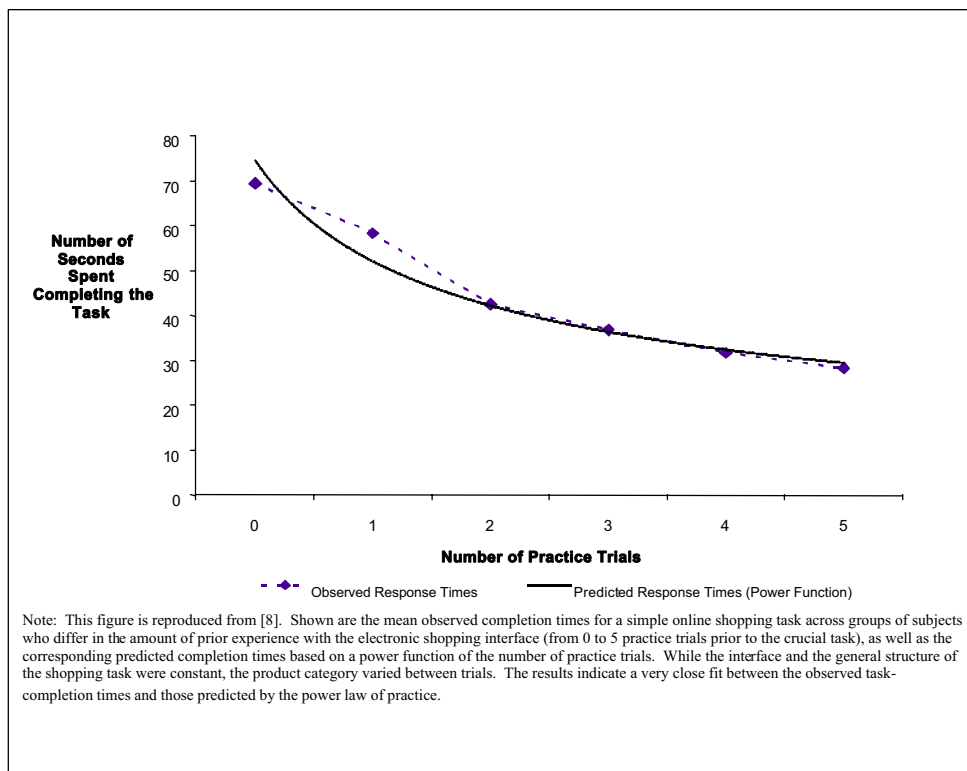


Figure 1. Task-completion time as a function of experience.

The Relationship Between Skill Acquisition and Preference Formation

Economists have long recognized the value of the knowledge and skills that humans acquire over time [11], which they have modeled as *human capital*.² According to Ratchford: “Human capital is basically knowledge, skill, or expertise embodied in people and acquired through investments in formal or informal education, training, or learning by doing” [10]. While the notion of human capital has traditionally been applied to returns on investment in schooling and training, and the relationship between investments in human capital and economic growth [2], it is also emerging as an explanation of human behavior. Specifically, the human capital model of consumer behavior postulates that, as a result of different consumption experiences over time, people develop preferences for specific items. Moreover, the accumulation of knowledge and/or skills that are particular to a specific item reduces the total cost of that item (a cost that includes time and effort as well as price). This is an important point because it ties the ubiquitous learning curve and the Power Law of Practice to human preference formation. In essence, the human capital model suggests that the savings, in terms of time, that are realized as a result of practice have an economic value so that the total cost of performing tasks or consuming items in the future is reduced. The reduction in future costs as a result of acquired skill means that things in which people have invested human capital (that is, for which they have accumulated relevant knowledge) will cost less and, therefore, be preferred to things in which no investment has been made. As a result, forward-looking people should seek to make investments in human capital that reduce the costs of future use or consumption.

This approach to the study of human choice behavior differs from traditional models of choice in that it explicitly considers time costs and the value of specific knowledge or skill. People with high time costs will be more affected by their investments in human capital than people with low time costs. In other words, investments in human capital will have a greater impact on the preferences of individuals that place a higher value on their time. The human capital model also recognizes that the accumulation of knowledge or skills specific to a particular item or circumstance leads to an increase in preference for that particular item or circumstance. As a result, the model makes an important connection between the acquisition of knowledge and/or skills and the development of preference.

User Skills and Interface Loyalty

Wernerfelt formalized the notion that the development of user skills can be an important determinant of loyalty [12]. He argued that experience can result in the acquisition of skills that make a particular item more useful than some other item, even though, given the same amount of experience with the other item, the latter would be equally useful. Applied to a computer interface, such as an electronic storefront, this suggests that users will come to prefer those stores for which they accumulate applicable knowledge and skill. For example, having used Amazon.com over time and having developed skills that reduce the effort/cost required to make a purchase at this vendor’s digital store, a shopper may prefer Amazon.com over its competition (for

²For a detailed taxonomy of the role of human capital in a consumption context, the interested reader should see [10].

example, BarnesAndNoble.com)—even though a competitor’s site may have been preferred had the person initially developed skill in using it.

The basic idea here is that practice reduces the time required to complete a particular task, such as shopping at an electronic store. The reduction in the time required to shop online has an economic value, which will vary depending on the value that the individual places on his or her time. As a result, the total cost (including the time cost) of, to continue with the earlier example, buying a book at Amazon.com is lower than the total cost of buying a book at Barnes and Noble’s site because of the human capital that has been invested at Amazon.com.

Wernerfelt [12] and Ratchford [10] develop their models by explicitly considering only the impact of *non-transferable skills*.³ However, some of the skills acquired in connection with one interface can, in fact, be transferred to other interfaces—that is, some skills are *transferable*.⁴ For example, learning to use SAS’s statistical software teaches the user about SAS’s software, but it also teaches the user something about statistics programs in general. Therefore, learning about SAS results in the development of skills that are transferable to other statistics programs such as SPSS. Nevertheless, learning to use SAS should also result in the development of non-transferable user skills that increase the consumer’s preference for SAS relative to SPSS. We believe it is important to recognize that both types of skills, transferable and non-transferable, can have a significant impact on consumer choice. While non-transferable skills may decrease the cost of using one product or interface relative to a competitor, transferable skills reduce the cost of using all products (or interfaces) within a particular category. Therefore, only the development of a user segment with non-transferable skills represents a competitive advantage for a particular interface.

Evidence from our empirical research indicates that, when competing interfaces are very similar, users will acquire skills that are easily transferable from one interface to the other [8]. As a result, they will be more likely to switch from the interface with which they have prior experience (the “incumbent interface”) to a different one (the “competitor interface”). In fact, when two interfaces are highly similar, the incumbent interface may well be at a disadvantage if users who are exposed to a highly similar competitor interface are attracted by the latter’s novelty. This possibility is demonstrated by our recent empirical results, which suggest that, when interface similarity is high, users tend to prefer the (more novel) competitor interface.⁵ However, in an environment where a greater proportion of non-transferable skills are developed—that is, when the competitor interface is substantially different from the incumbent—users tend to prefer the incumbent interface and are much less likely to switch to the competitor interface (see Figure 2). Therefore, it is important to note that, while experience results in the acquisition of both transferable and non-transferable user skills, only non-transferable skills result in a greater relative preference for the incumbent interface that increases as the amount of experience with the incumbent increases.

³Skills that can only be used in the environment in which they are acquired or with the item with which they are associated, and that do not generalize to other environments or other items.

⁴Skills that can be used beyond the environment in which they are acquired, and that generalize to other environments or other items.

⁵After the initial exposure to the incumbent interface, participants in our experiment were forced to use the competitor interface for one trial before making a choice between the two interfaces.

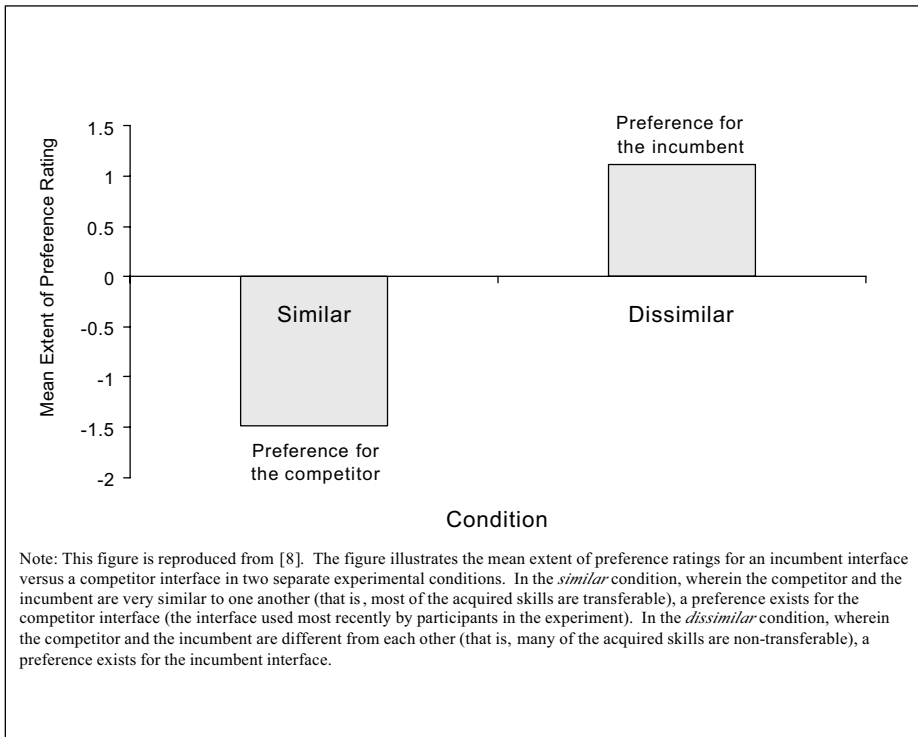


Figure 2. Impact of similarity manipulation on extent of preference ratings.

Summary

The preceding discussion is a broad and somewhat eclectic overview of the human capital link in the relationship between learning and loyalty. At this point, it is useful to summarize the conclusions from this discussion that contribute to a better understanding of interface loyalty. First, it is clear that most human learning proceeds along a learning curve that can be approximated by the Power Law of Practice. This means that with practice, skills are acquired that reduce the time required to complete a task. Second, the human capital model suggests that this reduction in task-completion time has an economic value such that, as practice with a particular interface increases (that is, learning progresses and the time required to complete a task decreases), the cost of using that interface decreases. Third, as the cost of use decreases, the user's preference for the incumbent interface relative to that for alternative interfaces increases to the extent that the acquired skills are non-transferable. While transferable skills may make an entire product category or type of software more attractive, interface loyalty is driven by the acquisition of non-transferable skills.

In essence, the human capital model suggests that users “will direct their consumption and search activities in ways that maximize the impact of their accumulated expertise” [10]. This is an important principle in the design of electronic interfaces, whether those interfaces facilitate online shopping, word processing, statistical analysis, or other activities. New users will tend to prefer interfaces with features that are familiar, and to which they can apply skills they have previously acquired. However,

our research and the human capital model suggest that, in order to promote the development of long-term user loyalty, it is also important to encourage the development of non-transferable user skills.

Following Card et al. [4], who argue in their third principle of user-interface design that it is imperative that interface designers know their users, we recommend that early in the market research and product development process an effort be made to understand the accumulated human capital of the target user group(s). It is important to consider that, from a user perspective, the cost of a new piece of software or of a purchase at a new online store incorporates not only the price of the product, but also the time cost associated with learning to use the product or to complete the purchase transaction.

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