

David Pepper

Kathryn Summers

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### **The Construction of the Novice in HCI Research**

The word *novice* has its roots in the word early Roman Catholics used to distinguish persons who had entered a religious order from those who had taken final vows. In current use, novices are people who in any profession or vocation have just begun a learning experience, and as in the past, they do so within an implied social framework. All fields of study are defined by rules and expectations that have to be satisfied in order for learners to be successful. As we shall see, the state of being a novice is a kind of intermediary zone -- or probationary period -- that must be overcome in order to attain acceptance and recognition.

In the fields of industrial psychology, human computer interaction (HCI), and general end-user computing (EUC), novices are basically "clueless" users of personal computers -- typically those without formal training, or any expectation of mastery of generally accepted PC computer skills. In part because the body of knowledge that ordinary people can be expected to know changes so rapidly, and to a certain extent simply because the penetration of PCs into the world of work is still in process, novices exist and persist at every age level, in every measure of corporate success and esteem; in every office and school, and in organizations of every type.

It is not surprising then, that in formal studies of human computer interaction (HCI), the concept of novices is well accepted. However, the definition of novices is inconsistent, and is established differently by many different researchers. The term "Novice" itself is really only meaningful in a larger context of potential mastery of a body of knowledge and learning. Following a weak circular logic, experts are defined as those who have achieved this mastery, and novices are those who do not.

In this way, the use of the term novice in HCI is a Romanizing<sup>1</sup> idea, which on the one hand invokes the continuum of a range of skills and capacities (from very little, to very much), and on the other hand conveniently associates the study of the novice, with all other studies of novices, and in doing so, participates in and bolsters the myth of the novice who seeks enlightenment and risks stigmatization of failure. However, the word novice is also really just a synonym for "learner", and the study of the novice can be understood more simply as the study of the process of knowledge acquisition and retention.

User groups with more measurable characteristics such as users with visual, auditory, kinetic, and tactile disabilities benefit from more widely established and more clinically measured criteria for defining them. And unfortunately, novices in HCI run the risk of being the straw-man creations of HCI researchers, in fact little more than a metaphor or narrative element. These sad facts can at times make novices seem a vague or even bleak topic of study.

However, there is much to be gained from formally establishing what a computer skills novice is, by defining to whatever degree possible the cognitive, social and motor characteristics of the novice, and inviting a shrewd analysis of how HCI theory can be applied to design tasks with the special needs of novices in mind. This is because novices -- or "beginning learners" -- are far and away the largest, most important cohort of any kind. They are in fact a universal user, and each of us will be or have been at some point counted among their ranks. Insights into the needs of basic computer skills learners apply at some time to every computer user on the planet. And as we explore the idea of what it means to proceed through a basic personal computer skills learning process it should become evident that we will each play the role of

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<sup>1</sup> Romanization of written languages is the coercion of a foreign language to use a roman/Latin alphabet for convenience. This is accomplished using phonetic transcription or transliteration, and the limitations of the union of the phonemes (the disunion) typically determine the success of this inelegant practice (Wikipedia contributors). In the same way that Romanizing offers a comfortable vehicle for communication at an almost unbearable expense, the term novice on the one hand resonates with a familiar and comforting narrative. But it also does so at the expense of precision in talking about what is actually the key subject of study. Rather than simply invoking the *novice*, using the word "*learner*" would beg for further qualifications of what is to be learned and what learning would accomplish.

novice again and again, whether through advancing disability from age or illness, or simply by the endless march of progress in technology, with its unfolding paradigm shifts, and hitherto unimagined new contexts.

### **Characteristics of the Novice**

Taking the metaphor and the commonly held definition at its face value, as novices are learners who have not yet learned, then it must follow that the defining cognitive characteristic of unskilled computer users are both an absence of knowledge of computers in general, and specifically how to operate computer interfaces. To this end unskilled users will have only a limited capacity for attention, processing of inbound information, and retention of things that are learned.

This difficulty in learning is because the novice is exploring new territory, and is doing so with limited mental map, mental model, and internalized hierarchy. Novices are more likely to lose their sense of place in navigation, and are more likely to be distracted by the cognitive load of presented by the interface, the tools, or the tasks. Furthermore when novice users also struggle with real disabilities the prospects of making the journey as a learner from novice to beyond, may simply seem hopeless.

Most design features that benefit novices can be generalized to all users. In terms of easing cognitive tasks, designs which aim to simplify meaning assignment, and which harmonize the mental model or hierarchical structure of the interface and software with that of the learner have the most to offer. In "Approaches to Web Search and Navigation for Older Computer Novices", Dickinson echoes a call for "'radically simple' design strategy" citing previous research in supporting dyslexics (her own research) and seniors (Dickinson 282). This seems to capture the spirit of designing interfaces for people who are bound to be cognitively engrossed in a learning process.

Extending the commonly held definition of novices into the social area, novices are inherently outside the realm of experts -- and likely to know it. Just as the metaphor implies,

novices are embedded in a social circumstance, and ultimately they seek entry, acceptance, brotherhood with established (if not expert) users. Synonyms for novices (of all kinds) include green, "noob" (newbie), beginning learner, rookie [driver], etc., and they convey some of the flavor of stigma that goes along with the identity of one who does not know.

Computer systems for novice users, particularly in the workplace, constitute an unlikely mix of qualities. On the one hand they are in many cases the means to make a livelihood, provide opportunities for communication (of many sorts), as well as positive vehicles for establishing or exploring an identity (think: church news letter, bowling league, "I love kittens", etc.).

On the other hand, computer systems, particularly in the workplace, represent possible dangers. Users are expected to avoid getting viruses, maintain working hardware, to prohibit security vulnerabilities, and in general to refrain from abusing technology for the sake of distraction and taking advantage in various ways.

Since novices are not defined in terms of physical attributes they have no particular inherent motor characteristics of their own. Designs which are better suited to novices will tend to be those which are better suited to all users in general. With this in mind, designs are better which are easier to physically interpret have a huge advantage (from the point of view of pre-attentive stage of perception). These metrics include the Gestalt laws of proximity, continuity, symmetry, similarity, and common fate.

Beyond perception, the world of physical characteristics also affects the learning process in the context of Fitts law which establishes a motor-physical basis for certain areas of the electronic interface to be more accessible and easier to operate than others (MacKenzie 35-40). Areas of the screen which do not require intentional slowing down and positioning to use with a mouse are demonstrably easier to use. This means that the outside corners and to a lesser extent the limits of the display all around are more accessible and less expensive in attention to use than trying to hover over a button, combo/select box, list-box, or text box to give it focus.

This insight also applies to the keyboard, although it does so in a somewhat distorted fashion. Keys which are at hand in a resting position have some advantages in speed of access, but many of them suffer from difficulty in pushing them alone or with specific intention. The question of which keys are the most usable is an important one which should not be ignored. Excluding situations where the whole universe of alphabet keys are required, Fitts law can be extended to highlight the keyboard's outmost regions, which have several usability hot-spots which are especially effective for navigation, choice making, and executing rudimentary universal commands. These include escape, control, space, arrow keys, keypad enter, keypad minus and plus, enter, and perhaps some of the F-Keys. To frame it in terms of physical characteristics, novices are more able to learn and use interfaces which exploit our natural ability to discern and strike certain keys and key areas on the keyboard. This is particularly true when input can be selectively denied from adjacent areas which are not mapped to the interface at a given moment.

### **The Shifting Definition of Novices**

In the following section several research papers about novices and experts are compared (the publication date is included as part of the narrative comparison, not the citation). Each one establishes a topic of study, and draws the stage with novices at one end and experts at the other. One of the interesting insights revealed in looking across this roughly chronological sample of EUC research, is that the topic of mastery is like stepping into a river -- always changing, and relative in interesting ways. Some of these relative aspects hinge on the framing of skill sets to be studied, thus someone who is a novice word processor might theoretically be an expert spreadsheet user. But the framework can be distorted on another dimension--as novices and experts are compared in ways in one study in a manner that may distinctly overlap and thus contradict other studies' definitions. For example, some studies focus on novice

computer programmers, many of whom would be considered expert computer users within the framework of another study's learning-skill scale.

Furthermore, and perhaps most amazingly, paradigm shifts in computing distort the skills that can and should be studied, perhaps as often as every decade. It is easy to forget the time many of us spent learning on 640x480 monochromatic screens, with text interfaces and 8.1 file name-spaces (limits not conventions). More nuanced paradigm shifts occurred with the rise of GUI-intensive personal computer operating systems and the subsequent task-switching, which in turn have given rise to multiple-desktop/multiple-monitor work patterns with many simultaneous programs running. The ascendance of first networking and then internetworking, as well as trends toward virtualization and system integration are likewise leading toward a future model for EUC in which a multitude of simultaneous connected platforms and OSs interact together in complex ways which obsolete and explode the previous paradigms. New combinations include a web of interrelationships between phone/PDAs, laptops, desktops, servers, etc.

In "Several Approaches For Improving User Cordiality in The Design of On-line Systems For Novice Users" (1981), Sandy E. Selander hypothesizes a number of principles for designers to use to aid in the creation of software that is "cordial," which Selander defines basically as easy to use and considerate of users who may not be familiar with the nuances of the software—or even masterful computer users at all (Selander 18). Only two of Selander's principles are really germane to the discussion of novices as a group, mainly because the others are now considered attributes of a formal software development process and can no longer confused with design features.

Selander calls for the development of three kinds of online help. The first is explicitly to support the system learning process with what she calls "menu listings" (i.e. interface help) (Selander 19). She also calls for "[help] key option displays" (i.e. help help), as well as what would now probably be called structured online documentation (Selander 19-20). Further

refinements suggested by Selander include context sensitive menus, and context sensitive help (in the sense of suggestions) (Selander 21), which are for the most part now widely thought to be desirable features – at least from the point of view of supporting novice users.

Selander also observes that the benefits of "System Organization" are of singular importance (Selander 20). She talks about the need to "present logical constructs for the novice user to comprehend." Adding, "If the user can internalize the system's structure, (s)he will feel more comfortable working with the system" (Selander 20). Among the ideas she develops further is the need for a navigational hierarchy which persists on-screen to help orient the user to their progress through a process (Selander 20).

A related feature that she emphasizes is context sensitivity in navigation and interface, which although it should be, still isn't a design principle that is well adhered to. The spirit of her ideas is that the system should have insight into what a user is doing, and that as the user makes choices/actions through selections and other kinds of inputs, the system should judiciously limit the further options the interface offers, by removing competing choices which if chosen would create contradictions or errors (Selander 21).

In "The Quality of Expertise: Implications of Expert-Novice Differences for Knowledge Acquisition" (1989), Marianne LaFrance concludes that experts' knowledge differs from that of novices in key ways, including two dimensions that are key to our discussion: their mastery and framing of experience in terms of an "underlying schema"; and in what she calls "the episodic nature of expert memory" (LaFrance 6). The expert sees circumstances of work tasks in terms of outcomes based on experience: "Experts not only have stored more information but have organized that information into more structurally and hierarchically meaningful patterns than have novices" (LaFrance 6).

This level of analysis allows what she refers to as "tactical" insight into what they are doing, rather than what she calls "factual" (LaFrance 7). Novice users by comparison are tasked with watching, interpreting, and remembering everything they are doing, perhaps for the

first time. Since they lack the insight into what is happening, they don't have the ability to draw meta-information level conclusions and assumptions from the incidence of work they are experiencing (LaFrance 7).

In "Modeling and Measuring End User Sophistication" (1992), Sid L. Huff, Malcoln C. Munro, and Barbara Marcolin develop and test a tool for measuring what they call "End User Computing" (EUC) sophistication. The model they create is organized like a Rubick's cube, in a 9x9 set of compartments, which rate a user's skills on a scale of high, medium, low performance on the three different axes in terms of skill-sets: breadth of knowledge, depth of knowledge, and finesse (a measure of ability with creativity or innovation) (Huff, Munro, and Macolin 4-7). These scores (which are rendered in cubic diagrams) can be used to count, weigh and visualize data representing a single individual (one instance, still in a cube), or be populated by aggregate data (also still in a cube) (Huff, Munro, and Macolin 6-8). The tool is intended to offer a more qualified, more insightful visualization of the attributes of a person, team, or organization in relation to others (in this case in multiple cubes).

Among the things that stand out in this study are the degree and way in which they articulate the importance of computer skills to the individual and the organization. They position these ratings within a changing landscape, where trends toward downsizing and Malthusian marketplace ethics apply pressure to organizations and individuals alike to justify their existence with proof of productivity (Huff, Munro, and Macolin 1). They also position this within a literature review of the conception of novices in academic research, which summarize at a high level how various research efforts have measured and defined their skills relative to experts (Huff, Munro, and Macolin 2-3).

However, it is in Karla Saari Kitalong's "In The Novice User Enters the Discourse Community: Implications for Technical Writers" (1990), that the definition of novices really develops the depth of complexity the topic really deserves. She critiques existing definitions of computer literacy and focuses on the idea that computer literacy is transmitted by

communicative events from experts to novices, and she does so, by focusing on a sociolinguistic analysis of how computer literacy experts communicate with novices (Kitalong 101-109). In doing so, she defines experts and insiders as a Swalesian "discourse community", and posits that gaining knowledge to become an expert happens in a communicative [social] milieu (Kitalong 105-109). Kitalong sees the study of beginning learners as possessing an inherently social dimension, and she sees the ignorance of this aspect as being at the root of many common misconceptions about the learning process that novices hope to traverse.

The attributes of Swales' discourse community idea are that members share public goals; have unique mechanisms for communication; and have specific conventions for what proves or establishes social success with the community (Wikipedia contributors). A simple example might be car stereo enthusiasts who form a social network replete with discrete goals, routinely comparing their stereos with one another in an oscillating process of competition and cooperation, each progressing together toward the ultimate goal of having the loudest, coolest, most expensive – i.e. most elite – car stereo imaginable.

Like the other researchers studying novices discussed previously, Kitalong cites several models that define novice in relation to expert, and breaks down and defines gradations in skills separating classes of users from one another to her satisfaction (Kitalong 101-104). This view shares much with many and separates novice from expert into hierarchical classes, which culminate for Kitalong in "full scale literacy", by which the novice is proved to have been transformed into an expert and can be "creative" (Kitalong 102-103).

However, Kitalong breaks with convention by pointing out how the prevailing model of computer literacy may fail to address the real goals of learners, who may not wish so much for full membership in the social organization of experts, but may in fact have slightly discordant personal goals for learning (Kitalong 103). In Kitalong's model everyone in the model understands that many users will never achieve mastery, that there are social obstacles to

seeking help, and most importantly that the stigma of being an outsider is an essential and inexorable part of the construction of the identity of being an insider (Kitalong 105).

For Kitalong, it is "technical writers" who have the task of spanning the gap, because they are charged with the responsibility of building bridges between knowledge seekers and the knowledge itself (Kitalong 108). These bridge-builders constitute a third part in the learning process, who enjoy some of the privileges of being insiders, but at the same time are experts in the process of making the journey from novice to expert (Kitalong 108). And these people who play the role of teacher and guide must somehow be outside or above the normal expert community members, or else they wouldn't be as effective at or motivated to give away the coveted access to expert information and status.

### **Conclusions: The Learning Interface**

By this point two themes which are difficult to reconcile should be apparent. On the one hand, "novices" are really just a fancy word that means "beginning learner". HCI research into novices hasn't really established a real definable class of user known as a novice. The definition for what a novice is totally dependent on the body of knowledge that is the context of the research. It is largely a false category – although one which is comforting, convenient, and which is widely believed in.

On the other hand, common sense says we must design for novices in part because design features that serve beginning learners well are largely assumed to be advantageous for all users. Moreover, system "learnability" is one of the greatest measures of usability overall. To this end, many principles of design stand out as of special benefit to the novice user.

Among these are widely accepted enhanced help features including help which focuses on the interface itself. This is often extended to the idea of context sensitive help and may be further extrapolated to the idea of context sensitive interface features which limits incorrect choices wherever possible.

Persistent navigational hierarchies and overall system organization should make it easy to see where the user has delivered focus. This applies to navigation and to task-level actions. To this end, granting focus to controls should show or hint what the user is about to do, rather than presenting a selection of choices that the user might do.

Physical limitations of perception, “mousing” and typing impose other design constraints on novice friendly design. Navigational controls should always be located on screen at the limits of the screen, and should be able to be operated by keyboard, using the keys which are the easiest to strike successfully – primarily a set of keys at the edge of the keyboard with very distinct locations, shapes, and dimensions.

Finally, the greatest advantage that can be employed to aid novices in interface design is probably an appreciation of the complex role that knowledge seekers play out in their relationship to the community of learners and experts around them. While it is hard to find a takeaway from Kitalong’s insights into the complex cliquy relationship between discourse community experts and beginning learners – what is clear is that the process of knowledge transfer is part of the survival of the social organization. And it is at heart a communicative process.

It is easy to see computer skills as something that exist in a vacuum, particularly if you work in information technology, since your work is typically an inward facing support role. But in truth, for users work tasks, computers and computer interfaces are inherently interrelated. And the goals for a user are almost never mastery of the computer in isolation. Their goals are much more powerfully definable in relation to one another, to the work itself, and often to other seemingly unrelated interests (like car stereos, or kittens).

With this in mind, the development of communicative opportunities within the interface itself promises a transformation. On a simple level this could replace a “submit a bug report” type feature with opportunities for communicating with other users, expert and novice alike,

through multimedia vehicles like instant messenger, or community based documentation like wikis, threaded discussions, and blogs.

Happily, as discourse community framed learning comes into focus, discrete technical problems may recede from prominence. The concept of system and interface design itself may be due for a revision where design requirements and deliverables take their rightful place alongside all mundane work items, and good design is seen as a part of a communicative, social process – an ongoing discourse, rather than some kind of final word or solution.

### Works Cited

- Dickinson, A., Smith, M. J., Arnott, J. L., Newell, A. F., and Hill, R. L. "Approaches to Web Search and Navigation for Older Computer Novices". Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. San Jose, California, USA, April 28 - May 03, 2007. CHI '07. ACM, New York, NY, 281-290. DOI=<http://doi.acm.org/10.1145/1240624.1240670>. This research reports the results of a study in which an experimental search interface called "Cybrarian" was developed to specifically address the needs of senior novices. The design of the interface was informed by User Sensitive Inclusive Design (USID) principles, which were applied by emphasizing adjustments to seniors' limited visual and auditory perception, dexterity, and cognition. The work makes an effort to articulate the relative challenges that senior novices face as well as to position itself within other research in the field on the same topic. It culminates in a data presentation of user's results on the Cybrarian system versus an unnamed ISP search system. This article presents a detailed list of design features which favor senior novices which would be of particular use to interface designers. This article also does more than most at creating a narrative description of the challenges that senior novices face and in this way is useful in establishing the importance that good and optimized interface design plays for all parties in the software development milieu.
- Huff, S. L., Munro, M. C., and Marcolin, B. 1992. "Modelling and Measuring End User Sophistication". Proceedings of the 1992 ACM SIGCPR Conference on Computer Personnel Research. Cincinnati, Ohio, United States, April 05 - 07, 1992. A. L. Lederer, Ed. SIGCPR '92. ACM, New York, NY, 1-10. DOI=<http://doi.acm.org/10.1145/144001.144011>. This research focuses on defining and measuring "End User Sophistication" within the study of "End User Computing" (EUC), which is basically the study of personal computer users within a larger organization. The

paper positions itself within the EUC field, and contains a literature review which explores how other research has defined end user sophistication, as well as providing detailed lists of skills which users' mastery has been graded on in various research contexts. The research culminates in describing a field study which yielded data that was collected and organized by an experimental model. The Huff model is like a Rubik's Cube, comprised of nine cubes within a larger cube, with each dimension of the cube symbolizing one of three user skill attributes: "breadth", "depth", and "finesse" (a measure of creativity). This research would be of particular use to people studying in the EUC field, and to anyone who is interested in modeling skill levels in a way which is designed to aid comparisons between individuals and/or work groups for use by non-technical decision makers.

LaFrance, M. "The Quality of Expertise: Implications of Expert-Novice Differences for Knowledge Acquisition. SIGART Bull., 108 (Apr. 1989), 6-14. DOI=<http://doi.acm.org/10.1145/63266.63267>. This research focuses closely on defining and comparing the knowledge of technical experts with technical novices. Although the focus of the article is on computer users, the scope of the study of expert vs. novice knowledge and knowledge acquisition extends to other fields, including chess players, bridge players, and others. Thus this research paper has a broad scope and aims at achieving generalized conclusions about expert-novice differences, rather than focusing on a particular field or skill set. The qualities that are said to distinguish experts from novices include: "schemas" (a pre-existing model of a task or subject which aid problem solving by reducing dependency on trial-and-error), "episodic memory" which is insight into problem solving from previous experience, and "robotic" behavior by experts, which also speaks to the way that their mastery relieves them of much of the cognitive load shouldered by novices trying to performing tasks they are unfamiliar with. Several other attributes identified describe basically the same phenomena: that experts' knowledge is

more complex, organized into larger units of information which become trusted constructions (black boxes), which the author calls "chunks", that allow a more goal focused approach to problem solving. This research provides a useful model of knowledge acquisition, which is very detailed, and broadly applicable across a range of skills.

Kitalong, K. S. "The Novice User Enters the Discourse Community: Implications for Technical Writers". Proceedings of the 6th Annual international Conference on Systems Documentation. Ann Arbor, Michigan, United States. D. A. Ainsworth, Ed. SIGDOC 1988. ACM, New York, NY, 101-110. DOI= <http://doi.acm.org/10.1145/358922.358941>.

This research paper focuses on the study of computer literacy for use by technical writers, and how it can be advanced by focusing on the social and communicative dimensions of knowledge transfer from experts to novices. A literature review summarizes a number of significant studies of computer literacy. In comparison, this research applies a sociolinguistic approach that is purported to reveal the importance of ephemeral and nuanced contextual aspects of work-places that affect the business of knowledge acquisition and transfer. In this sense it attempts to address what could be called a "mechanistic" view of computer literacy and replace it with something that is more organic and less predictable, less rational, and less uniformly defined in terms of productivity. To this end, it mirrors other social science research promoting the role/idea of "agency" in the interpretation of symbols and messages, and as in other sciences, this change in focus allows for [users] pursuing individual goals. This paper and this perspective shifts the focus of knowledge acquisition and redefines it in terms of knowledge transfer. This reframing highlights the cultural differences between the learner (who is by definition outside the discourse community of experts) and the experts who may transmit knowledge that can transform the novice into an expert. Despite the ultimate focus of this paper being upon technical writers, the model presented is of

particular interest to any applied work, in which successful knowledge acquisition/transfer is imperative.

MacKenzie, I. Scott. "Motor Behavior Models for Human-Computer Interaction". HCI Models, Theories, and Frameworks. Ed. John M. Carroll. Morgan Kaufmann Publishers, San Francisco, CA. 2003

Selander, S. E. "Several Approaches for Improving User Cordiality in the Design of On-line Systems for Novice Users. SIGCPR Comput. Pers. 9, 2 (Nov. 1982), 18-21. DOI=<http://doi.acm.org/10.1145/1037016.1037019>. This industrial research for "The Mitre Corporation" focuses on "cordiality" in interface design, which is an aggregation of attributes that are often called "usability", namely that which makes software easier to use and learn to use. The paper is somewhat dated, but many of the conclusions have become conventional knowledge in software design. Among the most important of these features are context sensitive help, online documentation, and a general trend toward reducing the complexity of choices presented to users based on the tasks they are performing. The natural evolution of this idea has resulted in what is commonly called "work-flow", and it in turn implies that evolved software contains a meta-data layer beyond the primary data it is primarily intended to store. Metadata, is data that is used to configure the application, and is pivotal in transforming what previously would have been a system of menus into a more usable, more customized tool or implementation. The article lacks positioning in terms of a literature review or significant attention to other research in the field, and reads more as a list of suggested features or principles for software design. This would be useful mainly to interface design researchers and practitioners.

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