DEVELOPING INTERFACE DESIGNERS FOR TOMORROW

A Focus on "Teaching" the Essence of Design Mastery

Barbara Gorayska
City University of Hong Kong
csgoray@ cityu.edu.hk

Chris Lonsdale
Chris Lonsdale and Associates
clonsdale@superlearning-asia.com

How do you develop as a wise, intuitive, ethical and creative Interface Designer? In this paper we present guidelines for effectively interfacing learner cognition that rapidly develops designers with a difference. We call it Integron Learning Design (ILD) (Gorayska and Lonsdale, 2000).

Background

Imagine you have been tasked to teach a standard, introductory course in Human Computer Interface (HCI) to a group of about 100 young people. You realize that most of these people are locked into a traditional, passive learner state. They expect to be given "model answers" to design problems. Overlay that with a growing inaptitude in dealing with abstract concepts[1] (e.g. 'tool', 'metaphor', 'visualization') and think about HOW you are going to teach the subject - something that is abstract, conceptual, and intuitive. This is the situation we faced in Hong Kong in 1999.

The situation reflects something funandmental (sic) happening around the world. Change in how the human brain interfaces with the world is afoot. You can envisage people integrated with a computer at any point in the brain-body-and-world continuum, engaging all forms of human intelligence. Science fiction is

[1] Most students in Hong Kong have learned most things formally, by rote, with little physical anchoring in the real world. In general, their standard of English is low.

rapidly becoming science fact. Look at a cell phone, and think - who comes to mind first? Captain Kirk? Mr. Spock? Bones?

Until recently, HCI designers could "get away with" a primary focus on the computing aspects of interface design. Now systems must be sensitive to the ways humans work (Mainelli, 2000). H-CI has turned into HC-I. The greatest challenge is in the realm of ethics, i.e. a focus on what should be done, rather than on what is possible or easy to do.

In the emerging interface culture, a person's competitive edge depends not on the breadth and depth of their knowledge (fact base) but on their metacognitive skills (fast learning, creativity, innovation, intuition, or vision) and ability to recognize which new ideas maximize human benefits. In that culture interface designers have to be a very different breed.

Creating HCI Designers with a difference

To succeed in developing designers capable of dealing with real complexities of interfacing human cognition, we need to (1) identify the essential characteristics of master designers, i.e. ***the essence of human-oriented design,*** and (2) aid learners to ***internalize its core process***: unique ways of filtering information, healthy attitudes (to "failure"), beliefs ('everything at the interface communicates') and the use of subtle mental tools (formulating good questions, sharp observation or switching metaphor). Learners must develop a *deep understanding* of intrinsic human factors: orientation in space and time, feedback, relevance and, most importantly, biological need to adapt. This cannot be "taught". It *CAN be learned*. Note the distinction. The challenge of the learning interface designer – you – is to design an interface that allows the core learning to *emerge.*

Two leading edge approaches to teaching HCI are overtly concerned about the psychology of the learner. Mantei-Tremaine (1998) sees teaching of HCI as an educational problem in how to help students develop intuition in solving user interface problems. Hartfield, Winograd and Bennett (1992) use external mentoring of project groups by experts from local industry or research and development laboratories.

Although both see working with users as more important than overviews of the field, they pay less attention to rapid development of the abovementioned critical factors that make up the essence of a design master. When engaged appropriately, learners embody this essence. Your task is to design an engaging learning environment rich in multi-sensory stimuli with repetitions, feedback loops and subject-related information fed into peripheral or unconscious perception, thereby building the essence.

The learning environments thus designed – integrons – target, interface with, extend, transform and integrate learner beliefs about themselves, their role in the society, and particular knowledge domains they are constructing and assimilating.

So…take a specific element of interface design – the concept of a tool. How do you get a learner to internalize, intellectually AND emotionally, the importance of the tool concept? Well, as they say, "you don't know what you've got till it's gone".

Example integron: Life-with-no-tools

Scene 1 – a 300 seat lecture theatre with students "clumped" up that back. Don't you just hate the distance? Anyway – *you work with what you're given*.

This (and any other) integron unfolds over several sessions. The experience starts at the end of the large group interaction ("lecture"). The learners watch a clip from "2001 – A Space Odyssey" where an ape conceives of a club while looking at a bone. Nothing is explained. The learners are assigned to groups to prepare a skit on "the evolution of human culture" [2].

Scene 2 – The following small group interaction ("tutorial") begins with bilateral exercises for left right brain co-ordination using Brain Gym ®. Afterwards the learners report on changes in how they feel. They focus internally and become aware of things in a different way and at a different level. This loop is, in

[2] The use of the word culture in the instructions rather than tools is critical, as only this leads to the self generated *insight* that development of tools and development of culture go hand in hand.

itself, a mini integron as it draws learners' awareness towards their internal responses to external stimuli of all sorts – a skill that we believe is important for designers to master.

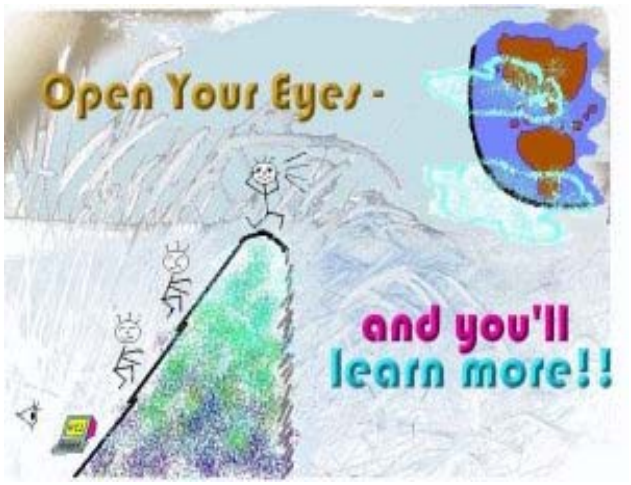

Figure 1. Student poster related to Life-with-no-tools

A short lead-in story (designed to have metaphorical impact) comes next and ends with a question 'What is a tool?' Skits on human cultural evolution are performed. An excited atmosphere helps learners realise how social co-evolution of people and tools can happen. The most powerful insight at debriefing time is that tools are today's solutions which expose problems of tomorrow.

The main event is a manual exercise. It takes place in six working "stations" around the room. A group at each station has to perform a task that is impossible to achieve without tools. Each task reflects the evolution of tools: making shapes out of a stone, calculating complex mathematical equations, reproducing pages from colour magazines, inputting paper printouts of graphics to some lesser known software. Four observing students are placed in each corner of the room to provide feedback at the end of the exercise. "Hidden" in the room (placed on a table in one corner) are tools relevant to the tasks. The whole event is filmed.

A 15 minute time limit incites the learners to grab whatever helpful objects *they* have near their stations, e.g. pens to chop the stone with, mirrors on walls, or pocket calculators, and come up with amazing solutions to these tasks that redefine them to suit the available tools.

Each group presents the initial task and their solution to the whole class. Another debriefing session pulls out observations from students and validates their own experiences. The facilitator refrains from giving ANY "correct" view of what happened, while occasionally adding a *personal observation* that *extends and deepens* what the learners have observed. Note the distinction.

The session ends with a disclosure of the hidden tools and a discussion of finding better solutions by looking beyond the boundaries of specified problem spaces (metaphorically simulated here by each task station).

Figure 2. Student poster related to Life-with-no-tools

At discussion time a previously “hidden” tool, a hammer, is shown to extend natural human characteristics. The learners then brainstorm properties of tools and play a classification game to identify common categories of important tool characteristics. In all cases, they are able to generate a full list of criteria for good tools. They then get the same list compiled from HCI literature, indirectly suggesting *they are already competent*. The session ends with lead out questions 'What do computers extend?' and 'What is tool design?' These are not answered, but rather *sown as seeds in the learners' minds*.

Figure 3. Student poster related to Life-with-no-tools

Scene 3 – The ‘Life-with-no-tools’ experience is fed back to the learners at the following large group interaction which starts with a film clip mix (using temporal juxtaposition) of the bodily behavior of the ape discovering a club along with the bodily behaviors of students inventing solutions to the impossible tasks.

From then onwards a poster is displayed in the classroom that brings together an image of an ape, a blocked thinking symbol of a solution outside of the problem space and a light bulb symbolizing an instant of the creative act.

Guidelines for ILD

Abstracting the principles of how 'Life-with-no-tools' was designed, we come up with a set of guidelines for ILD.

- *"Teach" people not subjects*

The ultimate target of learning is not assimilated HCI knowledge – it is a whole person capable of independent and creative thought. The integron-based environment makes learners use their brains more effectively, remember more easily and helps them generate the capability of chunking the design process differently according to particular demands of particular situations and application contexts. This is achieved through *directly and concurrently interfacing all levels of mental processing* of each individual group of learners.

Individual experiences connect with emotion and intellect and simulate real life conditions that trigger reflection. Learners naturally and effortlessly rediscover "old knowledge". Working in different groups for each experience, they develop team spirit in an atmosphere of mutual support and mutual trust. Having seen others making the same "mistakes", learners freely share observations about human behaviour. They benefit from giving user feedback on generated interface-prototypes and exchanging ideas on the subject.

- *Become a learner yourself*

It is essential to know the mindset of your learners. Recall the learners we started with. Traditional. Passive. Unable to work with abstract concepts. Integrons create a *learning ecology* to overcome such barriers. Concepts cease to be the object of instruction. They became embedded within the fabric of the learning interaction.

In the very first session our learners sketch an interface to an application that helps students learn faster. This confirms their learning habits. It reveals their narrow concept of a good interface (pretty screens that attract through superfluous animation) and their preferred modality (text, audio, graphics, or multimedia).

Subsequent monitoring of their body language and learning outcomes results in many real-time modifications of prepared integrons to better interface with specific learning needs.

- *Set goals for each integron for each cohort of learners*

Integrons have multiple goals. 'Life-with-no-tools' aim to: (a) sensitise learners to the fact that tools impact people; (b) increase their powers of observation; and (c) prime their thinking about design. Its *general, conceptual goals* are to (1) ground the learners' concept of 'tool' by immersing them in a direct experience of tool deprivation, and (2) facilitate discovering and abstracting the basic characteristics of tools. The *learning-to-learn goals* are to (1) aid learners in constructing their knowledge about tools and (2) train them in collecting empirical data from direct observation. The *HCI-design goals* are to get learners to (1) perceive computers as tools that extend humans, (2) assimilate a guideline to design for user tasks, (3) become aware of two human factors: people instinctively invent tools for impossible tasks and modify tasks to suit available tools.

In addition, learners are to intuit that (1) human evolution comes from development of tools, (2) tools change how people behave and think, (3) tools affect the identity and self-image of the user and (4) creativity is the fabric of everything we do.

Figure 4. Student poster related to Life-with-no-tools

- *Work with perceptual frequency*

Phenomena in the world can occur very rapidly (within milliseconds) or very slowly (over years, decades and millenia). These processes are not available to direct human perception. However, experts have been able to derive an understanding of such processes and, at the imaginal level, seem to directly "perceive" these processes.

Addressing the perceptual frequency problem means that a) we discover what experts in a given field consider relevant to the field (e.g. how available tools afford tasks) and b) we expose learners to active experiences that make these relevant things readily perceivable by them. Such experiences are designed as holographic *cross-sections* of an integrated, multifaceted, functional, mental model of the HCI expert, each layered with other possible cross-sections that are *revealed* on other occasions. They compress or extend the time it takes to acquire expertise in a way that real life cannot do. Real life experiences happen by chance. In ILD *experts* emerge by design.

- *Generate simplicity through focus*

Traditional methods aim at making HCI knowledge simpler by impoverishing the learning environment. In ILD content is not made simpler, because real life is never simple and learners need to master reality. "Elegance" of knowledge uptake and learning outcomes is achieved by *directing* learners' attention to different parts of the *enriched* environment. Simplicity is generated through *focus* rather than deletion: 'Life-with-no-tools' can fueled discussions about culture, good interfaces, design practice, human factors, pitfalls in problem solving and many more.

- *Create a shared micro-universe of discourse*

A film clip mix turns the experience of 'Life-with-no-tools' into a powerful metaphor that sets the scene for a discussion of the creative nature of design *as a mental task requiring mental tools*. The related poster is a visual anchor to this particular, expert's skill. The fed back learners' experience reminds them of the past event thereby supporting memory consolidation. Since other experiences are likewise filmed, fed back and displayed as posters, this phased repetition and anchoring of information increases as the course evolved until the *mastermind topography* becomes holistic in nature and each past experience can be used as an example of learned design guidelines.

- *Provide Q.E.D. symbol grounding before theory*

Integrons are what they teach. Going through an experience, learners take in raw data, often unconsciously. They are often left confused and unsure of what has happened to them. This is good! Each experience becomes a "ground" for more abstract concepts. For example, the experience of redefining impossible tasks help learners appreciate the danger of dialogues designed for system functions. Learner behaviour demonstrating relevant human factors is generated *before* the corresponding design guidelines are introduced. No further proof of their necessity or usefulness was necessary. Q.E.D.

- *Employ multiple embeddings and feedback loops*

Multiple embeddings and feedback loops force deeper reflection, while repeatedly putting similar ideas in front of learners from slightly different angles. Learners engage in a design methodology for cognitive technologies based on reflective questioning of perspectives (Gorayska and Marsh, 1999). They practice recursive thought. For example, to learn HCI design faster learners design interfaces to applications that help learn HCI design faster.

The longest recursive loop is one whereby learners became the *recipients* of an interface design process. ***Since the entire learning process is viewed as an interface (teacher-learner) design problem and feedback is consistently taken from learners to modify the course in real time, learners became sensitized to the importance of taking user feedback to modify interface design.***

- *Extend cognitive flexibility*

Learners deal actively with different representational media that convey the same content. This takes them out of their own preferred mode of thinking. They record observed real-life interfaces and own HCI activities in diaries. They tape-record or videotape user interviews. They design posters (figures 1 through 4) that visually present what *to them* is most important HCI "lesson" in each (integron) experience. "Lectures" use pictorial metaphors to complement, not summarize, the material found in literature and textbooks.

- *Mediate between learners' conscious and unconscious attending to data*

The learning environment includes appropriately positioned "gaps" in knowledge for learners' brains to fill in. It generats cognitive dissonance between old beliefs and observed behaviour. Learners thus engage naturally in lateral thinking. Posters provide input to peripheral perception. Whenever learners look around, they are revising. Facilitators use presuppositions and indirect commands: e.g., *'Who will be the first to derive a guideline here'* (1) states that the guideline can be derived, (2) asks learners to mentally search for it and (3) asserts that all will succeed.

Diverting learners' conscious minds away from the learning process is the hallmark of organic, natural learning. Consequently, activating and accelerating this learning is the hallmark of ILD.

- *Synthesize known approaches to learning*

ILD interfaces the holographic nature of the learner with the holographic nature of what is to be learned by adopting a unique, synthetic perspective on many approaches to accelerating learning (tip.psychology.org/theories.html; Schuster and Gritton, 1985). The qualitative result in HCI is a designer who has better command of content in the discipline and the meta-skills and orientation required to flexibly handle important changes in the profession as these occur in the world at large.

Does it Work?

Our study (http://www.integronlearning.com/pragmat.html.) showed a significant difference (Chi-Square: 99%) in exam scores between our learners and those taught with the didactic, hands-on method. The lower the Grade Point Average (GPA) of the learner, the more likely that learner was to improve significantly in terms of traditional assessment criteria. In all ILD courses taught so far it took eight of fourteen weeks (three hour immersion per week) to break the old mould in learner attitudes to HCI and learning.

Although designed for computer science undergraduates, many computer and IT professionals would benefit from taking the integron HCI course. All curricula can be learnt fast that way. This paper is designed as an *impoverished* integron. Think about it.

References

Gorayska, B. and C. Lonsdale, (2000). *Pragmatics of Learning: Integron Methodology for Learning Breakthroughs.* Quality Enhancement Fund. Project Series 1. City University of Hong Kong publication.

Gorayska, B. and J. Marsh, (1999). Questioning Perspective. In J. Marsh, B. Gorayska and J. L. Mey, eds. Humane Interfaces: Questions of Methods and Practice in Cognitive Technology,17-43. Amsterdam: North Holland.

Hartfield, B., T. Winograd and J. Bennett, (1992). Learning HCI Design: Mentoring Project Groups in a Course on Human-computer Interaction. *Proceedings of the twenty-third technical symposium on Computer science education*. Pages 246 – 251.

Mantei-Tremaine, M., (1998). A Psychologist Astray in Computer Science. http://www.victoriapoint.com/psychhci.htm. Accessed 17/1/02.

Mainelli, T., (2000). Crafting the Next PC Interface Experts agree: There must be a better way to 'talk' to a computer. PC World. March 16, 2000.

Schuster, D. H., and C. E. Gritton, (1985). *Suggestive Accelerative Learning Techniques*. New York: Gordon and Breach Science Publishers.