A CONVERSATION ABOUT INTERACTION DESIGN

Bill Moggridge

I would like to start this paper with a brief summary of a conversation about interaction design that I had with Sebastiano Bagnara, and then use this same discussion as headings for a more detailed explanation of my answers to his questions.

Sebastiano Bagnara – In your view, what is Interaction Design?
Bill Moggridge – Broadly, it's the design of everything digital.

Sebastiano Bagnara – What do you mean by everything digital?
Bill Moggridge – Digital objects, digital services and digital experiences.

Sebastiano Bagnara – Is there a narrower focus that applies particularly to the work at Interaction Design Institute Ivrea?
Bill Moggridge – Yes, the Institute focuses on the subjective and qualitative aspects of everything digital, learning and teaching how to create designs that are useful, desirable and accessible.

Sebastiano Bagnara – Is this focus valuable for business in today's economy?
Bill Moggridge – Yes, it is increasingly important for success in business, as more digital technologies are adopted by consumers.

Sebastiano Bagnara – Are consumers early adopters?
Bill Moggridge – No, emerging technologies are usually adopted by enthusiasts and professionals before consumers.

Sebastiano Bagnara – You say usually; does that imply some unusual exceptions to the rule?
Bill Moggridge – Yes, some technologies are used by consumers as soon as they emerge, for example those developed for games, and some services.

Sebastiano Bagnara – Who designs interactions?
Bill Moggridge – Interactions are normally designed by an interdisciplinary team.

Sebastiano Bagnara – What are the key concepts in industrial design that are most relevant
to interaction design?
Bill Moggridge – A focus on people, and iterative prototyping.

Sebastiano Bagnara – How did you come to move from your discipline to that of the design
of interactive systems?
Bill Moggridge – Designing the first laptop computer.

Sebastiano Bagnara – In your view, what is interaction design?
Bill Moggridge – Broadly, it's the design of everything digital.

"The decades ahead will be a period of comprehending biotech, mastering nature, and realizing extraterrestrial travel, with DNA computers, microrobots, and nanotechnologies the main characters on the technological stage.
Computers as we know them today will a) be boring, and b) disappear into things that are first and foremost something else: smart nails, self-cleaning shirts, driverless cars, therapeutic Barbie dolls, intelligent doorknobs that let the Federal Express man in and Fido out, but not 10 other dogs back in. Computers will be a sweeping yet invisible part of our everyday lives: We'll live in them, wear them, even eat them. . .
Yes, we are now in a digital age, to whatever degree our culture, infrastructure, and economy (in that order) allow us." (Nicholas Negroponte, 1998)

We seem to be well on the way towards fulfilling these predictions made by Nicholas Negroponte in 1998, although the "dot com madness" has faded and the invasion of technology was temporarily slowed by the economic downturn. Even if you doubt that we are already in a digital age, it is clear that we are marching relentlessly towards a condition where everything that can be digital will be digital2. It is also true, even if not always recognized, that everything is designed, whether it is digital or physical. Don Norman makes an eloquent case that we are all designers3, in that we manipulate our environment, selecting, building, buying and arranging everything around us for our own purposes, and to our own satisfaction. Before we get to do that however, there has been a process of design in the context of development and innovation, which has given form and character to the items that we select and manipulate.

There is a long tradition of design of the physical artifacts that we surround ourselves with, from architecture and civil engineering for spatial structures, through mechanical engineering and industrial design for everyday products, to haute couture for fashion. The infrastructure of education and disciplines for these skills is well established and understood, and flourishes in Italy with excellent standards and a long tradition. Our challenge is to bring this same excellence to the design of digital artifacts, and the term "interaction design" is gaining traction in linguistic usage, with a broad meaning of the design of everything digital.

Sebastiano Bagnara – What do you mean by everything digital?
Bill Moggridge – Digital objects, digital services and digital experiences.

I think of "digital objects" as encompassing all of the things that include electronic technology, or are enabled by electronic technology. We usually think of technology as expressed in the design of the personal computer, with keyboards, mice and screens, but digital objects are much more pervasive. Think of interactive toys, greeting cards with verbal messages generated by chips, or toasters equipped with fuzzy logic. In cars the value of electronic technology continues to grow, and was already more than a third of the total cost of a typical vehicle by the nineteen nineties. Computer systems control instrumentation, fuel economy, emissions, and emergency behaviors

like airbags and antilock braking. Most people are unaware how much of their driving experience has been subtly altered by this technology, which has invaded the vehicle transparently, so that we don't see it.

By "digital services" I mean all the aspects of services that you use that are enabled or enhanced by electronics, including everything that makes use of the internet, as well as parts of simple everyday experiences. When you stop for a coffee at the café close to the Institute in Ivrea, you are offered a human-to-human service, but when you eat at the restaurant a little closer into town, your order is compiled on an electronic notepad and transmitted to the kitchen wirelessly.
You still enjoy the human-to-human interaction, but your order reaches the kitchen faster thanks to the digital element of the service. When we are designing services, we try to think about designing the whole experience, and it is surprising how often the digital aspect occurs. For example, think about the design of a train service.

When IDEO was designing the Amtrak Acela4 train service, the team identified ten steps on the journey, as follows:

Steps	*Physical Aspects*	*Digital Aspects*
1. Learning	Advertising, Travel Agent, Word of Mouth	On-line, Auto Phone
2. Planning	Station Staff, Travel Agent, Brochure, Phone	On-line, Auto Phone
3. Starting	Other form of transportation	-
4. Entering	Station Architecture	Signage
5. Ticketing	Ticket Office, Travel Agent	On-line, Auto Phone
6. Waiting	Waiting Room, Station Facilities	Signage
7. Boarding	Doors and Luggage Storage	Auto Doors
8. Riding	Seats, Meal Services	Info., Media, Comms
9. Arriving	Station Architecture	Signage
10. Continuing	Other form of transportation	-

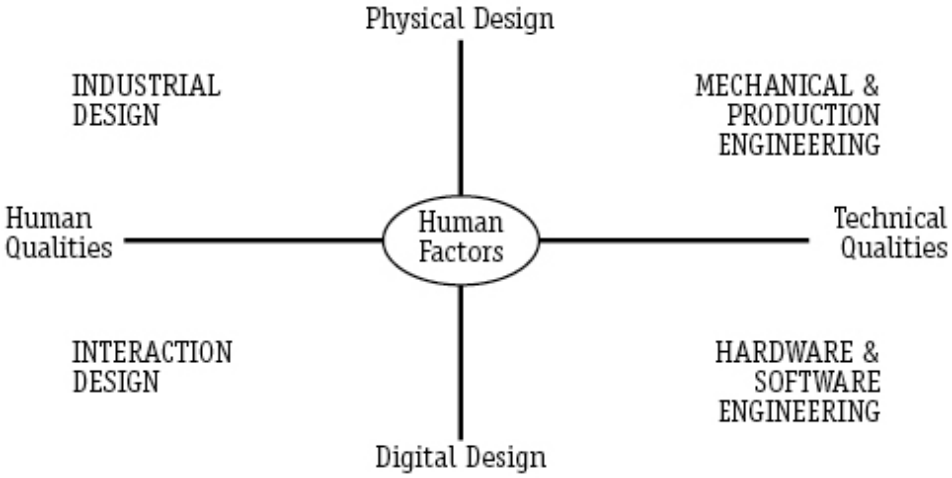
This chart summarizes the overlapping of the physical and digital aspects of designing the service. Notice that the traditional idea of designing a train, both interior and exterior, only applies to the boarding and riding steps in the journey, and the opportunity to enhance the experience with digital technology applies to all of them, albeit in an unknown form for starting and continuing.

The idea of "digital experiences" is useful as a catch-all for the design contexts that do not fall neatly into the object and service categories. In the computer realm, software for operating systems and applications is included, and this can apply to personal computers, laptops, palmtops and increasingly telephones, as internet access and message services gain in popularity. It can apply to computer and video games, as well as other forms of media and entertainment where digital technology is present. It can also apply to environments that are mediated in some way by digital technology; think of museum spaces, exhibits, hospitals, libraries, trade shows and art installations.
It applies to the web sites and navigational structures on the internet that are focused on information and communication, rather than services. Think of everything that is more than an object or a service, where bits might help.

Sebastiano Bagnara – Is there a narrower focus that applies particularly to the work at Interaction Design Institute Ivrea?
Bill Moggridge – Yes, the Institute focuses on the subjective and qualitative aspects of everything digital, learning and teaching how to create designs that are useful, desirable and accessible.

My broad view of interaction design includes the work of HCI (Human Computer Interaction) professionals, computer scientists, software engineers, cognitive psychologists, sociologists, cultural anthropologists and designers. It is natural for people outside the design and development disciplines to see this broad view, as they react to the resulting designs in terms of the experiences they have as users of interactive software, devices and services. If they think about the design at all, they are likely to do so as a singular entity producing the result, as they don't understand the individual roles of particular disciplines.

I also think of interaction design in a narrower way as a discipline that is related to my own experience and background as an industrial designer. It is the equivalent of industrial design in that the first concern of the designer is the human values of the people who will use the design; the aesthetics, subjective and qualitative values, and human factors: the designer creates a solution to give pleasure and lasting satisfaction, and hence to fit the market and make businesses succesful.



The diagram shows the positioning of interaction design as similar to industrial design except that the context is digital rather than physical, and the designer operates in the technological domain of hardware and software rather than three-dimensional objects and spaces.

Here are some examples from some future concept designs prepared by IDEO for BusinessWeek, illustrating a vision for the year 2010.

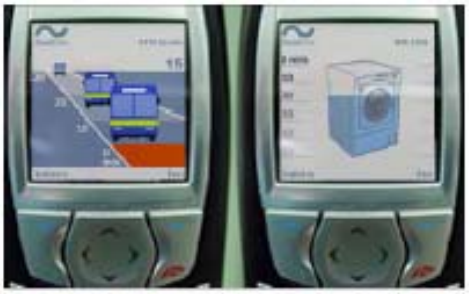
The PDA/Telephone combination is envisioned with two internal screens, one of which is touch sensitive, allowing soft buttons for commands and navigation, supported by voice recognition.

The workstation has a large and high-resolution flat screen, which can be operated by a stylus or touch, bringing back the precision of pen on paper, combined with the versatility of digital desktop and windows.

The exercise monitor can be worn on the surface of the skin, and gives real-time feedback about time pulse rate, and other physiological functions.

These examples show the kind of contribution that we can expect from the staff, researchers and students at IDII. They combine physical and digital design, and focus on creating designs that are useful, desirable and accessible for consumers in a future that is not too far distant.

The work at IDII has not yet had the chance to gain much momentum, as only on class has graduated from the program so far, but already there are examples of designs that are simple, effective and enjoyable for consumers. Fluidtime is one such example.



FLUIDTIME

The idea of the Fluidtime project is to design time services and tools that help busy people manage their time with greater flexibility. Currently, individuals have limited access to timely information about public services or even private appointments, and are left wondering when their bus will arrive or whether their doctor is on time. Increasingly, people live and work with a new set of habits regarding time, such as the increased use of the mobile phone to quickly schedule or change appointments. However, aside from the phone, few tools or services exist that support this new way of life, especially when people interact with public or private services. Fluidtime5 supports flexible planning by providing people with personalized, accurate time-based information directly from the real-time databases of the services they are seeking.

The Fluidtime team started by creating two services and their interface prototypes, the first aimed at public transport riders in Turin. On average 20,000 people use the public transport facilities in Turin every day, but not knowing when the bus will arrive can make the experience frustrating. The designers took advantage of the system implemented by the Turin transport authorities that tracks all the buses, and developed a service to make this data visible to travelers to minimize the frustrations of waiting. You can see the number of minutes that you can expect to wait, and the buses are also shown in a perspective view, so that you can judge at a glance how far away they are. The information fits on a small portable screen, such as a cell phone or connected PDA, and can also be seen on a computer or mechanical display unit.

The other service is a personalized and flexible scheduling system to help Interaction-Ivrea students organize shared laundry facilities. The fifty students and researchers at the institute share a washing machine, but having to book a time slot, remembering to bring the dirty laundry, keep the appointment, and check the machine in the basement to see when it’s finished. This all adds up to a frustrating experience. The Fluidtime service performs simple tasks, such as reminding people in the morning to bring their laundry to the Institute, or letting them know when their laundry slot is ready or their washing is done. Since the system knows the users’ profiles and how busy the day is, it can adjust its reminding behaviors from being strict to being relaxed. Ambient devices show the people who are using the laundry the progress of the machine and when it is time to collect the laundry.

Sebastiano Bagnara – Is this focus valuable for business in today's economy?
Bill Moggridge – Yes, it is increasingly important for success in business, as more digital technologies are adopted by consumers.

Gillian Crampton Smith, the founding Director of IDII, explains the importance of consumer oriented interaction design in terms of the adoption of new technologies, and she gives credit to David Liddle, an IDII Explorer, for articulating the three stages of this adoption, the enthusiast stage, the professional stage, and the consumer stage. David Liddle was the project manager for the Xerox Star when he worked at the Palo Alto Research Center (PARC), and went on to found Metaphor Computers, and then to lead Interval Research. Here is a quote from an interview6 in which he describes the three stages.

"The normal progression is first to "enthusiast" users, who actually love and appreciate the technology in an aesthetic way, who enjoy exploiting it. The fact that it may be difficult to use actually adds to the fun, and it's certainly the case that competing variants of it will always be operated very differently. This was clearly true of automobiles, clearly true of cameras and all photographic equipment, true really of all the things like that that we might think of. The enthusiast phase is really important because the enthusiasts take the technology far beyond what the inventors and designers imagined could be done with it. They're the ones who show you what really can be done with it, the extremes of its potential. During this period there's always a great deal of ferment, quickly produced competing approaches. The controls for such a technology usually vary a lot, because for a while at least, people try to use them as the basis for competition. If you're an enthusiast you're somewhat proud of you ability to manage all of the complexities and difficulties. Early automobiles broke down every four or five miles, and you had to stop and pump up the tires, or re-crank the starter or something, but that was a good part of the fun. It was after all just a Sunday afternoon thing that you did. The 35mm cameras used by the astronauts in the fifties nearly required a Ph D in optics to operate them.

Once enough enthusiasts have their hands on a technology, sooner or later one of them will say,

"I can use this in my work!"

They get a clever idea about how they're going to do something really practical with it. They decide to find a way to fit it into some practical part of their life, either literally their livelihood, or at least their home life in a practical way. As this begins to happen there is a great change in the priorities of the developers of the technology.
For one thing they become more focused on costs and prices, not because it's going to become inexpensive, but because it will now be judged to some extent by how practical or useful it's going to be. The people who buy it, whether business people or consumers are now saying,

"Well, is that worth it for what I'm going to do?"

There becomes a much more stabilized view about how much things are permitted to cost, and reliability and so on becomes important, and the controls for the way that the technology is used begins to standardize. In the case of the 35mm camera, when it went from very expensive exotica, to being broadly used by professional and serious amateur photographers, it suddenly stabilized. The viewfinder was in one place, you exposed by pushing with your right index finger, you wound the film with a lever with your left hand, and you focused in a particular way. There was a stabilization of the controls.

After a product has built up big enough volumes through this "professional" phase, that's when suddenly one begins to reach a price point where it's practical for consumers to buy it. It goes from being the buy based on love, based on the aesthetic property for enthusiasts, to a practical return on investment kind of purchase by a professional, and now it becomes a very easy discriminatory purchase, just arbitrarily done by a consumer, who feels it's practical and within their price range. The enthusiast wants that product to say,

> "Exploit me! Look at my capabilities."
>
> The professional wants the product to say, "Look at the productivity I can give you; here's how I'll change your activities."
>
> The consumer wants the product to say, "Look at how I fit in with your style! Here's who you are. Use me and enjoy my capabilities."

In the "consumer" stage the priorities for the product have dramatically changed, and one thing that we always see is that most of the important controls become automatic. Now, to follow our camera analogy, today when you buy a 35mm camera, if it even has film in it, it will read the film speed automatically and set the exposure automatically and set the flash automatically, and actually a chimpanzee can take pretty good photographs with today's highly automatic 35 mm camera. By the way, automobiles are extremely automated in the same way, as far as we've learned how to do it. Computing is the same way. In this third stage we see prices that allow easy consumer decisions, the automation of the most subtle and important of the controls, and a great emphasis on the compatibility of the lifestyle of the purchaser with the image of the product."

A clear understanding of these three phases in the adoption of digital technologies is valuable for entrepreneurs and business people in today's economy. Economy of scale does not operate to full effect until the consumer phase is in place, and then the opportunities for successful businesses are huge. As digital technology is still so young, most industries have not got past the enthusiast and professional stages, and therefore experts in the consumer stage are becomingly increasingly sought after. Educational institutions are inevitably slow to adapt to new realities, and as yet there are very few graduate and postgraduate programs teaching interaction design in the world. By focusing on the consumer phase of interaction design, IDII is in an excellent position to provide world-class leadership in the education of designers of the digital technologies that are adopted by consumers.

Sebastiano Bagnara – Are consumers early adopters?
Bill Moggridge – No, emerging technologies are usually adopted by enthusiasts and professionals before consumers.
Sebastiano Bagnara – You say usually; does that imply some unusual exceptions to the rule?
Bill Moggridge – Yes, some technologies are used by consumers as soon as they emerge, for example those developed for games, and some services.

The "enthusiast" and "professional" stages normally come before the "consumer" stage, but there are some exceptions to the rule, for example in the design of games. Brenda Laurel has been involved with the design of games since the mid seventies, most recently as the founder of Purple Moon7and has this explanation8.

"I think one of the reasons why games have led the way in interaction design in some respects is because the objective is to have fun. There's not a productive outcome, so all of the seriousness that we bring to work is not present in the design of these things. Being able to have a quick effect on what is going on is central to most action games, which is the canonical form of games, so direct manipulation and direct action, where you can forget about the equipment is really important in that genre. The other thing that I think people don't recognize about games that makes them more playable, is that most of the time subconsciously, the player is adopting a role, is thinking of themselves as a character; they're running a starship or driving a racecar. There's an assumption of ability that happens magically when they have a role that they can conform to. Imagination helps in playability in ways that it doesn't with something like a word processor or a spreadsheet."

Imagination helps the player, but there is very little tolerance for a game that is difficult to learn or boring. Many games have failed because the designers failed to create something that would give immediate gratification to the consumer. It is true that the designers and consumers of the earliest canonical games such as Spacewars were themselves enthusiastic computer professionals, but they would only use the games that entertained them. Their attitude to the design of games was much more like that of a normal consumer.

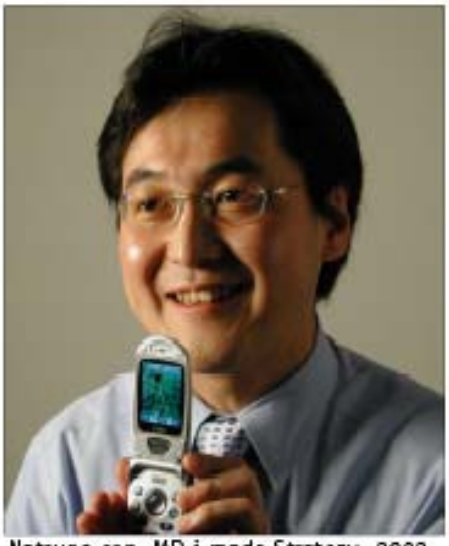
Consumer Services
There are examples in the service sector of technologies that are aimed at a consumer market immediately, rather than working through the "enthusiast" and "professional" phases first. This is very challenging for the designers, as they do not have the benefit of reviewing the history of the development of the technology. Instead of building another iterative step, to convert the service into a design that is easy enough to use and attractive enough for consumers, they are forced to try to achieve this in one creative leap. There will be increasing demand for these services, and there is a great opportunity for designers who are educated and skilled in design for consumers, such as those who graduate from IDII.

Case study of a successful consumer service: “i-mode”

First generation of i-mode, 1999

Second generation of i-mode

Third generation of i-mode



Natsuno-san, MD i-mode Strategy, 2002

The "i-mode" service from NTT DoCoMo is an example of spectacular success in the design of a service that was launched directly into the consumer market. "i-mode" gives cell phone users in Japan access to Internet based services, as well as messaging and normal cell phone use. After the first three years of the service, there were more than 33 million people subscribing to "i-mode" in Japan, about a quarter of the total population.

The entrepreneurial leader of "i-mode" behind the scenes at NTT DoCoMo is Keiichi Enoki.
He had established his reputation as an outstanding leader within NTT by the nineties, and in 1997 was given the task of starting a new mobile phone service by the company president Koji Oboshi, who

went on to become chairman. The idea was originally suggested to the president by a business consultant from McKinsey, who stayed with the program as external advisor. Oboshisan took the unusual step of asking Enoki-san to start a completely new venture, appointing him as general manager of the corporate sales department of a business that did not yet exist, and asking him to find and hire his own team, both from within and outside NTT. In the west we would call this a "spin-out", where the mother company keeps the ownership by providing the venture capital, but gives the appointed leader enough freedom to escape the weight of the corporate structure and culture of the parent. This allows the kind of new start behavior that is so fertile for innovation, with a small team of dedicated individuals who are highly motivated to succeed, can take advantage of the money and technology of the parent, but are unencumbered by large size and complex history.

In those days the market for mobile phone services in Japan was assumed to be only for business people, but Enoki-san had a vision of a much larger opportunity based on observing the behavior of his own son and daughter and their friends. His daughter Kyoko was a high school student with a passion for e-mail,

> "She is always exchanging e-mail with her friends. Even when we're having a meal, once she knows she has e-mail, she's on tenterhooks until she can check it. Why does e-mail interest her so much? What makes her so excited? You can get some interesting business ideas pondering over why she acts the way she does."

His son Ryo was in junior high, and never needed to refer to the instruction manual when he got a new video game or program for the computer. Enoki wanted to create a service that would be valuable and accessible to everyone, rather that just targeting the businessman. He expressed his vision as designing the service so that "Even children will use it!"

The first task was to put together the perfect team for the new venture. He advertised the available positions inside NTT DoCoMo, and forty people applied. He was looking for individuals with the right background and skills who would respond to new challenges as well as working well under stress. Helped by McKinsey he set up "stress" interviews with twenty four of the candidates, to test their response to pressure situations, and selected five people with business and technical backgrounds, two of them in their early twenties. This rigorous interviewing process helped Enoki form his ideas about what the new service should be like, as he was forced to answer questions from the applicants, and found himself more and more confident about his answers as he went along. His vision became clearer, that the service should appeal to young people and amateurs, as well as people with jobs and commutes. He could see that there would be new opportunities to achieve this, if the normal phone service could be enhanced by messaging and Internet access, but it would have to be designed in a way that would appeal to impatient youngsters and techno-phobic adults. There was no one in his team garnered from inside NTT DoCoMo who would find it easy to think about the nature of content and services that might have this appeal. That was when

he thought of bringing in Mari Matsunaga, who knew how to make magic with very few words in a classified employment advertisement.

Mari Matsunaga has been dubbed "the mother of i-mode" by the Japanese press, and was recognized as "Asia's Most Powerful Businesswoman" in 2000 by Fortune Magazine, for her contribution to the success of the business. She is an attractive woman in her forties, with a combination of panache and drive that has allowed her to break through the gender barrier, and achieve popularity and recognition as a leader and entrepreneur. She graduated from Meiji University with a degree in French Literature, and joined Recruit, the company that owns and runs a multitude of magazines full of classified ads. She served as chief editor of magazines such as "Employment Journal" and "Travail", and honed the art of communicating meaningful messages with very few words, a skill that would become of crucial importance in the confined space of the screen on a cell phone. She is a member of Japan's Tax Advisory Council, and appears regularly on TV shows. She has written a delightful book about the development of "i-mode".

Enoki-san arranged a dinner meeting with her through a mutual friend, and after a few minutes of small talk came straight to the point,

> "You know liquid crystal displays are used for the screens in mobile phones. I'm planning to use such a screen to distribute information up to a maximum of fifty character bytes. Matsunagasan,
> it's my hope that you'd assist us in developing the content of the information. You'll join us (at DoCoMo), won't you?"

Mari-san was shocked, as this was such a direct request to change her life. She had no love for mobile phones, thinking of them as an "electronic chain" around the neck of the user, and the cause of many interrupted meals and social occasions. She was a notorious innovator however, and enjoyed new challenges every few years. She had been at Recruit for more than twenty years, and was finding it increasingly difficult to find new motivation there. Enoki-san was a persistent suitor, following up the day after their dinner with a card of a van Gogh painting and the message, "Please work with me." The next time they met he told her about his children and the inspiration that they gave him for innovation in his new venture. She responded with a suggestion for a part time assignment that would allow her to contribute without leaving her job at Recruit permanently, but he insisted that,

> "If you decide to join us, I want you to come over to DoCoMo officially and be totally committed to the business."

She was fascinated by the design challenge of trying to create a new medium that would appeal to young people within the narrow limits of a fifty character liquid crystal screen. That combined with Enoki-san's vision and determination persuaded her, and she joined the team to lead the development of content in July 1997.

There were many aspects to the extraordinary success of this service in so short a time, but the ability of Mari Matsunaga to create short

and appealing messages in fifty characters was probably the most important characteristic that gave the service consumer appeal right from the beginning. Compare that to the many examples from the era of the "dot com madness" of spectacular failures in the design of new services that were aimed at consumers, perhaps because many of the designers and entrepreneurs who started new companies were experienced in developing products for enthusiasts and professionals, and did not have the skills to leap straight into the consumer world.
If only they had had the chance to study at IDII!

Sebastiano Bagnara – Who designs interactions?
Bill Moggridge – Interactions are normally designed by an interdisciplinary team.

The context in which most interaction design is practiced is complex, and often impossibly difficult for an individual to understand, let alone being able to design a good solution as an individual author. An team of people from diverse backgrounds and disciplines is needed.

Take the design of a cell phone and the service to which it is attached for example. The cell phone itself is a little technological miracle in the palm of your hand, complete with high resolution color display, an array of buttons, a pointing device, electronic circuitry and storage, main and backup batteries, transmitter and receiver. The team of people needed to design it includes experts in many aspects of engineering and technology, with specialists in each of the components, plus manufacturing engineering, integrated circuit, hardware and software engineering design. On the human side it needs a contribution from HCI, industrial design and interaction design, as well as the business disciplines of marketing and management. Just for the phone itself, an interdisciplinary team is essential.

Beyond the handset itself is a confusing hierarchy of overlapping systems. Each call is supported by the infrastructure of the network of cells, as well as the overall telephone system of lines, exchanges, optical networks, microwaves and satellites. In an ideal world all of this is transparent to the user who just wants to make a call, but in practice it often becomes annoyingly visible. The service provider is designing an offering in a competitive environment, often leading to an escalating range of features that soon become impossibly complex. The service provider is separate from the handset vendor. The handsets take longer to develop than the services, and are more intimately linked to the electronic behaviors of the input and output devices, and the chips that drive them. Because of these differences, a different interdisciplinary team is needed to design the service, with a similar mix of technical, human and business disciplines, but a different set of priorities.

Once you connect to web based services, each individual site or service that is accessible through the phone has interactions that are designed by separate teams of people. They try to provide a version of their offering to fit the scale of the interactions that work well on the phone, but they often do this with very little knowledge of the details of the interactive capabilities of the handset itself.

With all this complexity in play, it is not surprising that the modern cell phone is difficult to use. Several layers of interdisciplinary teams design the service, but coordination between them is
difficult to arrange.

Sebastiano Bagnara – What are the key concepts in industrial design that are most relevant to interaction design?
Bill Moggridge – A focus on people, and iterative prototyping.

Two of the key concepts that both disciplines have in common are "A focus on people" and "Iterative prototyping".

A focus on people
Designers of all types, from the architects of buildings to the interaction designers of consumer products, are often guilty of designing for themselves rather than for the people who are most likely to use the resulting designs. A process that helps the designer to focus on the users, and understand their needs and desires, is essential for the success of both industrial design and interaction design.

When I graduated as an industrial designer in the sixties, I expected to spend my life designing mass produced objects to be manufactured in metals and plastics. Thinking about what people wanted from the object was one of the considerations for the design, but there was an assumption that anthropometrics, or the sizes of people, would be the most significant aspect of human factors that would be needed, and that most of the consideration of the user would be about the subjective and qualitative values that would help the designer to create an appropriate aesthetic.
Thanks to the human factors work at the office of Henry Dreyfuss, anthropometric information for the designer was easy to find by referring to "The Measure of Man"10 or "Humanscale"11, so most of the research into what people wanted was aimed at discovering those subtle values that could inform an intuitive design process. Most of this was about context, so when I was designing an instrument to be used in surgery, I would don the mask and gown and watch what really happened in the operating theater. When designing a consumer product like a toaster for example, I could understand the user by trying it myself, by looking at the way other people used it, and by talking to them about their opinions of it.

Design problems soon got more complicated, and the human factors aspects started to be too complex for a designer to grasp. I find this hierarchy useful to explain the growth in complexity.

HUMAN FACTORS HIERARCHY

•	Sustainability	Design for the whole planet
^	Anthropology	Design for cultural differences
^	Sociology	Design for people who are connected
^	Psychology	Design for the way people think
^	Physiology	Design for the way the body works
^	Anthropometrics	Design for the sizes of people

Starting from the bottom of the hierarchy, the anthropometric information about the sizes of people is presented in "Humanscale" as a series of reference cards, allowing you to see the salient dimensions of people of different statures, gender, age and ethnic background by rotating a dial.
The series also includes reference cards that chart the variation in different contexts like seating, work, controls, strength and safety. This starts to give the designer the human factors information needed for physiological issues, but does not go very far into the understanding of the way the body works in specific situations, for example riding a bicycle, or typing on a keyboard for long periods of time. Once we delve into the specifics of a context like this, the inclusion of a human factors specialist in the design team becomes important.

Moving up the hierarchy, the psychology of subjective values and desires has always been an issue for designers, but once you start to design objects and services that are enhanced by electronic behaviors, you need a much more scientific understanding of the way the mind works.
If the design context includes machine intelligence as well as human intelligence, as it does with interaction design, the design team is likely to benefit from the inclusion of an expert in cognitive psychology.

Connecting everything together caused the next leap in complexity, when the internet made connectivity a part of most design problems and solutions. Communications technologies like telephones and broadcast media have been with us for long enough to settle down and be easier to understand, but the sudden explosion of the internet added the potential of connectivity to objects and services. Sociologists can help members of a design team understand the implications of this.

Design for global markets is often a challenge where the expertise of cultural anthropologists is valuable. They can help people in a development organization understand the nature of cultural differences, which probably will not be intuitively obvious to them without some direct experience of the different cultures. There are also variations of culture within a single market, as different groups of people have unique anthropological characteristics, based on their occupation, background or interests.

At the top of the hierarchy is sustainability, where designers need to understand the issues that will impact the environmental condition of our planet. At first thought, sustainable design seems to be in direct opposition to the nature of the consumer society that industrial designers and interaction designers strive to enhance, and therefore is a challenging subject for designers to come to grips with. Organizations and processes are emerging that allow the design team to understand and analyze the implications of their designs on sustainability, including the use of materials, energy, and the full lifecycle from cradle to grave. This knowledge is still immature, making design for a sustainable planet an intuitive rather than exact science so far.

IDEO Method Cards

Integration of human factors as a discipline started for us at IDEO in 1987 when Jane Fulton Suri joined our team in San Francisco. At first the designers took very little notice of her, but Jane is kind as well as thoughtful, and soon she was talking with everyone in the studio about the way people use the products, services and spaces that we design. In 1991 we made a commitment to include a contribution from human factors specialists on every project, and expanded our staff to enable the promise. As time went by, the human factors group evolved new methods for understanding people and their experiences, and soon collected a portfolio of tools and techniques.
When the number of methods was approaching fifty, they decided to create a deck of cards.

The idea of the IDEO Methods Cards12 was to make a large number of different methods accessible to all members of a design team, to explain how and why the methods are best used and to demonstrate how they have been applied to real design projects. The intention was to provide a tool that could be used flexibly to sort, browse, search, spread out, or pin up the cards. Each of the 51 cards contains explanatory text about how and when the method can be used and a

brief example of its application to a real design project, with an illustrative image on the other side. The cards are divided into four categories, Learn, Look, Ask, and Try, to make it easy to reference and share the methods. An article in Fast Company13 captures the way the cards are used.

"Fast Company decided to give IDEO's Method Cards a workout. In a conference room at the company's Palo Alto headquarters, we presented an Ideo team with two scenarios to see how they would begin wrapping their minds around a design problem. We weren't looking for an end. We were looking for a beginning -- the initial steps that would set the course of the eventual design. Here's what happened when Ideo let the cards out of the box.

First deal: A carmaker, recognizing that people are living longer and better, wants to develop a car that appeals uniquely to drivers over 65 years old. How can the carmaker better understand the concerns of this group of prospective customers?

Five Ideo staffers -- Jane Fulton Suri, David Gilmore, Kristine Chan Lizardo, Annetta Papadopoulos, and Aaron Sklar -- listen as I read the scenario aloud. Then they open their boxes and begin sorting and shuffling the cards.
Some they toss aside. Others they lay faceup in front of them. Our first-floor conference room is flanked by a wallsized window that looks out on a sidewalk. To the pedestrians passing by, it looks as if we're playing pinochle.

Gilmore, a British expat who once designed coins for the Royal Mint, holds up a card from the Ask suit. It's called Unfocus Group. To grasp the underlying design issues, Gilmore would assemble a diverse collection of people to talk about cars. He'd include healthy and active senior citizens, seniors with health problems, seniors who love cars, and seniors who don't. Fulton Suri, another Brit transplanted to the West Coast, chimes in: Why not also include a driving instructor and a state trooper for their perspectives? "And maybe they can help build something," she adds.
She fingers the Experience Prototype card from the Try suit. Perhaps the grandmas and the smokeys could suggest a prototype car feature that Ideo could quickly construct and let them test. Fulton Suri also selects Empathy Tools. To simulate what it's like to have limited mobility and dexterity while driving, Ideo designers could don clouded glasses, slip on heavy gloves, or bandage their legs before taking a test-drive. "Of course, not everybody over 65 has those problems," she says. But the carmaker could end up introducing some new features for one age group that everyone might value because of the simplicity and elegance of the design.

Gilmore emphasizes the Emotional Dimension card. Cars have "life trajectories," he says. Like furniture and certain pieces of clothing, they carry memories of a particular stage of a person's life. So he'd have seniors craft a personal history of the cars they've owned and what those vehicles have meant to them. Buying your first car is a rite of passage. But, Gilmore wonders, what does it feel like to buy what could be your last car?

Second deal: A national television network seeks to reinvent its struggling nightly newscast and to update a format that has been largely untouched for a generation. What are some ways to uncover new approaches to the nightly news?

Lizardo starts things off by shouting, "A Day in the Life!" A card from the Look suit, it asks the potential users to document everything they do in a given day. The goal is to discover how people actually spend their time – and how that affects when, where, and whether they watch the news. Fulton Suri, eyeing the four cards fanned out in her left hand as if she were playing poker, sees and raises Lizardo. She suggests pairing her approach with another card: Behavioral Sampling. Ideo would give subjects pagers and then contact them randomly throughout the day to ask what news and information is available to them at that moment and what they've encountered in the past five minutes. Surveys and focus groups don't yield this sort of texture nor do they set the problem in context. And in this
room, as elsewhere at the firm, context is king.
So is serious engineering. Two of the six people in this room are mechanical engineers, each with four patents to her name. One is Lizardo. The other is Papadopoulos, who offers the Foreign Correspondents card. She would enlist Ideo staff in different countries to watch the nightly news where they are and contribute their observations.
Along those lines, Sklar wants to broaden the inquiry by using Extreme User Interviews, a card from the Ask suit.
He'd try to understand the center by interviewing those who occupy the edges: "someone who doesn't have a TV, someone who gets all their news from the National Enquirer, someone who watches TV constantly."

Minds click. Ideas fly. How about Affinity Diagrams? How about Word-Concept Association? Says Fulton Suri: "Just the fact that I've got them in my hands is making my brain think about all sorts of different approaches." A breakthrough, it seems, is in the cards.”

Iterative Prototyping – The Gossamer Condor Gossamer Condor

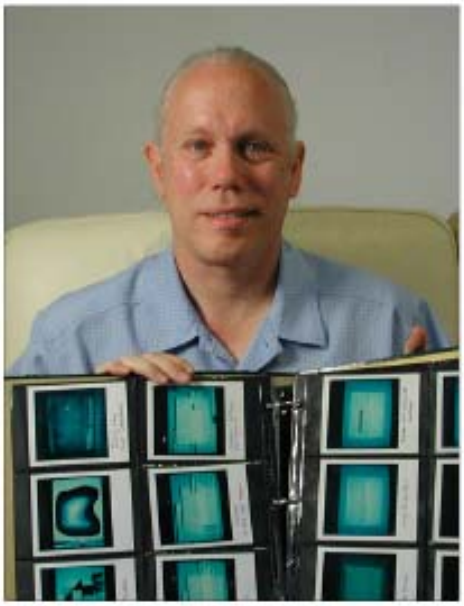
Gossamer Condor

The other key concept that both interaction design and industrial design have in common is iterative prototyping. Nobody gets it right first time, so the idea of "Try, try, and try again" is essential for successful development. The fastest and easiest prototyping method is often the best, particularly if there is time pressure to reach the final solution. A dramatic example of the success of iterative prototyping methods is the story of human powered flight.

In 1959, a British industrialist named Henry Kremer offered £5,000 for the first humanpowered aircraft that could demonstrate the same degree of aerodynamic control as the early Wright fliers, by tracing a figure of eight around two markers four fifths of a kilometer apart. After frustrated attempts by various enthusiasts, in 1977 the Gossamer Condor14 was the first craft to succeed, pedaled by the cyclist Brian L. Allen. The famous technologist Paul B. MacCready, Jr., who adopted a rapid prototyping approach to the development, headed the Condor's design team.
The plane was built of a delicate skeleton of thin tubes and tensioning wires, covered by transparent plastic sheeting that was taped in place. This proved a very flexible kit of materials, allowing the design to be changed as often as once a day, and a new prototype to be built. This rapid prototyping technique was so effective that the craft was an easy winner in the competitive tests, and a later generation of the design went on to be flown by pedal power for great distances, including a crossing between England and France.

Iterative Prototyping – Pull-down Menus Success in interaction design comes quickest when you put these two key concepts together, combining a focus on people with iterative prototyping. A formative step in the design of the user interface for computers illustrates this;

it was the design of the pull-down menu structure for the Apple Lisa, by Bill Atkinson and Larry Tesler.



Bill Atkinson

Larry Tesler

As the first user interface specification for Lisa was being formulated, Bill Atkinson and Larry Tesler formed a close partnership, and developed a working relationship that was round the clock.
Bill would work nights and Larry would work days. During the night Bill would make prototypes of user interface concepts, written in a robust enough code to support some form of testing. Then Larry would run user tests during the day. It was easy to find subjects, as many of the new Apple employees had never used a computer before. Larry would give Bill a report at the end of the day, and tell him what he had learned from the tests. Then they would brainstorm for ideas, and decide what to try next, so that Bill could go off and spend the night programming. In the morning he would bring in a new version, and then go home and go to bed.

They used this method for several intense weeks until the specification was solid, and it was during this time that they designed the arrangement of pull-down menus across the top of the screen that is so familiar today. Larry describes the breakthrough15:

"One day, I said to Bill, "Why don't you try moving the labels to the top of the screen. Then, you'll always have the full height and width of the screen to display the menus. The screen is small enough that people may be able to associate the menus with the window they affect."

Bill went home to try it. In one night, he developed the entire pull-down menu system! Everything! He hadn't just moved the labels to the top of the screen. He had the idea that, as you scanned your mouse across the top, each menu would pop down. They would ruffle like cards as you went back and forth. You could scan them all with

one sweep of the mouse. When Bill came in the next day, he went directly to Steve Job's office to give him a demo, and then came to show us. I went,

> "Oh right! This is what we want. We want everything to be apparent!"

He had come up with highlighting commands as you moved you mouse down inside them, command shortcuts, and a way of showing which window was active and associated with the menu bar. He'd thought up and implemented the whole thing in one night! I can't imagine what happened there in his home that night."

Sebastiano Bagnara – How did you come to move from your discipline to that of the design of interactive systems?
Bill Moggridge – Designing the first laptop computer.

I started the second office of my design practice in 1979 in California's Silicon Valley, and in the following year was fortunate enough to have the opportunity to design the GRiD Compass Computer, the first laptop.

GRiD Compass Computer, 1981

First model used to raise funding

First sketch of the final design, 1980

In 1979 there were a few luggable computers, but they were more the size of a sewing machine than a laptop, and there was no sign yet of the IBM PC or the Apple Macintosh. Back in the mid 1970s, Xerox Palo Alto Research Center (PARC) researcher Alan Kay had conceived the idea for a portable notebook computer that he called the Dynabook, with the dream of seeing it used for education, but Xerox was unwilling to fund the development of a real product, as their market strength was in office equipment rather than educational tools. John Ellenby had also Symposium on the Foundations of Interaction design: Paper from Bill Moggridge 21 worked at PARC, and went on to found his own company, GRiD Systems, to try to build a real notebook sized machine. He saw the components used in a computer steadily shrinking, and had the vision to realize that there was huge potential market for people who needed to move around for their work, and would like to carry the information in their computers

with them. He set out to create a computer that would fit in a briefcase and be usable away from the office.

He first asked me to visualize a design that would help people understand what he imagined, and could be shown to venture capitalists and potential employees. We felt that a three dimensional model would communicate much more powerfully than drawings, so I designed a concept and made a completely realistic looking model out of very unreal materials. The shape was like a fat dictionary that opened like a clamshell, to reveal a flat display on the top half and a keyboard on the bottom. The model did its job of convincing people that the concept had potential, and John successfully raised money and put together an amazingly talented team of founders for GRiD Systems.

We then set about designing and developing the first laptop. My contribution was the physical design of the enclosure, and the way that the screen was hinged to fold down over the keyboard for carrying. This geometry only accounted for one of the 43 items of innovation in the utility patent that we were awarded. Most of these innovations are taken for granted today, but they were new at the time, for example the flat electroluminescent graphic display, the low profile keyboard, bubble memory, and the enclosure in die caste magnesium. The metal housing offered a combination of strength and lightness, creating an amazingly tough machine that was sent up in the space shuttle, and dropped from military helicopters.

When the first twenty-five working prototypes were ready, I took one home and started using it. I soon realized that the physical design that I had spent so much time on was insignificant when compared to the design of the operating system and the interactive software. I only noticed the physical design for a few minutes in each session, but was buried in the delights and frustrations of the interactive behaviors for hours at a time. That made me decide to learn how to design interactions.

Interaction Design - A New Discipline

The need for a new discipline was obvious when I thought about the experience of using this laptop as a whole, including both the physical machine and the software. I realized that the values of design applied equally to both the physical and digital aspects of the problem, but that there were so many things that I knew about the techniques and tools of designing physical objects, where I did not know about the equivalent techniques and tools in the digital realm.

The design disciplines share a common process of creative visualization and synthesis of solutions. All designers work with the subjective and qualitative values of aesthetics as well as the functional values of problem solving. Architects, product designers, graphic designers, interaction designers, and all of the other design disciplines, share this process. They are drawn to these disciplines because they are people with similar talents, hovering between thinking of themselves as artists or problem solvers, and good at lateral thinking, and the synthesis of solutions from a basis of tacit knowledge. They are in different disciplines because they have been

educated to know about different technologies. They all need to be experts in understanding what people need and desire, but their technical expertise comes from different sources. The architect needs to understand the structure of buildings and the manipulation of space, the product designer needs to understand how to design for mass produced objects, the graphic designer needs to understand how to present information in two dimensions and the technologies of print, and the interaction designer needs to understand the structure of software behaviors, electronically enabled services, and environments.

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