Figure 45: The CitrusMate Electric Juicer

The noise that it made jangled my nerves in the morning.
Experience Design vs. Interface Design

...for they had gone out on a limb—but isn’t that where the fruit is?
—Jeff Lowe

For years we have spoken about the human–computer interface and user interface design. This has always been about where the human and the computer meet. There are dozens, if not hundreds, of books on the subject.

Nevertheless, or perhaps because of this, the term interface has been falling into disfavour.

For a few years, it seemed that Interaction Design was going to be the new buzzword. Various schools started to have programs in the area. People had Interaction Designer as the job description printed on their business cards. But the most significant indicator of the currency of the term was the number of people who claim to have coined the term.

We can leave them to fight that one out. The issue is moot, since yet another term has entered the fray: Experience Design.

I like it. The main reason is that it is the most human-centric of the lot. Despite the technocratic and materialistic bias of our culture, it is ultimately experiences that we are designing, not things. Yes, physical objects are often the most tangible and visible outcomes of design, but their primary function is to engage us in an experience—an experience that is largely shaped by the affordances (Gibson 1979) and character embedded into the product itself (Norman 1988; Gaver 1991). Obviously, aesthetics and functionality play an important role in all of this.

Stepping out of the world of technology for a moment, this shift from a techno-centric or materialistic perspective to a human-centric one is mirrored in the following lines from the Italian climber Reinhold Messner, in speaking about the transformations in modern mountaineering:

...in the first 200 years of alpinism, it was the mountain that was the important thing. ... But for some years now, especially on my own tours, it is no longer the mountain that is important, but the man, the man with his weaknesses and strengths, the man and how he copes with the critical situations met on high mountains...
(Messner 1979; p.60)

Perhaps all this sounds a little too ethereal. Let me give a concrete example to illustrate the difference between interface and experience design. At the same time, let’s just agree that from now on, I will use interaction design and experience design interchangeably. Why? Simply because the former is more in use, and after going through this example, I will have loaded it with the meaning that I intend, which is all that I really care about.

There are two things that you need to know for me to set up this example. First, I split my time between a house in Toronto and a cabin north of the city. Second, what gets me out of bed in the morning is fresh squeezed orange juice.
Figure 46: My Mighty OJ Manual Juicer
My first manual juicer, loaded and ready to go.

Figure 47: The OrangeX Manual Juicer
My second manual juicer. Its feel was a revelation.
For years, the thing that enabled this pleasure was the *CitrusMate*, shown in Figure 45. The only problem was, it was in the city, so it was of little use to me when we were staying at our place in the country. To put a stop to my whining in the morning, my wife took the initiative and bought me a juicer for the cabin. (This was not a totally selfless act, since I make juice for her, too.)

She bought the *Mighty OJ* juicer, shown in Figure 46. And I liked it. That is the good news. The bad news is, my experience with it made me hate the juicer in the city—that same juicer that only weeks before had been one of my most precious possessions. Why?

It is pretty clear from looking at the photos that these two products are very different. Nobody would confuse one with the other. They use different technology (electric vs manual). The user interface for each is also clearly different. But that was not the problem. Despite these differences, the usability of each was comparable, and the juice from each tasted the same.

For me, the difference that shaped my change in opinion was in the contrast in the overall experience of using the two products. Simply stated, having experienced the silent simplicity of the Mighty OJ, I grew to hate the noise that the electric CitrusMate made, especially first thing in the morning.

Thus did I emotionally separate from what had been a cherished possession.

So, after listening to my continual complaints about the noise of the electric CitrusMate, my wife got the hint. For my 55th birthday she bought me another manual juicer to replace it. The new one, shown in Figure 47, was from yet another company. It was the *OrangeX Manual Citrus Juicer*, designed by Smart Design in New York (Industrial Designers Association of America, 2001).

At this point, it is important that you compare the photos of the two manual juicers. Notice how similar they look. They both work by the same basic principle. They have the same user interface. You pull back the lever and place half of an orange face down in the "jaws." You then pull the lever in order to squeeze the juice into the container.

If you can use one, you can use the other. The juice tastes the same from each, and takes the same amount of time to prepare. And, from a distance, you might even mistake one for the other.

However, despite these similarities, from the perspective of experience, there is no comparison between the two.

The two manual juicers, the OrangeX and the Mighty OJ, have the same user interface. Yet, despite their similarities, the quality of experience using theOrangeX is as much better than that of the Mighty OJ as the Mighty OJ's is to that using the electronic CitrusMate.

It is not that the Mighty OJ is bad. In absolute terms, it hasn't gotten any worse. It is just that, relative to it, the experience in using the OrangeX is so much better. And, with that improvement comes a whole new standard of expectation or desire, which, perhaps predictably, also led to a whole new bout of whining on my part with the equally predictable result that my wife eventually (sooner than later) replaced the MightyOJ with yet another OrangeX.

So what is it in the OrangeX that brought about such a difference?

Although the OrangeX is significantly heavier, the meaningful difference is not due to weight. Rather, my pleasure is due to the feel of the action when pulling the lever down. There is a cadence in the action that is almost musical. This is something that no drawing or photograph can capture, since it has to do with feel, and it takes place over time. The point is, I just can't use it without a smile.

At this point I want to reiterate that both of these manual juicers have the same user interface. From this I want to emphasize that *usability has nothing to do with their differences*. It is the quality of experience that marks their difference. This brings us to the next point that I want to emphasize: this difference did not come about by accident. It was the result of conscious design.
Figure 48: Gear Mechanism of the Mighty OJ
Rotary motion of the arm raises and lowers the jaws of the juicer by means of a rack and pinion gear. The gear ratio is constant.

Figure 49: Two-Dimensional Study of OrangeX Mechanical Linkage
Cutting the parts out of Perspex and pinning them onto a board enabled quick testing of the linkage, as well as marking time lapse ghost images of the background. A chronological sequence of renderings (including this) is shown in Figure 44.
Photo: Smart Design
If we look more closely (see Figure 48), we see that the Mighty OJ has a direct linkage between the lever and the jaws. This is by way of the simple rack-and-pinion gear mechanism seen in the figure. This gives the unit what is best described as a constant gear ratio, where maximum force must be applied at the end, or bottom, of the stroke.

In contrast, the quality of the OrangeX action is due to the subtle difference of its leverage mechanism. By the nature of the linkage between the arm and the jaws, there is a kind of camming effect. This is what delivers the cadence that I so love. The effect of the linkage design is to vary the gear ratio, so to speak, so that at the end of the squeeze—where with the Mighty OJ you have to push the hardest—the pressure required is reduced, and you come to a gentle conclusion of the squeeze. You can actually take your hand off the lever at the bottom of the stroke and watch the final drops of juice drip into the container.

The workings of this mechanism can be seen by looking closely at Figure 48, or even better, at the mechanical study shown in Figure 49.

There are a couple of things that really interest me about what is shown in Figure 48. First, it has a lot in common with the engineering prototype of the Trek Y-Bike seen previously in Figure 28. Both illustrate a mechanical innovation that lies at the heart of the experience of final product.

The second thing to notice in the study shown in Figure 49 is how economical it is. It is just some Perspex cut out and pinned together at the points of articulation. Furthermore, as is seen in the figure, these were mounted on boards, which enabled the designers to trace key positions of the mechanism onto the background, thereby achieving something like the effect of a time-lapse photograph. It is, in fact, a 2D dynamic exploratory sketch of the mechanism.

But this is only one of a number of studies that led to the final design. A selected sample illustrating the process can be seen in Figure 50.

By means of working through such a series of renderings and studies, the team was able to achieve the dramatic experience that I have just described.

At this point step back and remember that here we are just speaking of orange juicers. Yet even with this type of mechanical product, we see the attention to detail, and the special techniques that are involved in achieving that level of experience.

The lesson to take away from this can be gained by contrasting these orange juicers with the behavioural complexities of the types of electronic appliances that many of us are involved in bringing to market today.

Consider this:

If it takes this much effort and detail to achieve this standard of quality with such relatively simple things as juicers, why would we expect to get a similar quality experience from our new-world information appliances without, likewise, adopting very explicit and deliberate processes directed at doing so?

So, if we do decide that we want to strive for a comparable standard of experience in the products that we are designing, and therefore adopt an appropriate process for doing so, what might that process be? Making a contribution toward answering this question is at the heart of what follows.
Figure 50: Selected Snapshots of the Progress of the Design

As we move across the pages left-to-right, top-to-bottom, we see the evolution of the concept rendered in increasing detail, starting with exploratory 2D sketches of the mechanism, through 2D and then 3D mechanical studies, then to physical 3D explorations of the form, and then to technical renderings that lead to manufacturing drawings.

Photos: Smart Design
Sketching Interaction

*When you come to a fork in the road, take it!*  
— Yogi Berra

So how might we find a process that enables us to design computer-based products with the same attention to user experience that we saw in the design of the OrangeX? I think that the answer lies in the OrangeX example, itself. Hence its importance.

It illustrated that the activity of sketching could be extended to other forms than just pencil on paper. The key here is to understand that sketching as I mean it has more to do with exercising the imagination and understanding (mental and experiential) than about the materials used. Hence, one might use pencil on paper, but one might also use a jar lid, a stick, and a piece of plasticine. It may even involve a computer. With the OrangeX example, the underlying process and objectives were the same, but the sketches themselves took on a more physical form than we have seen thus far. As I shall say more than once, the importance of sketching is in the activity, not the resulting artifact (the sketch). If sketches can take on physical form, be they 3D or sculptural, perhaps they can take on even more extended forms that will help us in our quest.

But how do we go deeper than this? If there are new forms of sketching, how can we pursue them?

One thing that we know is that sketches for experience and interaction design will likely differ from conventional sketching since they have to deal with time, phrasing, and feel—all attributes of the overall user experience. How rich is that?

Experience is a very dynamic, complex and subjective phenomenon. It depends upon the perception of multiple sensory qualities of a design, interpreted through filters relating to contextual factors. For example, what is the experience of a run down a mountain on a snowboard? It depends upon the weight and material qualities of the board, the bindings and your boots, the snow conditions, the weather, the terrain, the temperature of air in your hair, your skill level, your current state of mind, the mood and expression of your companions. The experience of even simple artifacts does not exist in a vacuum but, rather, in dynamic relationship with other people, places and objects. Additionally, the quality of people’s experience changes over time as it is influenced by variations in these contextual factors. (Buchanau & Suri 2000; p 424)

In light of this, let us ask again:

*What is the nature of sketching in interaction design?*
*How do you sketch interaction?*
*What is to an interactive system what the early sketch in Figure 35 is to Lance Armstrong’s time trial bike?*
*What are the fundamental skills required for sketching interactive systems?*
*What is the underlying process that one should follow to do this effectively and consistently?*
*What should be included in Sketching 101 in an Interaction Design curriculum?*
The tack that we are going to pursue is that sketching in interaction design can be thought of as analogous to traditional sketching. Since they need to be able to capture the essence of design concepts around transitions, dynamics, feel, phrasing, and all the other unique attributes of interactive systems, sketches of interaction must necessarily be distinct from the types of sketches that we have looked at thus far. Nevertheless, to be considered sketches, they must be consistent with the attributes that we discussed earlier, namely:

- Quick
- Timely
- Inexpensive
- Disposable
- Plentiful
- Clear vocabulary
- Distinct gesture
- Minimal detail
- Appropriate degree of refinement
- Suggest and explore rather than confirm
- Ambiguity

From our analysis of sketching in traditional design, we are able to find a compass that can help guide us in our exploration of sketching in this new domain. Although the surface of the renderings will be different, the underlying properties should be the same. Therefore, not only do we have a compass, we have a litmus test that helps us categorize examples that we encounter.
Figure 51: The Dynamics of the Design Funnel
The design funnel begins with ideation, and ends with usability testing. The former is largely dominated by sketching, which enables ideas to be explored quickly and cheaply. More refined (and expensive) prototypes provide the basis for the testing at the later stages of design. Where testing is a key concern, the most dominant artifacts are more refined (and expensive) prototypes. The transition from one to the other is represented by the transition from orange to yellow in the figure. As we progress, our overall investment in the process grows. This is indicated by the rising arrow and the y-axis label on the left. The y-axis label on the right side of the figure emphasizes that as our investment increases, so should the weight of the criteria that we use to evaluate our design decisions. In other words, you don’t manage ideation the same way, or with the same rigor, as usability. Finally, the circular arrows are a reminder that we include users throughout the iterative process, not just during usability testing.
sketches are not Prototypes

duct is the best of all instructors
Juilius Syrus

Now that what I mean by sketching interaction is becoming a bit more clear, it is inevitable that someone is going to ask something like, "Isn't what you are calling a sketch just another word for prototype or low-fidelity prototype?" The answer is emphatically, "No!" The distinction between a sketch and a prototype is—for me at least—one of the most interesting things to emerge as I went down this path.

Sketches and prototypes are both instantiations of the design concept. However they serve different purposes, and therefore are concentrated at different stages of the design process. Sketches dominate the early ideation stages, whereas prototypes are more concentrated at the later stages where things are converging within the design funnel. Much of this has to do with the related attributes of cost, timeliness, quantity, and disposability. Essentially, the investment in a prototype is larger than that in a sketch, hence there are fewer of them, they are less disposable, and they take longer to build. At the front end of the funnel, when there are lots of different concepts to explore and things are still quite uncertain, sketching dominates the process.

These notions are captured graphically in Figure 51. The circular arrows reinforce that the whole design phase is an iterative, user-centred process. The coloured change reflects a transition from a concentration on sketching at the front to one concentrating on prototyping at the back. Related to this, and signified in the colour coding, is the accompanying transition from ideation to usability testing.

From the management perspective, perhaps the most important component of Figure 51 is the ascending red arrow. What this says is that the weight of the criteria by which ideas or concepts are injected or rejected varies with the investment made in them. Stated simply, at the beginning, ideas are cheap, so "easy come, easy go" and "the more the merrier." As we proceed, we have more and more invested in the concepts in play, hence we need to adopt increasingly formal or explicit criteria for evaluating what goes, what stays, and where we invest our resources.

Because the investment in the product is low, the front end is the one time in the product pipeline when one can actually afford to play, explore, learn, and really try and gain a deep understanding of the undertaking. In fact, too much concern for quality too early may well have a negative effect. I found a wonderful example illustrating what I mean by this referred to in a blog from someone called Bill Brandon:
Figure 52: The Sketch to Prototype Continuum
The difference between the two is as much a contrast of purpose, or intent, as it is a contrast in form. The arrows emphasize that this is a continuum, not an either/or proposition.
The ceramics teacher announced on opening day that he was dividing the class into two groups. All those on the left side of the studio, he said, would be graded solely on the quantity of work they produced, all those on the right solely on its quality. His procedure was simple: on the final day of class he would bring in his bathroom scales and weigh the work of the "quantity" group: fifty pounds of pots rated an "A," forty pounds a "B," and so on. Those being graded on "quality," however, needed to produce only one pot—albeit a perfect one—to get an "A." Well, came grading time and a curious fact emerged: the works of highest quality were all produced by the group being graded for quantity. It seems that while the "quantity" group was busily churning out piles of work—and learning from their mistakes—the "quality" group had sat theorizing about perfection, and in the end had little more to show for their efforts than grandiose theories and a pile of dead clay. (Bayles & Orland 2001; p. 29)

Baxter (1995) argues that because the investment is so low and the opportunity to explore options is so high at the start, that this is also the stage in the product development lifecycle when you have the potential to realize the highest return on investment. Of course, this is a double-edged sword. It is also the point in the process where the consequences of an undetected bad decision, or an opportunity missed, can cost you the most (in real dollars or missed revenue). So, as the saying goes:

Fail early and fail often.

And learn.

But adequate investment at this stage happens too infrequently, especially with software companies. The paradox is that those same firms that can't afford a relatively small planned investment in design at the front end, seem quite able to afford the far higher unexpected and unbudgeted (but predictable) high back-end costs that result from a bad product being late and underdelivering on its potential.

Jumping in and immediately starting to build the product, even if it does get completed and ship, is almost guaranteed to produce a mediocre product in which there is little innovation or market differentiation. When you have only one kick at the can, the behaviour of the entire team and process is as predictable as it will be pedestrian:

You cling ever more tightly to what you already know you can do—away from risk and exploration, and possibly further from the work of your heart. (Bayles & Orland 2001; p.30)

Robert Cooper (1993; 2001) compares managing product development costs in terms of the type of risk analysis that one would use at the poker table, or in managing an investment portfolio. Mike Baxter summarizes this in terms of the following Gambling Rule:

When uncertainties are high, keep the stakes low. As the uncertainties reduce, increase the stakes. (Baxter 1995; p.10)

In summary, what all this says is that we must manage the front-end of the process differently than the back-end, regardless of whether we are looking at things in the large (the overall product pipeline—design, engineering, sales, etc.) or in the small (within the design funnel itself, where we must manage the sketching and ideation phase differently than we manage the back-end prototyping stage).