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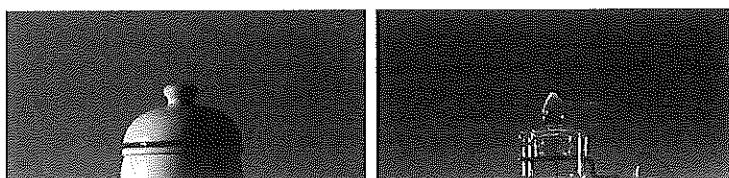
Advances in our understanding of emotion and affect have implications for the science of design. Affect changes the operating parameters of cognition: positive affect enhances creative, breadth-first thinking whereas negative affect focuses cognition, enhancing depth-first processing and minimizing distractions. Therefore, it is essential that products designed for use under stress follow good human-centered design, for stress makes people less able to cope with difficulties and less flexible in their approach to problem solving. Positive affect makes people more tolerant of minor difficulties and more flexible and creative in finding solutions. Products designed for more relaxed, pleasant occasions can enhance their usability through pleasant, aesthetic design. Aesthetics matter: attractive things work better.

"If we were to follow Norman's prescription, our designs would all be usable, but they would also be ugly."

THREE TEAPOTS

I have a collection of teapots. One was invented by the French artist Jacques Carelman for coffee, not tea, not that I can tell the difference. "Coffeepot for masochists" is what he called it, and it is quite unusable, for the handle is on the same side as the spout. It appears on the cover of "*The Design of Everyday Things*" (Norman, 1988). Mine is an imitation. Another was designed by Michael Graves — no, not the famous pot with the bird but a lesser-known one called Nanna, a teapot so ugly that it is appealing. Yet another is the tilting pot made by the German firm Ronnefeldt that I discovered while enjoying high tea at the Four Seasons Hotel in Chicago.

The Carelman pot is, by intent, impossible to use. The Nanna teapot looks clumsy, but actually works rather well. The tilting pot is made with deep consideration of the stages of tea brewing: place the tea leaves on the interior shelf and lay the pot on its back while the leaves steep. Then, as the brew approaches the desired strength, tip the pot up to a tilt, partially covering the tea leaves. When the tea is ready, stand the pot upright, so that the leaves are out of the liquid, preventing the tea from becoming bitter. And finally, when the teapot is empty, remove the cover, signaling the waiter that more hot water would be welcome.



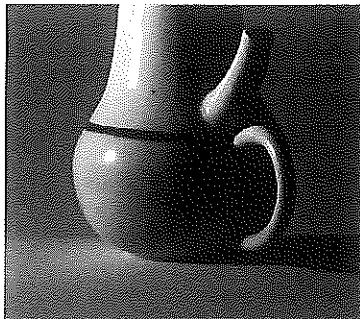


Figure 1 My impossible teapot. (Author's collection, after Carelman's "Coffeepot for Masochists." Photo by Ayman Shamma.)

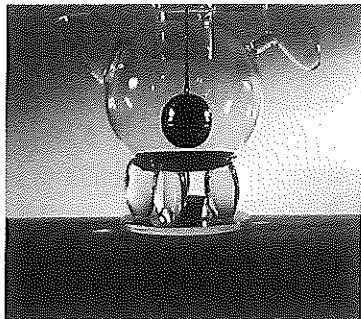


Figure 2 Michael Graves' Nanna teapot. So homely I couldn't resist it. (Author's collection. Photo by Ayman Shamma.)

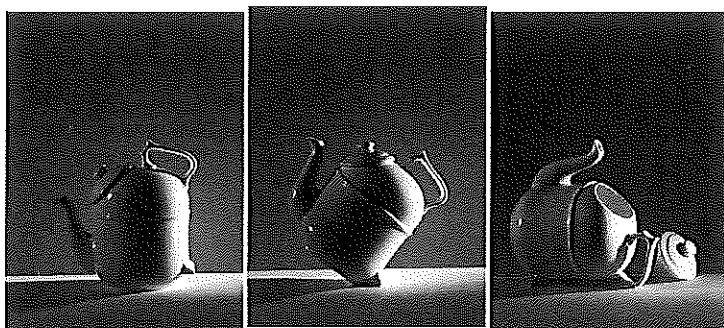


Figure 3 The Ronnefeldt "tilting" teapot. Put leaves on the shelf (seen through the opening on the teapot to the left), fill with hot water, and lay the teapot on its back. As the tea darkens, tilt the pot. Finally, when the tea is done, stand the teapot vertically, so the water no longer bathes the leaves and the brew does not become bitter. (Author's collection. Photo by Ayman Shamma.)

Three different teapots, one emphasizing usability (or to be more precise, its absence), one emphasizing aesthetics, and one practicality. But which one do I usually use? All of the above.

I do drink tea every morning, but at that early hour, even though I am not willing to compromise on taste, efficiency comes first. So, upon awakening I plod into my kitchen, push the button on my Japanese hot pot that heats the water from its 90° (Celsius) holding temperature while I spoon cut tea leaves into a little metal brewing ball, drop the ball into my cup, and use the now-boiling water to fill the cup. Wait a few minutes, remove the metal ball, and my tea is ready to drink. Fast, efficient, easy to clean.

But sometimes, when I have more leisure, or when with guests or family, I use one of the others. The Nanna teapot for its elegance, or the tilting pot for its practicality. Design matters, but which design is preferable depends upon the occasion, the context, and above all, upon my mood.

Why do I own several teapots? Because I like them. I proudly exhibit them on the ledge above the kitchen sink. In addition to their function for brewing tea, they are sculptural artwork, giving satisfaction in their appearance. I

enjoy standing in front of the window, idly comparing the contrasting shapes, watching the play of light upon the varied surfaces. When I do make tea, I choose the pot that matches my mood, and when I do, the tea tastes superb.

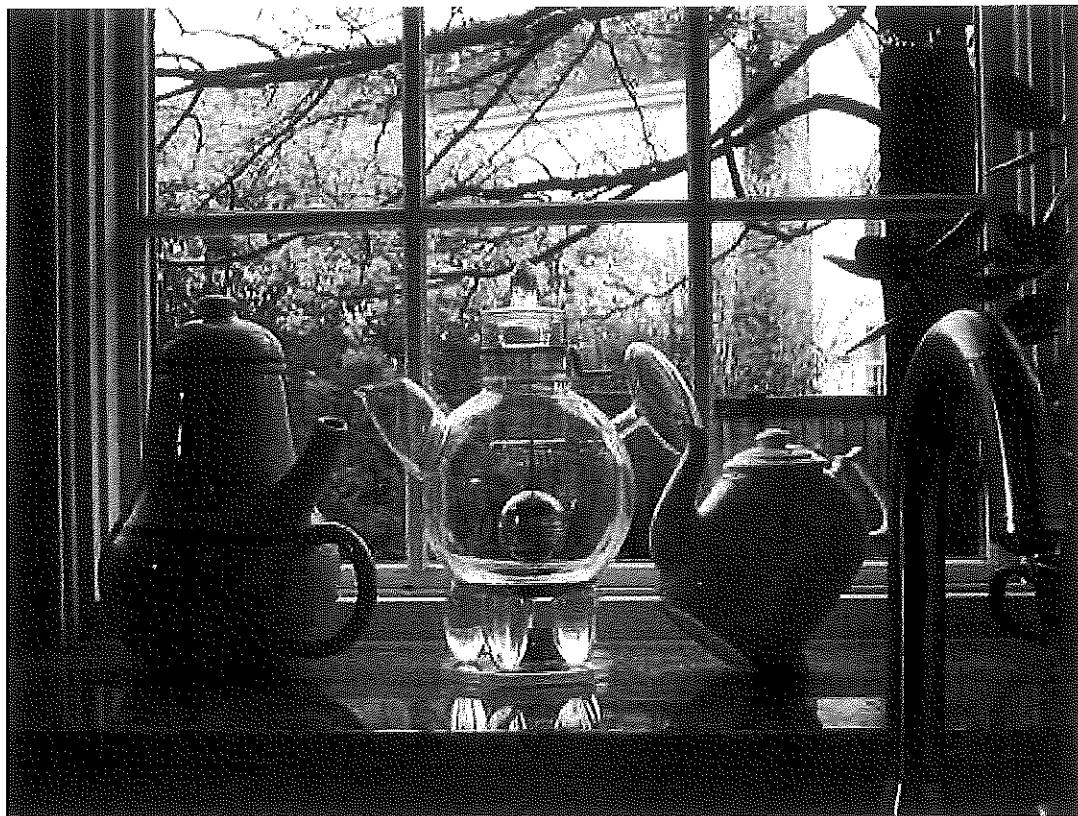


Figure 4. Three teapots: as works of art in the window above the kitchen sink. (Author's collection. Photo by Ayman Shamma.)

AFFECT AND DESIGN

In the early days of the personal computer, all the display screens were black and white. When color screens were first introduced, I did not understand their popularity. In those days, color was primarily used either to highlight text or to add superfluous screen decoration. From a cognitive point of view, color added no value that could not be provided with the appropriate use of shading. But despite the fact that the interface community could find no scientific benefit, businesses insisted on buying color monitors. Obviously, color was fulfilling some need, but one we could not measure. In order to understand this phenomenon, I borrowed a color display to use with my computer. After the allocated time, I was convinced that my assessment had been correct -- color added no discernible value for everyday work. However, I refused to give up the color display. Although my reasoning told me that color was unimportant, my emotional reaction told me otherwise.

The "usable but ugly" critique of *The Design of Everyday Things* has merit insofar as usable designs are not necessarily pleasurable ones. As my story of the three teapots indicates, pleasurable designs are not necessarily usable. But need these attributes be in conflict? Why not beauty and brains, pleasure and usability? When I wrote *The Design of Everyday Things*, my intention was not to denounce beauty. I simply

wanted to position usability in its proper place in the design world: equal to beauty, equal to function: equal, but not superior. I neglected the topic of aesthetics because I thought it already well covered elsewhere. Unfortunately, my neglect was interpreted by many to imply that I was against beauty, for usability at all costs.

The field of usability design takes root in the cognitive sciences -- a combination of psychology, computer science, human factors, and engineering. These are all analytical fields. The discipline prides itself on its scientific basis and experimental rigor. The hidden danger is to neglect areas that are not easily addressed in the framework of science and engineering.

The tensions between aesthetics and usability as well as those between affect and cognition have long bothered me, but it has not been until now that I have been able to make progress in bringing these areas together.

Affect and emotion are not as well understood as cognition, but the cognitive and neurosciences have made major strides in the past decade. Note that terminology is still a problem, so in this paper, to avoid the technical debate about distinctions among the concepts of affect, emotion, feelings, mood, motivation, and qualia, I use the reasonably neutral term of "affect." Affect and cognition can both be considered information processing systems, but with different functions and operating parameters. The affective system is judgmental, assigning positive and negative valence to the environment rapidly and efficiently. The cognitive system interprets and makes sense of the world. Each system impacts the other: some emotions -- affective states -- are driven by cognition, and cognition is impacted by affect.

The surprise is that we now have evidence that pleasing things work better, are easier to learn, and produce a more harmonious result.

AFFECT AND BEHAVIOR

Wash and polish your car: doesn't it drive better?

Affect makes us smart, that's the lesson of my current research into the role of affect. This is because affect is always passing judgments, presenting us with immediate information about the world: here is potential danger, there is potential comfort. This is nice, that bad. The affective signals work through neurochemicals, bathing the relevant brain centers and changing the way we perceive, decide, and react. These neurochemicals change the parameters of thought, adjusting such things as whether reason is primarily depth first (focused, not easily distracted) or breadth first (creative, out of the box thinking, but easily distractible).

Affect came early in evolutionary history, preceding the evolution of humans and playing an essential role in survival. There are physical dangers in the world: cliffs, stairways, slippery surfaces, speeding automobiles, and poisonous substances. The fast-acting system helps us navigate through life. This apparatus also influences how we judge things, whether the things be other people, the choice of place to live or eat, and the products we buy and use.

Affect also has a major impact on how well we are able to perform tasks. Negative affect focuses the mind, leading to better concentration. In cases of an immediate threat this is good, for it concentrates processing

power upon the danger. When creative problem solving is required this is bad, for it leads to narrow, tunnel vision. Positive affect broadens the thought processes, making it more easily distractible. When the problem requires focus, this is bad, but when the problem is best addressed through creative, out-of-the-box thinking, then this is precisely what is needed.

Affect therefore regulates how we solve problems and perform tasks. Negative affect can make it harder to do even easy tasks: positive affect can make it easier to do difficult tasks. This may seem strange, especially to people who have been trained in the cognitive sciences: affect changes how well we do cognitive tasks? Yup.

Imagine a plank 10 meters long and 1 meter wide. Place it on the ground. Can you walk on it? Of course - no problem. You can jump up and down, dance, and even walk along with your eyes shut. Now lift the plank 3 meters in the air. Can you walk on it? Yes, although more carefully.

What if the plank were 200 meters in the air? Most of us wouldn't dare go near it, even though the act of walking along it and maintaining balance should be no more difficult than when on the ground. Why would a simple task suddenly become so difficult - impossible, even? Tell yourself all you want that if you can walk on the plank on the ground, you can still walk on it in the air. You still won't walk along it, let alone jump and dance or, heaven forbid, close your eyes while walking. Fear dominates.

Why should affect have such an influence? Well, you might think to yourself, maybe it is windy. Maybe the plank might break. Maybe this, maybe that. But all this thinking comes after the fact: the affective system works independently of thought. Your thoughts are occurring after the affective system has released its chemicals. Mind you, you can override this impact. Circus performers and steelworkers can function on narrow platforms at great heights. You can learn to overcome your affective reactions, but it takes time, and practice. It requires a deliberate, conscious act, at least at first, to overcome the built-in responses. (Beware, though, circus performers and steelworkers sometimes do fall to their deaths.)

Note that the anxiety produced by walking a plank high in the air -- or even by performing in public -- can be beneficial. Anxiety focuses the mind, reducing distractions. It is when the negative affect is too strong that performance is inhibited, whether because of the fear of falling or stage fright. Some performers welcome anxiety, for they recognize that the proper amount helps them focus and do their best.

Just as negative affect can make some simple tasks difficult, positive affect can make some difficult tasks easier. In a clever set of experiments, Alice Isen has shown that if people are given small, unexpected gifts, afterwards they are able to solve problems that require creative thought better than people who were not given gifts. The positive affective system seems to change the cognitive parameters of problem solving to emphasize breadth-first thinking, and the examination of multiple alternatives. It also has the side effect of making people more distractible.

Anxiety has just the opposite effect: it biases the processing to be depth first, to focus and concentrate. Here, people are less distractible. Anxiety and fear squirt neural transmitters into the brain that narrow the thought process. In general, this is good for focus upon a specific threat or problem.

Both modifications to the normal state of cognitive processing have advantages as well as disadvantages.

Negatively valenced affect narrows the thought processes – hence depth-first processing and less susceptibility to interruption or distraction. Usually, this works just fine: when danger strikes, we need to concentrate attention, to avoid distraction by irrelevant, extraneous matters. Tunnel vision is often the correct approach. Positively valenced affect broadens the thought processes – hence enhanced creativity. This is useful when in a positive situation, with no time pressures. Then, it is often profitable to be distractible, to follow side thoughts, to release creativity. Sometimes, of course, the tunnel vision can lead to harm, just as sometimes the broadening of the thought process can distract can prevent solution.

Implications upon Design

Now consider the implications of these findings upon design. A short summary is that good human-centered design practices are most essential for tasks or situations that are stressful: distractions, bottlenecks, and irritations need to be minimized. In pleasant, positive situations, people are much more likely to be tolerant of minor difficulties and irrelevancies. In other words, although poor design is never excusable, when people are in a relaxed situation, the pleasant, pleasurable aspects of the design will make them more tolerant of difficulties and problems in the interface.

Start by considering tools meant for stressful situations, where the negative affect of the task leads to depth-first processing and, in the extreme case, tunnel vision. Tools that are meant to support serious, concentrated effort, where the task is well specified and the approach relatively well understood are best served by designs that emphasize function and minimize irrelevancies. Here the normal tensions of the situation are beneficial. The design should not get in the way: it must be carefully tailored for the task.

Take a simple example -- trying to escape a hazardous situation. Suppose that fleeing people encounter a door that won't open. The anxiety-produced response is to try again harder. When the first push doesn't open the door, press harder, kick, and even throw the body against it. In less stressful situations people might recognize that the correct solution is to pull instead of push, but not in high-anxiety producing ones. Designs intended for stressful situations have to pay special attention to matching the needs of the users, to making appropriate actions salient and easy to apply. In other words, the principles of good human-centered design are especially important in stressful situations.

Now consider tools meant for neutral or positive situations. Here, any pleasure derivable from the appearance or functioning of the tool increases positive affect, broadening the creativity and increasing the tolerance for minor difficulties and blockages. Minor problems in the design are overlooked. The changes in processing style released by positive affect aids in creative problem solving that is apt to overcome both difficulties encountered in the activity as well as those created by the interface design. In other words, when we feel good, we overlook design faults. Use a pleasing design, one that looks good and feels, well, sexy, and the behavior seems to go along more smoothly, more easily, and better. Attractive things work better.

If I did a good job in this section, you will have reached this point nodding in agreement. You may not realize how heretical that last sentence is: Attractive things work better. That's not the usual message of people who espouse making products more usable.

My studies of cognition showed that color computer displays (or color TV, for that matter) offered no information advantage over black and white. But I would never go back to black and white computer displays or black and

white television. So too should we not go back to ugly, ill-designed things. Heretical or not, it is time to have more pleasure and enjoyment in life. Although the cognitive analyses of usability and function are important, so too is the affective analysis. Let the future of everyday things be ones that do their job, that are easy to use, and that provide enjoyment and pleasure.

BEYOND BEAUTY

I can hear it now: "Hey, Norman says it's OK to be pretty," and off people go, feeling free to ignore decades of work by the usability community. That's the wrong lesson to learn from this essay.

There are many designers, many design schools, who cannot distinguish prettiness from usefulness. Off they go, training their students to make things pleasant: façade design, one of my designer friends calls it (disdainfully, let me emphasize). True beauty in a product has to be more than skin deep, more than a façade. To be truly beautiful, wondrous, and pleasurable, the product has to fulfill a useful function, work well, and be usable and understandable.

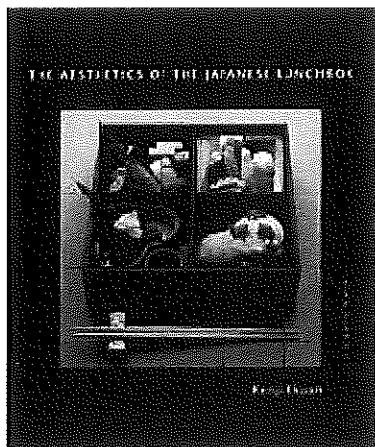


Figure 5. The Cover of Kenji Ekuan's book, *The aesthetics of the Japanese lunchbox*, demonstrating depth, beauty, and utility. (Photo from [MIT Press website](#) (<http://mitpress.mit.edu/catalog/item/default.asp?sid=F10FDAAE-8467-4140-A91E-3D12C86CBB84&ttype=2&tid=4122>): .)

Good design means that beauty and usability are in balance. An object that is beautiful to the core is no better than one that is only pretty if they both lack usability.

In the quest for enhancement of life, let us not be usability bigots. Yes, products must be usable. But all the many factors of design must be in harmony. Marketing considerations must be accounted for, aesthetic appeal, manufacturability -- all are important. The products must be affordable, functional, and pleasurable. And above

all a pleasure to own, a pleasure to use. After all, attractive things work better.

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AUTHOR'S BIOGRAPHY

Don Norman just received the CHI "Lifetime Achievement" Award, but nonetheless, he insists his lifetime is not over. If the last lifetime was devoted to usability, then let the next be devoted to design and aesthetics: this paper marks his coming out of the closet as a secret admirer of attractive products. Norman says that he spends 50% of his time with the Nielsen Norman group, consulting for and serving on advisory boards of numerous companies; 50% as Professor of Computer Science at Northwestern University; 50% working with colleagues at Northwestern on the study of emotion and affect; and the remaining 50% writing his latest book, "*Emotion & Design*," of which this article will be a part. He is on the board of the Institute of Design in Chicago. In his spare time he tries to cope with the ever-increasing barrage of email. He lives at www.jnd.org.

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