THE **ART** OF
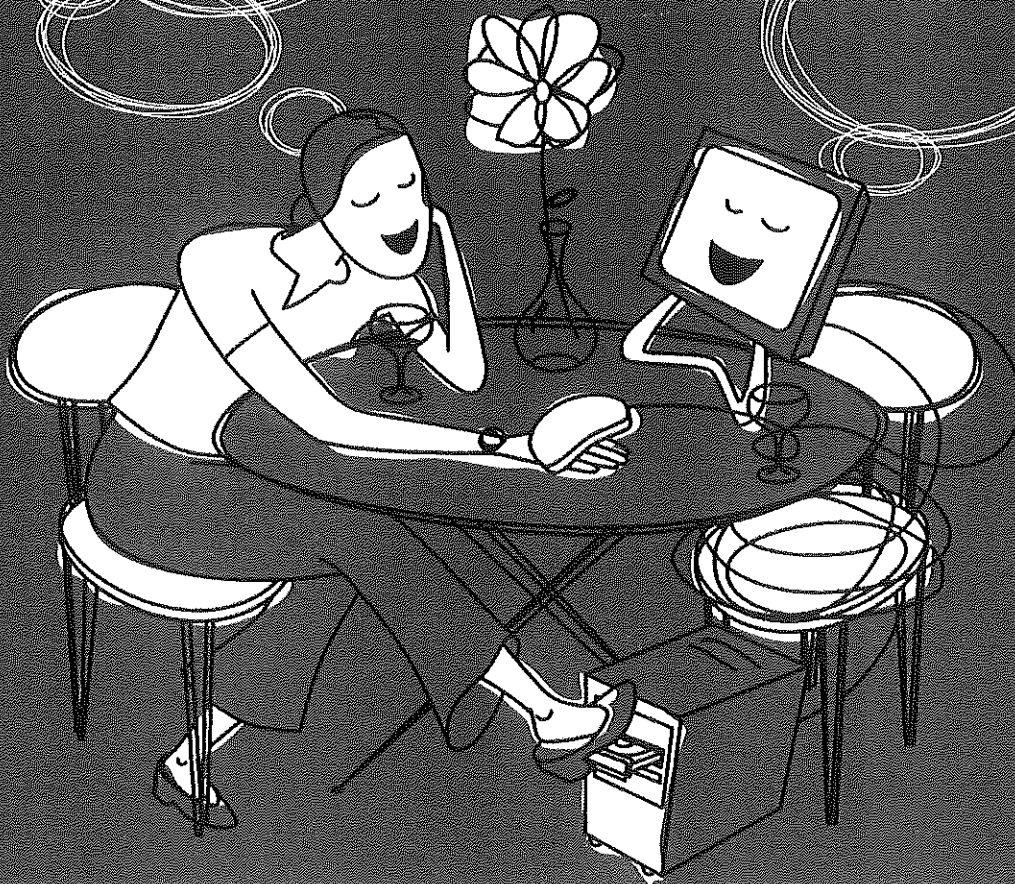# INTERACTIVE DESIGN

A euphonious and illuminating guide to
building successful software

CHRIS CRAWFORD

THE ART OF INTERACTIVE DESIGN
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THE ART OF

INTERACTIVE

DESIGN

A EUPHONIOUS AND ILLUMINATING GUIDE TO BUILDING SUCCESSFUL SOFTWARE

Chris Crawford

DEDICATION

To three friends who stood firmly behind me in my hour of need:
Laura Mixon, Veronique Raingeval, and Dave Walker.

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WHAT EXACTLY IS
INTERACTIVITY ?
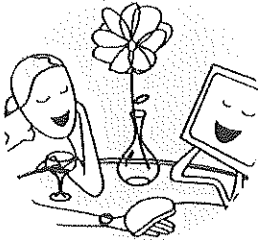
The term interactivity is overused and underunderstood. I choose to define it in terms of a conversation: a cyclic process in which two actors alternately listen, think, and speak. The quality of the interaction depends on the quality of each of the subtasks (listening, thinking, and speaking). And many things commonly held to be interactive are not.

Interactivity is one of the buzzterms of the times and as such is much abused. It's not that interactivity was heretofore unknown; on the contrary, I remember lengthy discussions on interactivity in the early 1980s. But the computing community didn't catch on to the importance of interactivity until recently. In the early 1990s, I garnered plenty of derision by insisting that interactivity was the core idea of computing.

So at least we're buzzing in the right general direction. But popularity has its costs, one of which is the way popular terms are given a different spin by every user. The result is that the poor term ends up spinning one way and then the other, becoming hopelessly dizzy with all the abuse. I'm reminded of the wonderful story from The Martian Chronicles about a Martian who visits a town of earthlings and is unable to prevent himself from transforming, chameleon-like, to meet the expectations of everyone he encounters. Thus, overwhelmed by these expectations, he dies from the frenetic effort.

So it is with the term interactivity, yanked around so much as to be half-dead, a pallid, bloodless nothingburger of a word. I'll bet that one day you'll walk into the grocery store and find a box of laundry detergent with a big banner slashing diagonally across its top, saying, "NEW! IMPROVED! INTERACTIVE!"

For example, take a gander at these photos:
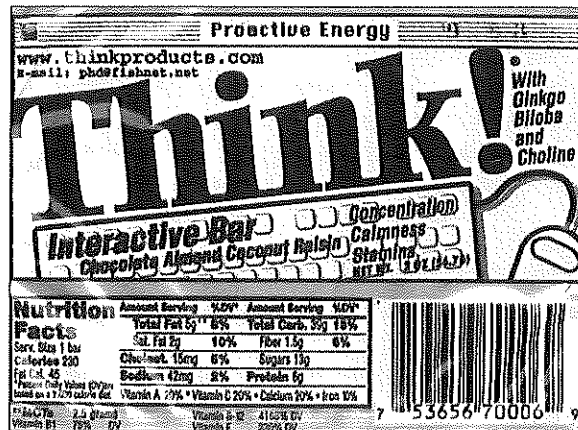
Or consider this definition of interactivity offered in a popular book: "By definition, the things people do on computers have always been interactive." Not very illuminating, is it? Or here's another definition offered on a website: "Interactivity . . . concerns itself with the various means by which human beings implement actions." Rather mushy, eh?

So let's start with a humbling realization: We really don't have a clear idea of what interactivity is. Plenty of people have slapped it onto their work and tried to sell "The Same Old Same Old Stuff" as "New Interactive Technology!" and, with all the hype, we've lost track of the word's true meaning. But let's not be too hard on ourselves; after all, any word that can launch a book this heavy surely has plenty of tricks up its sleeve. So let's roll up our own and get to work.

Defining Interactivity

I used to think that definitions were important, sort of like linguistic rules of the road, erected to keep people's utterances from crashing into each other in a demolition derby of language. But nowadays, I take a more easygoing view of definitions. Any idea worthy of my attention is probably too big and too complicated to be reduced to some schoolmarmish formula. The joy of thinking comes from all of those fascinating nooks and crannies that lurk in nuance. My task as a lexicographer is just as important as a cartographer's, but I don't see the scenery by perusing a map; I get out there and walk the ground. Nevertheless, a definition is a good way to get started, so I'll draw the map first, and we can start walking the ground later.

interaction: a cyclic process in which two actors alternately listen, think, and speak.

I'm using the terms actors, listen, think, and speak metaphorically, although the terms are literal to the most commonly experienced form of interactivity: conversation. Conversations, in their simplest form, begin with two people, say, Gomer and Fredegund. First, Gomer says something to Fredegund, at which point the proverbial ball is in Fredegund's corner. Fredegund then performs three steps in order to hold up her end of the conversation:

Step One: Fredegund listens to Gomer, paying close attention to Gomer's words (we hope). She gathers in all of Gomer's words and then actively assembles them into a coherent whole, requiring effort on her part.
Step Two: Fredegund considers Gomer's words. She contemplates and cogitates. The wheels turn in her mind as she develops her response to Gomer's statement.
Step Three: Fredegund responds to Gomer. She turns her thoughts into words and speaks them.

Now the tables are turned, and the ball is in Gomer's court. Gomer must listen to Fredegund, think about what she is saying, and react. Then he must express his reaction to Fredegund.

This process of conversation cycles back and forth, as an iterative process in which each participant in turn listens, thinks, and speaks.

We can generalize this notion of the conversation as an interactive process to any human interaction, although when we do, we must use the terms listen, think, and speak metaphorically. If we want to get academic, I suppose we could replace listen, think, and speak with input, process, and output, but that's so gauchely techie.

Here's a key point about the interactive process: There are two actors, not one. If I'm out in the woods and I hear to the sound of a tree branch breaking, and I meditate on the implications of such a sound emanating from my zenith, jumping out of the way just as the branch crashes to earth, I am not interacting with the branch; I am reacting. This is a crucial factor that many, many people don't understand, and it leads to lots of silly designs. You can't converse with a brick wall. It takes two people to have a conversation, and it takes two actors to have an interaction. If you, dear reader, were of an argumentative temperament,

you might suggest that the branch is an actor. I will concede your point in the most technical of senses: The branch does something, so it must be an actor. But I am using the term actor in the more common sense of a purposeful creature.

Extending the branch argument, some claim that when you open a refrigerator and the little light inside turns on, and then you close the door and the light turns off, you are interacting with the refrigerator because it responds to your actions.

Now I suppose that a person graced with sufficient open-mindedness (several cubic light-years' worth!) could accept such an argument, but the box inside which I think is a lot smaller than that. I have difficulty imagining Nintendo refrigerators with millions of people all over the country opening and closing their refrigerators for the sheer fun of it. Of course, if you want to get academic about this argument, then yes, the fridge listens (to the opening door), thinks (with all the processing power of a single switch), and speaks (by turning on the light). But this kind of interaction is silly and beneath the intellectual dignity of almost everybody. I'm concerned with interactivity that has some blood in its veins.

The Nintendo refrigerator offers us some intellectual utility, however, even if it can't entertain us, because some people will, in fact, be entertained by playing the refrigerator door game. As any exasperated mother will testify, small children can find a refrigerator light more entertaining than a television. So here is our puzzle: Is the refrigerator door game interactive or is it not? Surely it is interactive for the small child, and just as surely is it not interactive for adults. Does interactivity exist in the eye of the interactor? If my friend calls a rock interactive, do I have any basis for challenging her? Is interactivity utterly subjective?

Plenty of people claim that everything is subjective, so I won't try to convince you if you belong to that tribe. But if you're willing to grant the existence of occasional objective truths, here's an explanation that offers some practical value for a designer.

Degrees of Interactivity

We tend to think of interactivity as a Boolean property (either you have it or you don't) like virginity. But why not think of interactivity as a continuous variable with relative measures, more like our weight? In other words, we might speak of interactivity as high, moderate, low, or even zero, thus solving our problem with the subjective nature of interactivity. By using such measures, rather than the simple either/or proposition, we make it possible to accept that anything can be interactive and simply discuss the degree of interactivity subjectively. This, in turn, gives us a happier solution to the refrigerator challenge: The refrigerator does indeed interact with the user, but it does so at a low level.

But we still have a problem: How do we tell the difference between "high" and "low" interactivity?

Let's attack this problem by returning to our founding concept, the conversation. After all, most of us have amassed a wealth of experience with conversation and should be able to agree on which factors contribute to a good, intense, or rewarding conversation, and which factors ruin one. I'll formulate those factors in terms of the three standard steps of the conversation we looked at earlier, between Fredegund and Gomer.

Listening

If you want to have a good conversation, you have to listen well, and so does your partner. How many times have you been caught in Pointless Conversation Number 38, with someone who refuses to listen to what you're saying? He nods his head and smiles idiotically while you're talking and then resumes his single-minded lecture or reiterates the point you just demolished. Moving to the other end of the scale, have you ever had the magical experience of conversing with somebody who understands exactly what you are saying? The conversation soars, and you want it to last forever.

Thinking

The next requirement for a successful conversation is that both actors think well. This is fairly obvious; surely you can recall at least one conversation with a slow thinker. He gives it his best: He knits his brows in determined attention, he takes some time to let your words rattle around inside his head, but when his mouth opens, the words that come out just don't mean anything interesting. While this poor dolt doesn't anger us like the unlistening jerk, our conversation with him is just as useless.

The opposite extreme is also illuminating. I can recall several conversations with Alan Kay, a red-blooded genius of a computer scientist if ever there was one. I'd knit my brows and listen really hard as the ideas tumbled out of him and washed all over me. Most of the time, I'd respond with a deeply-considered "Yup," because I just couldn't keep up. But I'll never forget The Day I Kept Up With Alan Kay. He was talking about a subject in which I was thoroughly versed, although from a different background. I kept hitting him with arguments from my particular angle, and his ripostes were dazzling and fascinating. My mind was reeling from the implications of his ideas, and he seemed to be enjoying our conversation, too, which may be why he scowled when the phone interrupted us. I can still feel the glow from that conversation. Good thinking can make a conversation sparkle.

Speaking

Here's another obvious requirement for good conversation: You gotta spik good if you wanna converse fust-class. Ever tried to communicate with your local computer genius? Sure he's bright and pays attention when you talk, but the hodge-podge of acronyms and verbified nouns that he calls English might as well be Hungarian (assuming you don't speak Hungarian). This conversation with him is dead on arrival; you thank him for his brilliant solution and resume banging on your computer with your coffee cup.

No Trading Off

To interact well, both actors in a conversation must perform all three steps (listening, thinking, and speaking) well. Doing a good job with one of the three steps does not compensate for a bad job with the other two. In each of the preceding examples, the failed conversationalist performed two of the three jobs well but failed with the third, and that one failure was enough to botch the entire conversation.

The same principle applies to all forms of interaction. The most common design error in interactive products arises from a failure to appreciate this principle. The designer does a slam-bang job with two of the three steps but blows the third step, believing that the strengths of the first two will outweigh the weakness of the third. But one weak area in an interactive product (or a conversation) is like a weak link in a chain. The chain breaks regardless of the strength of the rest of the links.

Things That Aren't Interactive

Let's augment our definition of interactivity by discussing some things that aren't interactive. Printed books are my first target because you can't interact with them. A book can't listen or think. It can only speak; it speaks its words as we read them. It is therefore a combination of the worst traits of the jerk and the idiot mentioned earlier.

Do you disagree? Just say the word! Don't be shy, tell me what you really think. It's not that I don't care, but I'm not listening to you and I can't hear you; I'm sitting in my office in Oregon, which may be hundreds or thousands of miles away from you. Obviously, I also won't be thinking about whatever it was that you just said.

Of course, if you're frustrated, you are welcome to throw this across the room, but even then, there still won't be anybody listening to your frustrations or thinking about them. [Editor: This is not a good place to put my email address. Ha-ha-ha!] {Reader: ccrawford@lnet.com—Heh-heh-heh.}

Many writers (as well as my publisher) will object to my assertions, because, they argue, reading is indeed an interactive process. They point to the emotional engagement one experiences when reading a book, and to the active state of the reader's mind while reading between the lines and interpreting meaning.

Their assertions are true, but they do not support a claim that reading is interactive. Instead, they describe intense reaction, and interaction is not reaction on a higher plane of existence. There exists no continuum with reaction at one point on the continuum and interaction somewhere else. Interaction and reaction are apples and oranges, horses of different colors, tigers of different stripes. A stronger and stronger reaction does not transcend its nature and become an interaction. You can turn up the reaction volume as high as you want, but playing Beethoven's Ninth Symphony at 20,000 watts does not make it a painting.

The Greeks and Romans understood well the vast difference between the non-interactive written word and the interactive spoken word, perhaps because they were closer to the invention of writing and thus more sensitive to its weaknesses. For example, in Plato's dialogue "Phaedrus," Socrates says:

> "I cannot help but feel, Phaedrus, that writing is unfortunately like painting; for the creations of the painter have the image of life, but if you ask them a question, they remain silent. The same may be said of words. You would think them to be intelligent, but if you want to inquire further, and put a question to the words, you always get the same words for an answer. Once

words have been written down, they are scattered everywhere,
among people who may not understand them, and may not
know whom to ask about them. If these words are misused or
misinterpreted, their creator cannot protect or explain them,
and they cannot protect or explain themselves."

Cicero, in the Tusculan Disputations, Book 2, wrote "Certainly many examples for imitation can be obtained from reading, but fuller nourishment comes from the living voice, as they say, especially the voice of the teacher." Seneca wrote, "The living voice and the intimacy of a common life will help you more than the written word."

Other Non-interactive Activities

While dancing with another does provide an avenue of interaction, the interaction is between the dancers, not between the dancers and the music. Dancing alone to the music is not interaction; it is participation. The dancer doesn't set the beat or in any fashion provide feedback to the music makers (who could just as well be a compact disc). Participation is not the same thing as interaction, and really, really good participation isn't "upgraded" to interaction. They're different beasts.

Movies, too, garner a nix from me in the interactivity sweepstakes. (Remember, I'm not arguing that interactivity is the sole gauge of merit; it's simply a different dimension of measurement, and in that dimension, movies rate a zero.) It's not that I have anything against movies; some of my best friends are movies. But as of this writing, you still can't interact with a movie. How many times has your heart protested as you watched the protagonist in a movie do something disastrous? The car breaks down on a stormy night, and the only house nearby is a dark, looming mass with pairs of red eyes peering out. Nevertheless, our sprightly and fragile heroine gaily chirps, "I'll just ask for help at that nice house there!" Every bone in your body shrivels in terror at the prospect, yet she obliviously marches straight to the house.

If the movie were interactive, you might see our heroine pause and say, "Gee, I think I heard somebody in the audience urging me not to enter the dark house. I think I'll take that advice." But this never happens! The protagonist always does that stupid thing that you or I would never do in a million years. More important, the protagonist doesn't listen to anything you say. You can beg, you can plead, you can get down on your knees before the TV screen, but she's still going to knock on that creepy door with the gargoyle doorknocker. And surely she's not going to think about your protestations —when was the last time you saw a videocassette engaged in deep contemplation?

So there you have it: Movies don't listen to their audience, nor do they think about what the audience may be saying. Like books, movies can only speak to their audiences, and they do that very, very well. Let's appreciate them for what they are good at instead of press-ganging them into something they're terrible at.

The situation changes slightly when we get into performance art. While it's obvious that a pile of paper, a strip of videotape, or a lump of rock can't listen or think, performance artists can. Capability is not the same thing as action; performance artists seldom interact with their audiences at any deep level.

I've often heard the claim that plays are interactive because the actors are aware of the audience and allow its moods to affect their performance. This is true, I suppose, but let's be honest: Just how much time does an actor have to listen to the audience, consider its mood, and modify his performance to better satisfy the audience? I suppose that if you're one of the guys holding a spear in the background, you'd have the time, but if you're playing Falstaff and you have a few hundred lines of Elizabethan English to make intelligible to non-Elizabethan Americans, I don't think you'll spend your time on stage gauging the facial expression of each member of the audience and thinking how you can improvise something better than Shakespeare.

While actors are certainly capable of interacting with an audience, most devote the vast majority of their considerable talents to the speaking part of their jobs, not the listening part. Yes, plays can be said to be interactive, but I'd give them about a 0.01 on the 10-point Crawford Scale of Interactivity.

NOTE
An exception must be made for the modern experiments in interactivity, in which the audience plays a more active role than usual. In one project, audience members are guests at a wedding party populated with actors. These experiments certainly boast much higher interactivity than traditional plays, and I expect that we shall learn interesting lessons from them.

Other performers can sometimes obtain higher levels of interactivity. Audience size is the most important factor in permitting interactivity in performance art. Brute statistics make it impossible for one performer to meaningfully interact with thousands of fans, but as audience size shrinks, the statistical factors become less adamant. We try to limit class sizes because smaller classes afford more interactivity between student and teacher. The student-to-teacher ratio is one of the best simple indicators of the quality of a school.

User Interface

Let's be careful to differentiate the study of interactivity from some older fields, such as human factors engineering, which arose from the time-and-motion studies of the early twentieth century. The goal of human factors is to increase the productivity of industrial workers, and so, it places considerable emphasis on formal experiments designed to measure the time it takes a person to perform a task under controlled conditions. We're talking about hard science here; aesthetic factors play no role because efficiency is this field's sole concern.

The study of user interface is a modern offshoot of human factors. Its focus is narrower, with the goal of optimizing the communications between people and electronic devices. Consequently, some people prefer to refer to this as the study of human-computer interface. Its focus is more on communication than interactivity.

Interactivity design, on the other hand, addresses the entire interaction between user and computer. While it shares much with the study of user interface, interactivity design differs because it considers thinking in the process of optimization. The user interface designer optimizes the design towards the computer's strengths in speaking and listening, and away from its weaknesses in

these same areas. The user interface designer never presumes to address the thinking content of software (the algorithms that determine its core behaviors).

The interactivity designer optimizes the design for all three dimensions of interactivity; this entails additional balancing considerations and could conceivably produce results that the user interface designer, using his narrower considerations, would reject as incorrect. We can grasp the task of the interactivity designer by regarding the thinking content of software as its function, and the user interface as its form. In this frame of thinking, the user interface designer considers form only and does not intrude into function, but the interactivity designer considers both form and function in creating a unified design.

Another, more subtle factor that distinguishes the interactivity designer from the user interface or human factors designer is the combination of generational factors and two cultural factors (see Chapter 27 for a discussion on the wars between the science/engineering culture and the arts/humanities culture). The human factors people have been in the business a long time, and have developed a large body of truth for their field, most of it arising from experience with "big metal": mainframe computers, weapons systems, power plants, and the like. Their field is heavily "academized": You must have a Ph.D. to be taken seriously, and you spend a lot of time carrying out experiments to measure the efficiency of a design.

The user interface people tend to be less starchy. As a group, they're younger, less concerned with degrees, and sometimes less certain of themselves. Their expertise arises from the two decades of experience the world has had working with personal computers. Because the field is so rapidly changing, there's less confidence in eternal verities. And, like the human factors people, the user interface people are stronger on the math/science side of the problem than on the arts/humanities side of the problem. Indeed, most of them would say, "What arts/humanities side?"

By contrast, interactivity design people tend to come more from the "Webby" generation than the "Personal Computer" generation. They're younger, less technical, and stronger in the arts/humanities. They tend to be less technically adept than the human factors or user interface people.

Interactivity design faces an obstacle in the territoriality of the older and established human factors and user interface people, whose work is valuable and relevant. The problem is that user interface design is a more narrowly focussed field than interactivity design, and yet the user interface people seem to resent the intrusion of interactivity design into "their" field. They're perfectly willing to tolerate studies of interactivity —so long as those studies closely adhere to and build on the established traditions of the user interface field.

The pernicious effect of this attitude lies in its refusal to recognize the paradigm shift implicit in interactivity design. Much human intellectual advance arises from the steady refinement of an established set of ideas; occasionally, however, progress is more readily achieved by rearranging established truths under a new paradigm. Interactivity is such a new paradigm. Interactivity designers do not deny the hard-won lessons of the past; they seek to incorporate them in a wider perspective, which, in turn, requires some rearrangement. We must incorporate the wisdom of older fields into the larger design framework of interactivity.

Graphic Design and Multimedia

The web has enticed a great many graphic designers and multimedia people into the computer biz. These people have, in turn, provided a life-saving dose of vitamin C to a deathly scurvied industry. Their expertise in applying aesthetic considerations that improve the effectiveness of websites has opened the eyes of a great many technical people.

Unfortunately, these creative people have yet to shake off some of the inappropriate predilections of their earlier careers. In particular, some seem to confuse graphic design with interactivity design. While designing a visually effective page certainly demands great skill and creativity, page design alone is only part of the overall task of interactivity design.

Another common misconception is that the design process can be broken into two steps: the graphic design step and the "interactivizing" step. As you will see in later chapters, this is a serious error because good interactivity design integrates form with function. Those who cling tightly to the firm foundation of their expertise in graphic design, refusing to let go and strike out into the briny deep of interactivity design, will forever be graphic designers —not interactivity designers.

Summary and Conclusion

I have offered a definition of interactivity. I don't claim this to be the only good definition, or even the best; I really don't care to establish lexicographical dominance over anybody. I do insist that this definition is useful: That is, it generates guidelines for good design that make sense. Once interactivity becomes established in our culture, the academics will get a hold of it, and then you'll have more "high-quality" definitions than you ever thought you needed.

Review Questions

1. Are rugs interactive? Explain in your own words why or why not.
2. Come up with your own damn definition of interactivity.
3. Throw this book across the room. Measure the distance it traveled and the angle of impact. Draw appropriate conclusions in crayon.