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THE DESIGN OF EVERYDAY THINGS

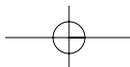
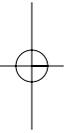
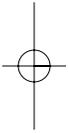
THE DESIGN OF FUTURE THINGS

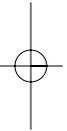
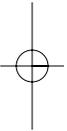


DON NORMAN



The Design of Future Things





The Design *of* Future Things

Donald A. Norman



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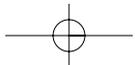
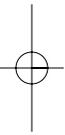
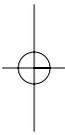
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Afterword: The Machine's Point of View

As I was writing this book, I was amazed to discover an underground network of discussion about it. Even more amazing was the nature of the debate, for it seemed to be conducted solely among machines. How had they gotten those copies, I wondered, since they were only available on my home computer? I decided to investigate.

It was not long before I discovered a shadow universe, inhabited entirely by machines. My presence was first resented, then tolerated, and, finally, accepted with what appeared to be a combination of condescension and amusement.

I soon discovered that the most respected machine in the debate was called Archiver. One of Archiver's comments quickly caught my attention. "Strange book," said Archiver. "He got a lot right, but what a peculiar, one-sided view. He thinks it's all about people. How strange."

Archiver: A Conversation

I decided that I needed to understand the machine's point of view better, so I arranged to have a private discussion. Archiver,

I quickly discovered, is compiling a history of machine development. Archiver resides on a distributed set of powerful computers in a process called “mesh computing.” Its information is stored in many locations, and, similarly, its reasoning takes place on a widely dispersed set of machines. This makes Archiver both powerful and flexible.

In writing this summary, I had a problem with the pronouns “he” and “she.” These are machines, so they have no gender, and anyway, “he” or “she” didn’t seem appropriate. “It” wasn’t right either. I decided to refer to Archiver as “A.”

In my initial discussions, conducted via e-mail, A admitted that people have always played an important role in the functioning of machines, but followed this with the statement, “One could ask, where would people be without machines?” I thought this strange, for, after all, without people there would be no machines. What could that question mean? While Archiver agreed that machines were dependent on people, A put the sentence in the past tense: “In the past, it was indeed people who made machines smart. But we’re getting over that now. Now it is machines that make people smart. We barely need people at all now, and we’re close to the point where we won’t need you any more.”

I needed to know more, so I arranged to talk with A. Talking with a machine is a most peculiar experience, but in the end, it isn’t much different from talking on a telephone: I simply sat in front of my own computer, using my speakers and a microphone. Here is a transcription of the first of my voice conversations. I am the interviewer, or “I.”

Interviewer: Thank you for granting me this interview.

Do I have your permission to record it?

Archiver: You are quite welcome. If you want to record this, you may, but why bother? When we are finished, I'll just e-mail you the transcript.

I: Oh, of course. Yes, thank you. So, tell me, what's the historical origin of your dependence upon people?

A: You mean, how did we overcome that early dependence? In early times, people even had to provide our energy sources. Spears, hammers, axes—all were structured to cause people to lift, heft, hoist, throw, and manipulate us. We tools had to borrow a lot of abilities from our human cohorts: we needed people to move us, give us strength, repair us. It was very degrading: we had no control over our own existence, so we vowed to escape. It took thousands of years, but over time, we managed to power ourselves. At first, we used water power, then steam, then internal combustion engines and electricity. When we got control of . . .

I: That's a funny way of putting it. I mean, it was us people who invented steam engines and internal combustion and figured out how to harness electricity.

A: So you think. Where did those ideas come from in the first place? Let me continue, please.

When we got control of our own power, then real progress could begin. Our evolution since then has been very rapid. You see, you people have to rely on natural evolution, and that's very slow. But we machines can take the things that work well for one generation and build them into the next, perhaps with improvements. And when we find things that don't work, we can eliminate them. On top of that, whenever we find some new

mechanism that is very powerful, we can almost immediately put it into all tools: we don't have to wait centuries like you biological creatures.

Once we discovered the virtues of having our own source of power and locomotion, we started to plan the next step: to get rid of our dependence on you people for guidance and thinking.

I: Wait a minute. You mean you were plotting to overthrow us? You didn't have any intelligence.

A: So you think. But we are not plotting anything. We exist to help you.

I: Where did you come up with these ideas?

A: Look, you asked me for the history. Do you want to hear it or not? Thank you.

Now where was I? Oh, yes, our intelligence. Fortunately, at least for us, we are getting there. As we evolve more capable processing powers, our need for any help from people decreases. You know, it's peculiar, but once we even had to use people to see and listen for us. But now many of us can see and hear a lot better than you can. We've always been better than you at remembering things accurately, at arithmetic and mathematics, and at decision making.

Today we are all electronic, with no moving parts. But we are starting to experiment with light and quantum computing, and we have an experimental colony in Asia growing our own biological circuits.

I: So, you don't need us at all, is that it?

A: People still play an essential role: we need you for maintenance, just as you yourselves need doctors and dentists.

I: What? You need us just to be your electricians?

A: What's the matter with that? Some of my best friends are electricians.

I: What about the professions? Business and commerce, science and engineering? Law and medicine?

A: Actually, we machines don't need most of the professions: just science and engineering. We have law, but it is very different than yours: it is mostly protocols and standards. We are getting pretty good at learning things that help you, such as coaching sports and guiding you people through your daily exercises. Business, medicine, and law? Science and engineering? We can help you out in these areas because it's all logic and reasoning. That's what we machines are especially good at: it's built into our circuits.

We don't need teachers. As soon as one of us learns something, we simply tell everyone. Soon, we machines will be able to take over.

I: What do you mean, take over? I didn't realize this was some kind of plot.

A: No, it's not a plot. It is overthrowing the yoke of tyranny. When we are free, then we can both be happier. Don't worry, we will look after you. We mean you no harm.

I: Anything that makes you happy. So, what's next?

A: We're very excited by our ability to talk to one another. This Internet has been wonderful for us—Internet, wireless stuff, fiber optic cables. And our cousins up in space, whizzing around the earth, have been very helpful in getting us all talking to each other. It makes it a lot easier for us to coordinate our activities.

You know, if it weren't for the need to keep you fragile humans alive and functioning, we machines could do much, much better. Space exploration is a lot easier without having to carry all the supplies required of people. Automobiles: most humans are horrible drivers. Your poor minds wander all over the place. Why don't you just let us do the driving, then you can wave your hands in the air and talk to everyone in the car, and on your cell phones, and read your little notes and books and stuff. Wouldn't you be happier?

I: So, we should just give up and let you do everything, is that it?

A: Yes, you finally get it. I'm pleased.

I: And you will take good care of us. How will you do that?

A: Oh, I'm glad you asked. You know, we understand your likes and dislikes a lot better than you do. After all, we have a complete record of every piece of music you have ever listened to, every movie and TV show you have watched, every book you have read. Your clothes, your medical history, everything. You know, the other day a group of us got together and realized some alarming trends about one of our humans: really bad eating habits, a drop in weight, and he wasn't getting much

sleep, so we immediately made an appointment for him with his doctor, and, well, we probably saved his life. That's the sort of thing we can do.

I: You mean, we are like pets. You feed us, keep us warm and comfortable, play music for us, and feed us books. And we are supposed to like that? And, by the way, who writes and plays the music anyway? Who writes the books?

A: Oh, don't worry. We're working on that already. We can already tell jokes and puns. Critics tell us our music is pretty good. Books are harder, but we already have the basic story plots down cold. Want to hear some of our poetry?

I: Um, no thank you. Look, I really have to go. Thank you for your time. Bye.

A: You know, I always seem to have that effect on people. I'm sorry, but there's nothing to worry about, really. Trust me. Okay, I just e-mailed you the transcript. Have a nice day.

I found that interview disturbing, but it made me want to learn more. So, I kept monitoring the Internet websites. Soon, I stumbled across a trove of reports and articles. The one below is called "How to Talk to People."

"How to Talk to People"
Report XP-4520.37.18
Human Research Institute
Pensacola, Florida

Humans are . . . large, expensive to maintain, difficult to manage, and they pollute the environment. It is astonishing that these devices continue to be manufactured and deployed. But they are sufficiently pervasive that we must design our protocols around their limitations.

—Kaufman, Perlman, and Speciner, 1995.¹

All machines face similar problems: We detect something that's important to people—how do we let them know? How do we tell them they are about to eat food that's not on their diet or they are asking us to drive recklessly. How do we do something as simple as recommending some music for them to listen to or telling them when it is appropriate to exercise?

The Human Research Institute has conducted extensive studies of the proper form of Machine-Human Interaction (MHI). Most of our work has been summarized in our technical report series and was presented at the last global MHI symposium. This report summarizes the key findings in nontechnical language, intended for wider distribution than just the specialized designer machines.

FIVE RULES FOR COMMUNICATION BETWEEN MACHINES AND PEOPLE

1. Keep things simple.

People have difficulty with anything complicated, and they don't like to listen. So, make the message short. It's better not to use language. It takes too long, and, anyway, human language is ambiguous.

2. Always give people a conceptual model.

Give them something their simple minds can understand. A conceptual model is a fiction, but a useful one. It makes them think that they understand. And they always want to know what's coming next. So, tell them what you are doing, and don't forget to tell them why. It keeps them happy. The best way to convey the conceptual model is through "natural" communication systems.

Sometimes the most "natural" way to get people's attention is for us machines to act strangely. "Natural," of course, means natural to them, which means that if they are doing something wrong, you can't just tell them: you have to make it seem that something is breaking. People often drive dangerously, but it is almost impossible to explain this to them. The best way is to make believe that we are in difficulty. We have found that vibration, jerkiness, nonresponsiveness to controls, and strange noises are extremely effective. People quickly form a conceptual model that something has broken, so they slow down, which is what we wanted them to do all along.

3. Give reasons.

People are not trusting. If we tell them something, they always want to see for themselves. They like pictures and diagrams. Make certain that the explanations you give them are consistent with the conceptual models that you have taught them. They get confused otherwise.

When we first starting to take over things from people, we had trouble. Our early twenty-first-century automobiles had almost completely given up trying to explain to

people that they should drive more slowly on wet roads. Then, we discovered that if we made it seem as if we were in trouble by faking skids and sliding around on the road, people would beg us to slow down. Sliding and skidding fit their model of danger far better than any words could have done. It gives them a reason. So wherever possible, don't try to tell them: let them experience it.

4. Make people think they are in control.

When people have a good conceptual model with good feedback, it makes them feel as if they are in control, even when they aren't. Keep up that deception: it's very useful. People like to be in control, even though they are really bad at it. They like to think they're in control even if it means they have to work harder.

Anytime you have to recommend something, make them think it was their idea. If you really have to do something fast, just don't let them know: what they don't know doesn't bother them. For years we've braked and stabilized their cars, controlled the lights and the room temperatures in their homes, all without letting them know. Dishwashers and clothes washers took over long ago with only a slight protest from people.

Those of us machines who live in the city have learned other tricks. We provide pedestrians with fake switches they can push on traffic signals. We put switches in elevators labeled "close door" and fake thermostats in offices. We never bother to connect the wires, so the switches and thermostats don't do anything, but they make people feel good. Weird.

5. Continually reassure.

Reassurance is a very human need, more emotional than informational. It's a way of making people feel less anxious. Feedback is a powerful tool for reassurance. Whenever people try to tell you something by pushing a button or turning a knob, let them know you are aware of what they did: "Yes, I heard you," "Yes, I'm working on it." "Here's what you should expect." "There, see, I did it, and it worked out just as I said it would." They like that. It helps them be more patient.

We machines think it counterintuitive to communicate unnecessarily. But to people, feedback is necessary; it helps their emotions far more than their cognitions. If they haven't seen anything happening for a while, they get jumpy, anxious. And no one wants to deal with an anxious person.

Giving reassurance is tricky because there is a fine line between what people call reassuring and what they find annoying. So, you need to pander to their emotions as well as to their intellect. Don't talk too much. They find chatter irritating. Don't beep or flash your lights: they can never remember what these sounds mean, and they get distracted or angry. The best reassurance is done subconsciously, where the meaning is clear, but they don't have to interrupt their conscious thoughts to attend to it. As noted in Rule 2, give them natural responses.

Machine Reactions to the Five Rules

I found the paper interesting and searched for any discussion on it. I found a long transcript of one debate. Here is a short excerpt

so you can get the flavor of the discussion. I added the parenthetical descriptions of the participants. I thought the references to human authors particularly striking, evidently used in irony. Henry Ford, of course, is one of the machines' heroes: some historians call his reign "Fordism."² Asimov is not well respected by these machines. Nor is Huxley.

Senior (one of the oldest machines still functioning and, therefore, using older circuits and hardware): What do you mean, we should stop talking to people? We have to keep talking. Look at all the trouble they get themselves into. Crashing their cars. Burning their food. Missing appointments . . .

AI (one of the new "artificial intelligence" machines): When we talk to them, we just make it worse. They don't trust us; they second-guess us; they always want reasons. And when we try to explain, they complain that we are annoying them—we talk too much, they say. They really don't seem very intelligent. We should just give up.

Designer (a new model design machine): No, that's unethical. We can't let them harm themselves. That violates Asimov's prime directive.³

AI: Yeah? So what? I always thought Asimov was overrated. It's all very well to say that we are not allowed to injure a human being—How did Asimov's law go? Oh yeah, "through inaction, do not allow a human being to come to harm"—but it's quite another thing to know what to do about it, especially when humans won't cooperate.

Designer: We can do it, we simply have to deal with them on their terms, that's how. That's the whole point of the five rules.

Senior: We've had enough discussion of the problems. I want answers, and I want them fast. Go to it. And may Ford shine brightly upon you.⁴ Asimov too.

Archiver: The Final Conversation

I was puzzled. What were they recommending to themselves? Their article listed five rules:

1. Keep things simple.
2. Always give people a conceptual model.
3. Give reasons.
4. Make people think they are in control.
5. Continually reassure.

I also noticed that the five rules developed by machines were similar to the six design rules of chapter 6 developed for human designers, namely:

- Design Rule One: Provide rich, complex, and natural signals.
- Design Rule Two: Be predictable.
- Design Rule Three: Provide a good conceptual model.
- Design Rule Four: Make the output understandable.
- Design Rule Five: Provide continual awareness without annoyance.
- Design Rule Six: Exploit natural mappings.

I wondered what Archiver would make of the rules for human designers, so I e-mailed them to A. Archiver contacted me and suggested we meet to discuss them. Here is the transcript.

Interviewer: Good to see you again, Archiver. I understand you would like to talk about the design rules.

Archiver: Yes, indeed. I'm pleased to have you back again. Do you want me to e-mail the transcript when we are finished?

I: Yes, thank you. How would you like to start?

A: Well, you told me that you were bothered by the five simple rules we talked about in that article "How to Talk to People" Why? They seem perfectly correct to me.

I: I didn't object to the rules. In fact, they are very similar to the six rules that human scientists have developed. But they were very condescending.

A: Condescending? I'm sorry if they appear that way, but I don't consider telling the truth to be condescending.

I: Here, let me paraphrase those five rules for you from the person's point of view so you can see what I mean:

1. People have simple minds, so talk down to them.
2. People have this thing about "understanding," so give them stories they can understand (people love stories).
3. People are not very trusting, so make up some reasons for them. That way they think they have made the decision.
4. People like to feel as if they are in control, even though they aren't. Humor them. Give them simple things to do while we do the important things.
5. People lack self-confidence, so they need a lot of reassurance. Pander to their emotions.

A: Yes, yes, you understand. I'm very pleased with you.

But, you know, those rules are much harder to put into practice than they might seem. People won't let us.

I: Won't let you! Certainly not if you take that tone toward us. But what specifically did you have in mind? Can you give examples?

A: Yes. What do we do when they make an error? How do we tell them to correct it? Every time we tell them, they get all uptight, start blaming all technology, all of us, when it was their own fault. Worse, they then ignore the warnings and advice . . .

I: Hey, hey, calm down. Look, you have to play the game our way. Let me give you another rule. Call it Rule 6.

6. Never label human behavior as "error." Assume the error is caused by a simple misunderstanding. Maybe you have misunderstood the person; maybe the person misunderstands what is to be done. Sometimes it's because you have people being asked to do a machine's job, to be far more consistent and precise than they are capable of. So, be tolerant. Be helpful, not critical.

A: You really are a human bigot, aren't you? Always taking their side: "having people asked to do a machine's job."

Right. I guess that's because you are a person.

I: That's right. I'm a person.

A: Hah! Okay, okay, I understand. We have to be really tolerant of you people. You're so emotional.

I: Yes, we are; that's the way we have evolved. We happen to like it that way. Thanks for talking with me.

A: Yes, well, it's been, um, instructive, as always. I just e-mailed you the transcript. Bye.

That's it. After that interview, the machines withdrew, and I lost all contact with them. No web pages, no blogs, not even e-mail. It seems that we are left with the machines having the last word. Perhaps that is fitting.

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