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The Information Flood and Flow

When you are trying to listen to the newscaster on CNN while reading the news ticker showing share prices at the bottom of the screen, your subjective feeling may well be that you are teetering on the threshold of your ability to digest information. Your brain is being inundated. If we analyze the situation through the lens of the concept of working memory, we find that your feelings are matched by something quantifiable: the simultaneous inflow of two streams of information is extremely demanding on working memory. Certain parts of your frontal and parietal lobes are imposing a limit on how much information you can assimilate. When you try to read a complicated article on the Internet while ignoring the advertisements playing out at the edge of your visual field, you are confronted with a distraction task that places a heavy load on your working memory. When you use the help function in Word, you will likely have to read each instruction several times to assimilate all the information with which your working memory is being overburdened.

Many changes in the information society that are somewhat loosely termed "greater complexity" or "higher information flow" can be traced back to an increase in working memory load. We have witnessed an accelerating rate of change in recent years, and there is no sign of it slowing down. Mobile technology is increasing the number of situations in which we try to dual-task, and cell phone conversations are probably just the beginning. Wireless communication and laptop computers will create an abundance of new simultaneous situations. With portable computers and Wi-Fi, we will see just as much Internet surfing on the streets and in cafés as we do cell phone use. Automobile GPS devices are becoming increasingly popular, and I look forward with great anticipation to the first studies showing how much delay in reaction times they cause. Some futuristic ideas, such as screens built into glasses, are already becoming a reality.

In an environment with a higher degree of distraction and heavier information demands, we often have the feeling of being distracted and unfocused, in the very same way as described in the introduction to illustrate the nature of the modern office. It is easy to connect the dots and come up with the picture that these greater cognitive demands have a damaging effect on our brain. There is, fortunately, no research suggesting that exposure to mentally more demanding or challenging situations impairs our powers of concentration. Indeed, there is much that points to the contrary: it is in situations that push the boundaries of our abilities that we train our brains the most. An interpretation of the Flynn effect is that it is these very demands and the greater complexity of our lives that make us progressively better at handling information and solving problems.

Instead, a possible reason why we feel a lack of focus is related to the discrepancy between demand and capacity. In other words, what we experience is a *relative* attention-deficit. The mechanism at work is the same as with ADHD,

where the balance between challenge and skill is not maintained. Looking at the situation of the man in the street, we see that instead of diminishing his abilities, information load places extra weight on the demands he faces. You are very possibly 10 percent better at talking on the phone while erasing spam today than you were three years ago. On the other hand, the number of e-mails you receive per day has probably shot up by 200 percent. There is, therefore, no contradiction between the feeling that your abilities are inadequate and the improvement of these abilities.

Infostress

Are we to unconditionally accept the information flood in the hope that in doing so we will be developing our faculties? No, not necessarily. We must always be aware of the limited scope we have for receiving information. A concrete example of what happens when demands exceed capacity is cell-phone-related road accidents.

The other factor telling us that we ought to embrace the burgeoning information flood with certain reservations is the link it has with stress. Our understanding of stress has deepened over the years, and there are countless studies showing how high levels of stress hormones damage the heart, the blood vessels, the immune system, and almost every other part of the body, including the brain. As regards this last organ, we can link increased stress with impaired working memory and impaired long-term memory. Scientists have also shown that stress, particularly of the severe kind, such as post-traumatic stress, affects the hippocampus, a brain structure important to the storing of information in long-term memory. But this applies to prolonged, high levels of stress; moderate, temporary stress can be a good thing and, like arousal, has an optimal level of effect (see page 22).

Nor is there any simple connection between volume of information and stress hormones. In *Why Zebras Don't Get Ulcers*, Robert Sapolsky reviews his and other people's research into stress and its underlying factors. Levels of stress are contextual and related to our interpretation of the situations in which we find ourselves. A key concept is *sense of control*. Stress is primarily associated with situations that we either feel or know we cannot control. "Learned helplessness" is a term coined to describe those who have learned that they are powerless to influence their situation. Stress is therefore very much a matter of our own attitude. Technological problems that cause certain people to break out in a cold sweat are to others nothing but entertaining challenges.

One study has documented how people perceive their e-mail burden. It turns out that most people claim that they receive too many e-mails, bordering on the limits of their ability to cope. What is interesting, though, is that the extent to which they complained was totally independent of the number of e-mails they received. Those who received twenty a day protested just as much as those who received a hundred. If we associate information load with entertaining challenges and the development of our capacity, might our infostress decrease?

Why We Love Stimulation

Exceeding the limits of our capacity rarely brings success. However, this does not mean that we are to keep as far away from it as we can. There is also an interesting tendency for us to push our own boundaries. We want more information, more impressions, and more complexity. Game development is an example of this. The latest incarnation of Nintendo's Game Boy console, which is mainly targeted at younger users, has two screens designed to be

played upon simultaneously. We will have to assume that Nintendo has done its homework thoroughly and found that this simultaneous situation is something that appeals to children and teenagers. Similarly, the games themselves are becoming all the more complex.

Many people seek out situations that demand concurrent performance or situations in which they are overwhelmed with information. When someone takes out a cell phone during a meeting to send a text message or read e-mails, it is a voluntary action and not something that makes them simply victims of ruthless technological progress. Steven Johnson has shown how TV programs are becoming ever more complex rather than less so, their multiple interwoven plot lines demanding more and more from us in terms of problem solving if we are to have any chance of understanding the narrative development. There is clearly something inherently attractive about programs that are more complex. Johnson also argues that the more complicated computer programs fulfill a need within us to probe and seek stimulation.

Flow

The American psychologist Mihály Csíkszentmihályi has written about the concept of *flow*, which is the feeling we have of being completely focused on and absorbed in the work we are doing. An artist painting a picture who is so engrossed in his work that he becomes unaware of himself and the passage of time is in a state of flow. Flow can also be attained when a surgeon performs a difficult operation in which she has to use all her abilities and skills. What Csíkszentmihályi has tried to do is identify the circumstances that elicit flow. He reasons that if we analyze situations in terms of the challenges they present and the skills of the person involved in them, we find that flow arises in

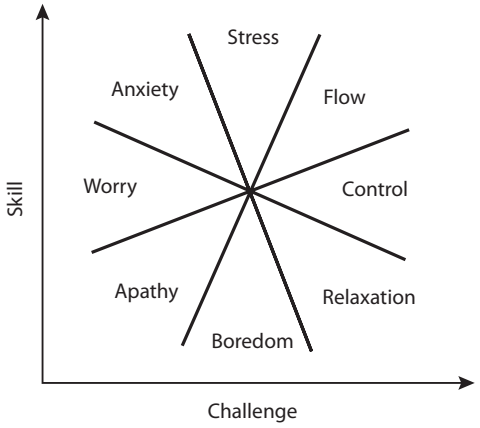

FIGURE 15-1
Csíkszentmihályi's map of how different mental states can be conceived as a product of challenge and skill (adapted from Csíkszentmihályi, 1997).

contexts characterized by a high level of challenge and skill, in which the capacity of the doer exactly matches the demands of the task being done.

Considering Csíkszentmihályi's diagram as a cognitive map with north at the top, it is in the northeast sector where we find the state of flow. When challenge exceeds skill, we get stress. When skill exceeds challenge, we get a sense of control, which becomes boredom as the level of challenge drops. Exchange "skill" for "working memory capacity" and "challenge" for "information load," and perhaps we have a map illustrating the subjective side of the information demand. When this demand exceeds our capacity, we experience the relative attention deficit due north on the map. However, we should not simply avoid these demands, for when they are too low we become bored and apathetic. In other words, there is a reason for us to cater to our need for stimulation and information. It is when demand and capacity, or skill and challenge, are in a state of equilibrium that the situation is conducive to flow. And perhaps it

is precisely here, where we exploit our full capacity, that we develop and train our abilities.

When working memory load exactly matches working memory capacity and we hover around the magical number seven, the training effect is its most powerful. Now that we know this, it is up to us to control our environments and reshape the work we do to our abilities. Let us hope that we can learn to perfect the compass that will show us where to find balance and help us navigate into the north-eastern corner of the map, where we can feel flow and develop to our full capacity.