Article: Addressing the Fundamental Attribution Error of Design Using the ABCS

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There are countless tales of system users being labeled "stupid" when they encounter difficulties. Too often, this criticism (or rather, insult) is hurled by the system designers[1] who are bemused when their apparently intuitive systems are dubbed unusable.

The situation normally arises when designers project their own mental models of how they would act in the same context onto their users. In doing so they project their own feelings, needs, knowledge, and goals onto their users. If their users are *exactly* like them, it therefore follows that those users should behave in exactly the same way as them. The corollary of this is that any problems that arise must be due to the users rather than the technology. We describe this as the *fundamental attribution error of design.* It derives from the fundamental attribution error in social psychology (Ross et al., 1977) which refers to the human propensity to attribute observed outcomes to personal characteristics much more strongly than external factors in a particular situation. We are as likely to make this error about ourselves in unfamiliar situations (self-blame) as about others in situations where we, as observers, feel comfortable (other-blame).

Of course, experienced designers are able to delineate between what *they* know, want, need, and can do, and what *their users* know, want, need, and can do. They understand that the technology may not always behave as users expect. They design their systems to provide appropriate feedback so that it appears *transparent* (or at least interpretable) so the users can make the appropriate attributions to answer questions like: *Is this an issue with the technology or did I do something wrong*? Based on the answer, the users can then take steps to diagnose the source of the problem, fix it, where appropriate, and learn from the experience.

Understanding users is hard, though. Some designers develop this understanding through experience, supplemented by case studies and recourse to the vast literature on design and engineering. Just organizing all the information in a way that is both tractable and useful is a major problem. Based on our work as researchers and practitioners we developed the *ABCS framework* (Ritter et al., 2014) to help manage this information and understand how it affects system design.

The ABCS Framework

The ABCS framework addresses four critical ways of thinking about users: their bodies (**A**nthropometrics); their typical behavior patterns and characteristics (**B**ehavior); their ways of information processing, reasoning, learning and communicating (**C**ognition); and their ways of cooperating, collaborating, and sharing with others (**S**ocial).

A: Anthropometrics

The basic characteristics of the human body (size, shape, weight, fitness) all affect how people use systems. Although bodies vary, there are some common, shared factors and some general guidance that can be applied to system design. We know, for example, that no human greater than 10 feet tall has been encountered to date. We can use information about the size and shape of fingers and hands to help determine the size of buttons on a device, and the size of the device itself. Where systems design abuts ergonomics the physical layout of the system can affect the users' well-being, potentially leading to ailments like upper limb disorders, and back pain. The human sensory and somatosensory systems are important in system design too: consider haptic perception—touch and tactile feedback—which is particularly important in touch screen technologies and some new ways of interacting that are emerging (Schmidt & Churchill, 2012).

B: Behavior

The behavioral characteristics of people are related to perception in broad terms. For interactive systems, in particular, this means that appropriate consideration has to be given to how both vision and hearing work. The ambient lighting conditions may be important, for example, because it takes time for people's eyes to adapt to low levels of lighting, so the environment could be designed to have gradual changes in lighting as they enter the work area. When designing systems where the display shows many objects they can be grouped to make it easier for the user to process them.

Alongside behavior we consider the role of motivation, which can be used to help explain why individual users behave in a particular way when carrying out a task. Systems for work settings can be designed to motivate users to get the task done, for example, whereas games would normally be designed to motivate people to continue playing.

C: Cognition
People use mental models of how systems work to guide how they use those systems. These mental models are developed using information acquired through cognitive processes that employ memory and attention—both limited resources—and learning. Systems need to be designed to present the right information in the right format at the right place and right time to both support task accomplishment and the development of these mental models; information that is not directly available should be readily findable. If the users' mental model is incorrect or if some required information is missing or confusing, it becomes harder to work out what to do next, and they may have to resort to using problem solving strategies such as trial and error (Churchill, 1994). In the worst scenario, incorrect mental models can lead to accidents (e.g., Besnard et al., 2004).

Understanding the way that users communicate is important too: their interaction with the system can be classed as a type of conversation. This process can be optimized using Grice's (1975) maxims. Information about communication and language can also be used to determine how content should be written and structured so that users can search for it and read it effectively.

S: Social factors
People mostly work together in teams to carry out tasks. How they interact with other team members can affect how they interact with technology, so it is important to understand the effects of individual limitations on working in teams, e.g., some people are natural leaders. The way that teams work together needs to be accounted for in system design to make sure that the technology does not adversely affect any social relationships that are critical to the tasks being performed. These could include reducing communication with possible reductions in learning (e.g., Baxter et al., 2005). The way that systems are designed for work settings will need to take into account organizational procedures, and regulatory constraints. Systems designed for social settings, however, will be much less constrained and people will be intrinsically motivated to use these systems.

The General Applicability of the ABCS
The ABCS framework grew out of our experiences in researching and developing interactive systems in domains including aviation, consumer Internet, defense, eCommerce, enterprise system design, health care, and industrial process control. It provides a relatively lightweight structure to guide how system designers can think about users, and start to ask appropriate questions about those users in their contexts trying to achieve their tasks and activities in the most effective, efficient and enjoyable way. Because the framework provides structure to guide designers to ask relevant questions rather than providing a prescriptive checklist of must-dos, we believe the ABCS provides a foundation for learning as well as for the design of systems that are more usable, more useful and more effective.

References

Baxter, G.D., Filipe, J.K., Miguel, A., & Tan, K. (2005). The effects of timing and collaboration on dependability in the neonatal intensive care unit. In F. Redmill and T. Anderson (Eds.), *Proceedings of the Safety Critical Systems Symposium 2005* (pp.195-210). Berlin, Germany: Springer-Verlag.

Besnard, D., Greathead, D., & Baxter, G. (2004). When mental models go wrong: Co-occurrences in dynamic, critical systems. International Journal of Human-Computer Studies, 60(1),117–128.

Churchill, E.F. (1994) *Models of Models: cognitive, computational and empirical investigations of learning to use a device*. PhD Thesis, University of Cambridge, UK.

Grice, H. P. (1975). Logic and conversation. In P. Cole & J. L. Morgan (Eds.), Syntax and semantics III: Speech acts (pp. 41-58). New York, NY: Academic Press.

Ritter, F.E., Baxter, G.D., & Churchill, E.F. (2014). Foundations for designing user-centered systems: What system designers need to know about people. London, UK: Springer.

Ross, L., Amabile, T. M., & Steinmetz, J. L. (1977). Social roles, social control, and biases in social-perception processes. Journal of Personality and Social Psychology, 35, 485–494.

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