translations are essential in complex visual invention processes because descriptive thought and depictive mental images are represented in different components of our working memory: the linguistic and visuo-spatial working memories, respectively. Fish draws on a strong metaphor – that of chemical catalysis – to describe how sketching affects the two "reactants" – the descriptive and depictive thoughts, and images. He proposes that we are in need of an amplifying device because our mental resources for visual invention, as embodied in visual mental imagery, were originally better adapted for perceiving and acting on the immediate present, than for imagining the future. Our hominid ancestors' survival depended on the brain's capacity, with the help of mental imagery, to make fast, flexible responses to unexpected opportunities and dangers, and not on its ability to plan for distant futures. Designing falls into the category of planning for the future, of course, and evolution has not adapted our brain's imagistic capacities fast enough to deal successfully with such problems. Therefore, external help in the form of sketches as an amplification device or catalyst plays such an important role in design endeavours. Fish explores his metaphor with reference to Robert Welch's sketches for a stainless-steel serving collection.

A very different vista on design is cast by Martin Woolley who looks at the implications of the powerful impact of computing on design representation skills in Chapter 8. Woolley asserts that professional expertise depends on a command of state of the art skills. Emerging Information Technologies are perceived as replacements for traditional skills, and therefore as potentially threatening to deskill professionals. The problem that Woolley formulates is that of reskilling. He discusses traditional design representation skills from the point of view of the control of tools used to exercise skilful practice. In this view the development of skills is intimately related to the control of tools. The present Information Age is defined as one of "self-directed" skills in which the autonomous designer/maker uses learned skills that are redirected under individual control. Controlling the use of tools and skills could be insufficient because the tools themselves have properties over which the designer has no control and the result might be deskilling. To overcome the problem of deskilling, Woolley proposes that the Post Information Age be one of "self-originated" skills in whose generation, development, and ownership the designer is to be proactive. This activity would empower the design practitioner and ensure his or her control not only over the use of tools, but also over the relevancy and appropriateness of the properties and capabilities they incorporate.

Finally, in Chapter 9 Gabriela Goldschmidt seeks to conceptualize an epistemological framework for the study of design representation. She proposes two perpendicular axes of enquiry. The first observes representation along the dimensions of cognition, history and culture, and technology and media. Fish's chapter, for example, would be considered as addressing the concerns of the cognitive dimension, whereas Woolley's contribution clearly falls within the technology and media dimension. Other chapters in this book, such as that by Penny Yates, fit in the history and culture dimension. The second axis of enquiry is that of the public versus the private contexts of representation which, in this view, are motivated by different goals and aspirations, although the underlying representational norms and conventions used in both may be similar. A clear distinction between the two is drawn, as instantiated by Goldschmidt and Klevitsky in Chapter 2. The two axes are conceived

by Goldschmidt to be the flexible means with which to structure studies of representation. Either axis may provide the lead, while the other axis is derivative or, alternatively, the two may attain equal standing and even describe a matrix, if this is advantageous to the exploration at hand. Interconnections among dimensions and axes are, of course, the outcome of the focus and priorities of every specific study, but the overall scheme attempts to describe a possible paradigm for the study of design representation.

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