

## Preface

In 1852, Hermann von Helmholtz, then a young member of the faculty at the University of Königsberg, delivered a lecture following the completion of his Habilitation. This lecture concerned the relation between the physics of the visual world and the perceptual experience of the world, and it outlined a thesis central to much of this young scientist's later work: To understand perceptual experience, one must understand three aspects of the interaction between the physical world and the observer: the physical energies of the world, the physiological codes of the sensory systems, and the psychological states of the observer.

Consistent with this analysis, von Helmholtz went on to pursue a program of research that had, as its cornerstones, rigorous mathematical analyses of the physical energies of the external world and sophisticated attempts at synthesis. Examples (drawn from an impressively large set of possible examples) include the mathematical physics of various sound sources and the creation of devices capable of synthesizing the vowels of human speech. In contemporary terms, the broad vision of von Helmholtz's work—spanning the physical, physiological, and psychological, and involving rigorous analysis and formal modeling—is consistent with the evolving discipline of cognitive science, the best of which integrates multiple levels of analysis in a rigorous manner.

Within the last three decades, interest in the psychological experience of human faces has drawn together workers in cognitive science from *diverse backgrounds*. Perhaps because of the numerous compelling experiential effects associated with faces and their ubiquity moment to moment, the research on facial perception and *memory has not experienced the disciplinary "balkanization" that has characterized* other areas of inquiry in cognitive psychology. Computer scientists talk to neural scientists who draw on the work of mathematicians who explicitly influence those conducting behavioral experiments.

The chapters that follow certainly illustrate the breadth of the research on facial perception and memory. However, in pulling together these chapters, we sought to do much more than illustrate breadth. We sought also to illustrate the synergies and tensions that inevitably result from adopting a broad view, one consistent with the exemplar established by von Helmholtz almost 150 years earlier. The raw material for this volume was a set of invited talks, delivered in a special session of the annual meeting of the Society for Mathematical Psychology, at Indiana University in the summer of 1997. The integrative perspective that we hope runs through the volume took shape in a series of conversations with Alice O'Toole during the following winter.

The challenge of the broad vision is outlined in the initial chapter. That chapter makes explicit von Helmholtz's three-part analysis of sensory experience in the domain of face perception and memory, and puts modern language on the analysis, with respect to the nature of the physiological and psychological codes, and the nature of and operations on the various of spaces of psychological information that must be considered. This chapter also provides links among these levels of analysis and the specific chapters in the volume. The five chapters that follow this introduction take up in specifics a number of questions regarding the general characteristics of the perceptual and psychological information spaces. These chapters are followed by two that consider the general characteristics of the real-time processes that must operate on these information spaces. The first of these two considers this question in a general manner, whereas the second approaches the question from the view of a particular (although general in its application) model of information processing. Following this, three chapters consider the integration of representation and process from the vantage point of computational modeling. The volume closes with a challenging set of questions and data regarding the entire enterprise.

In pulling these contributions together we (as editors) set for ourselves and the contributing authors the goal of presenting rigorous inquiries in a manner that invited critical consumption by researchers from a range of perspectives. Although we leave it to the reader to be the final arbiter, we hope to have created a volume in which any or all of the chapters can be read by interested and motivated workers from any of the disciplines represented in contemporary cognitive science. This proved, at times, to be a challenge for all concerned and, to the extent the volume succeeds on this dimension, credit is due to the authors, the reviewers, and (lastly) to the editors.

We should acknowledge the critical help provided by a number of people across the course of this project. First, a tremendous intellectual debt is owed to Alice O'Toole, who sparked some of the most informative and intellectually challenging discussions behind the organization of this volume. Second, thanks are due to the assistance provided by Kate McCutcheon and Sheryl Mobley. Third, the thoroughly professional editorial assistance of Kate Graetzer and Jenny Wiseman, both at Lawrence Erlbaum Associates, is sincerely appreciated. Finally, we both wish to publicly thank all of the contributing authors for their time and effort. We have learned much from this group of scientists and scholars, and sincerely appreciate their grace and good humor in allowing us to learn from them. Perhaps, with the explosion of scientific knowledge in the years following von Helmholtz, it is unlikely that any one scientist is capable of embracing the breadth of the challenge he laid down. However, our experience with this volume suggests that the intellectual community is more than able.

## ACKNOWLEDGMENTS

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