Memory, Brain, and Belief

Edited by
Daniel L. Schacter
Elaine Scarry

Harvard University Press
Cambridge, Massachusetts
London, England / 2000

Printed in the United States of America

Library of Congress Cataloging-in-Publication Data

Memory, brain, and belief / edited by Daniel L. Schacter and Elaine Scarry.
p. cm.
Includes bibliographical references and index.
ISBN 0-674-00061-7 (alk. paper)
1. Memory Congresses. 2. Belief and doubt Congresses.
3. Cognitive neuroscience Congresses. I. Schacter, Daniel L.
[DNLM: 1. Memory Disorders—physiopathology Congresses. 2. Brain Congresses. 3. Delusions Congresses. 4. Knowledge Congresses.
5. Memory—physiology Congresses. 6. Self Concept Congresses. WM 173.7 M53253 2000]
QP406.M44 2000
612.8'2—dc21
DNLM/DLC
for Library of Congress 99-40552

Acknowledgments

This volume is based on presentations at a three-day conference entitled "Memory and Belief" held at Harvard University May 16–18, 1997. The conference was sponsored by the Harvard Mind/Brain/Behavior Initiative, an interfaculty undertaking at the university dedicated to fostering new interdisciplinary approaches in research and teaching. We gratefully acknowledge the support of the initiative's leaders, Anne Harrington and Jerome Kagan, during the conception and planning of the conference. Ideas about the conference evolved in the context of a working group that met regularly to discuss memory and belief. We are thankful to members of the working group—Emery Brown, Joseph Coyle, Daniel Gilbert, Jerry Green, Jerome Kagan, and Robert Savoy—for intellectual stimulation and pragmatic advice that greatly improved the quality of the conference and of this volume.

Angela Healy provided extensive administrative support during all phases of conference planning and ensured that the meeting ran smoothly. Carrie Racine, an important member of the Schacter laboratory, has made invaluable contributions to the final preparation of the manuscript, carefully following up on and resolving all queries and inconsistencies. We are also extremely grateful to all the conference participants for their stimulating talks and chapters, which will no doubt enrich understanding of the relations among memory, brain, and belief.

D.L.S.

E.S.

Contents

Introduction 1
Daniel L. Schacter and Elaine Scarry

1 Mining the Past to Construct the Future: Memory and Belief as Forms of Knowledge 11
Chris Westbury and Daniel C. Dennett

PART I Cognitive, Neurological, and Pathological Perspectives

2 Cognitive and Brain Mechanisms of False Memories and Beliefs 35
Marcia K. Johnson and Carol L. Raye

3 Memory and the Brain: New Lessons from Old Syndromes 87
V. S. Ramachandran

4 The Role of Memory in the Delusions Associated with Schizophrenia 115
Chris Frith and Raymond J. Dolan

PART II Conscious and Nonconscious Aspects of Memory and Belief: From Social Judgments to Brain Mechanisms

5 Implicit Stereotypes and Memory: The Bounded Rationality of Social Beliefs 139
Mahzarin R. Banaji and R. Bhaskar

6 Belief and Knowledge as Distinct Forms of Memory 176
Howard Eichenbaum and J. Alexander Bodkin

7 Where in the Brain Is the Awareness of One's Past? 208
Endel Tulving and Martin Lepage

PART III Memory and Belief in Autobiographical Recall and Autobiography

8 Constructing and Appraising Past Selves 231
Michael Ross and Anne E. Wilson

9 Memory and Belief in Development 259
Katherine Nelson

10 Autobiography, Identity, and the Fictions of Memory 290
Paul John Eakin

11 Autobiography as Moral Battleground 307
Sissela Bok

Thinking about Belief: Concluding Remarks 325
Antonio R. Damasio

Contributors 335
Index 337

Introduction

Daniel L. Schacter
Elaine Scarry

Memory is central to mental functioning and plays a key role in numerous aspects of our everyday lives. Recollecting the concert we attended last week, recalling the plot of a favorite novel, acquiring the knowledge and skills to perform a new job—each of these and countless other cognitive feats depend on the effective operation of our memory systems. Without memory, our awareness would be confined to an eternal present and our lives would be virtually devoid of meaning.

In view of the pervasive role that memory plays in our everyday lives, it is perhaps not surprising that memory has been studied intensively by scientists and scholars in a variety of disciplines, ranging from cognitive psychology and neuroscience to psychoanalysis, history, and literary studies. Yet for the most part, studies of memory have proceeded within the boundaries of traditional scientific and scholarly disciplines, with relatively few attempts to bring together the insights of scientists and scholars who approach memory from the vantage points afforded by different disciplinary perspectives.

During the past several years, we have taken part in a small working group of scholars who have attempted to examine issues related to memory from a variety of disciplinary perspectives in both the sciences and the humanities, including cognitive psychology, social psychology, neurobiology, psychiatry, religious studies, economics, and literary analysis. Our memory working group has evolved within the context of Harvard University's Initiative in Mind/Brain/Behavior

(MBB)—an interdisciplinary undertaking that focuses on multilevel analyses of issues of mind, brain, and behavior. When the group was formed in 1993, we focused intensively on the nature of memory distortion: the ways in which, and mechanisms by which, the past may be sometimes remembered inaccurately. In May 1994 the working group organized a conference on memory distortion that brought together cognitive psychologists, neurobiologists, psychiatrists, historians, and sociologists. The conference sparked extensive discussion and debate concerning the bases of memory distortion at levels ranging from cells and synapses, to neural and mental systems, even to social groups (see Schacter, 1995, for the edited volume based on the conference that examines each of these levels of analysis).

In the aftermath of the memory distortion conference, the memory working group continued to meet and discuss pertinent issues, with discussion often focusing on the relations between cognitive and social expressions of memory on the one hand, and the brain bases of memory on the other. During these stimulating discussions of the relation between memory and brain, we often found ourselves confronting a seemingly inscrutable but undeniably important issue: the nature of belief and its role in memory. The problem was brought into focus most clearly by the large and ever-growing literature on so-called false memories, whereby people sometimes develop vivid and detailed recollections of events that never happened (Ceci, 1995; Conway, 1997; Loftus, 1997; Roediger, 1996; Schacter, 1999; Schacter, Norman, and Koutstaal, 1998). Perhaps the most striking feature of such inaccurate memories is that they are often expressed as powerful, seemingly unshakable beliefs about the past. Even though the events in question are sometimes highly unlikely or impossible—such as abductions by high-tech aliens or incidents from past lives—people nonetheless cling tenaciously to what Ceci (1995) has aptly referred to as "false beliefs."

Viewed from the perspective of what we ordinarily mean when we use the term "belief," observations of false beliefs about the past are perhaps not entirely surprising. For example, Webster's dictionary defines *belief* as "confidence in the truth or existence of something not immediately susceptible to a rigorous proof." To the extent that beliefs are defined by a subjective conviction about the truth of an assertion that cannot be proven, then memory could be viewed as a type of

belief: it is often difficult to offer any "rigorous proof" of what did or did not happen in the past. And because memory is a fundamentally constructive process that is sometimes prone to error and distortion, it makes sense that such beliefs are occasionally misguided.

In addition to our construction of memory as a kind of belief about the past, discussions within the memory working group of pertinent literature quickly led us to see other possibly interesting relations between memory and belief. Studies concerned with the phenomenon of *retrospective bias* have revealed that one's memories of past experiences can be influenced by one's current beliefs. For example, various studies have shown that recollections of past political views can be distorted significantly by present political beliefs (Dawes, 1991; Levine, 1997). Similarly, exposure to material that influences one's beliefs about the value of such simple everyday activities as brushing one's teeth can likewise alter one's recollections of how often one carried out the activity (Ross, 1989). Retrospective biases of this kind have potentially significant implications for understanding how the stories we tell about our pasts—our autobiographical memories—are shaped by the beliefs we hold in the present (Conway and Rubin, 1993; Rubin, 1996; Schacter, 1996).

Just as memories are shaped by beliefs, so too are beliefs shaped by memories. In a phenomenon known as the *illusory truth effect,* for instance, mere repetition of a statement can lead to increases in the strength of one's belief that the statement is true (for an example see Begg, Anas, and Farinacci, 1992). Related research exploring nonconscious influences of past experience on current thought and behavior—known in cognitive psychology as implicit memory (Roediger, 1990; Schacter, 1987)—has shown that recent experiences can implicitly influence social judgments and beliefs (Greenwald and Banaji, 1995). Such phenomena suggest that our beliefs about the world may be more malleable than previously suspected.

Faced with these intriguing and seemingly rich points of intersection between memory and belief, and continuing to examine the way in which memory depends on brain activity, members of our working group concluded that the time was right to bring together scientists and scholars whose research and theorizing explores aspects of the relations among memory, brain, and belief. This volume is based on a

May 1997 conference at which all of the contributors presented and discussed their research.

Westbury and Dennett initiate the volume with a philosophical treatment of fundamental conceptions regarding memory and belief. As they note, both terms are susceptible to being used in multiple, sometimes confusing ways that can undermine any attempt to understand the nature of the relations between the two. These authors provide a useful historical overview of the ways in which philosophers have attempted to delineate the boundary conditions of both memory and belief, and they describe remaining—and still vexing—terminological and theoretical obstacles to exploring their relations. Although experimental scientists are familiar with issues related to the definition of "memory," and manage to use the term productively in their day-to-day research, the term "belief" is considerably less familiar and perhaps more problematic. Following Westbury and Dennett's lead, a number of the contributors who explicitly examine the nature of belief attempt to come to grips with defining the term. As will become apparent to the reader progressing through the volume, we are still some distance from an adequate working definition of belief that is shared across scientists and scholars. We are hopeful that the present volume will stimulate discussion and analysis that will ultimately lead to a shared definition of belief that will facilitate investigation of its relation to memory and brain.

The chapters in Part I offer cognitive, neurological, and pathological perspectives on relations among memory, brain, and belief. Each of the chapters provides striking illustrations of various aberrations of memory and belief, presents preliminary evidence illuminating how such disruptions in cognition depend on underlying brain processes, and considers theoretical ideas that are beginning to elucidate these fascinating phenomena. Johnson and Raye focus on cognitive and neural aspects of false memories and beliefs. They outline a conceptual model, known as the source monitoring framework, that emphasizes the constructive nature of remembering and believing and delineates the component processes on which they are based. These authors describe conditions in which inaccurate or false memories may be heightened, such as following damage to certain sectors of the frontal lobes, and also examine delusional beliefs in schizophrenic pa-

tients. They dissect these conditions from the perspective of the source monitoring framework, and describe converging evidence from studies of brain activity in healthy individuals that provide beginning insights into the neural processes that mediate remembering and believing.

Ramachandran describes an array of intriguing—and often bizarre—aberrations of memory and belief, and elucidates the nature of these conditions with cleverly conceived clinical experiments. Stroke patients with frank paralysis who nonetheless believe they can move their limbs, or who believe that familiar loved ones are impostor duplicates of the missing real person, are shocking to us because of the sheer magnitude of the cognitive distortions that the patients exhibit. Ramachandran enlists such cases in an emerging experimental epistemology that seeks to illuminate the mechanisms that produce these strange departures from normal memory and belief.

Frith and Dolan focus primarily on elucidating the nature of delusional perceptions and beliefs in schizophrenia and related conditions. They examine a variety of issues concerning both psychological and neurobiological aspects of the phenomena, including whether false perceptions are sufficient to explain false beliefs; the role of central monitoring processes in delusions; the relation between delusions and memory loss, as seen in the condition known as psychogenic amnesia; and the nature of memory distortion, as seen in confabulations of brain-damaged patients and false memories in healthy individuals. In addition, Frith and Dolan enrich their analysis with cutting edge data from studies using new neuroimaging techniques such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) to illuminate the brain systems involved in remembering and believing. They focus in particular on the integrative role of the right prefrontal cortex and its possible function in the delusions and confabulations considered elsewhere in the chapter.

Part II of the volume examines the relation between conscious and nonconscious aspects of memory and belief and their relation to underlying brain mechanisms. Prior to the past decade or two, analyses of memory tended to focus on intentional, conscious recollections of past experiences. But beginning in the 1980s and continuing to the present, a growing number of studies have examined nonconscious influences of past experiences on subsequent performance and behav-

ior—a type of memory most commonly referred to as implicit memory (Schacter, 1987). Numerous experiments have documented the existence of implicit memory in simple laboratory paradigms involving the study and testing of lists of words, pictures, and other materials (for reviews see Roediger and McDermott, 1993; Schacter and Buckner, 1998). More recently, research on implicit memory has been extended into the domain of social cognition, where new experimental paradigms are beginning to uncover fascinating and potentially important implicit influences on social beliefs and judgments. Banaji and Bhaskar review their own experimental evidence and that of others for the operation of such influences, describing experiments that use implicit testing techniques to reveal the operation of gender and racial stereotyping. They couch their theoretical discussion in the context of what they call the "humbling view" that behavior is not classically rational but rather boundedly rational—subject to limitations imposed by cognitive and memory abilities that result in various kinds of biases and other deviations from so-called optimal behavior. Banaji and Bhaskar consider the import of their data and theory on the operation of implicit social beliefs in real-world contexts.

Research on memory has benefited greatly from the development of animal models that allow researchers to unravel the complex web of brain structures and neurochemical influences underlying different forms of memory. A number of researchers have developed animal models that allow the separation of implicit memory (sometimes referred to as nondeclarative or procedural memory) from explicit memory (sometimes referred to as declarative memory; see for example Eichenbaum, 1994; Squire, 1994). However, one would be hard pressed to find any treatment of issues pertaining to belief in nonhuman animals. Eichenbaum and Bodkin take on the somewhat daunting task of extending work and thinking concerning animal memory into the domain of belief. They adopt the position that belief and knowledge can be viewed as distinct forms of memory. Whereas we ordinarily think of beliefs as propositions, often expressed in a verbal manner, Eichenbaum and Bodkin conceptualize belief as "a disposition to behave in a manner that is resistant to correction by experience." By contrast, they construe knowledge as "a disposition to behave that is constantly subject to corrective modification and updating

by experience." Armed with these general definitions, Eichenbaum and Bodkin attempt to relate belief and knowledge to the performance of experimental animals on tests that are sensitive to different types of memory. They provide striking illustrations of how damage to the hippocampal formation can produce highly inflexible types of behavior that reflect, from their perspective, the operation of fixed beliefs. They also consider the relation between these phenomena and examples of implicit memory in humans, touching on the implications of their views for understanding pathological conditions such as psychosis, obsessive-compulsive disorder, and hysterical disorders.

Tulving and Lepage focus on the nature of awareness in memory for past events. They draw a sharp distinction between *consciousness,* a general capability of the brain that does not require an object (that is, one can be in a general state of consciousness), and *awareness,* a particular expression of the capability for consciousness that always has an object (one is always aware of something). They examine different forms of awareness of past events, drawing special attention to an "autonoetic" awareness that involves the ability to reexperience past events and imagine future ones. The crucial importance of this trait is illustrated by the case of an amnesic patient characterized by a selective and total loss of the capacity for autonoetic awareness. Turning to recent neuroimaging research, Tulving and Lepage summarize recent studies from their laboratory using positron emission tomography and event-related potentials to examine the nature of various forms of awareness for past events. Like Frith and Dolan, they are particularly concerned with the role of the frontal lobes in retrieval of past episodes.

The four chapters that constitute Part III of the volume consider memory and belief in autobiographical narratives from the perspective of psychologists who study autobiographical memory experimentally (Ross and Wilson, Nelson), or from the perspective of literary scholars who analyze the nature of autobiographies (Eakin, Bok). Ross and Wilson describe a pervasive phenomenon of human memory: current beliefs can shape and sometimes distort recollections of past events (see Schacter, 1999). They summarize studies that illustrate the numerous and varied manifestations of such retrospective biases, and propose a theoretical framework that attempts to account for how

present beliefs influence appraisals of past selves, focusing in particular on the documented tendency of people to derogate past selves.

Nelson explores the developmental roots of autobiographical memory and belief. She is especially concerned with the roles of social interaction and language development in shaping the gradual emergence of coherent autobiographical narratives in young children. She also discusses the related issue of how memory for past experiences is sometimes changed or distorted by "reactivating" or "rehearsing" aspects of the experience. Examining autobiographical memory development in the broad context of related cognitive changes, Nelson also considers the development of belief, discussing the implications of the young child's seeming inability to grasp the occurrence or nature of mental states in others that involve holding false beliefs. Tying together the various strands, she points out commonalities among the various memory and cognitive abilities that develop between two and five years of age, emphasizing a major role for language in allowing the developing child to move from a "single-mind" representation of reality to a "multilevel" representational scheme.

Eakin, in his analysis of memory and belief in autobiography, explicitly builds on insights derived from developmental analyses of autobiographical memory and related cognitive perspectives that emphasize the constructive nature of remembering. Using as an example Christa Wolf's *Patterns of Childhood,* in which Wolf speaks of certain portions of her past in the first person and others in the second and third person, Eakin explores the role of memory in making possible the most fundamental beliefs about self and identity—the concept of a single, extended self that spans the different periods of one's life. From Eakin's perspective, the extended self is "a fiction of memory" that follows from accounts of memory described by cognitive and developmental psychologists.

Bok examines the nature and function of autobiography in a broad historical context. Examining what she calls "bitterly contested memories," Bok focuses on cases in which different autobiographers—the five children of Sofya and Lev Tolstoy, the French Enlightenment friends-turned-opponents Jean-Jacques Rousseau and Madame Louise d'Epinay—tell fundamentally different and sometimes conflicting sto-

ries about the past. To what extent do these accounts reflect the kinds of memory biases discussed by psychologists such as Ross and Wilson, where recollections of the past are altered in line with current beliefs? How can research concerning memory and belief inform our understanding of contested autobiographical recollections? These and related questions arise naturally from Bok's nuanced analysis of battles over the content and meaning of the past.

In his concluding comments, Damasio synthesizes themes developed in the preceding chapters by exploring definitional, conceptual, neurobiological, and pathological aspects of belief in relation to memory and other cognitive and affective phenomena. He suggests a number of ways to bring the analysis of belief into the mainstream of contemporary cognitive neuroscience. It is our hope that this volume will serve to stimulate such a development, and to build bridges between the various disciplines that can enrich our understanding of the relations among memory, brain, and belief.

References

Begg, I. M., Anas, A., and Farinacci, S. (1992). Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth. *Journal of Experimental Psychology: General, 121,* 446–458.

Ceci, S. J. (1995). False beliefs: Some developmental and clinical considerations. In D. L. Schacter (Ed.), *Memory distortion* (pp. 91–128). Cambridge, MA: Harvard University Press.

Conway, M. A. (Ed.). (1997). *Recovered memories and false memories.* Oxford: Oxford University Press.

Conway, M. A., and Rubin, D. C. (1993). The structure of autobiographical memory. In A. F. Collins, S. E. Gathercole, M. A. Conway, and P. E. Morris (Eds.), *Theories of memory* (pp. 103–137). Hillsdale, NJ: Lawrence Erlbaum.

Dawes, R. M. (1991). Biases of retrospection. *Issues in Child Abuse Accusations, 1,* 25–28.

Eichenbaum, H. (1994). The hippocampal system and declarative memory in humans and animals: Experimental analysis and historical origins. In D. L. Schacter and E. Tulving (Eds.), *Memory systems, 1994* (pp. 147–202). Cambridge, MA: MIT Press.

Greenwald, A. G., and Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review, 102,* 4–27.

Levine, L. J. (1997). Reconstructing memory for emotions. *Journal of Experimental Psychology: General, 126*(2), 165–177.

Loftus, E. F. (1997). Memory for a past that never was. *Current Directions in Psychological Science, 6*(3), 60–64.

Roediger, H. L. III. (1990). Implicit memory: A commentary. *Bulletin of the Psychonomic Society, 28,* 373–380.

Roediger, H. L. III. (1996). Memory illusions. *Journal of Memory and Language, 35,* 76–100.

Roediger, H. L. III, and McDermott, K. B. (1993). Implicit memory in normal human subjects. In H. Spinnler and F. Boller (Eds.), *Handbook of neuropsychology,* Vol. 8 (pp. 63–131). Amsterdam: Elsevier.

Ross, M. (1989). Relation of implicit theories to the construction of personal histories. *Psychological Review, 96,* 341–357.

Rubin, D. C. (1995). *Memory in oral traditions: The cognitive psychology of epic, ballads, and counting-out rhymes.* New York: Oxford University Press.

Rubin, D. C. (Ed.). (1996). *Remembering our past: Studies in autobiographical memory.* Cambridge: Cambridge University Press.

Schacter, D. L. (1987). Implicit memory: History and current status. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 13,* 501–518.

Schacter, D. L. (Ed.). (1995). *Memory distortion: How minds, brains, and societies reconstruct the past.* Cambridge, MA: Harvard University Press.

Schacter, D. L. (1996). *Searching for memory: The brain, the mind, and the past.* New York: Basic Books.

Schacter, D. L. (1999). The seven sins of memory. *American Psychologist, 54,* 182–203.

Schacter, D. L., and Buckner, R. L. (1998). Priming and the brain. *Neuron, 20,* 185–195.

Schacter, D. L., Norman, K. A., and Koutstaal, W. (1998). The cognitive neuroscience of constructive memory. *Annual Review of Psychology, 49,* 289–318.

Squire, L. R. (1994). Declarative and nondeclarative memory: Multiple brain systems supporting learning and memory. In D. L. Schacter and E. Tulving (Eds.), *Memory systems, 1994.* Cambridge, MA: MIT Press.

Mining the Past to Construct the Future: Memory and Belief as Forms of Knowledge

1

Chris Westbury
Daniel C. Dennett

> The analogy between memory and a repository, and between remembering and retaining, is obvious and is to be found in all languages; it being natural to express the operations of the mind by images taken from things material. But in philosophy we ought to draw aside the veil of imagery, and to view them naked.
>
> *Thomas Reid,*
> Essays on the Intellectual Powers of Man *(1815)*

Jacques Monod (1974) observed that "ever since its birth in the Ionian islands almost three thousand years ago, Western philosophy has been divided between two seemingly opposed attitudes. According to one of them the true and ultimate reality of the universe can reside only in perfectly immutable forms, unvarying by essence. According to the other, the only real truth resides in flux and evolution" (p. 98). Three thousand years of argument has so far failed to find a clear resolution to this ancient opposition. There are still two committed camps of "Neats" and "Scruffies," who fall on either side of the fundamental debate identified by Monod. Some of the most exciting points of intersection between the interests of philosophers and scientists today are those at which the apparent incompatibility between the two camps demands to be resolved—those points at which it becomes clear that the stable, neat objects of scientific inquiry are attaining their objective status by managing to separate themselves (often using scruffy means) from an underlying scruffy flux of dynamic phenomena. When we try to understand such objects, questions of science merge unavoidably with questions of epistemology. The questions that interest us about memory and belief exist at this intersection. We will briefly consider each of these phenomena in turn. In

doing so, we will try to point out some conceptual confusions that spring from the way we use their names in informal discourse, and emphasize a strong underlying similarity in the ways that memory and belief relate to knowledge.

Memory

Every event in the world has effects, and the chain of effects that spreads from any event continues essentially forever; but only some events leave long-lasting traces. We single out the best cases of this for special notice: footprints, scars, and various sorts of records. Of all the dinosaur footprints that ever pressed into mud, only a tiny fraction are discernible today; of all the clay tablets ever impressed with hieroglyphics, only a select few survive—but like the dinosaur footprints, they permit us to read the past in a way that the other long-lived effects of the same causes do not. Fifty light-years from Earth, a sphere of 1947 Jack Benny broadcasts is expanding into the galaxy, almost certainly unreconstructible by any technology. If those programs were not recorded here on Earth, they would be gone forever. Events that leave no salient long-term traces can be called inert historical facts; they happened, but the difference they made no longer makes a discernible difference. There is no fixed best way to count facts, but by almost any usable method we would have to say that most historical facts are inert. One of the following is a fact: (a) some of the gold in Dennett's teeth once belonged to Julius Caesar; (b) none of the gold in Dennett's teeth ever belonged to Julius Caesar. Although one of these statements is true, it is almost certainly beyond all powers of investigation to determine which.

The past consists of all historical facts, inert or recoverable. The whole point of brains, of nervous systems and sense organs, is to produce future, to permit organisms to develop, in real time, anticipations of what is likely to happen next, the better to deal with it. The only way—the only nonmagical way—organisms can do this is by prospecting and then mining the present for the precious ore of historical facts, the raw materials that are then refined into anticipations of the future. As Norbert Wiener (1948) pointed out long ago, the fundamental method is trajectory sampling or tracking: gathering data