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10
Reality Monitoring: Evidence from Confabulation in Organic Brain Disease Patients

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This chapter addresses the problem of reality monitoring (Johnson and Raye, 1981; Johnson, 1988a) in the context of a general framework for memory research (Johnson, 1983, 1989; Johnson and Hirst, in press). Issues and findings from studies of confabulation in organic brain disease patients are considered within this framework.

MULTIPLE-ENTRY MODULAR MEMORY SYSTEM

The framework I find useful for thinking about cognition and memory is called a Multiple-Entry Modular Memory System, or MEM (Johnson, 1983, 1989; Johnson and Hirst, in press). According to MEM, memory is created by an intricate interplay of processes that are organized at the most global functional level into perceptual and reflective systems. The *perceptual system* records information that is the consequence of perceptual processes, such as seeing and hearing. The *reflective system* records information that is the consequence of internally generated processes, such as planning, comparing, speculating, and imagining. Each of these systems comprises more specific functional subsystems that in turn are made up of yet more specific functional components.

The perceptual system consists of two subsystems, P-1 and P-2; and the reflective system consists of two subsystems, R-1 and R-2 (Fig. 10–1). P-1 processes develop connections or associations involving perceptual information of which we are often unaware, such as the invariants in a speech signal that specify a particular vowel or the aspects of a moving stimulus that specify when it is likely to reach a given point in space. P-2 processes are involved in learning about the phenomenal perceptual world of objects and events such as chairs,

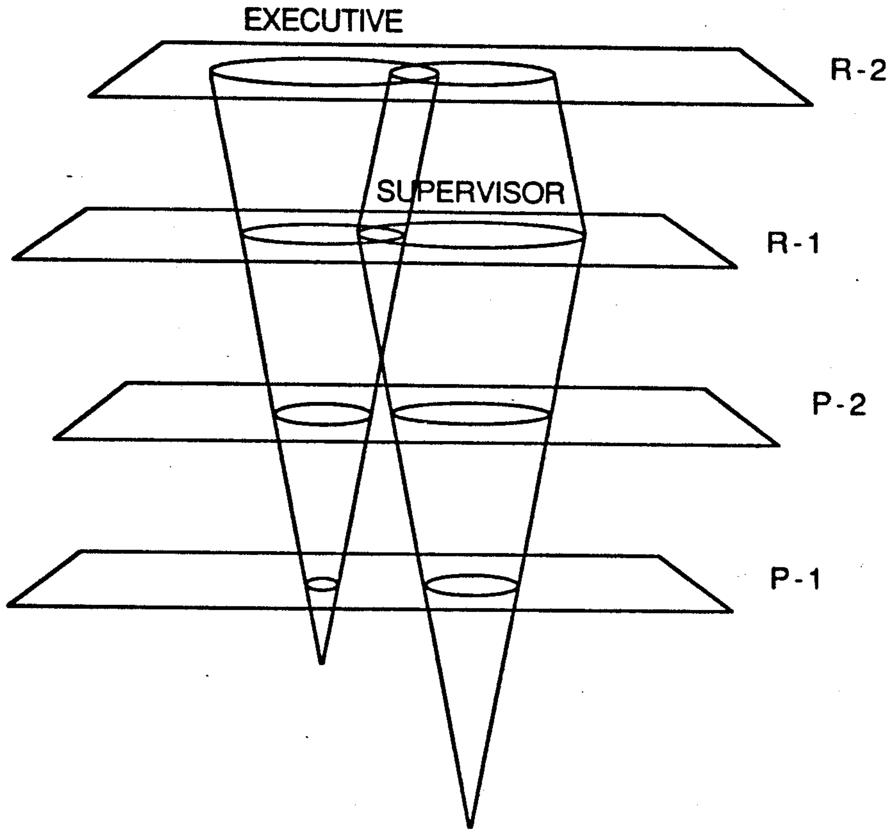

Figure 10–1. Multiple-Entry Modular Memory System, consisting of two reflective subsystems (R-1 and R-2) and two perceptual subsystems (P-1 and P-2). Reflective and perceptual subsystems interact through control and monitoring processes (supervisor and executive processes of R-1 and R-2, respectively), which have relatively greater access to and control over reflective than perceptual subsystems.

people, hearing your name, and catching a ball. A number of findings are consistent with a functional division between P-1 and P-2 processes (Johnson, 1983; Johnson and Hirst, in press). For example, "blindsight" patients may claim they cannot see a stimulus yet may be able to point to its location in space (Weiskrantz, 1986), a phenomenon that could occur if P-2 were disrupted but P-1 intact.

In contrast to perceptual processes, reflective processes occur independently of sensory stimulation. They are sometimes initiated by perception, but reflective processes allow one to go beyond external cues. They are generative; they allow us to manipulate information and memories of events, imagine possible alternatives, compare these alternatives, and so forth. As shown in Figure 10–2, both R-1 and R-2 involve component processes that allow people to sustain, organize, and revive information. Some of these component processes in R-1 are noting, shifting, refreshing, and reactivating. Analogous processes in R-2 are dis-

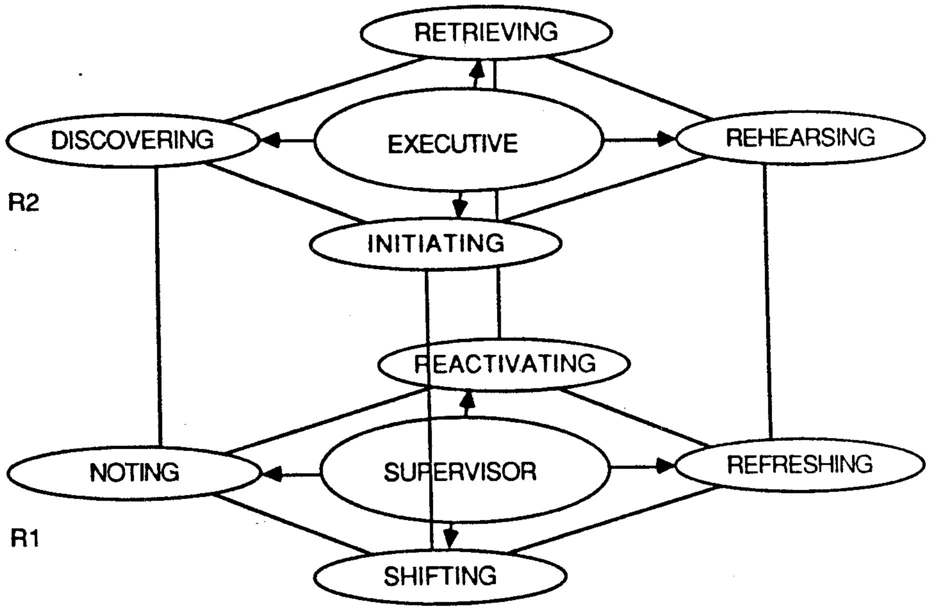

Figure 10–2. Some component processes of reflection. Basic reflective processes (noting, shifting, refreshing, reactivating, and supervisor functions) are represented on the bottom of the cube; and corresponding but more deliberate or strategic reflective functions (discovering, initiating, rehearsing, retrieving, and executive functions) are represented on the top of the cube.

covering, initiating, rehearsing, and retrieving [see Johnson (1989) and Johnson and Hirst (in press) for a discussion of these component processes].

The R-1 and R-2 subsystems also include control and monitoring component processes. For R-1 these processes are collectively referred to as *supervisor processes* and for R-2 as *executive processes.* Supervisor and executive processes set up goals and agendas and monitor or evaluate outcomes with respect to these agendas (Miller, Galanter, and Pribram, 1960; Stuss and Benson, 1986; Nelson and Narens, in press). Furthermore, they recruit other reflective component processes for these purposes. The difference between supervisor and executive processes is something like the difference between "tactical" and "strategic" control and monitoring processes or the difference between habitual and deliberate reflective processes. There is more control, effort, or will (e.g., Shiffrin and Schneider, 1977; Hasher and Zacks, 1979; Norman and Shallice, 1986) associated with executive than with supervisory processing. R-2 can handle more complex tasks than R-1. For example, under the guidance of an R-1 intention to *listen attentively to a story* told by your dinner companion, you might generate tacit implications of sentences, notice relations between one part of the story and an earlier part of which you are reminded, and so forth. Under guidance of an R-2 agenda to *critically evaluate the story,* you might generate objections to the logic of events in the story, actively retrieve other stories for comparison, and so forth. Normal cognitive functioning draws on different component processes of reflection as needed. Disruption of various combinations of component processes results in various patterns of cognitive deficit, including amnesia (Johnson and Hirst, in press) and, as discussed below, confabulation.

P-1, P-2, R-1, and R-2 activities may go on simultaneously, and they produce corresponding changes in memory. At some future time, exactly which of these records are activated depends on the kind of task probing memory (e.g., Jacoby and Dallas, 1981). A task in which you had to identify random syllables spoken by your dinner companion presented in white noise would draw primarily on representations formed by P-1. A recognition task in which you had to discriminate pictures of people who were and were not at the party draws primarily on representations formed in P-2. Recalling your dinner companion's story would draw on R-1 and R-2 records.

Under ordinary circumstances, subsystems interact with each other, although exactly how they interact needs further investigation. During remembering, representations from one subsystem may directly activate related representations from another, or interactions between perceptual and reflective memory may take place through supervisor and executive components. For example, an agenda initiated by the R-2 executive, e.g., *look for a restaurant*, might activate relevant perceptual schemas from perceptual memory (e.g., look for a building with a ground level window, tables visible, menu in window). It might also activate reflective plans adapted to the current situation (e.g., check the restaurant guide for this part of town).

Supervisor and executive processes are depicted in Figure 10–1 as cones passing through planes representing different subsystems. The sizes of the ellipses at the intersects of cones and planes reflect the relative degree of involvement of supervisor and executive processes in each subsystem's activities. Typically, executive functions have greater access to reflective memory than to perceptual memory and greater access to P-2 than to P-1 subsystems. An especially important aspect of reflection is that the supervisor and executive processes in R-1 and R-2 can recruit and monitor each other, as depicted by their overlap in Figure 10–1. For example, an R-2 agenda to *check the restaurant guide* can initiate an R-1 goal to *note the number of stars by each entry*. Interaction between R-1 and R-2 provides a mechanism for sequencing subgoals. It also gives rise to the phenomenal experience of reflecting on reflection. In addition, access to information about one's own cognitive operations provides a salient cue for identifying oneself as the origin of information. These R-1, R-2 interactions contribute to our concept and sense of self.

This general framework has been useful for organizing empirical facts obtained from cognitive-behavioral studies (Johnson, 1983), as well as for generating new research (Johnson and Kim, 1985; Johnson, Kim, and Risse, 1985; Hirst, Johnson, Kim, et al., 1986; Weinstein, 1987; Hirst, Johnson, Phelps, and Volpe, 1988; Johnson, Peterson, Chua-Yap, and Rose, 1989; see also Johnson, 1989). As well as being heuristic, the division between perceptual and reflective memories may capture functional organizations within the nervous system. Several behavioral dissociations support this claim. For example, memory for reflective processing develops later than memory for perceptual processes (e.g., Perlmutter, 1984; Schacter and Moscovitch, 1984; Flavell, 1985; Moscovitch, 1985);

and it appears that P-2 develops later than P-1 and R-2 later than R-1. Moreover, memories for reflective processing are disrupted more easily by stress, depression, aging, and the use of alcohol and other drugs than are memories for perceptual processes (Eich, 1975; Hasher and Zacks, 1979, 1984; Craik, 1986; Hashtroudi and Parker, 1986). Furthermore, the breakdown in memory functioning found in patients with anterograde amnesia appears to fall disproportionately on reflective memory (Johnson, 1983, 1989; Johnson and Hirst, in press; Cermak, 1982).

REALITY MONITORING

Because humans have a cognitive system that takes in information from a number of perceptual sources and that can itself internally generate information as well, one of the mind's most critical cognitive functions is discriminating the origin of information. We constantly use this ability in considering ongoing experience (Is what I see now "out there," or am I only imagining it?) and the products of past experience (Is my memory for an event that happened when I was 5 years old a memory for an actual event or an event I imagined as a child?) (Johnson, 1985). I have suggested we use the term *reality testing* for the processes by which people make such discriminations during ongoing experience (e.g., Perky, 1910) and the term *reality monitoring* for the processes by which people discriminate between memories derived from perception and those that were reflectively generated via thought, imagination, dreams, and fantasy (Johnson, 1977, 1988a; Johnson and Raye, 1981).

Reality monitoring refers not only to monitoring the origin of memories for events but also to discriminating the origin of knowledge, attitudes, and beliefs (e.g., Slusher and Anderson, 1987). Also, within the class of externally derived information we make discriminations (external source monitoring) among alternative sources (Did I see this or hear/read about it? (e.g., Loftus, 1979; Lindsay and Johnson, 1989). Within the class of internally generated information, self-monitoring discriminations are also made (Did I tell Joe or only imagine telling Joe? (e.g., Foley, Johnson, and Raye, 1983). Such self-monitoring discriminates intentions from actions. Although the discussion here and most of our empirical work to date focus on reality monitoring, many of the same factors are important for all of these discriminations, and the current framework provides the beginning of a systematic, integrated approach for considering relations among reality testing, reality monitoring, external source monitoring, and self-monitoring as they apply to either events or knowledge and beliefs (Lindsay and Johnson, 1987; Johnson, 1988a, Hashtroudi, Johnson, and Chrosniak, 1989).

Consistent with MEM, our approach to the issue of reality monitoring assumes that the memory system preserves both the results of perceptual processing and the results of more self-generated or reflective processing (Johnson and Raye, 1981). Reality monitoring failures occur when people confuse the origin of information, misattributing something that was reflectively generated to perception or vice versa. That is, reality is not directly given in perception or remembering but is an attribution that is the outcome of judgment processes.

Confusions can be understood by considering the phenomenal characteristics of memories for perceived and imagined events along with the decision processes people apply to activated information. We proposed that memories for perceived and imagined events differ in average value along a number of dimensions. Memories originating in perception typically have more perceptual information (e.g., color, sound), contextual time and place information, and more meaningful detail, whereas memories originating in thought typically have more accessible information about cognitive operations, i.e., those perceptual and reflective processes that took place when the memory was established. Differences between externally and internally derived memories in average value along these dimensions or attributes form one basis for deciding the origin of a memory. For example, a memory with little information about cognitive operations and a great deal of perceptual information would likely be judged to have been externally derived.

A second type of decision process is based on reasoning: Such processes may include, for example, retrieving additional information from memory and considering if the target memory could have been perceived (or self-generated) given these other specific memories or general knowledge. For example, I might have a memory of telling Ronald Reagan what I think of his policies, but I can correctly attribute it to a fantasy on the basis of the knowledge that I am not acquainted with him. In addition, judgments are affected by people's opinions or "metamemory" assumptions about how memory works. For example, I might believe that something that comes to mind quickly is likely to be an accurate memory of an actual event. Thus reality monitoring most likely produces errors when perceived and imagined events are similar along dimensions that normally provide a discriminative cue (e.g., if the imaginations in question are particularly rich in perceptual and contextual detail), when reasoning fails, when the relevant background knowledge is not retrieved or unknown, or when metamemory assumptions are inaccurate.

A number of experimental findings support this reality monitoring framework. For example, the more imaginations are like perceptions in perceptual detail, the more subjects confuse imaginations with perceptions. In one experiment (Johnson, Raye, Wang, and Taylor, 1979), we varied the number of times subjects saw pictures and the number of times they imagined each picture. Later, we asked subjects how many times they saw each picture. The more often the subjects saw the pictures, the higher their frequency judgments. More important, the more often the subjects imagined the pictures, the more often they thought they had seen them. Furthermore, compared to poor imagers, good imagers were more affected by the number of times they had imagined a picture. In another experiment (Johnson, Foley, and Leach, 1988a) subjects imagined themselves saying some words and heard a confederate say other words. Later, the subjects were good at discriminating the words they had thought from the words the confederate had actually said. In another condition, the procedure was the same except that subjects were asked to think in the confederate's voice; in this case subjects later had much more difficulty discriminating what they had heard from what they had thought. The results of both the good/poor imager study and the think-in-another-person's voice study are consistent with the idea that the more perceptual overlap there is between memories derived from perception and memories generated via imagination, the greater is the confusion between them.

According to the reality monitoring framework, remembered cognitive operations can also be a cue to the origin of a memory. In one experiment (Durso and Johnson, 1980), subjects saw an acquisition list consisting of some words and some line drawings of common objects. We then asked subjects to indicate whether each item had appeared as a word or a picture. We varied how the subjects processed the items initially. At acquisition, some subjects indicated the function of the referent of each item. For example, if they saw a picture of a knife (or the word knife) they might say "you cut with it." Still other subjects identified a particularly relevant feature of each object, for example, *blade* for knife. Other subjects had an artist time judgment task: If a picture was presented, they rated how long it took the artist to draw it. If a word was presented, they constructed an image of a line drawing of the referent and then rated how long it would take the artist to draw the imagined picture.

One important difference between the first two tasks and the last one is that the artist time judgment task involves intentional imagery, whereas the function and relevant feature tasks are likely to involve spontaneous, or incidental, imagery. That is, to answer a question about an object's relevant features, a person might think of a visual representation of the object and "pick out" a relevant feature. Intentional images are under voluntary, reflective control and thus the memories for them should contain more information about cognitive operations than the memories for spontaneous images. If so, people should later be better able to discriminate memories of voluntarily constructed images from memories of pictures than memories of spontaneous images from memories of pictures. Consistent with this prediction, in the artist time judgment condition, subjects rarely said a word had been presented as a picture. In the function and relevant feature conditions, they much more often claimed to have seen pictures of objects that had only been named. Thus spontaneous or incidental images were more likely to be confused with perceptions than were consciously constructed ones.

We have also investigated reality monitoring for naturally occurring, complex events. In one study (Johnson, Kahan, and Raye, 1984) subjects had to discriminate between memories for their own dreams and memories for dreams their roommate, spouse, or lover told them. Two points from this study are especially relevant here. Subjects occasionally misattributed something they dreamed to their partner on the basis of reasoning from general beliefs: "That couldn't have been mine because it is just not the sort of thing I dream." Also, subjects' ability to recall dreams was poor, and if this information was all we had, we might be tempted to conclude that dreams quickly fade away. However, recognition memory for dreams was high. The recognition results suggest that dreams persist in memory for some time and are a potential source of images and ideas.

In another series of studies, we investigated reality monitoring for various kinds of naturally occurring, autobiographical events. In one study (Johnson, Foley, Suengas, and Raye, 1988b) we asked subjects to remember an event from their own experience (a trip to the library, a social occasion, a trip to the dentist, a dream, a fantasy, an unfulfilled intention), and then we asked them how they knew that the event actually had (or had not) taken place. The explanations or justifications used most often were different for actual and imagined events. For actual events, subjects were likely to refer to characteristics of the target memory itself, such as temporal information (e.g., time of the school year), location information ("I know exactly where it happened,"), or perceptual detail ("I remember the exact color of his shirt"). Also for actual perceptions subjects were likely to refer to supporting memories. Actual events are embedded in anticipations before the fact (e.g., buying something to wear) and consequences after the fact (e.g., later conversations about the event or later regrets). People frequently refer to these supporting memories to justify their belief that an event really happened. For imaginations, the subjects referred to characteristics of the target memories or to supporting memories much less often. Rather, the overwhelmingly most frequent response for imaginations involved reasoning, such as pointing out inconsistencies between the memory and their general knowledge of the world (e.g., "I was a doctor but really I was too young to be a doctor, so it must be only a fantasy" or "the event breaks physical laws about time and space").

Reality Monitoring and MEM

Reality monitoring processes can be described more specifically in terms of the MEM framework. Reality monitoring requires people to discriminate memories generated by R-1 and R-2 processes from memories derived from P-2 and perhaps P-1 processes. Supervisory and executive processes in R-1 and R-2 are used in judgments about the origin of activated information. For normally functioning adults, most reality monitoring is guided by R-1 supervisory processes; that is, reality monitoring typically takes place rapidly, in a nondeliberative fashion, based on the qualitative characteristics of memories that are activated (e.g., amount or type of perceptual detail). The generally slower, more deliberate retrieval of supporting memories and initiation of reasoning processes (e.g., Does this seem plausible given other things I know?) are R-2 functions and are probably engaged less often. Although less frequently used, they are no less important, of course. Among other things, R-2 processes allow us to look back on ideas we initially accepted and question them.

Using this framework, consider the various ways in which reality monitoring could break down: Disrupted reality monitoring could result from decreases in the difference between phenomenal qualities of perceived and imagined events (disrupted experience or disrupted memory for experience), difficulty retrieving relevant supporting information, failures in reality monitoring judgment processes, or reduced motivation to engage in reality monitoring.

Disrupted Experience

As previously mentioned, if perceptual qualities of imagined events were unusually vivid, they would be more difficult to discriminate from perceived events. It might happen, for example, if reflective processes were especially successful in recruiting perceptual processes during imagination (Kosslyn, 1980) as is evidently the case with good imagers (Johnson et al., 1979). Conversely, if perceptual qualities of perceived events became less vivid, it would also reduce differences between perceived and imagined events. Decreased encoding of perceptual qualities of external events may happen as a consequence of normal aging. Older adults may pay less attention to perceptual aspects of events (Hasher and Zacks, 1988) and the reduced perceptual information in memory could produce an aging deficit in reality monitoring (Hashtroudi, Johnson, and Chrosniak, 1990; Rabinowitz, 1989).

Memories derived from perception typically have more contextual (temporal and spatial) information than memories derived from imagination. Some of this contextual information is inherent in the perception (e.g., perceptual processes spatially organize a face with the nose below the eyes), and some is the product of reflection. For example, the temporal relation between two events is often made salient because we think of the first event at the time of the second, perhaps to compare them (Tzeng and Cotton, 1980; Johnson, 1983). Remembering this reflective activity produces knowledge of temporal order. Anything that differentially reduces the amount of contextual information that usually is associated with perceived events or that differentially increases the contextual information associated with imagined events would make reality monitoring more difficult.

Similarly, any decrease in the cognitive operations information produced during reflection would disrupt reality monitoring. For example, as strategic R-2 reflection becomes a more habitual R-1 function, the resulting reflective entries in memory should be more likely to be confused with perceptual entries. Thus people are especially likely to believe they heard or saw something they only inferred when the inference was a particularly easy or habitual one (e.g., Johnson, Bransford, and Solomon, 1973).

Disrupted Retrieval

Supporting memories for events occurring both before and after a target event are used to help specify the origin of a memory. Anything that would make such supporting information more difficult to retrieve (e.g., disrupted reflective retrieval operations) should disrupt reality monitoring.

Disrupted Judgment

As mentioned above, much of the reality monitoring we do is relatively automatic or nonstrategic and is guided by R-1 processes. Thus if R-1 processes were eliminated or their efficiency or reliability reduced (as indicated by the dotted lines in Figure 10–3A), confusions between perceived and imagined events might be frequent. Some errors could be corrected, however, using R-2 processes to retrieve additional, supporting information or to reason about the plausibility of an event or belief in light of what else is known. On the other hand, if plausible memories were not subjected to a check for perceptual detail, they might be accepted too readily. Thus R-1 processes provide a check on R-2 processes as well as vice versa.

Figure 10–3B shows a situation in which R-1 processes are intact but R-2 processes are eliminated, or their efficiency or reliability is disrupted (indicated by the dotted lines). Reality monitoring judgments guided by R-1 processes and based on such qualitative characteristics as perceptual and contextual detail and

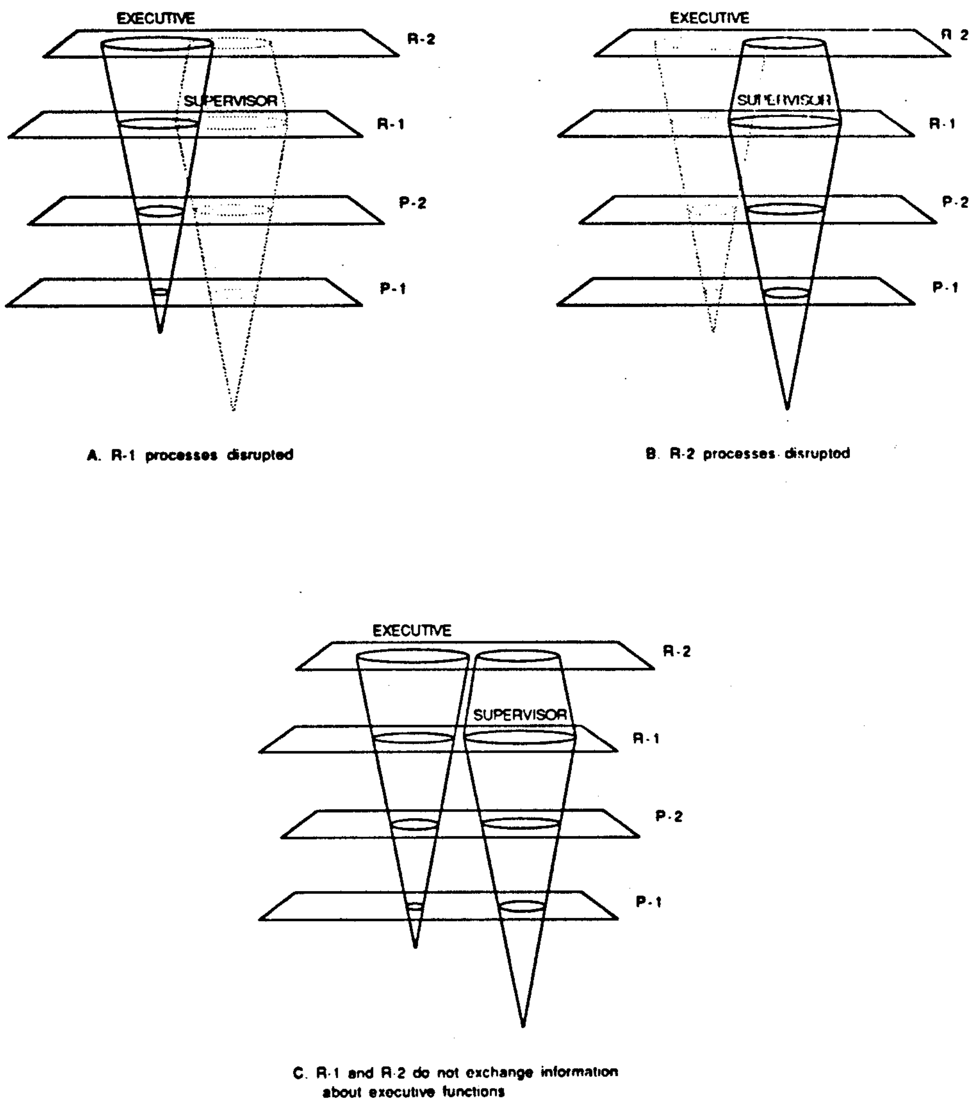

Figure 10–3. Some ways reflective processes could be disrupted.

information about cognitive operations would occur normally. Because of the R-2 deficit, however, there would be less chance of catching R-1 errors on vivid, but implausible, imaginations.

In addition to a global disruption of judgment processes, shifts in the criteria used for R-1 or R-2 processes could increase reality monitoring errors. For example, an increase in the similarity of perceived and imagined information would not necessarily leave a person's decision criteria unchanged. If one were aware that one was encoding less perceptual information than one used to do, one might lower the criterion for the amount of perceptual information required for attributing a remembered event to perception. The consequence of a lower criterion would be to increase the probability of misattributing imagined events to perception (as might occur in some cases of perceptual deficit).

Finally, Figure 10–3C depicts a situation in which both R-1 and R-2 judgment processes are intact but in which R-1 and R-2 supervisor and executive processes no longer exchange information about each other's functioning (compare Figure 10–3C to Figure 10–1). One important consequence of such a disconnection is that it would reduce the availability of cognitive operations as a discriminative cue for origin to either R-2 executive or R-1 supervisor processes.

Reduced Motivation

Any reduction in a person's estimate of the value of accurately reporting events, any decrease in motivation to engage in the effortful processing that is sometimes necessary for accurate reality monitoring, or any lessening of social constraints that promote concern for the truth would increase errors in reality monitoring. The basic underlying mechanisms in these cases, however, most likely are disrupted retrieval and judgment processes resulting from disrupted motivation and not any direct effects of motivation per se.

Summary

Discriminating the origin of information in memory is the outcome of an interplay of input, retrieval, and judgment processes. Reality monitoring involves judgment processes applied to information activated in reflective and perceptual memory systems. For optimal reality monitoring, reflective processes must have access not only to this activated target information but to other potentially relevant supporting information as well. Normally, R-1 processes operate almost continually and R-2 processes more intermittently. There is, furthermore, a critical balance between R-1 and R-2 supervisory and executive processes in that each provides the opportunity to correct errors resulting from the other.

As is the case for other cognitive functions, there are three basic strategies for investigating reality monitoring: studying reality monitoring processes in normal adults, studying the development of these processes in children, and studying the disruption of these processes under special circumstances or in special populations. Discussions drawing largely on the first and second strategies are illustrated elsewhere (Johnson and Raye, 1981; Johnson and Foley, 1984; Johnson, 1985, 1988a; Lindsay and Johnson, 1987; Johnson et al., 1988a,b; Suengas and Johnson, 1988). With respect to the third strategy, the reality monitoring framework can be used to clarify discussions of hallucinations (Bentall, 1990) and delusions (Johnson, 1988a) and to explore potential deficits in monitoring the source of information in older adults (Mitchell, Hunt, and Schmitt, 1986; Rabinowitz, 1989; Hashtroudi, Johnson, and Chrosniak, 1989; Hashtroudi et al., 1990).

CONFABULATION

Reality monitoring deficits that result from brain damage provide a valuable opportunity to evaluate further the usefulness of the present framework; they also provide some intriguing evidence about potential brain mechanisms underlying reality monitoring. To simplify the following discussion I have concentrated on confabulation, although some aspects of related syndromes such as denial of illness and reduplicative paramnesia could be discussed within the present framework as well.

The literature on patients who confabulate contains a number of ideas about mechanisms underlying confabulation that fit within the present framework in that they emphasize either phenomenal characteristics of the information activated during remembering or judgment processes. With respect to characteristics of the information, some investigators have emphasized the context-free and thus incoherent nature of the information retrieved (Kopelman, 1987) or the vividness of the experience (Whitty, 1966). Explanations emphasizing judgment processes include decreased self-monitoring ability (Stuss, Alexander, Lieberman, and Levine, 1978), decreased ability to provide verbal self-corrections (Mercer, Wapner, Gardner, and Benson, 1977), and disruption of a central executive (Baddeley and Wilson, 1986). The present effort attempts to organize these ideas in a larger framework of cognitive processing and memory and to give some of the ideas greater specificity within the context of the MEM and reality monitoring frameworks.

Defining Confabulation

Confabulation is not well understood. Part of the problem is defining what counts as confabulation. Whitlock (1981), for example, pointed out the inconsistent uses of the term in psychiatric textbooks. Most investigators agree that confabulation must be differentiated from lying and from the consequences of delirium and delusions (e.g., Talland, 1961; Whitlock, 1981; Kerns, 1986). That is, confabulations are false statements that are not made to deceive, are typically more coherent than thoughts produced during delirium, and do not reflect underlying psychopathology. These distinctions do not, of course, imply that these various phenomena do not have any processes in common, only that they are identifiable categories that are useful for analytic purposes.

Confabulation varies from relatively subtle alterations of fact to bizarre tales. For example, in a study by Kopelman (1987), subjects heard a story and were asked to recall it. It was a story about a woman who had been robbed and who reported the robbery at the Town Hall police station. One Korsakoff patient said "she asked for help from the Council." This relatively minor distortion would be scored as a confabulation. More dramatic examples of confabulation were reported by Stuss et al. (1978). One hospitalized patient who had frontal lobe damage described how he had played cards the preceding night at a club with his doctor and the head nurse. Another frontal patient fabricated a story of a drowning accident involving one of his children and thought his own head injury occurred in the rescue attempt. Another claimed that during World War II a teenage German girl shot him three times in the head, killing him, but that surgery brought him back to life.

Given this variation in patients' errors and false statements, it has been proposed that there are two distinct confabulatory phenomena (Talland, 1961). Talland suggested that *confabulation* involves a distortion of true events, e.g., misplacement of an event in time, whereas *fabrication* is fantastic and incongruous material involving figments of imagination. Some investigators distinguish between confabulation produced in response to questions (*reactive* confabulation) and *spontaneous* or *fantastic* confabulation (Berlyne, 1972; Stuss et al., 1978; Whitlock, 1981; Kopelman, 1987). Reactive confabulation tends to embellish true memories and to be plausible; spontaneous confabulation tends to be more bizarre, implausible, or fantastic. The distinctions between confabulation and fabrication and between reactive and spontaneous confabulation point to differences in the degree to which confabulation appears to draw on true memories or on imagination. The difference between distorted "true" memories and new fabrications may not, however, be so clear-cut. Even fantastic spontaneous fabrications might draw on accurate memories for premorbid fantasies and imagined horrors (Talland, 1961), reflecting a reality monitoring failure of attributing the products of prior imagination to prior perception. As we saw in our dream study, dreams persist in memory for some time, as do memories of waking fantasies (Johnson et al., 1984).

Relation to Memory Loss

Another issue that has been raised in the literature on confabulation is the extent to which confabulation is associated with or dependent on loss of memory. Confabulation is often found in amnesics, especially alcoholic Korsakoff patients. In fact, confabulation is sometimes defined as false statements made in connection with organic amnesia (Berlyne, 1972, cited in Shapiro, Alexander, Gardner, and Mercer, 1981) and thought to be a direct consequence of memory loss (Barbizet, 1963, cited in Stuss et al., 1978). In this view, confabulation is a gap-filling process (e.g., Wyke and Warrington, 1960) that is not different from the constructive processes found in normal individuals (Kopelman, 1987). Thus amnesics are said to fill in the gaps in memory much as normal individuals do; but because amnesics' gaps are so much more extensive, they show marked confabulation.

According to this constructive, gap-filling view of confabulation, as normal recall after long retention intervals approaches the low level of amnesic recall, normal subjects should show increasing confabulation. Contrary to this expectation, the literature reporting studies of normal memory includes little experimental evidence of anything approaching "florid" distortions in recall even after substantial retention intervals. Investigators looking for constructive recall have often been disappointed by the lack of intrusions in subjects' protocols (Alba and Hasher, 1983). Even in Bartlett's (1932) classic studies, after long retention intervals and repeated recall, subjects tended to produce briefer and increasingly stereotyped reports, not more embellished ones. The fact that normal subjects do not show as much gap-filling as the notion of unchecked constructive processes would lead one to expect suggests that people naturally engage in reality monitoring processes that help them distinguish true recall from their own constructions and reconstructions (Johnson and Raye, 1981). This fact in turn suggests that amnesics show confabulation not because they have memory gaps to fill but because the processes that normally monitor remembering are deficient.

There are several other problems with assuming that confabulation reflects nothing but a normal response to gaps in memory. Confabulation is not a necessary consequence of amnesia because many amnesics do not appear to confabulate. Furthermore, patients may confabulate only in the early stages of amnesia and then settle into a chronic state of profound amnesia with little or no apparent confabulation. Although confabulation is sometimes assumed to be a defining symptom of the Korsakoff syndrome, a number of investigators have pointed out that confabulation does not invariably occur in Korsakoff patients, and when it does it often is a transient component of an acute phase of the disease (Talland, 1961). Another problem with the idea of confabulation as a natural process of gap filling is that many amnesics readily admit to the gaps in their memory and do not appear to be compelled to fill them in. Finally, additional evidence regarding the dissociation of amnesia and confabulation comes from cases in which confabulation is found in the absence of marked amnesia. For example, Whitty and Lewin (1957) studied a group of patients who had undergone anterior cingulectomy for treatment of severe obsessional neurosis. This operation resulted in a striking tendency of patients to spontaneously confabulate, but they otherwise had clarity of consciousness, orientation for place and person, and awareness of the operation. Although some patients showed minor disorientation of time and misplacement of events, they did not have marked memory deficits. Thus, overall, it appears that amnesia and confabulation have different substrates (Stuss et al., 1978).

Although confabulation and amnesia may be distinct phenomena, at a more general level confabulation is itself a type of memory disorder. Confabulation is a failure of reality monitoring, and reality monitoring is a memory function, just as recall and recognition are memory functions (Johnson and Raye, 1981). Although we may want to reserve the term "amnesia" for a particular form of memory disorder, confabulation represents a memory disorder as well. The fact that the memory system can be disordered in the particular way we call confabulation provides evidence regarding normally functioning aspects of the complex, integrated cognitive system of memory.

Confabulation and Awareness

Another interesting issue is whether confabulating patients are aware that they do so. Although a striking feature of confabulation is that patients typically do not realize the absurdity or erroneous nature of their comments (Joseph, 1986), sometimes awareness accompanies or, rather, follows closely on the heels of confabulation. Most of Whitty and Lewin's (1957, 1960) cingulectomy patients were aware that they confabulated, and some of them actually described themselves as having difficulty discriminating fact from fantasy and dreams. ("My thoughts seem to be out of control, they go off on their own—so vivid. I am not sure half the time if I just thought it or it really happened,"—Whitty and Lewin, 1957, p. 73.) Furthermore, on occasion they corrected themselves without prompting, ("I have been having tea with my wife. . . . Oh, I haven't really. She's not been here today,"—Whitty and Lewin, 1957, p. 73.) Such observations provide some clues not only about the mechanisms of reality monitoring but about the nature of awareness.

According to the present view, awareness of confabulation arises as a natural outcome of normally functioning reality monitoring processes. For example, consider a remembered fantasy. The output of R-1 processes assessing the vividness of a memory may indicate that the event really happened. The output of R-2 processes assessing its plausibility may indicate it could not have happened. Awareness of confabulation would arise from the experience of conflict between the output of these two processes. That is, we do not become aware that we are confabulating unless we catch ourselves doing it (or somebody else catches us and we recognize the conflict). Presumably, Whitty and Lewin's cingulectomy patients were aware of their confabulation because R-2 reality monitoring processes that could detect errors from the output of R-1 processes were still intact. If the processes that do the catching break down, so does the awareness. Lack of awareness of confabulation would accompany a more extensive breakdown of reality monitoring processes, in particular perhaps a disruption of R-2 processes.

The more general point is that awareness or consciousness is not a separate system superimposed on other processes; rather, it is the natural outgrowth of certain (but not all) cognitive processes. If a process is disrupted, the awareness it gives rise to is disrupted. Disruptions in awareness can be specific because disruptions in processes can be specific.

Brain Regions Implicated in Confabulation

Available evidence about the brain regions disrupted in confabulating patients provides a reasonably systematic and suggestive picture. The relatively controlled lesions made in anterior cingulectomy patients produce dramatic but temporary confabulation lasting several days (Whitty and Lewin, 1957, 1960). Damage to the basal forebrain region produces confabulation that may last weeks to months (Damasio, Graff-Radford, Eslinger, et al., 1985), and damage to various areas in the frontal lobes produces confabulation that may last months to years (Stuss et al., 1978). Stuss et al. made a persuasive argument for the role of frontal lobe damage in confabulation. They reported five patients with demonstrable frontal lobe lesions who all showed spontaneous, persisting confabulation. At least temporary, and sometimes long-lasting, confabulation is found in Korsakoff patients, who often show prefrontal symptomatology as well as damage to thalamic nuclei that project to prefrontal and anterior cingulate cortex. The fact that confabulators often show perseverative tendencies, difficulty in shifting response sets, and lack of concern about incorrect behavior (all recognized symptoms of frontal damage) suggests frontal involvement.

In sum, disruption of areas immediately adjacent to the frontal lobes produces marked but transient effects. Structural damage to the frontal lobes themselves produces more permanent effects. Thus overall there is a fairly consistent pattern of evidence pointing to confabulation as a potential consequence of disruption of frontal lobe functioning, implicating the frontal lobes in normal reality monitoring processes.

Characteristics of Confabulation and Reality Monitoring Mechanisms

Transient confabulation may be produced by temporary disruption of an intact area either because of loss of some inputs, the presence of unusual inputs, or a metabolic upset that recovers. For example, cingulectomy patients may experience spontaneous activation of information with a high degree of perceptual content. This unusual perceptual input could be a consequence of disruption of reflective processes that normally inhibit access to perceptual entries (e.g., Johnson, 1983) or a consequence of signals from damaged areas that activate cortical areas subserving perceptual information. In either case, the high perceptual value of the information would easily pass the criterion for externally derived information according to the R-1 "fast-guess" reality monitoring judgment process, producing a reality monitoring failure. Alternatively, information activated by signals from a damaged area may not be more vivid perceptually, but it may lack voluntary cognitive operations information, thereby reducing the discriminability between perceived and imagined information. Assuming R-2 processes were still intact, the reality monitoring failures produced by R-1 processes that are most inconsistent with other knowledge (the most bizarre or implausible events) could be corrected with R-2 processes. This corrective process results in awareness of the reality monitoring problem.

Another potential reason confabulation is sometimes temporary is that R-1 and R-2 judgment mechanisms may learn to compensate for disrupted experience or disrupted retrieval either by tightening criteria or invoking R-2 more often. In this case, the patient might experience a period of awareness of confabulation followed by increased ability to withhold confabulated ideas. Thus some patients may not stop having confabulated thoughts but may develop strategies for dealing with them. A person's willingness to claim they remember something is affected by shifts in the criteria used for reality monitoring or shifts in criteria along with metamemory assumptions, and the nature of the criterial shift may be determined by a patient's personality or metamemory beliefs. For example, some amnesics, as they gain insight into their amnesia, may become reluctant to claim they remember something because they do not have the normal ways available for verifying veridicality (e.g., for retrieving additional information). On the other hand, other amnesia patients may react to the same situation by adopting more lax criteria. They might believe, for example, that if they are asked a question and an answer occurs to them, the answer must be correct or otherwise why would they have thought of it? This metamemory assumption would produce a type of reactive confabulation. Assuming that responses would be based on general knowledge or retrieval of fragments of autobiographical experience, most confabulation of this sort would not necessarily be unusual or bizarre. The confabulation seen in Korsakoff patients is often of this type (e.g., Talland, 1961).

Permanent confabulatory tendencies presumably are produced by irreversible damage to structures or mechanisms underlying R-1 or R-2 processes or their interaction. For example, disruption of R-2 processes would result in confabulation whenever particularly compelling but false information passes the R-1 criterion. How frequently this situation occurs should depend on individual differences in the criteria adopted or in the relative richness of memories for perceived and imagined events. Assuming that for most of us, most of the time, reality monitoring largely is a consequence of R-1 processes, the more frequently a patient confabulates, the more we might suspect that the confabulation is a result of unusual informational input (high in perceptual detail or low in cognitive operations), disruption of R-1 processes, or a combination of the two factors. Less frequent but more bizarre confabulations suggest disruption of the R-2 processes.

Of course, memory deficits, superimposed on reality monitoring deficits, compound any reality monitoring problem because patients are not able to remember previous reality monitoring judgments (even if correct) for a particular thought. If these thoughts recur (perhaps because of "priming" processes or more permanent effects of repetition), they may be even more likely to seem to have been initially perceived because of their ease of production. Also, insofar as some reality monitoring processes depend on activation and evaluation of supporting information in memory, anything that disrupts the availability of such information could disrupt reality monitoring.

As we learn more, it should be possible to express observed differences in reality monitoring deficits as specific combinations of disrupted processes (Table 10–1). For example, disrupted experience (e.g., unusually vivid imaginations or reduced intentionality) may underlie the type of confabulation we see in the case of certain drugs, brain stimulation, cingulectomy patients, and Anton's syndrome patients. Disrupted retrieval, especially in combination with lax criteria, could produce filling in of detail and displaced true memories. These sorts of confabulation are not particularly fantastic but are of the reactive type often seen in amnesics, especially Korsakoff patients. Disrupted judgment processes, especially disruption of R-2 processes, would result in less plausible and more fantastic confabulations of the sort characteristic of frontal patients. Various combinations of disruption may produce reality monitoring deficits as people age normally or in delusional patients. Table 10–1 summarizes several working hypotheses about which disrupted functions produce confabulation in various subject groups.

TABLE 10–1 Patterns of Disruption Hypothesized for Various Clinical Syndromes

	Aspect of reality monitoring		
Syndrome	Experience	Retrieval	Judgment
Normal Errors	+	+	+
Cingulectomy	−	+	+
Amnesia	+	−	+
Frontal disorder	+	+	−
Aging	−	−	+
Delusion	−	+	−
Confabulation (with memory deficit)	+	−	−
Global confusion	−	−	−

(+) indicates intact function; (−) indicates disruption in experience, retrieval, or judgment aspect of reality monitoring.

Evaluating such a scheme depends, among other things, on developing a better taxonomy of confabulation based on analyses of patient protocols. A great deal of useful information would result from a systematic and theoretically motivated analysis of the content of confabulations and a specification of conditions under which confabulations of various types are and are not produced. For this purpose, it would be desirable to have more consistency among investigators in the format used to report patients' confabulations. It would also be interesting to have subjective reports from patients about the qualities of their phenomenal experiences while remembering confabulated and actual events as well as while remembering previously imagined events (e.g., Johnson, 1988b). Such studies would give us important sources of converging evidence about the qualitative characteristics of confabulations of various types and etiology.

CONCLUSIONS

Reality monitoring is a fundamental memory function that anchors us in a perceived external world, in a felt past life with an autobiographical quality, and in a network of knowledge and beliefs that we take to be derived from experience in a veridical way. At the same time, reality monitoring produces in us a compelling sense of ownership over our own ideas, fantasies, and hopes. It is only when the boundary between externally derived and internally generated information becomes blurred, as in the case of confabulation or delusions, that we can fully appreciate how central this discrimination is to defining the characteristics of normal mental experience and to functioning effectively in the world.

Reality monitoring is the consequence of the coordinated activity of a number of processes embedded in a complex memory system (MEM). Although some of the components of these processes are shared with other functions (e.g., recall), the facts that reality monitoring deficits can occur in the absence of other memory problems and that other memory problems do not necessarily result in reality monitoring deficits suggest that reality monitoring is based on an identifiable, systematic organization of these components. Furthermore, the pattern of deficits produced by different types of brain damage provides some encouragement for the theoretical account of reality monitoring described here. The evidence is consistent with the idea that reality monitoring involves at least two types of judgment process: One is based on a nondeliberative evaluation of the characteristics of activated information, such as the type and amount of perceptual detail (tentatively identified in MEM as an R-1 function). The other is based on a more deliberate evaluation of the meaningful content of activated information in light of other memories and knowledge (tentatively identified in MEM as an R-2 function). Cingulectomy patients experience reality monitoring failures that appear to be the consequence of errors during the first type of process, produced by either unusually vivid mental experiences or disruption of R-1 judgment processes. Patients with frontal damage who confabulate experience reality monitoring failures that appear to be the consequence of errors during the second type of process, i.e., as a consequence of disruption of R-2 judgment processes. Finally, evidence from brain-damaged patients exhibiting confabulation is consistent in implicating the frontal lobes as critical for normal reality monitoring.

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