

Articles

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The Fractal Nature of the Mystic Chords of Memory? Parallels Between Changes in Personal and Public Memories

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Over the past three decades, psychologists have studied a colorful and common memory phenomenon known as flashbulb memories. These are unusually clear and detailed recollections of the events that surround learning of a surprising and emotionally arousing item of news (Brown & Kulik, 1977). People often hold many flashbulb memories. Some of these memories contain personal information such as hearing of the unexpected death of a parent (Conway, 1995; Luminet & Curci, 2009). Other flashbulb memories concern the news of hearing of an event of national importance such as the assassination of President Kennedy or the Challenger disaster. (Conway, 1995; Lanciano, Curci, & Semin, 2010).

Over the same period of time, historians have studied the phenomenon known as public memory. This field is concerned with evaluating how the past is remembered, understood, and interpreted. For example, the study of public memories could consider what kinds of monuments are erected and how they contribute to the sense of personal, communal, and national identity. The two research traditions have been pursued independently. However, there has been some communication and influence between them, and they often consider the same or similar instances, such as memories for 9/11 (Conway, et.al., 2009; Doss, 2010).

When this occurs, the two traditions study the phenomena at different scales with psychologists largely focusing on the individual level and historians largely concentrating on the societal level. One of the notable features of memory that can be observed in both areas is that memories can change, transform, and become altered over time. In this paper, we explore similarities between the patterns of changes in individuals' autobiographical flashbulb memories, the public memories of society as a whole, and the potential mechanism of memory schemas.

Flashbulb Memories

Previous research examining flashbulb memories report that these recollections are unusually vivid

memories for an individual's everyday life events (Conway, 1995). The memories are believed to be much more resistant to forgetting than typical autobiographical memories. They are triggered by a confluence of variables that are important to memory formation such as personal importance, surprise, consequentiality and distinctiveness (Conway, 1995). The early models of flashbulb memories predicted that once formed, the memories would persist largely unchanged for long periods of time. For instance, one of the authors of this article has a flashbulb memory for the Challenger Disaster that can serve as an exemplar of these memories. He was in graduate school and a classmate asked him as he was descending the stairs if he had heard the news. She was clearly upset and it was clearly bad news. This memory is as clear and vivid as if it had happened yesterday. It has not changed in over a quarter of a century. However, there is some suggestion in the literature that flashbulb memories may not remain accurate or stable over time. Neisser, Rubin, and their colleagues (Neisser, et.al., 1996; Talerico & Rubin, 2003), report that only about a third of the flashbulb memories remained consistent over periods of two to three years. Consideration of this finding served as the starting point for our study.

We examined memories in two groups of college students for the events surrounding the receipt of the news of the launch of Operation Desert Storm in 1991 and the death of Princess Diana in 1997. Students provided an open-ended description cued by the question "What were you doing when you first heard that the United States had invaded Kuwait (or that Princess Diana had died)? Memory probes were collected the day after the event and again 1, 2, 3, 6, 12, 24, and 60 months after the event. The first two memory probes were solicited in class and the remainder were requested by mail or personal contacts. Overall, we collected a response from 115 participants at each time probe.

Flashbulb memory research reports that these accounts tend to contain particular types of information. Brown and Kulik (1977) found that memory accounts frequently include six categories of information: 1) location where the information was learned; 2) ongoing activity; 3) informant; 4) affect displayed by others; 5) own affect; and 6) actions taken after hearing the news. Accounts from the first probe were examined for content using Brown and Kulik's six canonical categories to evaluate what kinds of information were retrieved. Almost all of the participants in this study included accounts of activity (97%), informant (96%), and location (95%). Fewer participants reported own affect (61%), aftermath (53%), and affect in others (41%).

Accounts were examined for consistency within each of the canonical categories across probes. All subsequent probes were compared to the report collected during the first probe. All subsequent accounts were examined to see if the accounts completely agreed, agreed with the gist, or disagreed. Table 1 displays the percentage of memories that completely agree or agree with gist at each probe duration. The percentage gradually declines over time. Most participants reported the same canonical categories of information during each report. In addition, most participants (about two thirds of the participants after two years) continued to report the same or similar kinds of information within each

category at each probe. The specific details included in each category sometimes underwent change. For instance, at the first probe one student reported, “I have a very short memory; I was driving home in my car listening to WMAQ radio after coming out of the Eagle Supermarket and went into a semi-panic about getting drafted. I bought hamburger patties, buns, fish sticks, curly fries, and Diet Sprite, a good decent meal before eating C-Rations.” This account included information about location, ongoing activity, informant, and own affect. This student offered a slightly different report during the one-year probe. “I still remember every single detail, for I’ve been known to have a razor sharp memory. I remember that I got out of my Psychology class and I was going to my Fiancee’s house and it was snowing. I was driving to the Eagle Supermarket where I bought Mrs. Paul’s 18 pack box of fish sticks and Ore-Ida Curley Fries. On the way to the store, I turned on WMAQ radio for an up-date; to my surprise, they were sent in to fight.” The student again reported the location, on-going activity, informant, and own affect. However, the specific details changed. The second report was scored as agreeing with the gist for ongoing activity and affect and the accounts of location and informant completely agree.

Category of Information	Months Since Original Probe						
	1	2	3	6	12	24	60
Informant	85	83	80	72	71	69	69
Activity	85	81	72	71	70	69	67
Location	87	83	75	70	67	66	66
Own Affect	82	77	71	66	62	51	43
Affect in Others	83	61	55	53	51	45	37
Aftermath	81	65	57	52	52	44	35

While most probes produced similar accounts, some subjects (about a third of the participants after

two years) produced remarkably inconsistent accounts. For example, one student reported being at home watching television when her mother told her that Princess Diana had been in a car wreck. She reported that they then turned the television to CNN to watch the coverage. In the follow-up probe, the student reported being at her boyfriend's house studying for an exam when her boyfriend came home and told her. In both of these accounts, location, ongoing activity, and informant were reported. Aftermath disappeared in the second probe and the other three categories of information disagree.

This pattern of results can be described by schema theory. Schema are cognitive structures that individuals use to organize and understand information and to store, maintain, and retrieve memorial information. Everyone holds many schema. For example, students have schemas for what a professor's office would look like and what kinds of activities occur in the office. Most schemas for a faculty office would include tables, chairs, books, computers, and papers. Students will use the schemas to comprehend events occurring in the environment and also to store and retrieve information in memory. Reliance on schemas can sometimes lead to memory errors. People have a tendency to remember details that are consistent with their schema, to forget details that are not consistent, and to create details that are consistent but were not a component of the original event. For example, Brewer and Treyens (1981) asked student research participants to briefly visit a faculty office and then were quizzed on the contents of the office. All of the students correctly recalled tables and chairs. These are consistent with the most common schema. Few students recalled the picnic basket that was on one table. It is not part of a typical office schema. Students also added details. A third of the students recalled seeing books. The office did not have any, but their schemas of an office did. Further, schemas are learned and can change over time. As this happens, the underlying memories can change. Thus, this theory offers the opportunity to predict and account for changes observed in memories.

All of the participants in our study were college students. All commute to school. Many use their cars as a locker and visit the parking lot after class to retrieve books for their next class. Almost all of them work at least part time. They would have possessed schemas common to working college students. They have knowledge structures based around school, work, and a college student's social life. Many of the changes in the memory accounts occur in the direction of the schema that make the memory account more congruent with the schema. The following account illustrates this change.

During the initial probe the student reported, "I had left school early and met two of my friends at the bowling alley. They were drinking beer and playing pool. My boyfriend called and said we had invaded. We asked the bowling alley guy to turn on CNN." At the two month follow-up probe she reported, "I had just left my Psychology class and went to my car in the parking lot to change my books. I turned on the radio and heard the reports. I went back into Moraine and watched it on CNN." This student had a schema of activities for a college student enrolled in Introductory Psychology. The news of Operation Desert Storm broke while students enrolled in that class would have learned the news as they were leaving class. Her memories changed to accommodate that structure. As a result, the

patterns of change observed in these autobiographical memories do not appear to be random. They change systematically as individuals appeal to their schemas to organize, construct, and reconstruct their memories.

Public Memories

Public memories also undergo patterns of change over time. Two examples from the American Revolution can illustrate these changes. The first example concerns the changing image of the Boston Tea Party. Boston during the years leading up to the onset of the Revolution was the center of growing unrest and protest over British policies. The unrest was manifested in a series of street actions involving a broad base of the population of the city including the Stamp Act Riots, the Boston Massacre, a series of instances of tarring and feathering, and the Boston Tea Party. Of all of these, the Boston Tea Party was the most radical and subversive. It clearly occurred outside of the established legal, political, and governmental systems and it involved participation and leadership from the working classes in colonial America. As such, it occurred well outside of the control of either the British or Colonial establishments, and both characterized it as a mob action. Further, its aim was the destruction of private property. In spite of the radical and subversive aspects of the action, it has become an iconic moment in the nation's fight for independence (Young, 1999).

The apotheosis of this event could only occur after the memories for the event had changed. The action was not discussed as one of the important precursors to the war until deep into the nineteenth century. At the time of the Revolution and in the decades subsequent, the dominant political schema placed a high value on leadership from the elites and a strong fear of mob action and radical thought. Only property owners could participate in the political system. The schema began to change during the Jacksonian Era. Most states dropped the landholding requirement for voting and office holding and efforts were made to encourage a broader participation in government. Under this milieu, it was safer to recognize the contribution of the participants of a street action such as the Tea Party (Young, 1999).

Immediately after its occurrence, protest leaders such as John Adams reported that they were chagrined by the mob action. Later, memories changed to incorporate the political elite into the leadership of the action. Even surviving participants in the action began to recall working alongside revolutionary leaders such as John Hancock. Even the name of the event has changed. After the event, it was known as the destruction of the tea. It received its current name over fifty years after the event. The name "Tea Party" provides a somewhat comical and frivolous tone to the event that places the event in the context of a parody. Thus, the common man could be recognized as contributing to the war, but only in a safer context than the original (Young, 1999).

The second example of changing public memories can be observed in the changing public image of the Battles of Lexington and Concord. These battles are generally considered to be the first military engagements of the American Revolution. Depositions were taken from participants immediately after

the battles. The initial description reported that 70 to 80 colonial militia members assembled in parade formation on the Lexington Green. They were not blocking the road to Concord and were not prepared for an engagement. They were met by a British force of 700. There was confusion over who fired first, but all reports agree that the militia were not able to return fire. Later in the day, the British forces met colonial militia that were able to exchange fire (Fischer, 1994).

According to the prevailing political milieu, it was important to the colonists that the confrontation was provoked by the British and that the Americans were innocent victims. The reports were consistent with that image. Later on, the schema changed. The minutemen evolved into the cultural icon of a native born American responding at a moment's notice to defend his and his neighbors' homes, land, livelihood, and freedom from tyranny and against despots. In this schema, it is important that the militia were able to engage the British. Fifty years after the engagement, the common account of the battle in Lexington included reports of returned fire and the number of militia members engaged had increased. Interestingly, the memories of the surviving militia members had also changed. By 1825, they could clearly remember that they stood their ground and fired until overwhelmed (Fischer, 1994).

Fractals

Flashbulb memories and other kinds of autobiographical memories have been studied extensively over the past several decades. It is clear that the contents of memories can change, sometimes dramatically, over time and that many of the changes obey predictions of schema theory. Public memory also changes over time. It is proposed that these changes may also be described by schema theory. This similarity should be expected. Scientists studying non-linear dynamical systems find that many phenomena are describable as having a fractal nature.

Two of the primary characteristics of a fractal are self-organization and a self-similar-pattern of organization at multiple levels or scales. A common example is that of a mountain. The overall shape is of a large triangle or cone-shaped mass rising from the surrounding country-side. Thus, it has an overall shape or organization. However, the surface of the mountain is not smooth. Rather, it has a great deal of texture and that texture obeys the same organization. There are many smaller peaks that arise from the side of the mountain. If you examine a smaller peak, it too has smaller cones on its surface and so on. There are peaks and valleys at innumerable levels of scale extending all the way down to the microscopic level. The same kinds of self-similar patterns of organization can be observed in many physical phenomena including waves, sand dunes, and fern leaves (Falconer, 2003).

Over the past 20 years, researchers in Psychology have found evidence of fractal organization across a broad range of psychological phenomena including social dynamics and visual memory (Clayton & Frey, 1996; Sulis & Trofimova, 2000). Hoyert (1992) reported a clear case of self-similar organization with an example of temporally coordinated behavior. The pattern of responding obeyed the same

structure and organization at short (a few seconds), medium (a few minutes), and long (a few days) time scales. At the shortest time scales, clusters of responses appeared that were separated by pausing. At the longest durations, periods of higher rates of responding tended to be clumped together and epochs of lower rates of responding (more pausing) tended to occur close together.

Human memory has been found to follow the same organization and processes at different temporal scales such as short-term and long-term memories (Cowan, 2008). In the present analysis, it appears possible that individual memories and public memories are obeying a self-similar pattern of organization at different levels. At the smallest level, individuals are retrieving accounts of personal experiences over a period of a few months to a few years and some of those accounts have undergone systematic patterns of change that could be described by schema theory. At the largest level, we can observe that the memories of whole groups of people who were not directly involved in a particular historical event change over a period of decades. Again these distortions seem to have been systematic and predictable on the basis of changing schemata. Thus, this appears to be another phenomenon in which a similar pattern of organization appears at multiple levels. Thinking of memory as having a fractal nature might aid both the psychological research and the historical research traditions gain insight into levels of organization and common mechanisms.

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