

Organizational Memory: Processes, Boundary Objects, and Trajectories

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Abstract

The term organizational memory is due for an overhaul. Memory appears to be everywhere in organizations; yet, the term has been limited to only a few uses. Based on an ethnographic study of a telephone hotline group, this paper presents a micro-level, distributed cognition analysis of two hotline calls, the work activity surrounding the calls, and the memory used in the work activity. We find a number of interesting theoretical concepts that are useful in further describing and analyzing organizational memory.

1. Introduction

After nearly ten years of research, the term *organizational memory* has become overworked and confused. It is time for a re-examination. The term is burdened with the practical wish to reuse organizational experience, leading researchers to ignore critical functions of an organization's memory and consider only some forms of augmenting memory.

We wish to step back and reexamine organizational memory. Accordingly, in this paper, we are primarily interested in exploring where memory exists currently within an organizational setting, rather than focusing on particular or potential technical enhancements.

Based on an ethnographic field study, we examine memory within an organizational setting. We believe that a descriptive examination that allows both a micro-scale analysis along with a theoretical development will be most useful. Accordingly, we have necessarily restricted our examination to a very small scale of operation because of the detail required. To do this we present a micro-level analysis of a telephone helpline for personnel issues, a particularly useful domain for studying organizational memory.

Our goal is to construct a theory of the middle for organizational memory, finding appropriate theoretical

constructions (e.g., [21], ch. 25). We approach this problem from distributed cognition theory [7, 10, 13, 14], described below, because its theoretical language spans the diverse manifestations of organizational memory – from private to public and small scale to large. Based in cognitive science's concern about cognitive states and in anthropology's emphases in social details and fluidity, distributed cognition theory serves as a useful conceptual framework for the analysis of conversational and social detail.

The paper begins with a brief synopsis of the organizational memory literature and its need for empirically-based analyses of organizational memory. The next section provides a brief overview of distributed cognition theory; unfortunately, the theory is too complex to present in full. We follow this with a description of the field site and ethnographic data collection.

These introductory sections will be followed with a detailed analysis of several hotline calls, progressively describing each call, the work activity surrounding the call, and the memory used in the work activity. The paper concludes with general implications for organizational memory research.

2. Organizational memory

The organizational memory literature holds many varying, and occasionally competing, definitions. Little, however, rests on empirical examinations of organizational memory within a context of use, even though there have been repeated calls for these types of studies. Walsh and Ungson [23], for example, note that:

Despite the general use of the term organizational memory, it is not clear that we have understood the concept or its implications for the management of organizations. (pp. 84-85)

Indeed, while Walsh and Ungson do distinguish a number of general components of organizational memory,

their paper is not empirical. Nor does it cite any empirical studies.

Generally, the other papers theorizing about organizational memory also theorize at a very grand scale, not relying on empirical data. Huber [8] argues that organizational learning and memory support would be useful, but the paper does not distinguish clearly what constitutes organizational memory. Stein and Zwass [20], while acknowledging the need for empirical studies, nonetheless rely on a model of the organization at a grand scale. Smith [18] uses a similar model.

Most studies of organizational memory have largely focused on the technology systems designed to replace human and paper-based memory systems. Many of these studies (e.g., [1], [12], [5]) have examined memory systems in use, but the studies have been limited. They often rely on narrow definitions of organizational memory or organizational tasks. More importantly, the studies have been limited to particular systems, and these systems are often prototypes.

The lack of empirical examinations of organizational memory is unfortunate. The need for systematic work to examine organizational memory is even more pressing than for many other organizational concepts. Organizational memory as a concept lends itself to a number of theoretical problems. Basing organizational memory, for example, in cognitive science's physical-symbol-system model (also called the information processing model) corrupts the metaphor as we move to groups and organizations. Organizations are hardly a single, unified entity, as the metaphor implies. Furthermore, organizational memory, as a collective function, must also be socially constructed, maintained, and driven.

Nonetheless, we do not argue for abandoning or ignoring organizational memory as a concept. Despite the conceptual problems, there is something arresting about the idea. As Bannon and Kuutti [4] state:

...that such a concept is appealed to across a wide range of studies, even if its definition is disputed, is testimony to the fact that even if people cannot agree on what exactly the term means, there must be some set of issues that can be subsumed under its umbrella that people feel are important and worth discussing. (pp. 156-157)

However, as we argued above, organizational memory as a theoretical concept must result initially from studies within an organizational field setting; that is, within a context of everyday use. With such a basis, system construction can be instituted upon these empirically-determined insights – instead of just building systems blindly.

This study is one such empirical examination. It is based in a field study within an organizational setting. In

the next section we introduce distributed cognition theory, why we think it is useful, and outline how to go about an analysis that includes individuals, technology and small-scale social activities and arrangements.

3. Distributed cognition

Distributed cognition theory provides a theoretical basis to examine how all the components of an organizational memory work in concert. This is possible because its theoretical language can equally describe the role of artifacts, individuals, and social phenomena.

A second advantage of distributed cognition, to be drawn upon below, is its commitment to a unit of analysis defined in relation to the complex phenomena being observed. As Hutchins shows in *Cognition in the Wild* [10], the information processing in a navigation team varies with the context and circumstances. Solo watch standing involves the interaction of one individual with various artifacts, structured via well-established procedures and routines. In contrast, the high tempo activity of entering a harbor requires the effort of several people, again in coordination with specialized tools and with each other. While the overall "intelligent behavior" exhibited by the system is the same, the means change.

A distributed cognition analysis begins by examining a functional system as a cognitive system. As with other cognitive theories, distributed cognition identifies the observed informational inputs entering, as well as those outputs leaving, a system. Inside the system the focus is about how the information is represented, and how these representations are transformed, combined and propagated through that system in order to produce the system's observable behavior [17]. It is the detailing of representational states and processes that helps the analyst to understand much of the system processing as it involves transitions between humans and artifacts. One records the representational state, the material media on which it is instantiated, as well as the processes that transform it.

Then for a distributed cognition analysis, the first task is to identify how the functional system in question works – in particular looking for exceptional cases in addition to routine operations [14]. Functional operation is decomposed into smaller units of analysis that make sense with respect to the particular task undertaken in the system. In some cases this may be based on task accomplishment, while other systems may call for a more event driven segmentation.

Once these smaller units are identified, each is observed and their representational states and accompanying processes are detailed. The common breakdown into representational states and processes provides the way to analyze how the observed details achieve the particular function that is the focus of a unit

of analysis. This presents artifacts, human actors, and organizational and social structures on an equal theoretical footing. With a description constructed in these terms we can begin to understand how technologies *and* social structures currently fit a system's operation.

Once analyzed into its component representational states and processes, the analyst uses that information to reconstruct the functioning of the system. This allows an analysis with respect to the context of use within an organization. By extension one can speculate about how changes in technologies might affect future operations. We believe that looking at the phenomena of organizational memory is well supported by taking this essentially cognitive view of a system, and in our interpretation, giving it a certain social twist. Before discussing how distributed cognition can be applied to a specific organizational memory, however, we must first present the details of the field setting.

4. Setting and data collection

This study is based on field observations of a telephone hotline group (called HLG here) at a well-established company, CyberCorp, headquartered in Silicon Valley.

HLG answers human resource questions for CyberCorp, primarily about benefits and personnel policies for the company's thousands of employees. In general, telephone hotlines are of interest in the study of organizational memory, largely because they are so information intensive. HLG agents have to start forming their answer within 45 to 60 seconds while simultaneously listening to the caller's elaborations and information. Many answers came directly from the hotline member's memory; hotline questions tend to be repetitive. There is also a great need for additional information sources: Facts must be double-checked, new questions arise, and answers become obsolete with new conditions.

The field study took place over a period of 18 months. A variety of data collection methods were used, including direct observation, video, semi-structured interviews, and social network analyses. Here we describe and analyze the responses to two calls captured on video. Both calls involve Joan¹. Joan was an experienced agent, having been at CyberCorp for five years and at HLG for one year.

Because of privacy reasons, only one side of the conversations was taped. Joan, however, described each call fully to the camera. (Moreover, we are concerned here with Joan's actions, rather than the intent of the

caller.) Throughout, Joan appeared to be natural and relaxed.

Joan, like the other agents, work in cubicles that are open to a central corridor (figure 1). Like many control room settings (e.g., [16]), the cubicles are close enough to easily hear the activities of other agents. Her chair faces away from the corridor between the cubicles. This arrangement is important for accomplishing her work.

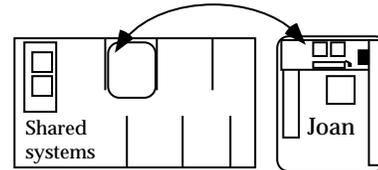


Figure 1: Joan's workplace. The left-hand portion shows how the cubicles are related to each other, as well as the shared terminals. The right is a larger picture of Joan's office.

Each agent has two monitors, where she uses a number of software packages. The telephone to the right of her monitors is another computational system that plays a role in the work. These computational systems and software will be discussed at length below.

4.1. Applying distributed cognition to HLG

Like other functional human system, HLG has the property that many of the system properties are directly observable. We can bound the portion of the system to be analyzed, based on the observed function and initially its temporal limits. Within this unit we expose information about the task, its resources, and organization.

In the case of HLG, the cognitive system's purpose is to answer or solve the caller's problem. The caller can be seen as the input to this system, and her question is a representational state traveling via the material media of the phone to one of the HLG agents. For each call the unit of consideration may vary. We might initially *bound* the system to include the caller, Joan, the telephone, and other materials (or *resources*) available to Joan. While her use of the telephone is an indicator of where the process is occurring, it does not completely define the limits of the task. In general, physical, resource, and temporal limits bound the functional system observed at any point in time.

In the case of HLG, a distributed cognition analysis shows how the work of the system is organized and reorganized to meet changing needs. A plethora of information is available in HLG. In some cases the required information is easily accessible, while in others it must be located or uncovered. In any case, information must be monitored, managed, and communicated in order

¹All participants and their individual attributes have been disguised for publication.

to do the job. The details of this information use form the basis for our description and analysis.

In the remainder of the paper we will present the analysis itself. We present the analysis of two HLG telephone calls. (We observed at least 300 calls, taped approximately 60, and chose 10 for analysis in a manner similar to [9] and [7].) Both of the calls presented here are necessarily simple. Space limitations prevent us from presenting longer calls, but more importantly, even simple calls turn out to be surprisingly complex and rich when fully analyzed. It is, indeed, in these simple calls that the organization and function of organizational memory can be best mapped.

5. A mundane task: verifying a database entry

Below is the first HLG call. We intersperse portions of the transcript with our analysis, as is common in ethnographic description.

In this call, Joan performs an "employment verification". A caller (for example, a mortgage lender) wishes to determine whether a person is actually an employee of CyberCorp, and has called HLG for this information. The employment verification is one of the most common and simplest procedures that HLG does, although it can be relatively time-consuming. We picked this as the first example because it is so simple.

In order to determine whether the person is actually an employee and to determine their job classification, the agent must look up the person in a separate database. Because of technical incompatibilities, the database must be accessed on a separate terminal. There is one of these terminals for all of the agents, and it is located relatively close, about three meters from Joan's desk. The agent, then, must disconnect her headset from the phone, walk to this central table with two VT100-type terminals, go to the proper one and look up the person on the EMPLOY system.

Previously, the agent printed out the information and mailed it to the requester, requiring a pleasant trip to the printer and the chance to talk to colleagues. (When we began the study, there was a bowl of candy or some other food next to the printer, an indication of how central the printer was to the group's social activity.) Later, the process was changed so that the agent printed the document for the secretary to send. Two weeks before the videotaping, the process was again changed. Employment verification calls were routed to the secretary for handling, and written verification was no longer provided. On the day of the video, the secretary was unavailable, and the agents were again providing this service. Thus, this exchange was quite familiar.

5.1. Answering the phone

The first three turns of this call are routine, but even so they demonstrate critical aspects of the organization's memory. Turn 1 begins the call with a standard opening [6]. It consists of Joan greeting the caller, and acknowledging that the caller was forced to hold for some period of time. The telephone system automatically routed a call to her as soon as she finished the previous call, but the caller had been forced to wait for an available agent. Turn 2 acknowledges the caller's request, in this case an employment verification.

1	HR Hotline. This is Joan, thanks for holding...
2	I can do that.

Turn 3 is more complex, as Joan does several things simultaneously. She starts a new call-tracking record in the CAT (Call Tracking) system for the new call, closing out the old one that she had not quite finished. She also asks for the relevant information, namely the employee's name and social security. As she is hearing this information from the caller, she is also typing the information into the call-tracking record. When she is finished obtaining these two pieces of information, she asks the caller to hold, knowing that this will take a minute or two to look up.

3	Hold one moment.... (Joan closes her old CAT record, and starts a new CAT record.) I just need to get, to get a little more information. M...A...N...D...E...L? (Joan types name as she is
3	sounding the letters.) Do you have a social security number? (She types the social security number as she listens.) Okay, hold on, please

5.2. Determining the answer

After a quick aside to the camera explaining her action, Joan writes down the information that she just typed onto a piece of scrap paper. At the same time, she restarts a conversation with Lisa, another HLG agent, about a case. The caller in this side exchange has had problems with the health insurance that one can obtain after being laid off. (The law that requires the continuation of health benefits in the US is called COBRA. This case will be discussed later in the paper.)

At the end of turn 5, Joan goes to the EMPLOY terminal, which is physically behind her cubicle. (As

mentioned, there are separate terminals for two different employee databases, and part of Joan's routine is selecting the correct database.) She types, looking at the piece of scrap paper, and pulls up the appropriate record.

As she is talking, she is typing the keys into the EMPLOY system, a personnel database program. Despite a few exchanges, the situation with the COBRA caller is too complex to finish shortly. Agents are under time pressure to finish calls quickly, since this is measured. Lisa therefore asks Joan to wait until later or at least until after her present call is complete.

Finally, Joan obtains the information in the EMPLOY database, double-checks it, and writes down the result.

4	(Joan disconnects the telephone) [to observer] I'll go check the system for employment verification. (She reaches over to her left to get a piece of paper and then writes the social security number down.)
5	[more familiar tone] Oh yeah, you did Lisa. This poor COBRA man.
6	(Joan walks to the EMPLOY terminal.) Well, you know, for one thing, he's so freaked he's going to get dropped.
7	(Typing, standing up at EMPLOY) <inaudible exchange>
8	[waves hands as if to indicate there is more] I'll tell you.
9	(Types at EMPLOY keyboard, points at screen, then writes on the piece of paper, looking at the screen).

5.3. A not-so-simple case of distributed memory

...it is possible to identify a number of cognitive systems, some subsuming others. ...Each system produces identifiable cognitive properties, and in each case the properties of the system are explained by reference to processes that transform states inside the system. ([10], p. 373)

We pause here to discuss some considerations that arise from a distributed cognition analysis. Even by turn 9, Joan has used both processes and artifacts that are considered memories. She used two separate software systems, a telephone system, and scratch paper, all of which maintain state for Joan. In her execution Joan does not use monolithic memory, as a strictly technocentric model would have it. Instead, she uses many small and apparently redundant memories.

The flow of information in the call is shown in figure 2. This is a straightforward piece of cognitive processing; it consists largely of transferring information from memory to memory. It is a very structured process, where any variation is in the caller's response (although Joan attempts to structure the responses through standard conversational routines). Skill is required in knowing which memories to create and trigger, but little processing is done on the actual information.

As mentioned, the call is initiated by the telephone system's short-term memory of the group's activity. The telephone system, showing Joan's station to be free, routes the call to her. Joan then hears the caller's information, holds it ready using working memory and types that information into the CAT record. (Joan's working memory bridges gaps between virtually all of the other technologies used for this call. For brevity subsequent uses of Joan's working memory are omitted here and in figure 2, but they are critical to understanding what to do with the technology.)

Joan then takes the information in CAT and reproduces it onto a piece of paper, which is a mobile form of memory. She appears not trust to her own memory, but resorts to something reconstructible. She then types the information from the paper into the EMPLOY system. EMPLOY is a typical type of organizational memory, a corporate database with employee records. Joan places the EMPLOY output onto the paper again in turn 9. Later in the call, she will provide the information to the caller, index the call for her call-tracking system, and change the telephone system's state.

Although figure 2 presents the flow of representations as an individual process, there are actually multiple group and organizational processes occurring simultaneously. Joan's employee verification process is *simultaneously embedded* within several other processes. Joan uses CAT, the call-tracking system, seemingly as a short-term memory aid. Its major use, however, is to provide other agents with the ability to reconstruct the history of a caller's problem. (Although it is unlikely to be so invoked for an employment verification, this is its typical use. Since Joan knew, from her experience, that no one was likely to consult the record again, she did not provide many details about the call. But see the situation in the subsequent call.) In addition to maintaining group memory, however, the CAT program also creates transformed, longer-term memory in the form of statistics, based on the indexing done by the agent during her wrap-up period. These statistics are used by management to govern the group's future behavior, as has been typical in organizations since the late nineteenth century [24, 25].

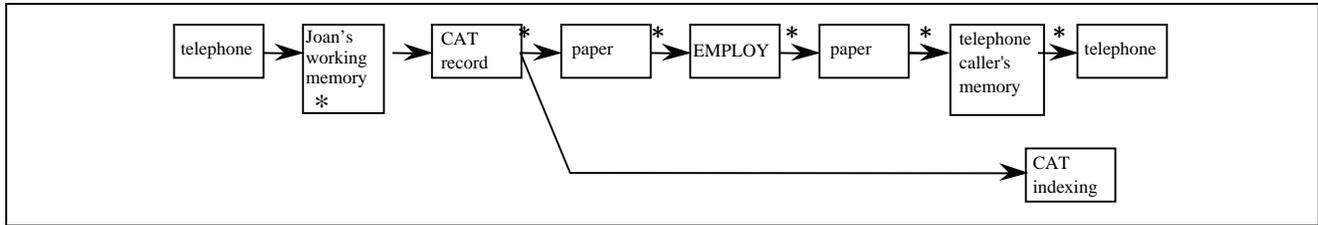


Figure 2. The various media supporting the flow of cognitive processing across the employee verification process. An asterisk indicates that Joan's working memory is also a factor.

Employee verification is also embedded in a call-handling procedure, governed by the telephone system. The telephone system paces the production of the group and routes callers to group members. In this, it is also a form of short-term group memory; it embeds a group memory about the form of the call-handling procedure. It is also used to create longer-term statistics.

To recap, even within these three turns, Joan uses many discrete memories [20, 23]. The memories have *mixed province*: Sometimes the memory used is individual and private; sometimes it is group and public. But all of these memories must be used together seamlessly (or nearly so) to create an organizational product (the product being not only the solution to the call but all of the institutional arrangements surrounding it). The density and connectedness of memories used as resources in this environment is remarkable.

The call, of course, continues past Joan's finding the employee's record. Next Joan must provide the answer in a way that satisfies both her and the caller's organizations.

5.4. Giving the answer to the caller

In turn 10, Joan returns to her seat and goes through her standard re-opening of a conversation. She then provides the caller with the required information, which is the start date for the person's employment indicating that the person is actually an employee. She provides the date slowly, presumably because she knows the caller is writing her answer down. The caller then requests the person's job classification. Joan normally provides this information; the caller merely asks before she can provide it. The job classification is used by some organizations to double-check the person's mortgage or credit application. At the same time that Joan provides this information, she also indicates that she cannot be questioned further about it.

After an attempt to end the conversation in turn 12, Joan provides her name in turns 13 and 14. She provides her own job classification in turn 15, and the conversation ends in turn 16.

10	(Joan returns to cubicle and reconnects to her telephone.) Thanks for holding on. (Looks at paper) What I have for this employee is a hire date of 9...2...4...90.
11	Well, what it shows is drafter, C...A...D, space, A. I don't know what it means, but that's what it says (slight laugh).
12	Okay, well done.
13	My name is Joan.
14	Jameson, J...A...M...E...S...O...N
15	[Questioning, hesitant] I'm an HR representative.
16	You're welcome, (fading) bye.

After hanging up, she signals to the telephone system that she is finished with the call. The telephone system then gives her a maximum of five minutes to "wrap up". As is usual, she goes through the indexing of the call within the call-tracking system. This takes only a moment; she uses the extra time between calls to handle backlogged tasks from earlier "problem calls."

5.5. Memories as boundary objects

The application of these abilities must be "organized" in the sense that the work done by each component ability must be coordinated with that done by others. ([10], p. 154)

We showed above how Joan's processing was dependent on many small memories, including her own. However, solving a problem may not be dependent solely on an individual's cognition and the artifacts (memory or otherwise) within the environment. Turns 10 through 16 show how Joan's work and the work of the caller are socially organized, as well as the role of memory in that organizing.

First, Joan and HLG are dependent on another organizational group to maintain the database used to verify an employee's benefits. Considering the call more broadly demonstrates the important set of organizing

arrangements required to fully process this information [10]. For example, there are a set of arrangements to imbue and inscribe the memory with authenticity and veracity [3]. The HLG agent relies on the payroll group for the correctness of the information, when they create and maintain an employee record.

This employee record serves as a *boundary object* [11, 19]. While the representation is the same, the meaning changes along with its users [7, 10, 15]. Joan knows none of the details of the record's creation or maintenance; almost all of the context has been lost. She does not know whether there are problems with the employee's employment or whether there are extenuating circumstances. Indeed, she merely assumes that the EMPLOY database is "good enough" for this organizational process. (Interestingly, the EMPLOY database is midway between two other databases in its correctness. There is an authoritatively correct database maintained by the payroll group; it is used for benefits questions. However, it does not provide all of the job information required in turns 10 and 11. There is also an on-line employee phonebook. However, the phonebook is not always up-to-date; CyberCorp's operators, who do not need to be authoritatively correct and complete, maintain it.)

Second, Joan is providing another organization with information for its memory. The "fact" of an employee verification is now being incorporated into the outside organization's memory, and again the memory serves as a boundary object. Contextual information is necessarily lost. The external agent relies on HLG to be correct, and the external agent is therefore relieved of any necessity of understanding CyberCorp's internal memories. This relief assumes that Joan, as organizational representative, will perform the task correctly. Presumably the information provided in turns 10 through 12 (i.e., Joan's name and position) are needed by the second organization to verify the accuracy of this new information for its memory; yet, this information hardly constitutes verifiability. The process basically exists upon mutual trust sanctioned by the social arrangements surrounding the process and its memory.

As representational state moves between individuals, inter-organizational and intra-organizational boundaries it must necessarily lose some of its context. As Star [19] points out, boundary objects in an organization work because they necessarily contain sufficient detail to be understandable by both parties, but at the same time, neither party understands the full context of use by the other. This requires the information will be decontextualized as it passes the boundary. This decontextualization, and perhaps commodification, must be expected by those that will try to use the memory.

To reuse a memory, the user must then *recontextualize* that information. The information, if not supplied by the

same individual, must be reunderstood for the user's current purposes. Hutchins [10] shows that there are compelling organizational reasons for why flexibility in recontextualizing is a good thing. For example, it supports use of the same objects as learning opportunities at different times and places in an organization. Elsewhere we have written about the decontextualization problem with organizational memory systems [2], but the call shows that a difficulty, even if not outright inability, in recontextualization, would make the memory useless or nearly so.

5.6. Memories as processes

To summarize, we described an employee verification, one of the simplest procedures that HLG performs. Yet, this simple procedure exposed a number of interesting aspects of organizational memory. The procedure involved nine different *memories*, and the human agent involved either translated among representational states or reconstructed memory states. We also noted that this process was *simultaneously embedded* within several short-term and long-term memory processes (such as the formation of suitable group statistics and a call-history).

Perhaps most importantly, memories had *mixed province*. They were sometimes the province of the individual (e.g., Joan's scratch notes) or the group (e.g., the call-handling procedure embedded in the telephone system). But, often enough, the memory that served Joan as individual memory also had a definition as a group and even an organizational memory. The call-tracking record, for example, was used by Joan to aid her short-term memory, by the group to reconstruct a call-history, and by the organization to monitor the activities of the group.

We also noted the importance of *boundary objects* and *recontextualization* on the part of the user in this analysis. In this verification call, the boundary object was standardized and recontextualization was straightforward. Both Joan and the caller do not expect there to be exceptions or breakdowns in the process. In the next situation, however, Joan must deal with an exceptional call, one that clearly involves breakdowns. This next situation more clearly delineates what we see as the critical issues in recontextualization, namely those of trajectories and their projected consequences.

6. Re-reading the record

The second situation (below) involves re-reading a previously created call record. The situation spans a number of hours, and we present only portions of the transcript here for space reasons.

The "COBRA man", as Joan labels him in the previous call, had called earlier in the day, checking his coverage. As mentioned, in the US companies are required to

provide medical insurance for laid-off employees for one year. The law is called COBRA, and at CyberCorp the medical insurance was called “COBRA benefits” or simply “COBRA”. For the ex-employee to obtain his COBRA benefits, he had to periodically send in checks to CyberCorp. The ex-employee called to determine whether his current check had been received, because he had already had a problem with an earlier payment. The CyberCorp record, a spreadsheet, did not show his current payment. The ex-employee then pointed out to Joan that this had happened before, and at the time, he had been found to be fully paid. He therefore asked whether this could have happened again. Joan said she would investigate.

As part of her investigation, Joan looked at the earlier CAT records for this ex-employee. As mentioned, the CAT system allows an agent to pull up previous call records for a caller. Generally, this was used as a group memory of previous calls on a problem. Occasionally, the CAT records were used across problems to consider the history of a caller, especially one with an organizationally problematic situation. For example, one such call involved a caller who was trying to cage an extension to his short-term disability. In the COBRA call, Joan tried to use the previous CAT records to shed some light on his reliability and his current problem. Unfortunately, the earlier CAT records were not sufficiently complete – the ex-employee was providing details that were not in the record.

In the following exchange, Joan double-checks with Lisa about one of the calls, one that occurred three months earlier. Because of the conversation’s length, we include only excerpts here.

Joan begins by restarting the COBRA conversation as Lisa is about to leave for the day; this was slightly over an hour after the verification call. Joan briefly describes the situation and what she can reconstruct of the previous call. Lisa initially says rather sharply that she remembers nothing of the call. Nonetheless, in turn 4 she offers to look at the call record, and by turn 8, she is engaged in the problem.

7	Joan	I’ve got the calls. There are like four COBRA calls, so I’ve got the, uh, ..., uh the serial numbers.
8	Lisa	Give me mine. (helpfully) It might ring a bell.

While Lisa reads her record, Joan provides a description of the caller’s state-of-mind. Lisa’s actions cannot be determined from the video, but during this period, there are conversational cues that she is reading her CAT record. She does not provide any cues that she

remembers very much, if anything. Joan continues to describe the ex-employee’s comments:

21	Joan	And, you know, the feeling that nothing is happening for him. So he says, so, what if I get hit by a truck when I go outside and I don’t have coverage? What’s going to happen to me?
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The description in turn 21 seems to trigger Lisa’s recollection. As the recollection continues in turns 26 through 38, Joan and Lisa show many conversational signs, such as overlapping speech, that they are now acting in concert. (In the following, the slashes \ / and / \ indicate overlapping conversational areas on the tape; a = sign indicates that there was no appreciable pause between two words.)

In turns 26 through 34, Lisa provides the memory that a person from the Benefits group came down to Lisa’s cubicle with the ex-employee’s file. Together they determined that there had been an error: The payment had been logged incorrectly. (There is a hint in turn 28’s intonation that the Benefits person might have brought the file down with the intention of proving the ex-employee wrong, but had been proven mistaken herself by Lisa.)

26	Lisa	\I actually do remember that./ I remember she had his file. She brought it down= =
27	Joan	(agreeing) =mm-hm
28	Lisa	and she went (quickly, mock tone) oops (normal voice), it got logged wrong. He is paid.
29	Joan	Okay.
30	Lisa	Yeah it was our error..
31	Joan	Yeah.
32	Lisa	Not ours, but it’s their error in logging it. They didn’t log it in..
33	Joan	Well... (Joan starts to put away a cup on her desk)
34	Lisa	When they received it.
35	Joan	I’m going to go ahead and...and do the escalation. I didn’t think that you’d have any impact to the call. That’s fine. I was just wondering because he’s said= =

36	Lisa	=I know that CyberCorp had made an error there
37	Joan	/Um, okay\
38	Lisa	\At the ti/me

Joan declares in turn 35 that she will go ahead and send the problem on to Benefits as an “escalation”. Organizationally, the HLG is dependent on other groups to handle more complicated or complex situations; these are called escalations. Escalations were problematic organizationally because there is a fine line between taking action inappropriately or incorrectly and between wasting the other group’s time. In fact, there was a fair amount of tension between the Benefits group and HLG. HLG felt that Benefits looked down on them for not knowing the Human Resources (HR) subject area sufficiently, and HLG agents wished to be regarded as professionals. Indeed, HLG perceived themselves as the future of the HR profession, as did the CyberCorp management. But this was a future unwanted by most of Benefits, since hotline work was perceived by the Benefits professionals as leading to HR deskilling in CyberCorp. Therefore, inappropriate escalations sometimes furthered political tensions. Since escalations were always to some extent problematic, Joan and HLG felt the necessity to confirm the details of a problem before sending it on to Benefits.

In this exchange, Joan has recovered critical details of the previous call. The ex-employee was providing an accurate account. By checking into the record, Joan determined that he was probably telling the truth about the current situation. More importantly, Joan recovered key contextual information about Benefit’s analysis of the situation. In order to accurately weigh the evidence to be presented in the escalation, the CAT record, being incomplete, needed extraordinary recontextualization.

Of course, if the record had been available only as a decontextualized object, it may have been possible for the escalation to succeed. However, one can easily imagine that extra work (if not the repeat of the diagnostic effort) would have been required by the organization.

6.1. Trajectories and the memory process

...consider the cognitive properties of the team as a whole. ...It is not the case that two or more heads are always better than one. ([10], p. xvi)

Lisa chose to write up a terse CAT record on the previous call, necessitating Joan’s extraordinary recontextualization. Agents wrote very short, terse CAT records when they felt that no one would later need the record. For example, the CAT record for an employee verification might be a single line, if the agent even wrote a record. Employee verifications were not revisited.

In Lisa’s call, she assumed that she should hurry through the write-up. HLG gets rewarded for fast wrap-ups, and avoiding copious notes for all calls is required. The ex-employee’s payment had been found, the logging corrected, and the problem rectified. The *trajectory* of future use appeared to be obvious.

Trajectory [10, 22] describes the path of an event; in this case, we mean it to be the likely trajectory as anticipated. Strauss [22] explains trajectory by using the example from medical diagnosis: The treatment of a fever is dependent on its anticipated trajectory. Treatment of a simple fever for a healthy 25-year-old male is quite different than that for an HIV-positive male. The anticipated trajectory of a situation is often critical to organizational processes and is usually based on trajectories of past experience – what Hutchins calls developmental trajectory. Past experience in the development of the practice, the practitioners and the conduct of the activity affect the present of the activity.

The incentives for keeping memory follow the developmental trajectory, the assumed trajectory, and its *projected consequences*. In this case, Lisa assumed that the call would never be referenced again; she had little incentive to write a complete call record. Joan had to deal with the unanticipated (and perhaps unanticipatable) consequences of Lisa’s projecting the trajectory incorrectly.

One can perhaps see this more clearly in Joan’s escalation of the current problem. She must weigh the event’s trajectory and projected consequences to create a correctly formed escalation.

As mentioned, she must now escalate the problem to the Benefits group; she must therefore create a boundary object. Slightly over 20 minutes after her conversation with Lisa, Joan begins to rewrite the CAT record for the current call; this will also be sent to Benefits as the escalation record. The trajectory is now that the CAT record will be reused as a boundary object for a group with which HLG has had problematic relations; indeed, it may become part of the evidence in any later status conflicts. The anticipated consequence is that Joan’s HLG supervisors and the Benefits group will judge the quality of the record as such an object.

In a lengthy aside to the observer as she prepared the escalation, Joan pointed out the facets of “appropriate” escalation in this case. She tells the camera that she must pick her facts with care, removing extraneous detail (i.e., decontextualizing the actual record), and double-checking any detail that remains. (In the following transcript, [...] indicates that a section of the conversation was removed for space reasons.)

Part of what Joan must do is to lay out the “facts” of the case. Initially, this is what she traces through as she describes the process of creating an escalation. She has

verified that the COBRA man is providing accurate details, and she states this is important.

She [Lisa] did give me good information because, um, he, the employee had told me that he had called before and spoken with Lisa and, um. (pause) The Benefits specialist came down, and said well, I know, he's covered. [...] So that is, uh, something I can put in this call...

She goes on to say that she needs to suggest to Benefits that the ex-employee may be correct.

Lisa's given me information I can share with Sally [a Benefits person] saying, I've spoken to Lisa and she said yeah, it was logged wrong, and you know, you have his file. Is this possible ... that this has happened again, or what is the situation.

So far, she is merely detailing the "facts" as she has uncovered them. However, Joan then continues her comment by explaining why she is spending so much time creating the "appropriate" escalation record. A considerable amount of time is removing extraneous detail from the CAT record.

A lot of this information I just take as I'm writing, as I'm, um, taking the call, and it's not just pertinent information to share with the Benefits folk, but that's, you know, having to go back and just kinda clean up the call before we send it over...as an escalation.

One motivation for her rewriting the record may be to cover any uncertainty or incompetency as the call gets escalated. Some of this is for the welfare of the HLG; this record serves as part of the group's organizational "face". This is compounded by her inexperience with COBRA benefits, as she acknowledges.

Part of the amount of time it takes is really making sure that the information we're sending over is really accurate and ... when there are um, areas, like, I don't live and breathe COBRA information, so what might be important, what I might think is important information, might be nothing to them.

Finally, she points out that a proper escalation, as a boundary object, must have all of these attributes.

One of the supervisors, um, will check and make sure it's accurate information and the call notes are complete. And she'll say did you check, you know, the system, or did you check this out.

As this situation shows, raw CAT records are hardly useful. They can jog an individual's memory, but we saw that Lisa needed additional cues to actually recover her memory. They can serve as a group memory, but Joan could not adequately recontextualize Lisa's record. Finally, the CAT records can serve as boundary objects between groups, but this can take considerable work.

Obviously, not all attempts to reuse CAT records were failures. Most reuse appeared effortless and seamless. This example, however, highlights the everyday work that must be done to make reuse appear effortless in its success. Much of that work involves being able to properly recontextualize a record, given that the person who created it properly understood its later reuse. In other words, later recontextualization succeeds or suffers from earlier assumptions about the record's trajectory.

7. Conclusions

This study has many limitations. As with many ethnographies, the representativeness of HLG and its activities could be argued. We have been able to present only a few simple cases here. Yet, within these limits, we have tried to show that:

- There is no such thing as *an* organizational memory per se, as the organizational memory metaphor attempts to invoke. We have tried to detail how a supra-individual memory works in its use of multiple people and many artifacts. Our analysis also demonstrated the utility of distributed cognition theory in understanding such a supra-individual memory.

These simple calls and their distributed cognition analysis exposed a number of interesting aspects of this organization's memory at a micro-level. We also showed how:

- The employment verification procedure involved nine different memory states and the human agent involved either translated among representational states or reconstructed memory states.

Even this simple procedure was a complex case of distributed memory. *Memories* were complexly distributed, interwoven, and occasionally overlaid. They had a *mixed province*. Sometimes they belonged to the individual (e.g., Joan's scratch notes) or the group (e.g., the call-handling procedure embedded in the telephone system). But, often enough, the memory that served as individual

memory also had a definition as a group and even an organizational memory.

- While knowledge management largely restricts itself to viewing organizational memory to repositories of experience “objects” that are magically reusable, we have tried to show that it is more fruitful to consider organizational memory as both object and process. Memory is both an artifact that holds its state and an artifact that is *simultaneously embedded* in many organizational and individual processes.

The container metaphor is easier to consider computationally, but it is extremely limited organizationally. The distributed cognition view of a network of artifacts and people, of memory and of processing, bound by social arrangements, provides a deeper and ultimately more usable understanding of organizational life. It describes how memory as representational states can be both separated from organizational actors, and is at the same time, necessarily bound to their actions and understandings.

- The second call highlighted the issues of *decontextualization* and *recontextualization* that are required to effectively turn a memory “object” into a memory process. As memory crosses between groups or even across time, it becomes a *boundary object*, attempting to serve the needs of both creator and reader but lacking the full context of either. To properly serve the reader or re-user of the memory, the creator must properly project the consequences of the memory’s later use, or *trajectory*. This can be a difficult matter, although people do it everyday in their work.

This paper has highlighted many of the issues and problems in creating memories that are used and are found usable by groups and organizations. We have also proposed a number of theoretical concepts [21] (distributed memories, simultaneous embedment, mixed province, boundary objects, recontextualization, and trajectory) that enabled us to analyze the use of memory in these calls.

However, we have seen, even in these examples, that memories do get created and reused. More work will be required to examine the details of how work activities evolve memories.

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