Chapter 18 – Discussion

SCRIPTING GROUP COGNITION

The Problem of Guiding Situated Collaboration

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Abstract: The concept of scripts has considerable appeal as addressing or at least naming an urgent issue in CSCL: how to use the promise of networked computers to guide groups of students to engage in desirable and successful collaborative learning. However, the concept of scripts is often applied inconsistently or founded on problematic theoretical grounds. Reconceptualizing scripts as situated resources rather than implementable plans for action is therefore undertaken here to align the concept with current socio-cultural thought. Studying how such a resource is made sense of in detailed interactions is then recommended for studying how scripts can be designed to guide situated collaboration.

1. INTRODUCTION

The term *script* encapsulates many connotations. This grants it the power to bring diverse topics together to cross-fertilize each other, as has been done in this book. At the same time, the term's overloaded meanings threaten to dull its focus and emasculate its power; if it conjures up different visions for each reader, the term loses its power to build *shared* meaning.

The publication of this multi-perspective and trans-disciplinary book on scripting in CSCL reflects an important joining together of researchers under the banner of the term *script* to delineate a major contemporary movement within a field that often suffers from feelings of theoretical and methodological fragmentation. Perhaps a useful role for a discussant in trying to support this convergence is to highlight its central claims, trace its historical roots and clarify its foundations.

This chapter will proceed by commenting on the senses of the term *script* that can be associated with several of the theoretical sources referenced in Chapters 16 and 17: Schank and Abelson (1977), Vygotsky (1930/1978),

Suchman (1987) and Schwartz (1995). In reviewing this history, the chapter will define a view of scripts that may differ from the term's commonly understood sense. It will then conclude by revisiting central claims of Chapters 16 and 17 in terms of this refined view.

2. SCRIPTS AS COGNITIVE MODELS

The script metaphor has its commonsense roots in the theater. Actors follow a script, which defines the narrative context, roles, actions and outcomes of a play, movie or television drama. Although the public idolizes the actors and remains ignorant of the script designers, the real agency lays in the script, not in the pretty faces that mouth it. The play's intelligence is that of the author, put into word and onto paper, reified and made persistent so that it can control the action that may later take place on camera, in the author's absence, for the benefit of a projected audience at yet another time and place.

Pop sociology would have us all playing socially defined roles. Somehow, conventions of our culture define what everyone (present company perhaps excluded) does, says and thinks. When we enter a restaurant, we supposedly slip into the customer role and interact with the person in the waitress role according to a well-defined script.

This is not quite the sense of script that Schank and Abelson's *Scripts, Plans, Goals and Understanding* (1977) proposed. In their pioneering contribution to artificial intelligence (AI) and cognitive science, they were exploring a computational model of how people understand stories. They proposed that people organize their memories of how events like visits to restaurants proceed by constructing data structures that represent knowledge of generalized events and connections among events, like causal relations. This theory of scripts is quite complex, attempting to incorporate much domain knowledge as well as linguistic structure. It is specifically designed to account for our ability to make sense of stories by speculating about mental representations of commonsense knowledge that allow us to fill in the implicit relationships between consecutive narrative utterances.

Written in the heyday of rationalist AI research, Schank and Abelson's concept of scripts assumed that human minds worked like computer programs, accessing data structures and drawing long sequences of logical conclusions. Motivated by toy problems like analyzing artificially simple narratives about restaurant visits, such theories have not stood up well to subsequent reflection, especially when people try to extend the theory beyond its original restricted domain of understanding stories to human activity more generally.

The restaurant script, with its necessarily large collection of associated variations, sub-scripts and related scripts might help one to analyze restaurant visits in stereotyped television plots or in boring visits to the local diner. But these are not necessarily events worth writing about. A story needs to have an element of novelty or interest – precisely something that goes outside of the generalized script. And every actual restaurant visit involves spontaneous human interactions that improvise around the assumed roles with personality, humor and humanity.

There is also the theoretical question of whether we really walk around with these huge, detailed, logically organized data structures covering all our commonsense, social and personal knowledge. It may be more reasonable to imagine that we *construct* on the spot generalized versions of something like restaurant scripts as spontaneous resources for thinking about specific stories or events as they confront us. This is not the way computers were programmed to organize knowledge in the 1970s, but it seems plausible given the way stories are actually told to people, at least in face-to-face situations. A story is designed by the teller to interact with the audience (Livingston, 1995). The teller continually adjusts the telling to form a desired interaction with the recipient of the story. Through subtleties of gaze, intonation, body position, facial expression, gesture, rhythm and word choice, the narrator and the recipients maintain an intimate alignment that ensures moment by moment that the story is actually being shared. Assumptions of what each other hold to be generalized patterns of, for instance, restaurant behaviors, may play significant roles in this dance of shared meaning-making.

3. SCRIPTS AS SOCIAL RESOURCES

The notion that we should look at the details of interactions among people in groups rather than speculating about mental representations in individual minds in order to understand human knowledge was developed in Vygotsky's *Mind in Society* (1930/1978). Inspired by a deep grasp of Marx's (1867/1976) social philosophy around the time of the Russian revolution, Vygotsky argued on theoretical and empirical grounds that what is distinctive about the way that people learn is the construction of new skills in interactions with others within cultural contexts: "Human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them" (p. 88).

Vygotsky's concept of the zone of proximal development distinguishes a person's intellectual abilities when working alone from those when collaborating with others. The fact that learners have significantly higher skill levels when working in dyads or small groups suggests that intellectual develop-

ment generally takes place during interactions with others. Vygotsky was able to show with controlled experiments that children could accomplish tasks with external memory aids and with collaboration that they could not do on their own. Older subjects could achieve these tasks on their own, suggesting that they had somehow internalized the intersubjective or environmental aids in the intervening years. Vygotsky was not able to study the detailed interactions whereby collaboration and external artifacts were used, let alone observe directly the mechanisms of internalization. However, his visionary – if sketchy – theories inspired the emphasis on collaborative learning in socio-cultural contexts within CSCL.

Vygotsky's theory of learning suggests that scripts not be taken as models of mental representations of individual learners, but be used for structuring social environments to foster collaborative interactions that can engender intersubjective knowledge building.

4. SCRIPTS AS COMPUTER-BASED RESOURCES

A methodology for studying the moment-to-moment interactions of dyads and small groups engaged in collaborative problem solving – with computer support – is motivated, described and illustrated in Suchman's *Plans and Situated Actions* (1987). The use of video analysis based on principles of ethnomethodology (Garfinkel, 1967) as practiced by conversation analysis (Sacks, 1992), allows Suchman to propose an approach that she explicitly contrasts with the AI approach of Schank and Abelson: "Instead of looking for a structure that is invariant across situations, we look for the processes whereby particular, uniquely constituted circumstances are systematically interpreted so as to render meaning shared and action accountably rational. Structure, on this view, is an emergent property of situated action" (p 67). For instance, structures of meaning, goals, roles or turn-taking in conversation are not pre-existing structures, but are constructed interactively by the on-going discourse itself (Garfinkel & Sacks, 1970; Sacks, Schegloff, & Jefferson, 1974).

For Suchman, plans such as the scripts of Schank and Abelson are not rigid blueprints for action that are simply implemented as stated, but are flexible resources that people construct, interpret, adapt and use in their specific, situated acts of making sense. People's commonsense understandings of their plans may be similar to the AI view, but if one studies closely the role that plans play in actual activities – such as accomplishing office tasks – one gets a different view. In Vygotsky's (1867/1976, e.g., pp. 28f) analysis, planning skills evolved out of resources for interpersonal interaction. Young children simply act and then may retroactively give a name to their action

(e.g., to a drawing they did, when prompted for a description). Later, they verbalize actions to be taken: at first in an attempt to control another person's behavior (e.g., their caretaker), and subsequently to control their own future behavior. In such ways, verbalizations of action (plans) can function either before or after the actions as ways of making shared sense of the actions.

In Suchman's ethnomethodological terms, plans are resources that may be used to prepare for and guide up-coming actions or to give an accounting of on-going or completed actions (i.e., they are often retroactive rationalizations). Under this analysis, plans are not causal agents of the action, but are possible useful accompaniments to the action that play (at least originally) a largely interpersonal role rather than an individual mental function. The social functioning of verbal plans (or their silently internalized derivatives in thought) is hidden in the taken-for-granted everyday functioning of human existence, and plans are then conceptualized based on their adult, conscious appearances. Commonsense folk theories – and the rationalist abstractions of these theories in AI – project plans into mental representations that cause planned action.

Suchman studies the use of a computer-based help system for a sophisticated copying machine. The help system defines an AI-type script that was designed on assumptions about mental models of scripts in users' heads controlling their actions. Suchman documents the failure of this approach by showing how dyads of users negotiate their understandings of various problematic states of their copying tasks through interactively trying to make sense of various resources in their environment, including messages from the copier, their shared discourse, verbalizations of their goals, generalizations of past experiences and attempts at various actions.

The fundamental problem, as Suchman points out, is an asymmetry in the data that the copier computer has about the on-going work context and what the users understand about the situation. This asymmetry is closely related to the fact that people do not make sense of their activities according to generalized scripts. Rather, they make use of an unconstrained set of resources that they make relevant in their environment. Perhaps most importantly, they engage in subtle processes of problem solving to overcome breakdowns in the kinds of anticipated normal patterns of events that might be captured in scripts and plans. Such problem solving is critical to success because breakdowns are ubiquitous. Analysis of the discourse of dyads or small groups engaging in situated problem solving can reveal how people actually make use of available resources and where they get stuck trying to follow computer scripts. The detailed collaborative procedures captured on video and comprehended through intensive and repeated study are rarely what designers of computer-based scripts might have planned for.

The copier help system is a script that provides computer support for small groups to collaboratively learn how to use the copier. It is an instance of scripting for CSCL. It mediates the users' collaborative actions and their meaning making. It poses the central practical tension that gnaws at the enterprise of CSCL:

a) Collaborative learning is achieved under unique circumstances whose significance is interactively constructed by the learners and cannot be predicted.
b) Computer support attempts to define a specific context and to direct the meaning-making process in order to (i) guide the learning toward pedagogical goals and (ii) provide a real-time model of the learners' state that can steer the delivery of computational resources.

Based on her theoretical, methodological and empirical study, Suchman recommends (p. 181) that computer support compensate for its limitations by: (1) extending its access to the actions and circumstances of the user; (2) clarifying for the user the limits of the computer's access to the users' rich interactional resources; and (3) providing a wider array of alternative resources, particularly to help the users respond to unforeseen breakdowns. These recommendations should be implemented based on careful empirical study of a given application, along the lines of Suchman's video analysis of copier usage. Only this way will designers discover: (1) the relevant factors of the use situation; (2) the way that the user treats the computer as an interaction partner; and (3) the kinds of breakdowns that can occur and the resources that users take advantage of to make sense of and overcome the breakdowns.

5. SCRIPTING GROUP COGNITION

It is not easy to study the details of how people use situational resources to construct shared meaning in computer-mediated learning tasks. In particular, it is hard to delineate what is accomplished by individuals and what is best analyzed at the small-group unit of analysis. Hardest of all, perhaps, is to describe how individual and group cognition – once distinguished – work symbiotically. Schwartz' *The Emergence of Abstract Representations in Dyad Problem Solving* (1995) takes some steps in this direction.

Schwartz scripts three controlled experiments – one in a lab with video camera and two in classrooms – that compare individuals and dyads working on the same science problems. In order to get at the problem-solving process, Schwartz looks at the intermediate problem representations that the students construct, rather than at their final solutions. He finds that although

there is little significant difference between individuals and dyads in their final solutions, the groups construct more abstract representations. Schwartz concludes from this that the group-level cognitive processes are qualitatively different from the cognitive processes of the isolated individuals: "Group cognitions sometimes yield a product that is not easily ascribed to the cognitions that similar individuals have working alone. In particular, groups have a tendency to construct representations that are more abstract than individuals' representations" (p. 322).

In the first experiment, where the activities were captured on video, Schwartz was able to see how the dyads were forced to construct collaborative representations, to negotiate their meaning and to overcome breakdowns in shared understanding. These unique, situated, unpredictable interactions and verbalizations produced and made visible joint articulations of the structures of the objects in the scientific problem, leading to insights into the final solution. Because of their interactive work in overcoming the additional hardships introduced by having to negotiate and maintain shared understandings between two people who started with independent ideas, the dyads performed significantly better than would be predicted based on combining the best individual performances of the dyad members.

Unfortunately, the other two experiments were not videotaped and therefore the interactions of the dyad members could not be analyzed. Consequently, Schwartz was largely reduced to speculation that if the interactions could be studied they would show that the processes of overcoming breakdowns in maintaining mutual knowledge fostered the joint construction of abstract graphical and verbal representations that were useful for problem solving: "I suspect that interactional studies would find numerous forms of negotiation depending on the individuals' knowledge and the affordances of the task at hand... Although the process and products of representational negotiation may take numerous forms, I believe that careful attention to the conditions preceding a period of representational negotiation will reveal strong evidence for the important role of mutual-knowledge problems in the co-construction of representations" (p. 348).

6. SCRIPTS FOR FRAMING COLLABORATIVE INTERACTIONS

The preceding quick review of Schank and Abelson (1977), Vygotsky (1930/1978), Suchman (1987) and Schwartz (1995) has attempted to reconceptualize the concept of scripts as situated resources rather than implementable plans for action so as to align the concept with current socio-cultural thought. It has recommended the micro-analysis of how such resources are

made sense of in small group interactions in order to guide the design of scripts based on actual examples of the kinds of situated action for which the scripts are intended.

Dillenbourg and Jermann (this volume) display a healthy recognition of the nature of scripts as flexible resources. They take the concept of script not as a cognitive model of how people actually decide what to do, but rather as a design metaphor for finding the delicate balance between too little computer control to be helpful and too much control to allow for flexible group interactions.

Interestingly, they finesse the problem of constraining group interaction by confining scripting to the individual or whole-class activities that precede and that follow the core small-group collaborative activities. They define CSCL scripts to be instructional sequences that prepare for and then reflect upon, but do not interfere with peer interactions. Adopting Schwartz' conclusion that the power of collaborative learning comes from the effort necessary for the group to build a shared understanding, Dillenbourg and Jermann use scripts to set up situations in which groups will be forced to construct group meanings – their SWISH model. The meaning-making phase itself is then left unconstrained, for it is too fragile, complex and unpredictable to be supported by a script that is written in advance.

Chapter 16 is clearly a synthetic presentation, based on extensive experience using scripts in real learning contexts. It would be nice to see some of the detailed interactions that were observed during the experimentation as examples that motivate the principles enumerated in the chapter. Presumably, page limitations for the chapter prohibited that, and one must go back to the earlier individual studies for such examples.

7. SCRIPTS FOR LEARNING AND FOR LIFE

Carmien, et al. (this volume) call for a distributed cognition perspective to account for the interplay of mental and environmental phenomena. While this is an important move, the details of the particular theory developed are also decisive. The preceding discussion has argued for building more on Vygotsky and Suchman than on Schank and Abelson in defining an approach to distributed cognition or group cognition (for a fuller account, see Stahl, 2006). Rather than starting from a theory of individual cognition and then supplementing it to build a "person-plus" theory, it has invoked Vygotsky's theory in which individual cognition is a social-cognition-minus product of internalization processes. In place of adopting a view of scripts as controlling data structures, it has recommended Suchman's conception of situated resources.

Vygotsky's and Suchman's alternative approaches could be used to account for the design, study and analysis of tools for living and tools for learning. Computational tools mediate between people, for instance between a cognitively disabled person and their caregiver or a group of students and their teacher. The tool can be viewed as an externalization of the caregiver's or the teacher's guidance. The users must learn how to use the tool, and they may or may not be able to internalize its guidance to varying degrees.

Carmien, et al. cite Suchman and recognize the dangers of technology-driven design. Careful study – such as that done by Suchman – at a detailed level of interactional granularity would be needed to analyze the specific processes of internalization and externalization and to design the tools for a successful fit to the situated meaning-making interactions through which the tool is put into service. This would also ensure that the users' situated needs drive design.

Together, Chapters 16 and 17 pose central issues for theory building, assessment methodology and design practices in scripting CSCL. They present contrasting approaches themselves and stimulate the consideration of yet other alternatives.

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