
EDITORIAL

From First Principles: Toward a More Reflexive Social Science

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There is something very distressing about research that theorizes thinking and speaking in terms 5
 of scripts and conceptions. The problems with such theories become evident when we see how
 people navigate in completely ordinary ways novel situations that they do not previously pos-
 sess conceptions or scripts for. Despite the flaws inherent in scripts and conception theories,
 those doing research on the cultural dimensions of mind and activity rarely engage in critical
 analysis of such inadequate theorizing. The purpose of this editorial is to make suggestions for a 10
 more reflexive approach to the social sciences. I offer an example that reveals the deficiency of
 theories that approach thinking and speaking in terms of scripts and conceptions:

At the front desk of the lounge for business travelers at an American airport:

Person 1: Ah, we are meeting up again.

Person 2: Yea. 15

Person behind counter: You have a different ticket. You are not traveling together?

Person 1: No, we just met in the security line up; and now here again.

In this episode, two persons (“travelers”) meet again at the desk in the lounge of an airline.
 The “agent” checks the first traveler’s membership card and boarding pass while the two travel-
 ers greet. As the first traveler begins turning away, the agent checks the second traveler’s docu- 20
 ment and then, with surprise, states that the ticket of the second person is not for the same flight
 as the first traveler. Person 1 then explains that she had met the second traveler previously in the
 security line, thereby providing something like an explanation for the head nods and greetings
 that the agent had taken as a sign that they were traveling together—as evident from the conjoining
 of two topics: the different ticket and the traveling together. 25

This is a simple, everyday episode where three individuals talk to each other *for the first time*
 in their lives (it certainly was so for me, one of the participants). In fact, the first sentence
 already sets up the understanding of my text that in this way the participants did not have avail-
 able (participants do not walk into an airport lounge cogitating, “I am now walking into a business

lounge; now I am talking to the agent,” and so on). The episode describes an event that is both constructed (figured) and reconstructed (preconfigured, reconfigured) as a possible event in this kind of situation (airline frequent flyer lounge). Person 1 and 2 recognize each other as travelers, the person behind the counter does so as well, and Person 1 and 2 recognize the person behind the counter as a customer agent. Despite being engaged in a first-time experience, interacting in absence of a “routine script,” the participants successfully pull off this encounter and conversation in the foyer of the lounge without having thought about what they would say. They also did not have any background about one another (except for the fact that one of them clearly is an airline employee and the other two apparently travelers—they both came through the security check and wore no clothing that designated them as specific kinds of people [security officers, pilots, hostesses]). The three successfully pulled off an encounter even though this event was highly singular and unique. 35 40

This event is but one example of the ways in which people realize, in real time and without cogitating, social situations and conversations. Impressively, people succeed in such novel encounters continually throughout their day. The airline employee apparently made an inference about the relationship between the two individuals based on the resources available to her (e.g., behavior and temporalities). The two travelers also made inferences about one another, for example, about being travelers. There were signs of understanding, such as when they greeted and talk to each other for the first time in their lives. In much the same way, human beings often make inferences and revise them in an ongoing way as new resources become available in situ that contradict previous assumptions. We can see here how everyday folk are social analysts in their own right, making inferences and drawing conclusions as they go about working with the resources made available to them. What are the competencies (methods) that allow everyday folk without training to analyze texts or video to do such analyses? What are the competencies (methods) that everyday folk bring to social situations that allow them to successfully participate even in novel encounters of this kind? What are the kinds of competencies (methods) that a professional analyst of social situations has to bring to understand what has been going on in the episode, such as recognizing the apparent misunderstanding that the airline agent had about the two travelers? These are precisely the kinds of questions we need to ask to determine the competencies social analysts necessitate to analyze classrooms and interviews about education and school-related phenomena. 45 50 55 60

Here I am interested in the constitutive, lay, and professional competencies (methods) that allow some members of a culture to (a) become professional analysts of social situations, and (b) extract from recorded events instances that can help the onlooker make attributions about individual participants involved in the interaction under scrutiny. I am concerned not just with what people in general (and learners in particular) *know* but with a much deeper problem: how to better understand the ways in which researchers extract various social and psychological phenomena from the textual and visual records available to them. That is, I am concerned with a more reflexive social science than we find generally practiced today. I suggest that professional analysts have to have precisely the same kind of competencies as the lay participants, both with respect to understanding what is going on and to making inferences about other’s thoughts and relations. More so, as my introductory episode exhibits, to understand the *conversation as phenomenon sui generis*, we need not engage in an infinite regress to look for more and more background information to show how it *determines* the unfolding of the social event. Thus, we should not allow ourselves to use what we might know about the various 65 70 75

participants before the introductory episode to *explain* the episode. Such “looking backward” could produce a determinate or causative narrative about the unfolding episode and therefore would reduce the participants to cultural dopes. More so, we also should not allow the end result of the encounter (as determined by a transcribed “interview” or identified “misconception” or “script”) to be used, teleologically, to *explain* earlier parts of what happened. Such claims and methodical approaches have consequences for the way in which we deal with, analyze, and make inferences from talk (whether it is science classroom talk or interview talk about topics such as the nature of science, epistemology, or explanations for certain natural phenomena). 80 85

Of course, there are considerable consequences when working with mental models, scripts, knowledge frameworks, and the like. It does not surprise me that such research has had as little impact on classroom instruction as it has. There is a big step from the ordinary, everyday conversations in school classrooms—which are in many ways like the interview that we reproduced in its entirety—to conceptions, conceptual change, scripts, and the like. When engaged in real-time talk—full of stumbles, mumbles, malapropisms, egregiousness, errors, slips of tongue, starts and restarts, pauses, and the like—how is a teacher to get to the identification of misconceptions and conceptual change? Precisely because different forms of language may share meaning and very similar forms of language may vary in meaning, the determination of conceptions and conceptual change is not something that evidently unfolds in everyday conversations. More so, the very capacity to determine something such as misconception has to exist in the everyday, ordinary competencies of laypeople, some of whom become professional analysts. We should be concerned with understanding language as a phenomenon *sui generis*, not as a neutral medium for externalizing conceptions and conceptual change to make them available to teachers and science education researchers. 90 95 100

I like to think about social science research in terms of an expression that I learned as a physicist: “from first principles.” The expression is used to mean that a student is to mathematize some phenomenon beginning with a simple statement, such as Newton’s law $F = ma$. Or geometers can show, simply on the basis of the parallel theorem, that the interior angle of a triangle is 180° . Again, the derivation is from first principles (e.g., the theorem that in a flat [Euclidean] world [topology], parallel lines do not intersect). Working from or to first principles, here understood as the mundane methods everyday people (Greek, *ethno*-) use to pull off social situations. We thereby come to think about articulating and exemplifying a way of doing social science research from first principles rather than on the basis of a set of procedures that carry with them numerous presuppositions, many of which are untenable once subjected to critical scrutiny. We no longer seek information that the co-conversationalists do not have while engaged in conversation because such information does not help *explain* the conversation (understood as a phenomenon that sublates individuals and their contributions). To understand the conversation as such, we cannot go to hidden intentions and conceptual frameworks but rather have to understand how other participants make use of their mutual productions (i.e., verbal, gestural, prosodic, bodily, etc.). As the episode in front of the entrance of the airline lounge shows, in everyday interactions we do not have such information available. We therefore should ask this question: “How do participants pull off successful conversation given what they have available (when they are unfamiliar with one another such as many interviewer/interviewee pairs in conceptions and conceptual change research) *in and from the conversation itself*?” 105 110 115 120

PRESUPPOSITIONS ABOUT . . .

As a researcher I am not primarily interested in conceptions, conceptual change, mental frameworks, or scripts; I am certainly not interested in the analysis of but one situation (e.g., the introductory episode) to *exemplify* certain points about conversations and language in everyday use. 125
 Yet there is a lot that we can learn from the microanalysis of even fractions of social situations. My general question for research is this: “What is it that allows us (human beings) to understand others, in everyday situations, including interviews, especially when these interactions are first encounters?” From this question and pertaining to science education, a second important question can be asked: “Under what conditions and presuppositions can we arrive at ‘misconceptions’—a 130
 concept that implies there is something hidden from view (behind people’s talk)?”

. . . Background Information

To answer these and similar questions, we can closely look at everyday talk—interview talk being only a special case. We may select one interview, but we could have selected any other interview to make the same points. We may select certain interview episodes but could have 135
 selected any other form of conversational transaction (such as the transcription of a classroom episode) to make the same points. An important one is that we *do not interpret* what a speaker says; rather, we observe what others do and say in their turns when they follow this speaker. Working from first principles, we need not make assumptions about the contents of people’s 140
 minds and intentions, unless, as part of the conversation, they say that they have something on their mind or some intention (though it is impossible to verify if what such a person says *really* is his or her intention or what she *really* has on her mind). All human transaction participants *ever* have for making sense of the talk and action is *what the other actors makes available*. It therefore helps us little if some complain that they are not given any information about who 145
 “traveler 1,” “traveler 2,” and the “agent” are. In fact, in situations where we encounter unfamiliar faces (e.g., talking on a plane to someone else or walking up to a group of conference participants) we participate in and make sense of social situations *without* knowing anything whatsoever about our interlocutors. Nor do we know *why* certain specific topics spring up and are maintained. When I cross the street to greet my neighbor, he does not know why I talk to him 150
 about our respective gardens rather than about the weather, and he does not know why I might ask him about his recovery from a heart attack rather than about the sunny day. I may not know myself the reasons why I broach these rather than other topics. I may just be interested in making neighborly conversation or reproducing a sense of belongingness on our street. In any case, when crossing the street to greet my neighbor I never do know where our dialogue will go. I do 155
 not build a mental model of the conversation or topic. Rather, I cross the street and talk, my intention being formed and realized simultaneously in the very moment that I talk.

. . . Determinations

There are dangers in using theoretical concepts deterministically (teacher “power” *causing* certain student behavior or “status” *determining* student–student transactions), because in this approach antecedents are said to *determine* the present behavior. For example, in one study 160
 I spent 4 months following around a seventh-grade student, Davie, who instructs the science

teacher of another seventh-grade class how to conduct research in a local creek and where to do such research. He subsequently supervises two groups of seventh-grade students simultaneously and prepares them for an exhibition of their results as part of an environmentalist open house. There, he teaches visitors of all ages. Just based on my videotapes, there is a lot of evidence supporting the conclude that Davie is a highly literate person, especially with respect to science but also with respect to mathematical representations of scientific phenomena, yet Davie is jerked out of class on a regular basis to get fixed for the “learning disability” that he was diagnosed with. Thus, the approach to conversation we should take is to identify what the interaction participants make available to one another as resources for making, marking, and detecting sense, including the silences that occur whenever “things go without saying” so that everyone appears to be aligned to the same aspect of reality and in the same way. 165 170

The same sort of thinking leads some researchers to make a problem out of the difference between beliefs (as articulated in interviews) and action (as visible through classroom observation). The underlying presupposition is that beliefs should be consistent with actions—that is, *predetermine* the latter. Such research, however, does not recognize the different nature of the two situations, interview and classroom, and therefore, the different motives, goals, and resources that are at work and available. The talk and actions in the two situations should not be expected to be similar or consistent; differences, rather than sameness of beliefs and actions, are the norm. This is consistent with observations many studies in the social sciences make and have made. The mental model, conceptions, and script approaches, however, expect “beliefs” and action to map onto each other because they correspond to the same underlying conceptual (mental) structure. This sameness frequently is not observed and therefore *ought to* raise questions about the suitability of the underlying theoretical model. 175 180

A reflexive social science should be concerned with the question of how we make attributions about other people, the contents and structures of their minds, and their intentions, when all that we have is what they say in language and do with their bodies. One answer is that professional analysts bring the same *cultural* competencies that allow speakers to make sense, as lay analysts, of one another’s talk. That is, the researchers, to make sense of a conversation, have to bring the same cultural competencies that allow the speakers (including interviewee and interviewer in a conceptual change interview) to make sense of what others say—and do so without access to the background information many social scientists use as explanatory resources. In my own research, I do not allow myself to draw on background information that the participants do not have or make available. I view all resources (language, gestures, body orientations) as indeterminate with respect to their deployment and the sense that is marked in the process. 185 190 195

... Talk as Text

Another correlated presupposition many researchers generally make is that all words are equal, whether they are spoken at the beginning or at the end of the interview. The interview texts are transcribed and then analyzed as evidence for the underlying concept equally expressed at the beginning and at the end of the interview—unless some “conceptual change” occurs in the process. Perhaps we ought to reject such an approach and take instead each conversation, each event, from a first-time-through perspective. Conversations are like snowballs that grow as they roll down hills. Toward the end of an interview certain information, topics, and behaviors are known that were no apparent at the beginning of the conversation because the participant has 200

made them available. Such information cannot be used to analyze earlier parts of the interview. 205
 In other words, conversations *integrate themselves over* and become social (societal) events that
 are phenomena in their own right that cannot be explained in a determinist manner from the psy-
 chological, sociological, and other background information. Because social situations unfold in
 time, the resulting product of the transaction leads to the coproduced (convolved) nature of the
 transcripts (protocols). Under what conditions could anything like the interviewee's independent 210
 talk—let alone conception—be deconvolved¹ from something that utterly and irremediably is
 the product of an irreducible *social* process? Here, too, there are unarticulated assumptions that
 most interview analysts (including conceptual change researchers) make about the nature of a
 conversation—assumptions that we reject in our article.

LANGUAGE 215

A Resource

Language never provides *all* the necessary resources for understanding what is being communi-
 cated in a particular situation. Language is but one of the resources that people use to articulate
 and mark sense. Other resources that we describe are gestures and body positions. But this does
 not mean that anything goes. As soon as gestures, body positions, or movements are expressed 220
 in words, they are distorted: In *Thought and Language*, Lev Semenovich Vygotsky held ges-
 tures and speech to be irreducible to one another, and, as the Italian saying goes: *traduttore*,
traditore (translating is betraying). I would never claim that language preordains the conversa-
 tion, because rather, I think of and present conversations as integrating themselves over so that
 the beginning of a conversation mediates but *does not* determine what happens later. That is, we 225
 claim that language provides certain structures that both constrain and enable the conversation.
 In fact, to understand spoken language, grammar itself has to be seen as *accomplishment* rather
 than as preordained. The same is valid for the topic, which is never predecided but always an
 achievement, including the topical cohesion across stretches of the interview. In actual use,
 language is not deployed willy-nilly but *recipient designed*. What someone says and how she 230
 says it cannot be found entirely within her (mind): an account of our working day provided to
 our partner/spouse will significantly differ from the account of the same day provided to a
 5-year-old child. We should not analyze data sources as if the interviewer and interviewee are
independent agents but rather take the *conversation* as the phenomenon to be understood, which,
 as a collective entity, cannot be reduced to the individuals and their intentions. As every reader 235
 knows from everyday experiences on university committees decisions often arise that none of
 the participants could have foreseen coming. To understand such decision-making processes, we
 do not have to look outside the conversations, but rather, should follow them in minute detail
 from a first-time-through perspective, which will prevent us from resorting to teleologically

¹*Deconvolution* is a term used in physics and mathematics to denote the process of separating two functions f and g that have been *integrated one over* the other to yield a third function $h = \int f \circ g$. One can extract g from the resultant function h if one knows f . In the present instance, the conversation is equivalent to h . But because the contributions of the two speakers (equivalent to f, g) are not independent, the conversation cannot be reduced to the individual speakers.

determinate explanations. In this way, my approach is a nondeterministic one, as it takes conversations to *emergent processes* rather than predetermined and preordained phenomena. 240

Difference, Repetition, and Sameness

Some researchers make the assumption that different words and sentences can have the same meaning regardless of how and when they are used. But this, too, is an assumption and presupposition that I reject and that *Thought and Language* gives us many reasons for doing so. Two different expressions are two *different* expressions. And because they are different, they are not understood in the same way. We know this from everyday conversations where a listener may ask, “What do you mean?” or “Can you explain this again?” The two situations utterances are very different, though they seem very similar. In the second, the listener “got it,” whereas in the first he did not. Positing that two different expressions say or mean the same thing requires the assumption—that the expressions were constructed, through interaction, as *the same* despite obvious difference between the utterances. Because semantic fields change with the slightest change in delivery, the sense, too, is not precisely the same—though for all purposes at hand, it might be taken to be the same. In the advocated approach, sameness therefore *does not exist* but *has to be made*, which is an approach requiring *fewer presuppositions* and therefore leads to more parsimonious descriptions and explanations. We thereby do not take a hard stance on what language does and can do. Rather, it is a hard stance to say that there are many *different* ways to say *the same* thing without in fact checking, in the pragmatics of concrete situations, whether the different ways are the same. 255

Intellectual Glass Bead Games 260

In doing research I am not interested in intellectual glass bead games² but in real, everyday conversations such as the one at the beginning of this editorial. In such conversations, we always have to cope in some way. I know this from my own experiences of, for example, shopping in Spain where I managed to buy what I wanted although I do not speak Spanish. Yet I was able to make do, and others helped contribute to the process so that I was able to eventually leave the market place with the products I wanted to buy. Again, I had to relay on the resources at hand to contribute to my “conversations”—I pointed to things, drew on my French, dug up the remnants of six years of Latin instruction, deployed iconic gestures, and so on. What does a professional analyst require to make sense of the videotapes that recorded my praxis of shopping in Spain, where both the shopkeepers and I are lay psychological and sociological analysts trying to pull off the exchange of money and produce? The professional analyst requires precisely the resources that the shopkeeper and I made available to one another. There is no doubt that the shopping trip would have looked differently had it been recorded in my hometown Victoria. 265

Language and other patterned forms of action are all that we have during communicative encounters with other people. My fundamental point is that these encounters need to be theorized in terms of what people make available to each other, because this is all *they*, as lay analysts, had to respond to and thereby keep the encounter going with. If we try to look beyond 270

²The term *glass bead game* is a reference to Hermann Hesse’s novel by the same name in which a priest engages in games that have no pertinence or relevance to life outside the monastery.

what was available to the participants we end up describing and theorizing events from third-person perspectives, which will fail to capture why people do what they do because these outside vantages do not properly take into account the irreducibility of the moment-by-moment construction of the interaction. The lay analysts observed this unfolding firsthand and the professional analyst aims to capture the process on tape. Outsider accounts necessarily have to make inferences about why people do what they do, whereas insider accounts begin with what is available to people in their lifeworlds—their personal worlds as these appear to them, produced by resources, affordances, and constraints.³ More important, in everyday conversation we generally do not reflect, plan our sentences, and then talk just as we do not plan where to place our feet before walking. In this sense, lay analysts are highly competent social actors who act appropriately in real time, without (any or much) reflection. But if we accept that human beings participate in conversations without reflecting, planning, and then implementing what they cogitated, we are in a quandary: We also have to accept that speakers do not have a conscious mental model that drives their speech. The intellectualist approach to knowing and learning—as embodied in the work of the French philosopher Maine de Biran, who wrote in the late 18th and early 19th century in response to Immanuel Kant—hits a stumbling block that it cannot move out of the way.

A mental model approach to talk does not satisfy the criterion of parsimony of glass bead players: Speakers and listeners would require (in their head) a huge production and inferencing machinery that they could consult when they were asked about pertinent issues. There are many instances in everyday life where people talk about topics they have not thought about before. They therefore *could not have had* a preset mental model driving what they said. Anyone reflecting on everyday conversations they have had over the last 24 hr will note that they did not plan, think beforehand, consult a mental model, or spill out what they said, nor did they simply leak the contents of their minds.

Cultural Relativism

Some may charge the position outlined here to constitute cultural relativism. Cultural relativists, with respect to language, suggest (in the wake of the work that Sapir and Whorf have done) that there is a systematic relationship between the grammar of a language an individual speaks and the way in which this individual understands and acts in her world. I personally would not want to be categorized in such a group. All that is proposed is to look at conversations through the eyes of the people who have a conversation. As participants, we do not know what comes next and where the conversation will lead. And yet we contribute to a conversation—most of the time without knowing what words we will speak, what gestures we will use, or what body orientations we will assume. The other person facing us has our productions as resources for making their contributions—productions that we generally cannot know in advance. What we will say therefore remains *indeterminate* and *undetermined* until the moment that we actually speak. In some instances we may have listened only partially, trying

³This is not to say that the insider view is without problems. Rather, insiders do not inherently have the means for understanding the ways in which the language and artifacts (objects, tools, forms, language) they use have been formed for purposes that run counter to their interests. That is, it takes a lot of effort to get at the ruling relations invisible in the everyday world.

to ready ourselves to make a specific point. But interlocutors generally do not plan in advance—certainly not interviewees who participate in conceptual change interviews and certainly not interviewers who implement an unstructured or semistructured interview protocol that allows them to adjust to the responses they get. This is the case even when speakers have a written protocol in front of them (as was made obvious to me last week during a round of hiring interviews at my university). Although the questions to be asked *were supposed to be the same* for all applicants for the job, the four individuals that read questions from their paper *never* read them exactly as these were noted. That is, if I had tried to predict *precisely* what a member of the hiring committee would say by looking relying on the protocol, I would have been wrong each and every time.

CODA

Learning scientists generally, and conceptual change theorists specifically, do not address the question of how students move from one conception to another, nor do they deal with the question of what assumptions that have to be made to get from the heterogeneous talk during some interview to a single conception. Is the transmission between the concept and talk noisy so that the *same* in the head leads to different things when they are verbalized in speech? What about those situations where gestures and words are consistent with two different conceptions, as some of the literature in psycholinguistics appears to indicate? Accepting for a moment that the mental model approach is useful, how does a student go from having conception₁ to having conception₂? What is there in the transition between the two conceptions? Is there no conception? Is there a conceptual mix or mayhem? Are there two conceptions? How do the conceptions emerge when a previous conception did not exist?

Social scientists should be more principled about what they do and how they do it. Working from first principles would be one way of being more principled. First principles are precisely this: principles that constitute the very condition for anything like science education research to emerge from the normal, mundane, everyday, and immortal competencies of the world that science education theories attempt to describe. If it were not this way, social science researchers would attempt to explain something that they do not already understand, even in implicit ways. What are the everyday competencies that underlie the actions of researchers from which emerge, for example, the competencies required to create theories concerning conceptual change, schemas, or scripts? These questions are not intended to dismantle or deconstruct particular forms of research. Reflexive social scientists bring to light the presuppositions that have to be made to get to mental models in the light of what interaction participants make available to each other. Given the amount of inference making involved, a more parsimonious approach to conducting research is required. We need an approach that theorizes precisely what people make available to one another in everyday talk and an approach that examine how these resources for conducting conversation get used. Interlocutors interact without having to consult heavy conceptual machinery and they interact without requiring reflection or planning.

Some may ask rhetorically, “Since language provides all the resources to interview participants, why bother with anything else?” This precisely is what we should be asking because this is the phenomenon: *the methods people use for getting relevant things done*, their *ethno-methods*.

These methods are enacted during participation in teaching-learning events and during interviews about natural phenomena. Why should we theorize about a machinery that is available neither to conversation participants nor to teachers? Why not theorize the phenomena and resources phenomenally available to science teachers so that they know how to act, in real time, on the things their students say and do (without having to consult in their table matching conceptions and talk to find out what conception they are currently facing)? 360