

Towards a Praxeology of Teaching

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Both preservice and seasoned teachers experience a considerable gap between theory and prescriptions for teaching and their day-to-day practice. We conceptualize this gap in terms of the difference between descriptions of practice and practice itself. Descriptions cannot include the tacit understanding against which specific acts of teaching become meaningful; thus, they are inherently out of synchrony with practice. We illustrate how Bourdieu's notion of *habitus* (a set of dispositions) accounts for appropriate actions in situations where there is no "time out" for deliberation and how coteaching can support preservice teachers' development of this habitus.

Les étudiants-maîtres comme les enseignants chevronnés ressentent l'écart considérable entre la théorie et les règles de l'enseignement et leur pratique quotidienne. Les auteurs conceptualisent cet écart en termes de différence entre les descriptions de la pratique et la pratique elle-même. Les descriptions ne peuvent inclure la compréhension tacite par rapport à laquelle des activités précises d'enseignement prennent un sens; aussi ces descriptions en elles-mêmes ne concordent pas avec la pratique. Les auteurs illustrent comment la notion d'*habitus* de Bourdieu (un ensemble de dispositions) explique la pertinence des actions effectuées dans des situations où il n'y a pas de temps pour délibérer et comment le coenseignement peut favoriser le développement de cet habitus chez les stagiaires.

It was hard, for I remember at the university you're hearing all these ways and methods . . . these idealistic ways. When you actually get out there it's different, putting it into actions . . . I don't know what anybody else did, but I was sort of stumbling through things myself . . . I know that in September it was a real struggle and a real battle. (Nadine, 28 January 1998)¹

Such comments from preservice teachers are familiar, even expected. And despite our empathy, we recognize Nadine's experience as constituting much of the history and lore of teachers' first professional experiences. Part of her frustration stems from experiencing the rift between the theoretical discourse of the university and the reality and demands of the classroom. We maintain that this division between theoretical accounts of technique

and practice can be characterized in terms of temporality and context. We further argue for a *praxeology* (*praxis*, action, and *logos*, talk, speech) of teaching rather than a theory of teaching practice, and we propose *coteaching* for its development and as a model for inservice and preservice teacher development, evaluation, and research. Vignettes drawn from the experiences of preservice teachers with whom we have worked and from our own classroom experiences illustrate the gap between technique and practice. The vignettes also illustrate the manner in which coteaching can help to bridge this division through the development of an appropriate *habitus*, a system of structured and structuring dispositions that helps one to act appropriately in diverse contexts.

METHODS AND IDEALISTIC WAYS

Teacher education programs generally include courses on methods of teaching. Underlying many of these courses is the presupposition that teaching can be described, and therefore explained, as a set of techniques that are then offered to university students as “methods”:

Empirical and theoretical research in cognitive psychology make possible the construction of theoretical models [of instructional strategies], on which predictions can be based. The application of a model of [student] understanding of physical phenomena leads to detailed specification of a strategy for beginning physics instruction which can be expected to produce desired changes in students. (Champagne, Klopfer, & Gunstone, 1982, p. 46)

So represented, teaching is a matter of identifying the appropriate strategies and assembling them into a (lesson) plan to be employed in the classroom. Such rationalist views of teaching continue to pervade the field: Knowledge of teaching is described as declarative and procedural, located exclusively in the mind (Clermont, Borke, & Krajcik, 1994) and called up by talking *about* practice (Copeland, Birmingham, DeMeulle, D’Emidio-Caston, & Natal, 1994). It is no surprise that university teacher education classrooms continue to be filled with talk about strategies, techniques, and skills. Yet, despite extensive research on teaching and efforts to make the university education of teachers more relevant to their daily experience, discontinuities persist between university discourses about teaching and the practice of teaching (Liston & Zeichner, 1991; Roth, Masciotra, & Boyd, 1999; Tom, 1997; van Manen, 1990, 1995). This invites the question why the rift between descriptions of teaching practice and enacted teaching practice continues to exist.

One answer is that practice becomes problematic when work is thought to be knowable in the abstract. The problem lies in the *contingent* and *extemporaneous* features of practice, neither of which are captured in the *decontextualized* and *deterioralized* descriptions in *theories of practice* (Bourdieu & Wacquant, 1992). This shortcoming, in turn, may lead to an emphasis on *technique* rather than actual *practice*, the difference being that technique is removed from context whereas practice demands consideration of the unfolding time and context in which action takes place (Orr, 1998).

DESCRIPTIONS AND PRESCRIPTIONS

Theoretical discourse about practice in teaching, business, and administration alike implies that it can be viably described in abstract sets of techniques to be considered, changed, deployed, taught, and learned independently of the contingent and temporal constraints of situated practice (Bourdieu & Wacquant, 1992; Hargreaves, 1994; Orr, 1998). For example,

CONTROL THE TIME AND PLACE FOR DEALING WITH OFF-TASK BEHAVIOR:

You are more likely to achieve a productive interchange about preventing recurrences of off-task behaviors in a private conference with a student than you will when both of you are worried about others in the vicinity. Do not make the mistake of making a major issue out of one student's off-task behavior in front of other students in order to exhibit the undesirability of the off-task behavior. (Cangelosi, 1993, pp. 207–208)

Such recommendations for action are typical in teacher education classes. However, students as individuals and collectives are dynamic entities. Therefore what teachers' actions look like is a very different thing from their description *a posteriori* as embodying such prescriptions. Consider the recent experiences of Cam, Nadine, and Ken.

Cam, a student in a master's-level urban teacher education program, came to school with a well-prepared lesson plan. However, the lesson plan could not anticipate the contingencies that would arise at the moment Cam was to teach his lesson.

I tried to introduce the lab, move the desks, get them into groups, and get them started on the lab. But no one would go with me. I had probably 5 or 6 kids out of the 25 in the class actually interested in doing what I wanted them to do. They were unruly, totally disrespectful, loud, and obnoxious. Everything I wanted to do took about 3 times as long as I wanted it to. When I finally got around to handing out the materials and getting them started, it was 10:15, 19 minutes left in the period and they hadn't even started the experiments yet! (Cam, 4 November 1998)

The lesson did not unfold as planned. The plan did not and could not embody the contingencies of the moment, the interactions that are the grounds for and lead to the construction of “teacher” and “student.” Cam experienced a difference between what he expected and the actual trajectory as the lesson took unexpected turns in response to the interactions of people with each other and their setting. Nor did any of the techniques that Cam was familiar with work in the here and now of this classroom. Cam’s experience illustrates a problem created by the gap between theory and practice — plans and techniques are abstract representations that do not embody the temporality of lived experience, a temporality always enacted in and as part of praxis.

During a four-month study in Nadine’s classroom (Roth & Boyd, 1999), there were repeated instances when students such as Tory questioned her request that he leave the classroom so that she could deal with him away from the other students: “Why do I have to leave? I haven’t done anything.” Although the request worked with some students, it did not always work with Tory. As she said in our opening quotation, she was stumbling through the first few months of her student teaching, unable to deal satisfactorily with important aspects of teaching such as discipline and productive questioning.

In the abstract, when the unfolding events left her time to reflect, Nadine knew a number of techniques to deal with discipline problems: Take the student outside the classroom and talk to him/her without an audience present, write the name of the misbehaving student on the chalkboard with action to be taken after class, talk quietly to the student and attempt to dissolve the issue, and continue the discussion in the forum selected by the student. However, as Nadine found out, knowing these techniques only in the abstract does not enable one to act appropriately in a particular situation, for in praxis, there is no or little time for deliberation. Her interactions with Tory always seemed to lead to similar problems. Furthermore, a technique that worked one day did not always work.

Well, I think, I think that it’s just the *here and now*. And, I mean, it’s easy to think of, well, somebody says *this* to me, then I follow this and this and this. But every situation is so different and every student is so different. (Nadine, 24 April 1998)

Here, Nadine recognized the context-dependent quality of instructions: “Every situation is so different and every student is so different” that it is uncertain how an instruction (“[a more experienced teacher] says *this* to me”) can be used in a particular situation. The problem does not lie with poor instructions but with the ontological differences between instructions and situated actions (Suchman, 1987). Thus, the significance of instructions

must be discovered with reference to particular circumstances. The specifics of the relation between the instruction and the situation have to be worked out then and there.

At this point, it may be tempting to suggest that the experiences of both Cam and Nadine simply show their inexperience — all new teachers suffer through such events. Although this may be true, we suggest that the lack of congruency between instructions and practice remains problematic throughout a teacher's career. Consider Ken, who is now teaching a science class in the Opportunity cluster of an urban school with an almost exclusively African-American clientele (Roth & Tobin, in press; Tobin, Seiler, & Smith, 1999). Many students in Opportunity have histories of academic failure, have criminal records, are teenaged mothers, or attend school sporadically. Despite his 35 years of teaching experience and generous advice to his student teacher, Cam, when Ken began teaching in Opportunity, he generally failed to teach the science he had planned.

During an end of topic test, I had occasion to speak privately to about four students because they were speaking at a volume that was not only audible but also quite distracting to others in the class. When I spoke quietly to Ramon, his public response to me was that he had finished [the test] and it therefore was acceptable for him to talk to others, exchange papers, and relax. At that point I had several options. I could speak to him outside, try to continue the discussion quietly, or continue the conversation in the forum he had selected. Each option is fraught with clear problems. If I ask him to step outside and he refuses to do so, then the incident has been escalated to a degree that will result in either detention or suspension. It also leads to confrontation. If I speak quietly to him and appeal to his sense of reason and good citizenship, it moves the responsibility back to him to be decent and not distract others. However, his actions prior to my speaking to him suggest that he is unlikely to agree to interact privately. He wants to win any debate, and he needs a jury of peers to have a chance. The option of having the discussion at a level that is loud enough for all to hear is unacceptable because it disrupts everyone from their work and gives others like Ramon a chance to join the exchange. A final alternative is to walk away from Ramon and ignore his efforts to be disruptive. This alternative only forestalls [sic] the inevitable next occurrence of unacceptable behavior. (Ken, 1 March 1999)

In Ken's experience, speaking quietly with a student normally made it possible for him to negotiate with the student what to do next. The situation was different in this science class: What normally worked even without having to objectify the situation and next move did not work here. Thus when Ken asked Ramon to step outside and Ramon refused, Ken was forced to deal with a situation Cangelosi (1993) explicitly suggests avoiding. Rather than having an opportunity to negotiate, he was forced to consider his next move and, in this, get even further out of step with the

unfolding events. Although his objectification of the experience and his consideration of his options may have appeared to fly by, the necessary detachment and time were sufficient for Ken to “lose touch” with the situation (Masciotra, Ackerman, & Roth, in press; Masciotra & Roth, 1999; Roth & Lawless, 2000). Such detachment makes “reflection-in-action” impossible (Eraut, 1995), an important reason to introduce the notion of *Spielraum*, room to maneuver without reflection (Roth, Lawless, & Masciotra, in press).

All too often, teaching methods manuals are based on the assumption that there are simple *a priori* relations between descriptions of practice and actual practice. When actual teaching does not look like the description, supervisors, administrators, students, parents, or peers blame the teacher. The inherent gap between description and praxis is not acknowledged. Yet readers will certainly have had experience with the difference between reading instructions (e.g., a cookbook, a software manual, programming instructions for a VCR, or directions for assembling furniture) and working out what the instructions seem to describe. So it is in teaching: Teachers find the connections between directives and practice through experience. For this reason, descriptions often break down under the pressure of context and time. Techniques are partial and inadequate descriptions extracted for purposes of communication (Bourdieu, 1980), and excellence and masterful practice cannot be based on them.

Some ethnomethodologists have taken an interest in understanding the relation between practice and descriptions of it, particularly the relationship between instructions and what instruction-followers actually do (e.g., Amerine & Bilmes, 1990; Bjelčić, 1992; Bjelčić & Lynch, 1992; Law & Lynch, 1990; Sharrock & Button, 1991; Suchman, 1987). Research shows that a motivated and competent reader will almost always arrive at definite conclusions about what instructions say even though the instructions may be only marginally adequate in providing what is needed to determine their meaning and even though there are no specifiable methods for reading instructions. Instruction-followers will, *then and there*, in the *here and now* of the particular situation, contrive ways of dealing with the seeming discontinuity. But to do so, they have to draw on their understanding of the possible and actual courses of actions and their outcomes. To know what teaching techniques “really” mean, then, teachers need to read them using their familiarity with circumstances in which such techniques are applicable. This is not a simple matter, as our examples from Ken’s, Cam’s, and Nadine’s teaching show. Even an experienced teacher may not be familiar with the particulars of some settings: Ken had not previously taught in an urban school and therefore was not familiar with the circumstances in which his techniques describe appropriate actions. His experience is not

unique (Bullough & Baughman, 1997). Teachers attempting to employ a particular technique need to understand not only how the technique works but also how it works in a particular situation and what really does rather than what conceivably may happen.

TEMPORALITY OF PRACTICE

People doing something seldom deliberately articulate everything they do and every aspect of their context. People seldom place their feet or choose nouns, verbs, and adjectives that they arrange in a proper sequence: They simply walk or talk. In many ways, we understand the world too well, much as the proverbial fish “understand” the water they inhabit: It has become so much part of their existence that it has become transparent (invisible). When real-time activities are objectified, they lose their transparent and temporal character. Practitioners work without objectifying precisely because they find themselves *in* the situation; they are part of the setting they inhabit “like a habit [clothing] or familiar habitat” (Bourdieu, 1997, p. 170, our translation). Thus, everyday praxis — teaching, repairing photocopiers, doing research, cooking, or gardening — is better described in terms of transparent coping than in terms of deliberate action (Dreyfus, 1991). The keyboards we used to write this article were transparent for the activity of writing; we were concerned with, for example, ideas, text, and choice of words. Keyboards emerge from the background into consciousness only in cases of breakdown or a change in their normal way of functioning or when we describe the activity of typing. In teaching, transparent coping allows the teacher to relate to students instead of focusing on the mechanics of implementing classroom management routines.

Temporality is not captured in existing theories of practice (Agre, 1997; Bourdieu, 1997) or teaching manuals. Practice unfolds in time, irreversibly, with its own rhythm, tempo, and directionality. The experience of practice is therefore temporally asymmetrical in that it can be known only from its beginning to the present, not in its completion. This temporality is constitutive of practice. However, it is destroyed by the objectifying of the researcher, for to be knowable, the practice has to be complete so that it can be lifted from the totality of experience. But as complete entities, the described practices and techniques have lost not only the context from which they were lifted but also their temporal aspect. In this “freezing” (Collins, 1990), polymorphic (multiple uses) and polythetic (multiple meanings) actions are converted into monomorphic and monothetic actions, that is, into techniques (Berg, 1998; Bourdieu, 1980). The freezing is not problematic in itself, but it is problematic when texts conflate and therefore confound the frozen images of practice with practice itself. Yet preservice

and experienced teachers alike often begin with these and similar descriptions of teaching only to be surprised that in their day-to-day praxis things often do not work out as expected. As Nadine discovered, there is a difference between the description of practice and the practice itself.

This still leaves unanswered the question, “How do teachers come to act appropriately despite doing so contingently and extemporaneously?” With Bourdieu (1980) we answer, “By developing *habitus*.”

HABITUS

Habitus is best understood as a set of dispositions that structure actions, perceptions, and expectations (Bourdieu, 1980). It stands in a dialectical relation to its material and social setting; it embodies the structures of this setting and constitutes a set of structured, structuring dispositions. From a phenomenological and Critical Psychological perspective, the experience of *being-together-with* others and things in the world predates experience of Self (Holzkamp, 1983; Ricoeur, 1992). Each individual comes to embody *habitus* through inclusion in a world always and already structured by the culture into which he is born (Heidegger, 1996). *Habitus* works in experience as an open system of dispositions that constantly adapts to produce practices that are appropriate in their context.

Habitus can be viewed as a *modus operandi* that functions *in praxis* according to norms that are not explicit principles. It is a “feel for the game” that allows practitioners to do what they do in a situation and at the right moment without the need to make thematic what has to be done. This feel, characteristic of what Bourdieu (1980) calls the practical sense (*sens pratique*), articulates the sense (*Sinn*) that constitutes the background necessary to anything resembling cognition. It makes unnecessary knowledge of an explicit rule for a practice. By analogy, native speakers can speak and write correctly without being well versed in (able to state the rules of) grammar, the explicit rules that govern their own tongue. Competent practice does not require explicit theoretical knowledge.

Habitus, though the prevalent modality of action associated with the experience of being-in-the-world, does not rule out other modalities. It may be accompanied by a strategic calculation of costs and benefits and, therefore, by an evaluation of objectified choices (Bourdieu & Wacquant, 1992). Deliberation may take over when *habitus* breaks down (for example, in a novel setting) or when *habitus* generates inappropriate actions, the routine adjustment of actions and context has been disrupted, or appropriate actions are no longer ready-to-hand. However, deliberation is

associated with the processing of representations, tokens of objectified experiences. This modality of action, as artificial intelligence and cognitive science researchers have shown, takes much longer than the epistemic actions and embodied computation of habitus (Kirsh & Maglio, 1994). Because deliberation takes time, the resulting action will necessarily be too late, because the world does not stop (Agre, 1997).

Although habitus is generally formed implicitly, it can be transformed by reflection on action “via socio-analysis, i.e., via an awakening of consciousness and a form of ‘self-work’ that enables the individual to get a handle on his or her dispositions” (Bourdieu & Wacquant, 1992, p. 133). The efficacy of the analysis depends on the existing habitus and the conditions. Thus, Ken, who engages in analyses of his teaching and reflection on his and other teachers’ practices in Opportunity, may be able to re-structure his habitus so that he can teach successfully in *this* school. However, such “self-work” does not come easily to even the best intentioned and most dedicated. As well, the analysis itself can never occur in a moment of action, for it requires time. Furthermore, inherent in abstraction is the loss of the indexical ground against which the actions have occurred and their meaning. Descriptions no longer include the specifics of the situation and in particular lack what made the actions meaningful in the first place.

Analysis requires freezing the activity. Descriptions are necessarily static and lead to the specification of techniques; in turn, practice gets presented as assemblies of techniques to be used in deliberation, the results of which are implemented. Implementation is problematic in a dual way. First, because descriptions and techniques are abstracted, converted from the dynamic and continuous world into the digital form of linguistic representation (e.g., Hutchins, 1993),² it is always questionable whether they can be re-grounded in the context in which they are supposed to be implemented. Second, deliberation prior to implementation requires internal time while external time continues (Agre, 1997).

Habitus embodies the structures of the world; it fits the world because of its structural coupling (Davis, 1996), an analog correspondence of agent and world. Deliberation associated with representation, logical consideration, and reflection not only is partitioned off from the world (in the mind) but also is different in kind from the world and has its own time (Agre, 1997). Although abstraction allows imaginative freedom, it creates phenomena that have little or no necessary relationship to physical space and time. In contrast, the analog computing of habitus arises from the dynamic and coupled relation between individual and world, leading to continuous updating and synchrony between the two.

COTEACHING AS BEING-TOGETHER-WITH

Implementing techniques on one's own — having to develop habitus without the benefit of seeing it in action, that is, from the experience of being-together-with another — frequently involves painstaking and frustrating trial and error.

I mean for me, as [for] classroom control, it has just all been trial and error, that is, learning as I went along, finding what works or what doesn't work. I felt . . . just thrown into it right away. I think [my cooperating teacher] just wanted to throw me in there and have me figure out what worked and what didn't work. I find that frustrating, that I didn't have any modelling, because I know there's other ways, I know there's other things out there, and I know that it works, but I haven't seen it. (Nadine, 14 March 1998)

Nadine was describing the protracted learning process by which she came to achieve classroom control. There was no simple, linear, direct way she could implement the abstract techniques that she had learned in a course. Ken had similar moments when he felt left alone, sometimes abandoned, by the regular teacher, Mr. Spiegel, who sat at the back of the classroom. Whereas Mr. Spiegel's experience of teaching in this school (though short) could have been a considerable resource for dealing with some of Ken's problems, his withdrawal forced Ken to develop his own expertise.

In response to the problems experienced by preservice teachers and on the basis of our experience of teachers learning from teachers as they co-participate in praxis, we have developed *coteaching*. Coteaching is a mode of teaching grounded in being-together-with as the fundamental condition of existence (Roth, 1998a, 1998b; Roth & Boyd, 1999; Roth, Masciotra, & Boyd, 1999; Roth & Tobin, in press). In coteaching, two practitioners share responsibility for teaching a class. They plan lessons together and work together in the classroom rather than splitting activities as often happens in team teaching. Coteaching does not preclude one person's taking a greater and more central role in some situations (e.g., during planning or questioning).

Coteaching works because habitus generates practices only *in relation to* particulars; as with other practices (Bourdieu & Wacquant, 1992), there is no better way to experience teaching than doing the real thing together with another practitioner. The benefits of coteaching fundamentally arise from being-together-with: People learn and harmonize their practices without having to make their learning thematic.

It is the objective homogenizing of group or class habitus resulting from the homogeneity of conditions of existence that enables practices to be objectively

harmonized without any strategic calculation or conscious reference to a norm, and to be mutually adjusted *in the absence of any direct interaction* or, *a fortiori*, explicit coordination. (Bourdieu, 1980, p. 98, our translation, italics in the original)

In quoting Bourdieu, we do not suggest that reflective practice should be abandoned but that an additional mode of learning is neglected if we focus only on reflection. Being-together-with, which underlies non-thematic learning and coordination of practices, allows co-participants to experience events under the same temporality, openness towards the future, and constraints to act without the leisure of theoretical (timeless) reflection. Practitioners experience synchrony between themselves and with the class. Under certain conditions, two experienced practitioners can conduct lessons, improvise, and exchange roles with a feel for the implicit intention of the other and without objectifying the events and communicating about them (Roth, 1998b; Roth & Tobin, in press).

If the learner is to acquire habitus without the tinkering required in trial and error, teaching a practice (*métier*, craft, trade) must be different from teaching propositional knowledge.

A number of modes of thinking and action, and oftentimes the most vital ones, are transmitted from practice to practice, through total and practical modes of transmission founded upon the direct and lasting contact between the one who teaches and the one who learns (“Do as I do”). (Bourdieu & Wacquant, 1992, p. 223)

This description is viable for learning not only material practices such as those of butchers and midwives (Lave & Wenger, 1991) but also the conceptual and methodological practices of academic researchers (Bourdieu, 1997; Roth & McGinn, 1998), and it is especially appropriate for learning to teach (Roth, 1998b).

In seven studies we conducted, all the teachers who engaged in coteaching emphasized the amount they learned. Even experienced teachers made comments such as “I don’t think three university courses could have given me what [coteaching] gave me in these two months” and “This experience has changed my thinking about this unit [although] I wrote it, tested it, and had done workshops with teachers on it for the past three years.” In our research, student teachers particularly benefitted from working with a more experienced practitioner:

Yes, that was helpful for me too, to listen to your questions and hear your questions *then and there*, as it happened, and then to think about how it related to the demonstration and where you were trying to go with that question. (Nadine, 23 March 1998)

We suggest coteaching not only for preservice and inservice teachers but also as a different way of conceptualizing the supervision and evaluation of teaching (Roth & Tobin, in press). Supervisors and evaluators who are also absorbed in the process of teaching get an inside perspective on the eventualities and potentialities in *this* particular classroom. During the moments when the other has taken the lead, coteaching allows reflection on the other's actions. Since this experience of being-together-with can be objectified later, the participants collectively elaborate an evaluation. Thus, Ken, who at first provided his student teachers with advice on what and how to teach, could develop a sense of what it meant to teach in the here-and-now of *this* class only by working side-by-side with a student teacher or with the regular teacher. Furthermore, all our studies show that coteaching provides a rich ground for developing a professional discourse, a praxeology (understood as talk about practice) associated with an ever-increasing understanding of practice out of practice (Tobin, Roth, & Zimmermann, in press). Praxeology is grounded in a hermeneutic phenomenology designed to develop understanding through rigorous explanation-seeking enquiry but always remaining in and enveloped by the situated understanding of day-to-day praxis (Roth & Tobin, in press). Thus, coteaching provides promise for closing the gap between theory and practice in that it objectifies practice out of practice but is always attached to practice.

CODA

In this article, we have conceptualized the theory-practice gap in terms of the difference between objectifying descriptions of practice and temporally unfolding practice itself. Teachers may automatically be in trouble, then, when they draw on prescriptions encapsulated in "teaching techniques," for these prescriptions do not come with background, the practical sense necessary for appropriately putting them into action. Furthermore, the objectification of one's situation needed to deliberate among alternative techniques takes time and puts one out of touch with unfolding events. Thus, because there is no "time out" in practice, teaching (like many other practices) relies on habitus to generate appropriate actions. Our work suggests that coteaching is an excellent context in which to develop and adapt preservice and experienced teachers' habitus. Coteaching also provides a ground for developing habitus through a praxeology in which we can embed Bourdieu's socio-analysis.

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NOTES

1. All names have been changed to ensure the anonymity of participants.
2. Hutchins (1993) discusses the difference between the analog form of cognition in the experience-based navigation of the Puluwat Islanders (Micronesia) and the digital form of cognition (tools, skills) in Western navigation. Whereas analog cognition requires being part of the world, structurally coupled, to complete the practice of navigation, digital Western navigation can operate in the abstract.

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