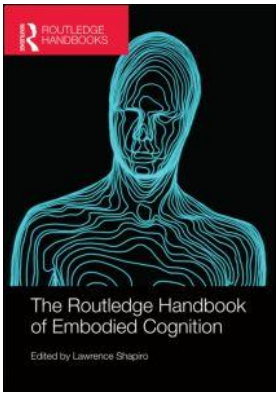

The Routledge Handbook of Embodied Cognition

Lawrence Shapiro

The Embodiment of Culture

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THE EMBODIMENT OF CULTURE

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What is the nature of culture? Is it a form of human values that floats above individual experience? Or, does culture arise from the mundane interactions of individuals with their physical and social environments? We provide answers to these questions in the following four sections of this chapter. In the first, we describe problems with standard conceptions of culture, including how it is learned and transmitted and how culture interfaces with psychological experience. In the second, we develop an approach based on ideas of embodied cognition: at the level of the individual and the small group (e.g. family), culture is the tuning of sensorimotor systems for situated action. In the third and fourth sections, we sketch the results from two empirical investigations that demonstrate the promise of this approach. One of the investigations documents how culture can influence distance perception by taking into account expected effort of interaction (e.g. Proffitt, 2006) with in-group and out-group members. The second demonstrates how close physical interaction of the sort hypothesized to lead to sensorimotor tuning can literally change the body schema so that dyads become closely attuned to one another; that is, they form an in-group.

The problem: a dualistic conception of culture

Pinning down a commonly accepted psychological characterization of culture is difficult (cf. Atran, Medin, and Ross, 2005; Kitayama, 2002; Kroeber and Kluckhohn, 1963; Tripathi, 2001). Nonetheless, there are two common working assumptions. The first is that culture is a package of propositional constructs like values, beliefs, and world views (Markus and Kitayama, 1991; Oyserman, Coon, and Kemmelmeier, 2002; Triandis, 1995). These rule-like structures specify the normative or prescriptive social code prevailing in the local group. The second is that this cultural grammar provides frames for making sense of incoming information, and simultaneously functions as the motivational force that biases behavior in predictable directions (Hong and Chiu, 2001). Note that these working assumptions create a duality: culture is both a set of abstract norms and a set of sensorimotor behaviors.

This duality is found amongst researchers who argue that culture proper should be exclusively identified with the abstract norms (Oyserman *et al.*, 2002), and also amongst advocates of a broader conception of culture that encompasses both ideations and behaviors (Kitayama, 2002;

Markus and Kitayama, 2010). The camps differ only as to whether genuine culture should be confined to one of the elements of this duality.

The duality raises questions such as, "What if stated values and observable behavior do not coincide?" and "Where should the label of 'genuine culture' be attached?" As an example, Cohen and colleagues (Cohen, Nisbett, Bowdle, and Schwarz, 1996) arranged for male participants from the southern and northern US to be bumped and then called "assholes." The researchers then collected biomarkers of stress and aggression and placed the participants once again in a potentially insulting situation. Relative to the northern participants, southerners showed an increase in cortisol (indexing stress) and testosterone (indexing potential aggression) levels, as well as a stronger behavioral face-off tendency during the second episode of potential insult. Thus, Cohen *et al.* produced strong behavioral and physiological evidence to claim that the South is dominated by a "culture of honor" that stresses masculine toughness and aggressive defense of reputation. Several years later, however, D'Andrade (2000) used verbal questionnaires to excavate the abstract normative value system that allegedly underlies those bodily manifestations of honor. But D'Andrade found no difference between southerners and northerners in value systems. Does honor exist apart from its bodily "manifestations?" Is the "value system" of honor psychologically real?

The discrepancy between the proposed genuine ideological foundations of culture and its behavioral manifestations is especially conspicuous in cognitive sociology. Swidler's (2001) informants endorsed the ideological belief that love is the basic motivation for marriage. But in contrast to this endorsed value, they did not actually bring their marriages to an end despite admitting that their marriages were no longer sentimentally fulfilling. Similarly, Vaisey (2008) interviewed teenage informants after they chose (on a survey) either to "do what makes me happy" or "do what God or scripture says." During the interview, both groups made similar decisions about acting in practical situations that implicitly required moral decisions. When asked to justify their behavioral choices, both converged on "gut instinct" and when pressed, they offered incoherent justifications. This finding is similar to those of Haidt and Hersh (2001) who report that participants rejected culturally degenerate acts (e.g. recreational drug use), but resorted to vague rationalizations for doing so.

The dual working assumptions also seem to produce a bias when interpreting observed effects of culture in regard to cause and effect. If in one and the same cultural population, a unique social characteristic is reliably established (e.g. how the individual relates to the in-group and out-groups) and a distinctive sensorimotor tendency is equally reliably marked as prevalent (e.g. the scope of visual attention, categorization biases, memory of inanimate scenes, or learning styles), only the former is characterized as defining for the cultural profile of the group, whereas the latter is typically conceived as the effect of culture on cognition (e.g. Nisbett and Miyamoto, 2005; Norenzayan, Smith, Kim, and Nisbett, 2002; Varnum, Grossman, Kitayama, and Nisbett, 2010). That is, the abstract norms are conceived as constitutive of the psychological fabric of culture and the sensorimotor behaviors merely secondary or consequent.

Markus and Kitayama's (1991) seminal conception of the "self" is an exemplar of this bias in interpretation. The main postulate is that the "self" is an emergent, abstract set of norms reflecting the individual-group relationship dominant in the local setting. In individualistic societies (e.g. North America), the value system stresses freedom of choice and achievement, while collectivistic cultures (e.g. East Asians) stress group-connectedness and social commitment. Individuals in the former setting typically develop "independent" self-construals with social orientations that center around self-direction, autonomy, and freedom of expression. In the collectivistic settings, "interdependent" self-construals are anchored in harmony and social commitment. Critically, Markus and Kitayama stressed that " … these divergent views of the

independent and interdependent selves can have a systematic influence on various aspects of cognition … " (1991, p. 224), a view that is rephrased in their recent review of the theory as "Independence and interdependence have significant consequences for cognition" (Markus and Kitayama, 2010, p. 425).

An alternative: the sensorimotor account of culture and behavior

In our alternative, there is no self-contained, multilayered psychological structure that could be labeled "culture." We do not claim that culture does not exist, nor do we assert that culture is not a valuable construct at the sociological level of analysis. Instead the claim is that culture is not a psychological structure that exists apart from more mundane learning and behavior. Thus, our account aims to substitute for the dualistic value-behavior conception of culture a unifying postulate: the psychological underpinning of culture consists of an individual's sensorimotor tuning arising from and guiding social interactions.

An important point of departure for our account is a particular understanding of human knowledge. The embodied approach assumes that knowledge resides in the multimodal manner in which the agent interacts with the environment. On this account, the body is not a mere input and output device controlled by a cognitive machine. Instead, both the anatomical and physiological sensorimotor characteristics of the body define the knowledge profile of the agent.

Convincing examples come from developmental psychology. For example, Dahl *et al.* (2013) demonstrate how the maturation that enables crawling sets the stage for a new type of sensorimotor knowledge that then becomes the basis for understanding stability in the world and wariness of heights. When an infant is being carried, there is no consistent correlation between the infant's proprioception and visual stimulation. However, once the infant begins to crawl, she keeps her head steadily pointed toward the goal. In this way, the infant can experience the consistent and strong correlations between commands to the muscles, proprioceptive feedback, and importantly, optic flow. This correlation then becomes the basis for a stable world. That is, a particular type of movement produces a particular flow of optical information, and it is that correlation that indicates that the world is stable and it is the infant that is moving within it. When that correlation is disrupted, it is a signal that the world is changing and that caution is needed. For the infant in the laboratory, that disruption is caused by placing the infant near a visual cliff, which causes the infant distress, but only after it has learned to crawl and tune itself to the correlation of proprioception and optic flow. Adults experience this sort of distress when in a stopped car and another car in the periphery begins to move. The sensation is that the world is changing and that one's own car is moving, and it produces a fearful stomping on the brakes.

As another example, Sommerville, Woodward, and Needham (2005) show that three-month-old infants can attend to adult goals, such as grabbing an object, but only after the infant develops some skill in grabbing and holding objects herself. Similarly, with older children, categorization of objects depends on how they have interacted with them (Smith, 2005). These examples demonstrate how knowledge, both particular and abstract (e.g. knowledge defining a stable world, knowledge about goals, and knowledge about categories) arises from sensorimotor interaction with the world.

We propose, similarly, that culture enters the scene not as a self-contained layer on top of behavior, but as the sum of sensorimotor knowledge brought about by a bodily agent interacting in a social and physical context. As such, culture diffuses the web of sensorimotor knowledge, and can only be arbitrarily circumscribed from other knowledge.

In the next few paragraphs, and in the research we present later, we apply this sensorimotor account to the development of interdependent and independent selves. We do not see this as the only application of the account, but as an example of how it applies to questions regarding culture.

On our view, interdependent and independent selves are constituted primarily by two pervasive types of sensorimotor interactions that are acquired and maintained through immersion in environments with different patterns of interpersonal interactions. The interdependent self develops when there are close interactions with the family and in-group members. These interactions "tune" the sensorimotor system to promote efficient interactions within this group. By tuning, we mean a process of neuroplasticity, or learning. For example, on learning a new behavior (e.g. how to crawl, how to walk, or how to talk), the mirror neuron system (Gallese, Keysers, and Rizzolatti, 2004; Rizzolatti and Craighero, 2004) tunes itself so that these skills are used in recognizing the homologous actions taken by others. After tuning of this sort, recognizing those actions is faster and more efficient than before tuning.

Furthermore, we propose that after sufficient sensorimotor tuning, the familiarity and fluency of tuned actions confer on these routines a value-like normative status; they become the "natural" way of engaging the world. Thus, strong sensorimotor tuning creates an in-group: the people with whom interactions are literally easy, efficient, and thereby enjoyable. In contrast, when people look, dress, smell, or talk differently, it is, we propose, literally more difficult to interact with them. As an example, consider conversing with an unskilled speaker of English; it can be difficult and exhausting. The unskilled speaker will pronounce and use words in unusual ways, use new metaphors and gestures, and use a syntax that does not easily match our tuned system. Thus, there will be misunderstandings, ambiguities, and the need for restatement that literally takes time and effort and may generate annoyance because the extended interaction interferes with other goals.

Again, the developmental literature provides a powerful example. Before an infant is strongly tuned to its native language, it can perceive phonetic distinctions that are not incorporated into the native language (e.g. Aslin, Jusczyk, and Pisoni, 1998; Kuhl, Williams, Lacerda, Stevens, and Lindblom, 1992). However, once the infant has had considerable experience with the native language, the ability to perceive non-native distinctions is lost (e.g. the inability of native Japanese speakers to perceive the /l/ versus /r/ distinction).

We propose furthermore that the frequency and familiarity of tuned interactions make them more accessible to reflective, discursive consciousness. Thus, these sorts of interactions can be communicated through language and endorsed to a lesser or greater degree when encountered on a survey.

In contrast with the interdependent self, we propose that the independent self arises from more varied interactions with a broader array of people, sights, sounds, and actions. Thus the independent sensorimotor system becomes less narrowly tuned to particular practices.

By way of analogy, consider the different tuning required for soccer and (American) football players. Their knowledge of the "natural" mode of conduct in their respective game cultures is fundamentally constituted by an implicit repertoire of how to engage the ball, team members (i.e. in-group), and opponents (out-groups). For example, the suppression of a reflexive motor command to handle a looming ball manually in the case of the soccer (but not football) player is a preverbal, non-ideological bodily tendency that establishes his belonging to the soccer culture.

Of course, becoming a coach necessitates acquiring some skill in communicating knowledge in the form of instructional rules. This, however, does not necessarily bring about a change in the representational format of the basic knowledge from sensorimotor to symbolic or abstract. That is, the coach may describe the rule verbally, but it requires physical practice to instantiate the rule in behavior.

Thus, contrary to the mainstream view, explicit, verbalizable value statements come secondarily to what makes up culture. From the enculturated layperson's view (when serving as a participant in a cross-cultural study), values are not the source for culture but are contingent attempts to find an abstract generalization that captures the relevant confluence of implicit bodily routines. As such, the verbal value statements conform to the underlying procedural dispositions to the extent that these are accessible to consciousness and can be verbalized.

For our account to have any force, it must be the case that social and physical environments that foster interdependent and independent selves differentially afford the sensorimotor tuning we propose. The following excerpt from Adams and Markus (2004, p. 343) suggest that is the case:

> Given an exclusive emphasis on "subjective culture", there is a tendency to interpret cultural patterns like independent and interdependent construals of self … [citing Markus and Kitayama, 1991] as differences in subjective beliefs. Instead these concepts refer to different constructions: beliefs built into the physical patterns of everyday life. The independent constructions of self and relationship that are prominent in mainstream American settings are not merely beliefs about separation. Instead, they are linked to a reality of separation that is built into structures of everyday life like dating practices, residence in apartment units, and individual ownership. Similarly, the more relational or interdependent constructions of self and relationship that are prominent cultural patterns in many West African settings are not merely beliefs about connection. Instead, they are linked to a reality of connection that is built into structures of everyday life like arranged marriage, residence in lineage compounds and the practice of eating meals from a communal bowl.

Research on child attachment theory has also documented systematic differences in child-rearing practices between Western and Eastern settings. In Japan (Rothbaum, Weisz, Pott, Miyake, and Morelli, 2000), Cameroon (Keller, Voelker, and Yovsi, 2005), India (Saraswathi and Pai, 1997), and Mexico (Brazelton, Robey, and Collier, 1969), children are carried along in daytime and sleep next to their mothers at night. Children are watched and even breastfed by neighbors and relatives. Mothers are keen to quickly or even anticipatorily respond to their children's distress signals, which "minimizes self-other distinction" (Greenfield, Keller, Fuligni, and Maynard, 2003, p. 470).

Thus, from the birth onward, the child's sensory and motor systems are immersed in tangible socio-physical environments with a tacit predominance of either independence/individualistic or interdependence/collectivistic practices. Only (or predominantly) by virtue of their substantial incarnation in the palpable physical and interpersonal structures of the local environment do these practices gain their psychological force and appear to the researcher as an ideology. They carve a peculiar profile of sensorimotor tuning of the child's body as she strives to make sense and effectively participate in the daily behavioral "rituals" dictated by the local social and physical ecology.

In short, the account we advocate as an alternative does not stop at the assertion that culture is embodied. Rather, we understand culture, that is, sensorimotor tuning, to infuse virtually all knowledge. Culture does not have domain-specific mechanisms of its own, but works through biases in interactional sensorimotor mechanisms.

Clearly, this conception of culture raises enough empirical questions to fill several lifetimes of research. We begin by reporting on two projects that address some of those salient questions. In the first project, we ask if our conception of culture, based on tuning of sensorimotor

mechanisms, can play out in a prototypical sensorimotor task: distance estimation. In the second, we ask if close sensorimotor interaction can result in the formation of an in-group.

Project 1: culture and distance estimation

How do we estimate the distance to objects? Almost certainly, we are not born with built-in rulers that give us measures in feet or meters. Instead, we seem to use body-based rulers (Proffitt and Linkenauger, 2013): eye height provides the unit for measuring the height of an object (e.g. it's about as tall as I am), the hand is used for scaling graspable objects (I can easily grasp it), the length of the arm scales reachable objects in peripersonal space (I can reach it), and the amount of effort needed to traverse a distance is used as a measure of that distance. Thus, as reviewed in Proffitt (2006), participants reported inflated visual distance to targets that required more motor effort to reach. Similarly, participants who were wearing a backpack, exhausted, in poor fitness, elderly, or in ill-health reported hills to appear steeper when compared with their fit, healthy, younger, or rested counterparts.

We combined Proffitt's insights with our speculations about culture to generate the cultural-effort hypothesis: because it is easier to interact with in-group members than out-group members, in-group members should be seen as literally closer than out-group members. However, because sensorimotor tuning to the in-group is stronger for those with interdependent self-construals than those with independent self-construals, we predicted that the difference in distance estimation would be greater for interdependents.

In the first experiment (for details, see Soliman, Gibson, and Glenberg, 2013), Participants filled out the paper-and-pencil Singelis (1994) scales to get a measure of interdependence and independence. For example, agreeing that, "I feel good when I cooperate with others," is taken as evidence for an interdependent self-construal. We computed the ratio of the interdependence to independence scales, and we refer to this ratio as "measured interdependence." The participants practiced making distance judgments in terms of number of seconds it would take to walk to a target, namely, an experimental confederate. Finally, the participants moved to a new location and judged distances to the confederate (literal distances were between 6.77 and 22.43 meters). Importantly, the participants were American students and the confederates were American students (in-group).

Of course, judged distance (seconds) increased as a function of literal distance; on average, each meter of literal distance increased the judged distance by 0.86 seconds (see Figure 20.1). More importantly for the cultural-effort hypothesis, there was a statistically significant interaction: the more interdependent the participant, the shorter the estimated distance to the in-group confederate, and this was particularly true for the longer distances.

The fact that we observed an interaction (that the difference in judged distance between interdependents and independents increased with distance) and not simply an overall difference between interdependents and independents is important for demonstrating that the groups were using different measurement scales (Proffitt and Linkenauger, 2013). Note that when the unit of measurement differs, the difference becomes larger with increased distance (an interaction). For example, suppose that person A measures distance in feet, and person B measures distance in yards. At a distance of 1 yard, the two measurements, 3 (feet) and 1 (yard), differ by 2. But at a distance of 5 yards, the two measures, 15 (feet) and 5 (yards), differ by 10. Thus, the interaction is strong evidence that the interdependents and independents are measuring distance using different scales, namely different amounts of expected effort.

Although the data from Experiment 1 are consistent with the cultural-effort hypothesis, this novel finding needs to be replicated, it needs to be extended to other cultures, and we need to

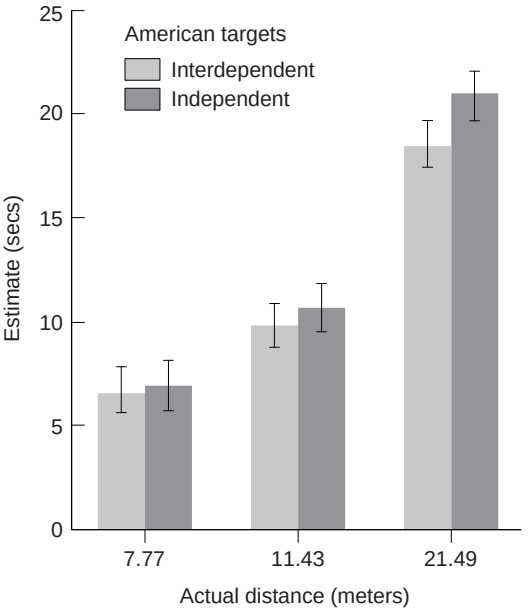

Figure 20.1 Mean estimated distance (in seconds, sec, to walk to the target) as a function of actual distance (in meters, m) for American participants judging distances to American (in-group) targets. The "interdependent" mean estimates are for one standard deviation above the mean measured interdependence; the "independent" mean estimates are for one standard deviation below the mean measured interdependence. Error bars indicate one standard error.

test additional predictions. For example, when judging distances to out-group members, we should find the reverse effect. That is, interdependents are strongly tuned to the in-group, and so interactions with out-group members should be seen as particularly effortful. For independents, who are not strongly tuned to the in-group, interactions with the out-group should not be particularly effortful. Thus, when interacting with the out-group, we predict that literal distances should appear farther for interdependents than for independents, the reverse of the data in Figure 20.1.

We tested these ideas in a new experiment that included both Arab and American participants. Our confederates were two dark-skinned women, one of whom wore a hijab (Arab head covering). The idea was to make it appear that the confederates were members of the in-group for the Arab participants and members of the out-group for the American participants.

The distance estimates are displayed in Figure 20.2. Again, there is a large increase in estimated distance with real distance (0.81 seconds/meter). In addition, there were two statistically significant interactions. The first interaction was between culture (Arab or American) and measured interdependence. For the Arabs, when judging distance to in-group members (the Arab-looking confederates), the interdependents produced smaller estimates than the independents, thus replicating the effects seen in Experiment 1, but with participants from a different culture. For the Americans, when judging distance to out-group members (the Arab-looking confederates), the interdependents produced larger estimates than the independents, thus confirming the reversal predicted from the cultural-effort hypothesis. The second interaction indicated that these effects of culture and self-construal increased with distance, replicating the interaction in Experiment 1, and strongly confirming the prediction that the groups are using different measurement scales.

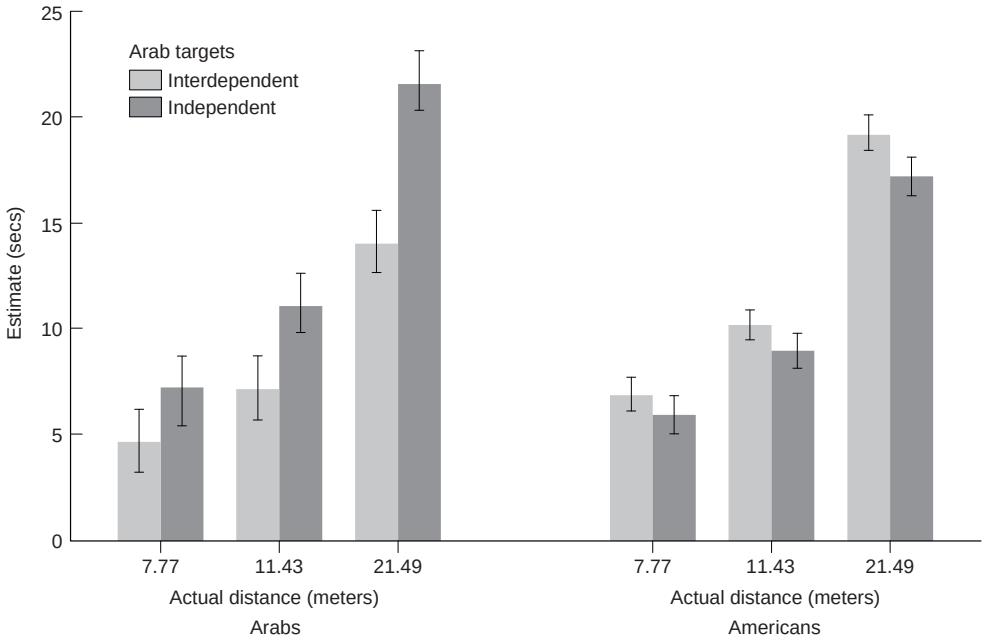

Figure 20.2 Mean estimated distance (in seconds, sec, to walk to the target) as a function of actual distance (in meters, m) for Arab participants (on the left) and for American participants (on the right). Both groups of participants judged distances to Arab-looking targets. The "interdependent" mean estimates are for one standard deviation above the mean measured interdependence (for Arab or American groups separately); the "independent" mean estimates are for one standard deviation below the mean measured interdependence. Error bars indicate one standard error.

These findings can be seen only as preliminary: it is still necessary to replicate using participants from additional cultures, and although Proffitt's mechanism of expected motor effort seems to be a plausible cause underlying these cultural differences in visual estimates, this mechanism still needs to be directly implicated. Nonetheless, the findings are clearly consistent with the cultural-effort hypothesis in particular and with our claims about the sensorimotor nature of culture in general. They point to the possibility of redefining interdependence and independence by recourse, not to explicit values and beliefs, but to sensorimotor interpersonal repertoires that are either narrowly tuned to in-group interactional practices, or more broadly tuned, and appearing to be more culturally diverse.

Project 2: tuning the sensorimotor system and the joint body schema

An important part of our approach to culture is the idea that frequent interaction and coordination tunes the sensorimotor system in the service of efficient interaction. The first project presumed greater tuning among same-culture participants and greater tuning for interdependents than independents. In the second project, we attempt to create sensorimotor tuning and measure some of its manifestations, namely, changes in the body schema.

Primates use a body schema to track the locations of their limbs. This schema is malleable (a) because it must change with development and growth, and (b) because it adapts with tool use

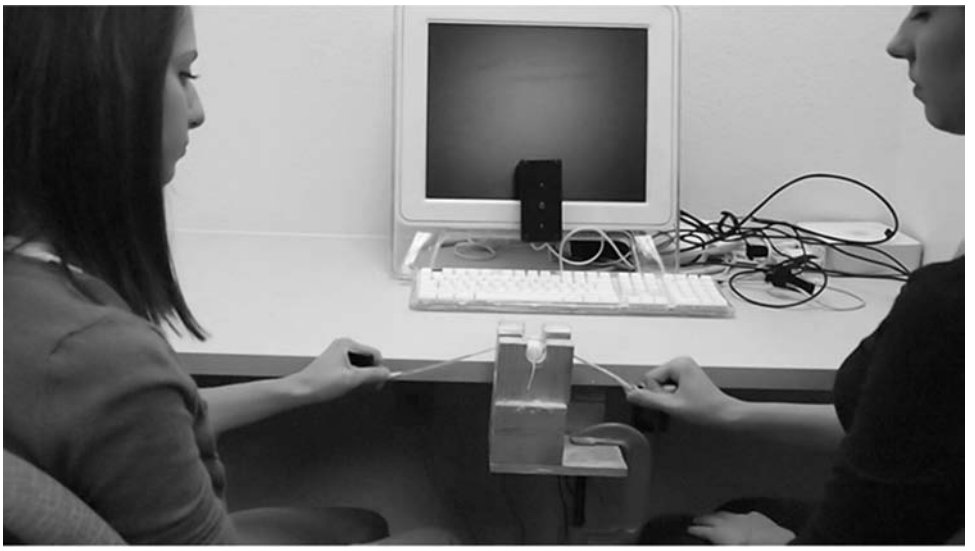

Figure 20.3 The arrangement for inducing and measuring the JBS (joint body schema) effect. The confederate, on the left, is using her left hand to help saw the candle. The participant, on the right, is using her right hand. Note that her left hand is in her lap. The candle is held horizontally in the wooden holder. The LEDs are mounted on the bottom of the screen. During the measurement phase, the confederate holds her left hand near the LEDs so that her index finger is near the top LED and her thumb is near the bottom LED.

(as reviewed below). Here we predict that adaptation of the body schema when coordinating with another person will be particularly strong among those with interdependent self-construals. That is, because interdependents have a developmental history of closely attending to (in-group) others, they should show a particularly robust adaptation of the body schema.

The experiments had two phases. In the first phase, the participant and the confederate coordinated for five minutes by moving a flexible wire back and forth to cut through candles (see Figure 20.3; for details, see Soliman, Ferguson, and Glenberg, submitted). The task required close coordination to keep the wire taut so that it would cut. In the basic experimental condition illustrated in Figure 20.3, the participant (on the right) uses her right hand to hold one end of the wire tool, and the confederate uses her left hand.

The second phase of the experiment was the flash/buzz paradigm as developed by Maravita, Spence, Kennett, and Driver (2002). Using this procedure, the participant has a cell phone buzzer attached to the index finger and another attached to the thumb. One of the buzzers is activated, and the task is to indicate (using a foot pedal) whether the thumb or index finger had been stimulated. The task is trivially easy. However, if the two fingers are held next to LEDs, and the LEDs flash in temporal synchrony with the buzzer but spatially incongruously (e.g. the thumb is stimulated by the buzzer but the LED next to the index finger is flashed), participants are slowed and make errors.

Maravita *et al.* (2002) demonstrated that tool use can modify the interference from incongruous trials in the flash/buzz procedure. Namely, before using a tool, the LEDs interfere with localization of the vibration only when they are near the fingers, that is, in peripersonal space. After using a tool (e.g. a rake), the LEDs can be located at the end of the tool, outside of the usual peripersonal space, and still interfere with localization of the active buzzer.

Maravita and Iriki (2004) review the physiological basis for this effect. In brief, there are bimodal neurons in the parietal cortex that have both somatosensory and visual receptive fields focused on the hand. That is, touching or stimulating the hand increases the firing of these neurons on the basis of the somatosensory receptive field. The same neuron also has a visual receptive field so that looking near the hand increases the firing rate of the neuron. Thus, the neuron appears to be useful for coordinating between vision and touch. Furthermore, after tool use, the visual receptive field migrates to include the effector end of the tool even if that end is outside of peripersonal space. Now the neural firing serves to coordinate the sight of the end of the tool with the feel at the hand. Thus, tool use adapts the body schema so that it incorporates the tool in the service of effective wielding.

We had two questions. First, does close coordination with another person act to adapt the body schema as if the other person were a social tool? That is, would our participants adapt their own body schemas to incorporate aspects of the partner in the service of effective coordination? Second, would this adaptation of the body schema be more pronounced for those with interdependent self-construals? If so, then after coordination in the candle-cutting task, when the in-group confederate holds her hand near the LEDs, incongruous flashes should interfere with the interdependent participant's ability to localize the buzzing stimulus on her own fingers. We refer to this possibility as the development of a joint body schema (JBS).

The experiments also examined several other constraints on the development of the JBS. First, the interference produced by the confederate's fingers near the LEDs should only be found after the confederate and the participant jointly cooperate in cutting the candle. When the participant cuts the candle herself by using a wire with a plumb weight on one end (to replace the confederate), there should be little interference produced by the confederate's fingers near the LEDs. In fact, we will use as a measure of the JBS the following difference of differences. After the participant and the confederate have coordinated in cutting the candle, we measure the time for the participant to correctly localize the buzz on her fingers when the confederate has her fingers near the LEDs. The first difference is between the mean for incongruous trials compared with the mean for congruous trials (when the flashing LED is near the confederate's finger that is homologous to the participant's finger that is stimulated). This difference indicates the interference produced by incongruous trials. We also compute the same difference after the participant has cut the candle by herself, although the confederate holds her fingers near the LEDs. The difference of the differences is produced by subtracting from the first difference (the interference effect after coordination) the second difference (the interference effect after no coordination). This difference of differences tells us whether by coordinating with the confederate, the participant has adjusted her own body schema, that is, whether the confederate has become a social tool. This difference-of-differences score is depicted on the far left in Figure 20.4, and we will refer to it as the JBS effect.

Second, if the body schema of the participant is actually affected (rather than the participant simply learning to attend to the confederate's hand), then the JBS effect should be most pronounced when the participant is buzzed on her left hand, the hand homologous to that used by the confederate in jointly cutting the candle. The JBS effect should be reduced if the participant is buzzed on her right hand. The right-hand (non-significant) JBS effect is illustrated by the bar second from the left in Figure 20.4.

Third, if the confederate uses her right hand to cut the candle, then there should be a reduced JBS effect on the participant's left hand. This non-significant JBS effect is illustrated by the third bar.

Fourth, and most relevant to the current purposes, if the participant has an interdependent self-construal, that is, her developmental history has primed her to attend closely to others, then she should

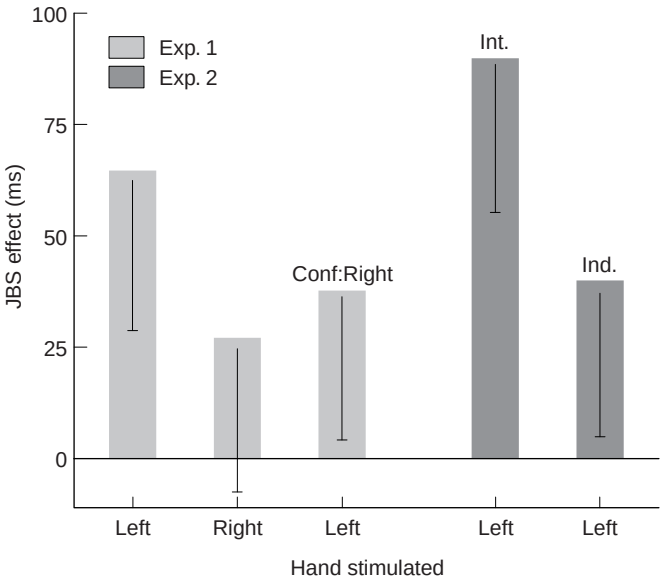

Figure 20.4 The mean JBS (joint body schema) effect (in milliseconds, ms, see text for explanation). In all conditions, the confederate held her left hand at the LED (see Figure 20.3). In all conditions except the one labeled "Conf:Right," the confederate had used her left hand to help cut the candle. For Experiment 2 (Exp 2), the "interdependent" (Int) mean estimate is for one standard deviation above the mean measured interdependence; the "independent" (Ind) mean estimate is for one standard deviation below the mean measured interdependence. Error bars are one standard error although only the lower error bars are illustrated.

develop a large JBS effect compared to participants with independent self-construals. The statistically significant JBS effect for interdependent participants is illustrated in the fourth bar, and the non-significant effect for the participants with independent self-construals is illustrated in the fifth bar. (The data contributing to the first and fourth bars are from different participants. Thus the data provide a replication of the JBS effect across experiments; see Soliman, Ferguson *et al.*, submitted, for details.)

We think that the JBS effect is likely to be much more than a laboratory curiosity. Note that societies offer multiple opportunities for close coordination: dancing, singing, marching, praying, cooking, manufacturing. All of these opportunities can, we suspect, create multiple JBSs that become the basis for the in-group. Furthermore, we suspect that having a JBS is a precondition for a strong empathetic response. In fact, others have already demonstrated that synchronous behavior does enhance empathy. Finally, the notion of a JBS helps us to understand not just in-group favoritism, but also out-group derogation. That is, people with whom one has interacted feel close, perhaps even part of the self, because of the JBS. In contrast, people with whom one has not interacted appear distant, separate from the self, and perhaps even different in kind.

Conclusions

In this chapter, we presented the first pass of a unified sensorimotor account of culture. In place of dualistic conceptions that propose a distinction between values and behaviors, we conceive of culture as a repertoire of bodily modes of interaction. These modes develop through, and

ultimately serve, effective participation in socio-physical ecologies. In support of this view, we empirically demonstrated two effects. First, part of having an interdependent self-construal is to experience more bodily effort when interactions with out-group members loom. Second, interdependents easily adapt their own body schemas to incorporate the kinematics of an in-group partner. Being an independent, on the other hand, partly means that one is likely to experience less differential effort when interacting with in- or out-group members, and after interacting, the independent will maintain a stronger distinction between self and other. These preverbal bodily ways of relating to others, we believe, constitute the foundations of the psychological fabric of culture.

References

Adams, G., and Markus, H. R. (2004). Toward a conception of culture suitable for a social psychology of culture. In M. Schaller and C. S. Crandall (Eds.), *The psychological foundations of culture*. Hillsdale, NJ: Erlbaum.

Aslin, R. N., Jusczyk, P. W., and Pisoni, D. B. (1998). Speech and auditory processing during infancy. In D. Kuhn and R. Siegler (Eds.), *Handbook of child psychology: Cognition, perception, and language* (5th ed.). New York: Wiley.

Atran, S., Medin, D., and Ross, N. (2005). The cultural mind: environmental decision making and cultural modeling within and across populations. *Psychological Review, 112*(4), 744–76.

Brazelton, T. B., Robey, J. S., and Collier, G. (1969). Infant development in the Zinacanteco Indians of southern Mexico. *Pediatrics, 44*(2), 274–83.

Cohen, D., Nisbett, R. E., Bowdle, B. F., and Schwarz, N. (1996). Insult, aggression, and the southern culture of honor: An "experimental ethnography." *Journal of Personality and Social Psychology, 70*(5), 945–60.

Dahl, A., Campos, J. J., Anderson, D. I., Uchiyama, I., Witherington, D. C., Ueno, M., *et al.* (2013). The epigenesis of wariness of heights. *Psychological Science, 24*(7), 1361–67.

D'Andrade, R. (2000). The action system hypothesis. Paper presented at a colloquium given by the Committee on Human Development at the University of Chicago, May.

Gallese, V., Keysers, C., and Rizzolatti, G. (2004). A unifying view of the basis of social cognition. *Trends in Cognitive Sciences, 8*(9), 396–403.

Greenfield, P. M., Keller, H., Fuligni, A., and Maynard, A. (2003). Cultural pathways through universal development. *Annual Review of Psychology, 54*, 461–90.

Haidt, J., and Hersh, M. A. (2001). Sexual morality: The cultures and emotions of conservatives and liberals. *Journal of Applied Social Psychology, 31*, 191–221.

Hong, Y., and Chiu, C. (2001). Toward a paradigm shift: from cross-cultural differences in social cognition to social-cultural mediation of cultural differences. *Social Cognition, 19*, 181–96.

Keller, H., Voelker, S., and Yovsi, R. D. (2005). Conceptions of parenting in different cultural communities: The case of West African Nso and northern German women. *Social Development, 14*(1), 158–80.

Kitayama, S. (2002) Culture and basic psychological processes – Toward a system view of culture: Comment on Oyserman et al. (2002). *Psychological Bulletin, 128*(1), 89–96.

Kroeber, A. L., and Kluckhohn, C. (1963). *Culture: A critical review of concepts and definitions*. Cambridge, MA: Harvard University Press. (Orig. publ. 1952.)

Kuhl, P. K., Williams, K. A., Lacerda, F., Stevens, K. N., and Lindblom, B. (1992). Linguistic experience alters phonetic perception in infants by 6 months of age. *Science, 255*(5044), 606–8.

Maravita, A., and Iriki, A. (2004). Tools for the body (schema). *Trends in Cognitive Sciences, 8*(2), 79–86.

Maravita, A., Spence, C., Kennett, S., and Driver, J. (2002). Tool-use changes multimodal spatial interactions between vision and touch in normal humans. *Cognition, 83*(2), B25–34.

Markus, H. R., and Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review, 98*(2), 224–53.

——(2010). Culture and selves: A cycle of mutual constitution. *Perspectives on Psychological Sciences, 5*(4), 420–30.

Nisbett, R. E., and Miyamoto, Y. (2005). The influence of culture: Holistic versus analytic perception. *Trends in Cognitive Sciences, 9*(10), 467–73.

Norenzayan, A., Smith, E. E., Kim, B., and Nisbett, R. E. (2002). Cultural preferences for formal versus intuitive reasoning. *Cognitive Science, 26*(5), 653–84.

Oyserman, D., Coon, H., and Kemmelmeier, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses. *Psychological Bulletin, 128*(1), 3–72.

Proffitt, D. R. (2006). Embodied perception and the economy of action. *Perspectives on Psychological Science, 1*(2), 110–22.

Proffitt, D. R., and Linkenauger, S. A. (2013). Perception viewed as a phenotypic expression. In W. Prinz, M. Beisert, and A. Herwig (Eds.), *Action science: Foundations of an emerging discipline*. Cambridge, MA: MIT Press.

Rizzolatti, G., and Craighero, L. (2004). The mirror neuron system. *Annual Review of Neuroscience, 27*(1), 169–92.

Rothbaum, F., Weisz, J., Pott, M., Miyake, K., and Morelli, G. (2000). Attachment and culture: Security in the United States and Japan. *American Psychologist, 55*(10), 1093–1104.

Saraswathi, T. S., and Pai, S. (1997). Socialization in the Indian context. In H. S. R. Kao and D. Sinha (Eds.), *Asian perspectives on psychology*. Thousand Oaks, CA: Sage.

Singelis, T. (1994). The measurement of independent and interdependent self-construals. *Personality and Social Psychology Bulletin, 20*(5), 580–91.

Smith, L. B. (2005). Action alters shape categories. *Cognitive Science, 29*(4), 665–79.

Soliman, T., Ferguson, R., and Glenberg, A. M. (submitted). Humans develop an interpersonal joint body schema.

Soliman, T., Gibson, A., and Glenberg, A. M. (2013). Sensory motor mechanisms unify psychology: The embodiment of culture. *Frontiers in Psychology*. doi: 10.3389/fpsyg.2013.00885.

Sommerville, J. A., Woodward, A. L., and Needham, A. (2005). Action experience alters 3-month-old infants' perception of others' actions. *Cognition, 96*(1), B1–11.

Swidler, A. (2001). *Talk of love: How culture matters*. Chicago: University of Chicago Press.

Triandis, H. (1995). *Individualism and collectivism*. Boulder, CO: Westview Press.

Tripathi, L. (2001). Culture as a psychological construct. *Psychology Developing Societies, 13*(2), 129–40.

Vaisey, S. (2008). Socrates, Skinner, and Aristotle: Three ways of thinking about culture in action. *Sociological Forum, 23*, 603–13.

Varnum, M., Grossman, I., Kitayama, S., and Nisbett, R. (2010). The origin of cultural differences in cognition: Evidence for the social orientation hypothesis. *Current Directions in Psychological Science, 19*(1), 9–13.