



Resonance in dance: The art of blending bodies

Edward C. Warburton

University of California, Santa Cruz
Theater Arts Department
tedw@ucsc.edu

Introduction

"That dancer there," the choreographer pointed, "he is close but far, far away from me." Standing next to the choreographer, I wondered what she meant. The dancer was just a few feet from us and appeared focused and attentive, but the choreographer sounded dismissive. I had observed the dancer as someone who learned the steps and spatial patterns quickly. He could artfully and skillfully repeat them on command. His interpretation of the choreographer's movement vocabulary seemed nuanced and articulate. He was clearly motivated to contribute helpful solutions to the various choreographic problems that arose over the course of the rehearsal process. The choreographer appreciated his mental and physical effort. But I sensed something odd between them. What did "far, far away" mean? Later, the choreographer explained:

The tone of my work needs more ... attention ... more suspension ... (she demonstrates movement) that flow together sets the tone for the entire dance and he (the dancer) is out of synch with it, the others. He's got the steps ... not on the same wavelength ... I don't know, just far, far away from me and that's not gonna work. I don't know if this is going to work.

Our conversation took place during ArtsCross: a creative-research collaboration among dance artists and academics from Beijing, London, and Taipei. Over the course of several years, I observed a dozen dance-makers who expressed sentiments similar to the quote above. When choreographers and dancers ex-

¹Em inglês, *wavelength*, termo técnico do campo da Física. (N.T.)

pressed most satisfaction with the works in progress, I witnessed what can be described as a shared sense of energy, rhythm, flow, and coherence. I wondered, what does one mean by saying “on the same wavelength” with someone else, or that two people are “in synch,” or that something “sets the tone” for something else? In interviews, I asked ArtsCross dance artists to confirm my observations with a single descriptor: the word “resonance” was the most commonly used term (other terms included togetherness, flow, and relationship).

In what ways does dancing signal resonance: how do dancers resonate? In this theoretical essay, I unpack the idea of resonance and reflect on its nature and role in creating and performing dance. I begin by defining resonance, exploring its use in various disciplines. I describe the ArtsCross project. I recount the research questions that led me to posit resonance as a unique kind of human social cognition in the context of self-other matching. I consider findings from cognitive and neuroscience on self-other matching in three domains: motor, perceptual, emotional. I review how reflective, controlled, explicit, social (“higher order”) cognitive functions—like imitation, perspective-taking, and empathy—relate to lower-level, reflexive, automatic, implicit functions, such as motor resonance or emotional contagion. I focus on the varieties of empathy in dance as especially salient for the embodied, felt experience of resonance. I introduce a theory of cognition developed by Gilles Fauconnier and Mark Turner (2002) called “conceptual blending.” I hypothesize that “embodied conceptual blending” is a key mechanism for developing resonance in dance. I explore issues that arise about the role and function of dance resonance and speculate on gender differences. I discuss the implications for dance research and education.

Resonance

The term resonance (from Latin *resonantia*, “echo,” from *resonare*, “resound”) originates from the field of acoustics. Musicians observed “re-sounding” in musical instruments when strings started to vibrate and to produce sound without direct excitation by the player. Resonance became the term for the fact that, when a

specific fundamental frequency is created by any other object in the neighborhood of the original object, the original object responds to that frequency by re-sounding or “resonating” with it. The phenomenon of resonance has been explored in a variety of disciplines. In physics, for example, resonance occurs when a vibrating system or external force drives another system to oscillate with greater amplitude at a specific preferential frequency. Physicists have observed this with all types of vibrations or waves: there are acoustic, electromagnetic, mechanical, nuclear magnetic, and many other kinds of resonance that result from vibrating “wave functions.”

American popular culture also uses resonance as a metaphor to describe relations. In social psychology, researchers have long understood resonance as connotating empathic connection. In English, “I resonate with that” commonly indicates an understanding or acknowledgment that the person has had a similar experience. Whereas in the West the word refers to social behavior, Eastern philosophical traditions use a concept of resonance that is central to the divine as well as human wellness based on a system of energy centers that affect wellness.

As suggested by its linguistic origins, research on acoustic resonance has a long history in music. It is worthwhile to mention the concepts of musical consonance and dissonance, which are related to but not the same as resonance. According to the Oxford English Dictionary, consonance means “harmony; accord or agreement, harmony of sounds; a simultaneous combination of tones conventionally accepted as being in a state of repose.” Dissonance is “disharmony; inharmonious or harsh sound, discord, cacophony; simultaneous combination of tones conventionally accepted as being in a state of unrest and needing completion; unresolved; discordant chord or interval.” Unlike consonance, in which two or more frequencies combine to create harmony, resonance occurs when the wavelengths are exactly the same; that is, when two wavelengths of similar frequencies come together as one. This merging into a single amplified wave is described in physics as rhythmic entrainment: sound waves that emanate from vibrating bodies merge into single, amplified waves when they are vibrating at similar frequencies and thus result in resonance. Whereas resonant waves are defined as having attained a state

² For additional details go to www.rescen.net/events/ArtsCross_index.html to learn more about the goals, participants, and outcomes of the ArtsCross project.

of rest, dissonant waves are regarded as incomplete, unresolved, and seeking completion. Resonance, then, suggests the presence of heightened energetics, rhythmic coordination, a state of flow, and increased coherence as vibrating bodies merge into a singular unity. Clearly, a necessary, but not sufficient, condition is physical proximity. Dance researchers have long recognized that human beings in physical proximity interact on many levels of consciousness, using reflective and prereflective bodily awareness. As Sheets-Johnstone (2009) writes, "our tactile-kinesthetic body is always present and present along a gamut of possible awareness from marginal to maximal. Any time we wish to pay closer attention to it, there it is" (p. 260). A keen bodily awareness allows skilled performers to monitor the efficacy of their performance and that of others, contributing to a sense of agency and enjoyment in the dance experience. Given applications of resonance in music, physics, and psychology, several questions of interest arise. What are the underlying mechanisms that create the conditions for resonance? What are the effects of two or more individuals interacting with one another when the resulting "system" is resonant? What is the nature and role of resonance in dance?

ArtsCross

The source of my inquiry into resonance derives from ArtsCross: a multi-year, creative-research collaboration among dance artists and academics from Beijing, London, and Taipei with a double focus. On the one hand, nine choreographers from the three cities are selected to work over three weeks with mixed groups of dancers, also from the three cities, to create a 10-minute work on a theme. On the other hand, a cluster of academics, gather to watch, reflect upon, and exchange ideas about the process in action. As the lone American academic, I participated because of a research interest in the cognitive processes and relational practices

³O conceito de *entrainment* descreve uma tendência comum entre sistemas físicos e biológicos de coordenação de eventos temporalmente estruturados através da interação, cf. CLAYTON, Martin; SAGER, Rebecca. In time with music: the concept of entrainment and its significance for ethnomusicology. ESEM Counter Point, Vol.1, 2004. (N.T.)

⁴"our tactile-kinesthetic body is always present and present along a gamut of possible awareness from marginal to maximal. Any time we wish to pay closer attention to it, there it is"

that support (or undermine) the doing, making, and watching of dance.

My ArtsCross research focused on the relationship between the object of the dance and the subject who dances. The ethnographic method of investigation used a qualitative, phenomenological research lens. Over the course of three editions (Taipei 2011, Beijing 2012, London 2013), I participated in five group interviews (three with choreographer groups, two with dancer groups), conducted twelve individual interviews (six choreographers, six dancers), and spent over six weeks and 180 hours (five days per week with an average of six hours a day) in the dance studio observing and recording the creative process in documentary videos and field notes. In addition, as part of the academic team, I regularly contributed to seminars, roundtables, and online conversations, and I presented initial findings at each of the three concluding conferences.

ArtsCross participation resulted in a large amount of qualitative data that continues to stimulate a broad area of research. At times, the data prompted me to address research questions with experimental study beyond the ArtsCross context; other times, I focused on developing in-depth case studies of specific choreographers; still other times, I engaged in comparative study across the three ArtsCross editions to uncover themes and ideas. This latter approach has led to more speculative, theoretical concerns about the nature of dancing and dance making. Throughout, I have sought to contextualize my understanding in a multi-level perspective so as to advance a larger inquiry into the question of what “becoming” means in dance. I respect the epistemological tensions created by mixed methods research, but also believe it represents an opportunity to transform these tensions into new knowledge through rigorous application and dialectical discovery.

The art of dance emerges from a continuous stream of evolving affect, conceptual processing, physical sensation, and psychomotor skill all bound together in time and space to create connections between individuals and ideas. In the three weeks of ArtsCross, these connections must be made very quickly. Choreographers and dancers must work intimately to integrate all the necessary information that allows them to create and perform highly sophisticated dance works. To approach this com-

⁵Para mais informações, conhecer os objetivos, participantes e resultados do Projeto ArtsCross visite: www.rescen.net/events/ArtsCross_index.html

plex problem, I began by investigating the dance makers and performers separately. I asked, what are the cognitive processes by which choreographers create, and performers build up an adequate representation of, a dance composition that is complex both “horizontally” (extended overtime) and “vertically” (multilayered at any given moment)? For choreographers, I found the immediate concern is the purpose for invention and process of selection: that is, the manner in which originality and quality will “get into” or “get put into” the dance during creation. Experienced choreographers can easily default to recycled movement and audience-pleasing spectacle, especially when rehearsal time is minimal. But true creativity happens when someone does something new that is also useful or generative or influential (Csikszentmihalyi, 1996). Researchers understand the “creativity problem” as both structural (domain-based) and strategic (cognitive-based): it involves a selection process that precludes reliable responses and promotes surprising ones (Kaufman and Sternberg, 2010). I watched this tension flare up behind the scenes of ArtsCross dancer auditions. All choreographers wanted to select those performers who seemed most fully engaged in the moment, often overlooking more technically advanced dancers.

For ArtsCross dancers, the brief window of time between the first rehearsal and final performance meant an overriding concern for the memory of, and felt understanding for, the choreography. Memory is an alluring topic for cognitive scientists interested in the performing arts (Chaffin et al., 2008). Performers have a remarkable, multidimensional capacity for making and retaining memories. How? I found that ArtsCross dancers employed a unique strategy to augment dance learning: a movement reduction practice called “marking.” In contrast to dancing “full out,” dance marking involves enacting the sequence of movements with curtailed size and energy (Kirsh, 2010). It can be considered a way of modeling for oneself. My experimental research has shown that dance marking confers cognitive processing benefits: loosely practicing a routine by “going through the motions” improves the quality of the final dance performance by reducing the mental strain needed to perfect the movements (Warburton et al., 2013).

It is necessary to understand the mental states of individuals, but these studies neglect the inherently social nature of dance cognition. It takes two to tango, both literally and figuratively. The choreographer may be concerned with making good

⁶Confiável aqui é um sinônimo para “já conhecida”. (N.T.)

choices—and the dancer may be concerned with remembering those movement choices—but they must work in concert to create an artistically pleasing product. This is especially true in the goal-directed environment of ArtsCross where, by definition, the model of work-in-progress demands joint attention. This realization led me to pay closer attention to the relational practices of participants. Soon I noticed “resonance” was a shared linguistic concept among participants who talked about the success (or failure) of positive group dynamics leading to stage production.

The focus on socially-distributed cognition points to a method of theoretical inquiry that generates insight into dance experience by taking an “enactive” approach (Varela et al., 1991). Enaction is an especially powerful theoretical lens for understanding social cognition in the context of self-other matching in dance for three main reasons. First, the enactive approach emphasizes embodied cognition and the roles of emotional and relational experience in meaning making. Second, it demands consideration of the ways reflective, controlled, explicit social (“higher order”) cognitive functions relate to lower-level, reflexive, automatic, implicit functions. The recent proliferation in dual process models in neuroscience and psychology assumes hierarchical processing (deWaal and Ferrari, 2010), and dance is a good example. Dancing highlights one of the many ways emotion and cognition are linked from early perception to higher order reasoning (McNeill, 1997). Finally, enaction posits a mental model that encompasses three intertwined modes of bodily activity—somatic, kinesthetic, mimetic—that may be important for understanding resonance in dance (Warburton, 2011). These three considerations guide the following synthesis of the cognitive and neuroscientific literature as I seek to build a theory of dance resonance.

Self-other matching

The propensity, aptitude, and need for self-other matching is a distinguishing characteristic of the human species. It encompasses phenomena like motor resonance, mimicry, copying, imitation, empathy, and perspective taking. Current models tend

⁷A expressão em inglês “it takes two to tango”, além de se referir à dança em si, como neste texto, significa também “se um não quer, dois não brigam”. (N.T.)

to make a two-way distinction. One system of self-other matching is described as unconscious or preconscious, implicit, automatic, low effort, rapid, perceptually driven; the other system is described as conscious, explicit, controlled, high effort, slow, and analytic or reflective (reviewed in Evans, 2008). For the sake of simplicity, the first sort of system will be referred to as “reflexive” and the second as “reflective,” although this two-way distinction is likely also overly simplistic. Mimicry is often used in the literature as a general, nonspecific umbrella term for any kind of reflexive, non-intentional, overt self-other matching. Copying is used as a general, nonspecific umbrella term to refer to any kind of intentional, reflective, overt self-other matching. The research literature on self-other matching in three different domains—motor, visual, emotional—provide clues to the presence of resonance in one’s psychological repertoire.

Reflexive processes

Somatomotor self-other matching can occur at a reflexive level via motor resonance. Motor resonance is a general idea implicating the activation of common neural or psychological substrates for observed and executed action: e.g., observing another’s action causes my motor system to “resonate” with theirs. Dancers have been used extensively in neuroimaging studies to provide evidence for a shared physiological basis of action execution and observation based in motor resonance (Bläsing et al., 2010). When motor resonance causes the overt output of an observed action, this is termed “motor contagion.” A well-known example of motor contagion occurs during infancy: for a brief period in development (up to 3 months), neonatal humans copy observed orofacial and finger movements (Meltzoff and Moore, 1977). In adults, motor contagion in everyday social interactions is sometimes called the “chameleon effect”: the tendency to mimic unconsciously others’ postures, mannerisms, facial expressions, and behaviors. Motor contagion increases liking, smoothes social interactions, and is more common in empathic people (Chartrand and Bargh, 1999).

The tendency to reflexively mimic others played not just a functional but an instru-

⁸Referentes a reflexos motores (N.T.)

mental role in ArtsCross social interactions. In discussing their selection of dancers with whom to work, several choreographers commented unwittingly on this unconscious behavior. One person said that some dancers “fit in ... no matter who they work with, they just blend in into them, they seem to click with everybody” and another agreed, adding “... they move into rhythm quickly.” It perhaps comes as no surprise that rhythm has been posited as the neural basis of dancing (Brown et al., 2006). Researchers have found some evidence that systematic training with rhythmic exercise correlates with a decrease in reaction times (i.e., the interval between a stimulus and the onset of motor response) and what has been called “body readiness” in the performing arts, which is the ability to maintain a sustained, selective attention and respond quickly to others and the environment (Ribeiro et al., 2014). Another choreographer noted that “she [the dancer] is not really imitating other people ... I see her move to other people, to see their perspective ... she changes position so that she can see what they see ... her face even reacts the same, like, automatically ... I, like, literally see in her eyes what the other person is reacting to.” Where the earlier descriptions recall motor mimicry, this description refers to visual and emotional domains: specifically, the phenomena of gaze following and emotional contagion. Gaze following describes when a person shifts her eye gaze direction in order to match her own visual perception to another individual’s (Emery et al., 1997). It is easy to see how following gaze direction is a broadly adaptive trait. If something has drawn my conspecific’s attention, it likely deserves my attention as well, since we share food sources, predators, prey, and potential mating partners. Bringing one’s own perception into congruence with someone else can also serve as first step toward bringing behavior into congruence. It is not surprising that this basic behavior occurs automatically across the animal kingdom. In addition to the somatomotor and oculomotor domains, self-other matching also occurs in the autonomic/emotional domain. The instantiation of an observed emotional or autonomic state in one’s self can act via a reflexive, implicit mechanism that extends to very low-level functions, such as pupil size and respiration (Harrison et al., 2007; Jeannerod & Frak, 1999). The “contagion” of autonomic states has been well studied across animal species in the domain of pain, fear, and anxiety. Crying is contagious in human infants and, in adults, photographs of others in danger or pain induces a freezing postural response (Facchi-

netti et al., 2006; Geangu et al., 2010). Taken together, these findings suggest that choreographers have good reason to respond positively to those dancers who display a reflexive, unconscious ability to rapidly establish affiliative relationships. Dancers who help keep everyone on course, giving frequent positive feedback and creating a prosocial climate, can promote a sense of shared purpose.

Learning and reflective processes

Beyond reflexively “mimicking” expressions or “catching” emotions, humans can also learn what to express, watch for, or feel by observing others through social learning. Anyone who has been around a young child will recognize the human capacity to copy behavior in less automatic, more controlled manners. In fact, many species are capable of using observational learning to copy another’s goal-directed action. Rats can learn to run a maze by observing another rat; some birds socially learn each other’s songs (Zentall, 2004). The impressive variety of social learning in the natural world includes various ways of categorizing observation of others. Most primate social learning is classed as either emulation (copying an action’s goal or result but not specific movements or methods) or imitation (copying both the goal and methods) (Whiten et al., 2009).

Every dance maker has a unique style, and ArtsCross choreographers recognized immediately those dancers who could easily imitate and quickly copy. Humans have a natural tendency to imitate. Indeed, as far as we know, humans are the only species on Earth that regularly over-imitates. Overimitation refers to copying component movements which do not contribute to reaching the action’s goal. In the human brain, the parietal mirror region is thought to perform sensorimotor mapping of the spatial and temporal details of observed and executed movements. It is possible that this increased neural connectivity might allow humans to map observed actions onto their own motor systems with greater kinematic detail, and may be related to our propensity for overimitation (Bonini et al., 2009).

In the performing arts, overimitation is a valued performative skill. Judith Bulter

⁹Estados autonômicos são referentes ao sistema nervoso autônomo que controla funções como a respiração, a circulação e a digestão. (N.T.)

(1988) has defined "performativity" as repetition with a difference, i.e., the capacity not simply to communicate but to construct and perform an identity. Although Butler focuses on gender and political identity, the idea has been widely applied to theater studies. In dance, one can imagine selecting those who readily display a "performativity of self-other matching." ArtsCross choreographers appreciated good imitators. However, when repetition with a difference mattered most, they gravitated toward those who somehow amplified the dance actions by "adding color," "turning up the volume," or "crisscrossing texture" into the movement vocabulary. Such value for a performativity of self-other matching implies an important connection between overimitation and resonance in dance.

Copying and social learning require understanding that another's perceptual knowledge can differ from one's own, but it does not always connote an overtly reflective process. Overimitation involves some of the same neural substrates as reflexive motor resonance. But overimitation is more commonly associated with the reflective processing that allows for the reproduction of goal-directed actions (and repetition with a difference). A truly explicit measure of a reflective process is the ability to attribute perspectives to others which are separate from one's own. This idea, called "theory of mind," is fundamental to emotional responsiveness and empathy (Premack and Woodruff, 1978).

Empathy

Emotions can be viewed as mechanisms of communication. The term empathy refers to the sensitivity to, and understanding of, the communication of mental states of others. Empathy is "the ability to see the world, including one's own behaviour, from another person's point of view is to display empathy" (Hollin, 1994, p. 1240). According to Hogan (1969), empathy is "the act of constructing for oneself another person's mental state" (p. 308). Eisenberg and Strayer (1987) regard empathy as "an emotional response that stems from another's emotional state or condition and that is congruent with the other's emotional state or situation" (p. 5). As these definitions illustrate, the term empathy is multidimensional, comprising both affective and cognitive components: mental perspective taking (cognitive

empathy) and the vicarious sharing of emotion (affective empathy).

Empathy seems to play a central role in human survival. An important aspect of empathy is that it serves to bond individuals to one another, mothers to infants first and foremost. Empathetic responsiveness that discriminates in favor of close kin, loyal reciprocators, and in-group members is likely to have been selected for during hominid evolution. As Jane Goodall (1986) has written, "If we know that another, especially a close relative or friend, is suffering, then we ourselves become emotionally disturbed, sometimes to the point of anguish. Only by helping (or trying to help) can we hope to alleviate our own distress" (p. 386). Several studies show a link between reflective and reflexive self-other matching of emotion. Subjects who score high in affective empathy (AE) scales have stronger facial mimicry for observed emotions and show greater contagion for pupil size (Harrison et al., 2007).

However, it is also true that social expertise in a world of emotional beings requires the ability to understand the minds of others and predict their overt behavior without necessarily sharing their emotions. Preston and deWaal (2002) use the term "cognitive empathy" (CE) to describe a referential understanding of another's emotional state. ArtsCross choreographers underscore the value of CE as a way to negotiate in the complex environment of creative production: "it's good when they [dancers] feel me, feel my movement intention, but if I'm having a hard time or bad day, I can't have them catch that bad vibe." Another explained, "I need to work with people who don't get overwhelmed easily by my personality ... I mean, I want them to know that I'm [feeling] good or bad or whatever but not get distracted by it."

Healthy empathetic responses would seem to require the ability to use CE and AE in an integrated way. Working together, the two empathic capacities complement each other, for example, facilitating prosocial engagement and behavior when choreographers and dancers alike are struggling to create (and interpret) original works. AE could facilitate prosocial motivation and CE could provide prosocial in-

¹⁰"the ability to see the world, including one's own behaviour, from another person's point of view is to display empathy"

¹¹"the act of constructing for oneself another person's mental state"

¹²"an emotional response that stems from another's emotional state or condition and that is congruent with the other's emotional state or situation"

sight. CE might help manage AE responses: AE could make us feel like helping someone else who is struggling and CE could clarify what sort of help is appropriate. AE might guide and regulate the use of CE, restraining the manipulative abuses of empathy, such as acting “as if” we care to gain some advantage. Integration of AE and CE seems particularly important when interacting in intimate, emotionally charged settings: with family members, good friends and, in the case of artistic creation, close collaborators.

Researchers and theorists have speculated on the variety of empathetic responses that emerge from the dance experience, including somatic, kinesthetic, and mimetic (Warburton, 2011). Kinesthetic empathy (KE) in particular has a long history with a recent upsurge of interest among dancers and neuroscientists. KE describes the experience of dance spectators who experience kinesthetic empathy when, even while sitting still, they feel they are participating in the movements they observe, and experience related feelings and ideas. With a basis in reflexive processes, like motor resonance, it is widely assumed that KE is sine-qua-non for self-other matching in dance participation. It takes two to tango, and it helps enormously if at least one of the dancers has experience observing and doing tango dance. The foregoing review does not dispute or contradict this claim. Instead, it points beyond KE to the social cognitive and more reflective processes of AE and CE at work in dancing and dance making.

In sum, this section has unpacked the ways that resonance can be understood as a kind of human social cognition in the context of self-other matching. The literature review provides specific examples of how reflective processes are related to reflexive processes in self-other matching across species in three specific domains—in the motor domain (somatomotor movements), in the visual domain (cognition about perception), and in the autonomic/emotional domain (empathy). In each of these domains, there are early-developing, automatic processes that rapidly match the observer’s state to others’. More complex forms of self-other matching in each domain emerge later in development. They involve some of the same neural substrates as their related lower-level processes as well as other neural systems associated with representational thought. As predicted by the enactive approach, the

¹³“If we know that another, especially a close relative or friend, is suffering, then we ourselves become emotionally disturbed, sometimes to the point of anguish. Only by helping (or trying to help) can we hope to alleviate our own distress”

functioning of lower-level processes like motor resonance can impact higher-level processes. Abnormalities in motor resonance for body movements may lead to deficits in imitation: for example, the paralysis of one's own facial muscles impairs recognitions of others' facial expressions (Neal and Chartrand, 2011).

It stands to reason that phenomena like motor resonance, mimicry and copying, imitation and overimitation, perspective taking and empathy reflect an ongoing interaction between "reflexive" and "reflective" systems in the embodied mind dancing enaction. These processes also provide important windows on the concept of resonance in dance. In addition to reflexive states that lead to kinesthetic empathy, the fact that others' emotions can also be matched in more explicit, reflective manners is foundational to any conceptualization of resonance. A well integrated capacity for AE and CE would seem to be desirable for self-other matching in dance making and performance. With these cognitive-emotional, reflexive-reflective processes in mind, it is time to turn to the question that motivates this inquiry. How do dancers signal resonance: how do they resonate?

Conceptual Blending

The purpose of this section is to build on the foregoing review to construct a theory of how resonance in dance works. Any effort to operationalize "dance resonance"—i.e., define for the purposes of further study—requires consideration not only of the underlying social cognitive processes but also a theory of what psychological mechanisms can prime dance resonance for enaction. I propose the "embodied conceptual blending" hypothesis. This idea extends Gilles Fauconnier and Mark Turner's (2002) idea of "conceptual blending" in cognitive linguistics to the nonlinguistic realm of nonverbal communication in dance.

A well integrated capacity for anything, especially something that deals with meaning-making, depends upon previous experience and knowledge. The knowledge we have in long-term memory that we use to interpret our perceptions is organized into associational patterns, knowledge elements, or resources that tend to be primed or activated together. Cognitive blending theory refers to these as mental spaces (Fauconnier and Turner, 2002). Fauconnier and Turner describe how the hu-

man mind combines two or more mental spaces to make sense of linguistic input in new, emergent ways. Blending usually occurs at a subconscious level, although the explicit thought required in collaborative creative activity causes many of its details to become explicitly apparent. Like the learning process itself, blending is nonlinear and non-deterministic. The precise way a person blends two input mental spaces together depends strongly on cues in the linguistic input and on physical and mental context.

Consider an example from a popular American television show. On a recent episode of the competition dance show, *So You Think You Can Dance*, one of the judges told a contestant that "you really knocked him out." The judge was referring to the dismissal of another dance contestant. When someone hears "Dancer Y knocked out Dancer X," that person will construct a meaning for the statement by blending two mental spaces. Mental spaces typically contain both elements and an organizing frame of relationships, processes, and transformations. A Boxing mental space containing elements such as opposing fighters, punches, injuries, and so on would be blended with a TV Business mental space containing elements like ratings, rankings, employment, marketing campaigns, and profits. In the blended space *Boxing Dancers*, statements like "Dancer Y knocked out Dancer X" and "With her new routine, Dancer Y hurts Dancer X's chances to stay in the battle" make sense. Such statements cannot occur in the TV Business space alone because no one is literally knocked out in dance competitions. Nor can such statements occur in the Boxing mental space alone, since dancers are not boxers.

Conceptual blending theory derives from a theory of language use and metaphor that grounds understanding in the body (Gallese and Lakoff, 2005). For example, in America, the blend "death tax" evokes a whole different set of images and associations, a different set of feelings in the body, than the blend "estate tax," though both in fact refer to the same thing: i.e., a tax levied on the net value of the estate of a deceased person before distribution to the heirs (Blair, 2009). This bodily aspect of blending theory aligns with the somatic marker hypothesis of neuroscientist Antonio Damasio (1999). The term "somatic marker" describes how body-states become linked with our conscious responses to experiences. This can involve linking fear or pleasure (or both) with a particular situation, such as the construction of "stage fright," which may cause a rush of adrenalin and a whole

array of other neurochemical responses that are based on prior experience and linked to conscious thoughts of fear and excitement. These markers become our repertory of habitual emotional (body-state) responses in guiding our reactions to new situations.

Fauconnier and Turner make two statements in particular that seem relevant to resonance in dance; they reminded me of instances in which I've seen conceptual blending at work in ArtsCross. The first: "Blending is a compression tool par excellence. Selective projection from different related spaces and integration in the blend provides an exceptionally strong process of compression" (2002, p. 114). The second tells us that we cannot escape the blend: "In the case of sensation and perception, our conscious experience comes entirely from the blend: we 'live in the blend,' so to speak" (p. 83). These statements suggest that we use blends not just to convey information or create new information, but also to evoke feelings in order to get others to 'live in the blend.' What happens when goal-directed behavior is oriented more toward integrating nonverbal communication rather than verbal language?

Embodied conceptual blending

As a nonverbal domain par excellence, the art of dance is particularly interesting in relation to conceptual blending. Dance encompasses a body of discipline-based knowledge and skills—along action, dynamic quality, shape, space and time dimensions—that are structured culturally and which can be acquired, practiced, mastered and then advanced through the act of creation. Dancers learn to embody these concepts in different styles (e.g., ballet, jazz, modern dance, tap). Though language is an important means of communicating ideas and concepts, a significant amount of dance knowledge and skill relies on nonverbal, procedural, and socially-distributed learning processes. Dance thus requires a different kind of conceptual blending beyond language.

The fundamental insight of the embodied-cognition literature is that even very abstract thinking may be parasitic on evolutionarily older brain systems that originally subserved purely sensory and motor interactions with the world. This is

as true for language acquisition as it is for dance acquisition. However, in practice, language is thinking represented at its most abstract level; whereas dancing is a representation of thinking in action (Stevens and McKechnie, 2005). Language learning requires linguistic input and “conceptual blending.” Dance learning requires kinesthetic input and a conceptual blending that relies on physical embodiment. Conceptual blending in dance merges one’s embodied (body-state) self-other matching repertory of habitual physical-emotional responses with cognitive-linguistic ones. This is what I call “embodied conceptual blending.” I hypothesize that embodied conceptual blending is a key mechanism for inducing resonance with others through dance. To ground this hypothesis in dance experience, I provide the following portrait of a work-in-progress: a sketch of the art of blending bodies. This illustration is an amalgamation of several ArtsCross rehearsals in different cities with different dancers and choreographers, all of whom had expressed a felt experience of dance resonating. Imagine “you” as dance maker and “her” as dancer walk into the rehearsal studio. Unconsciously, she mimics your posture and mannerisms. You show her some movement motifs, including variations on your signature side-hop-slide step. You emphasize a shift in head position and eye focus in the side-hop-slide. She changes position to see what you’re talking about. She demonstrates bodymind readiness with a sustained, selective attention and responsiveness. You wait and watch silently as she interprets the demonstrated movement ideas. Her imitation is a pretty good copy as she appears to draw on salient somatic markers: she clearly knows how to glide the side-hop-slide as you demonstrated it. As she moves, she simultaneously begins to learn how to perform your unique dance style. You provide feedback, performing the movement and saying “make the side-hop-slide lighter and longer ... don’t miss the head tilt.” She performs another copy, compressing the demonstrated and interpreted movement into a unified whole. You nod. She introduces some over-imitation into the movement, “repeating with a difference,” “adding color,” “crisscrossing texture.” You say “yes, okay.” Her enaction of an embodied blending successfully integrates your movement ideas with her felt experience of it. This all happens in matter of

¹⁴ “Blending is a compression tool par excellence. Selective projection from different related spaces and integration in the blend provides an exceptionally strong process of compression”

¹⁵ “In the case of sensation and perception, our conscious experience comes entirely from the blend: we ‘live in the blend,’ so to speak”

minutes. (Naturally, in true dual processing manner, the combining and recombining of blends arising from reflexive and reflective processes are accomplished in an iterative fashion over a longer period of time.)

The room gets warm. Ignoring her, you complain about the heat and stare distractedly out the nearest window. She notices your irritation but continues to practice, staying in physical proximity to you. In short order, she is sweating profusely from exertion. She walks over to grab a towel and drink some water. You glance sharply to look at her. She smiles, shakes her body, and laughs. You chuckle and say, "yeah, we're working hard, like dogs ... okay, let's see what else we've got." She follows along as you move seamlessly through a short section. There's a sense that you both are in the flow of the moment with shared focus and energy. The repetition of sequences takes on a rhythmical quality: start sequence, stop sequence, go, go, go, stop, revise, go, go, stop, revise, go, go, go, stop, rest.

The dance rehearsal takes the shape of a dialog between you and her, verbal thoughts and nonverbal suggestions passed back and forth. Thirty minutes pass quickly. She seems to wait until just the right moment to suggest an alternative ending, anticipating the moment when you get stuck for a long period of time. You purse your lips. She smiles and shrugs as if to say "maybe?" It seems like coherent suggestion. You nod slowly, saying "From the beginning, let's see it." She enacts an embodied conceptual blending, compressing movement ideas, merging her personal movement signature with your dance style, and responding with a balance of affective and cognitive empathy. You and she negotiate successfully the artistic challenges and emotional stress of making a dance. Later, I ask your opinion. You say, "Good, pretty good start. We were in synch ... totally resonated with her suggestions ... she obviously got what I was trying to do ... maybe I'll actually be able to finish this dance."

Discussion

In physics, resonance describes when a vibrating system or external force drives another system to oscillate with greater amplitude at a specific preferential frequency. In dance, "resonance" describes a shared sense of energy, rhythm, flow,

and coherence. It involves physical proximity and emotional openness, and it is felt in the body as synchrony: an intimate connection to self and other. When resonating, one feels a calm, grounded, and relaxed state of “flow” consciousness. Choreographers and dancers seek resonance for the purposes of creating and performing dance. My literature review and analysis suggests that resonance is a unique form of social cognition in the context of self-other matching. It arises from a dual processing mode encompassing reflexive and reflective systems in at least three domains: motor, visual, and emotional.

My research shows that resonance in dance is a complex but underexplored phenomenon that can be illuminated by the theory of conceptual blending. Resonance illustrates how such reflexive processes as motor resonance, mimicry and copying, visual perspective-taking, and autonomic contagion give rise via social learning to more reflective processes, such as learning by imitation, theory of mind, and empathy. ArtsCross provides rich clues to dance resonance as emerging particularly from the relationship between automatic, implicit functions, such as gaze following and the “chameleon effect,” and more controlled, explicit social cognitive functions like overimitation and affective plus cognitive empathy. Dance resonance also promises a greater awareness and amplification of nonverbal connections among individuals and, possibly, within and between groups. I propose the “embodied conceptual blending” hypothesis to explain how resonance in dance emerges in the self-other blending of dance ideas and movements experiences across physical, visual, and emotional dimensions.

Several questions of interest arise from these descriptions of the role and function of resonance in dance. I am particularly struck by the roles of affective empathy (AE) and cognitive empathy (CE) in constructing “resonant” environments for performers and choreographers alike. The relationship between understanding others' minds and the vicarious sharing of emotion is a basic issue in human evolution. If we assume that AE and CE work optimally as two separable, complementary systems, then they can act as one integrated system in many circumstances but also can be separable in key circumstances of functional and evolutionary significance. If resonance in dance provides an example of optimal empathic flexibility, do gender differences exist?

If (a) there has been heritable variation in the mental relationship between AE and CE during hominid evolution, (b) the mental variation led to variation in behavioral

tendencies and inclusive fitness, then (c) natural selection acted on the variation in the relationship between CE and AE. If one accepts that evolutionary logic can potentially predict the extent of the separability of the systems and variation between individuals in functionally significant ways, then it stands to reason that it can also predict the relationship between CE and AE in contemporary humans. For instance, there is no doubt that empathy plays a central role in childcare.

As Plutchik (1987, p. 43) has pointed out, an "important aspect of empathy in an evolutionary context is that it serves to bond individuals to one another, especially mothers to infants." Relatively reduced separability of AE and CE may facilitate successful childcare and social bonding. Relatively increased separability of the systems may facilitate competitive, aggressive, and violent behavior. Assuming that women have tended to be more involved in childcare than men during human evolution (a reasonable assumption given that men do not lactate and can seldom be sure of paternity) and assuming that men have tended to be more involved in competitive behavior, then the extent of the separability may have become linked to sex. Relatively reduced separability of the two systems may have been selected for in women and relatively increased separability of the two systems may have been selected for in men.

The question of gender differences in AE and CE directly influences the nature of resonance in dance. If female empathy tends toward the relatively reduced separability of AE and CE, then it may be challenging for some female dancers to identify when and how to leverage AE or CE for maximum effect in any given situation. A reduced separability of AE and CE may not increase resonance in dance, but it would not reduce the capacity for it either. Alternatively, if male empathy tends toward relatively increased separability of AE and CE, then the potential for empathy imbalance is much greater. A male dancer with high AE sensitivity but low CE ability would find it difficult to distinguish between one's own emotions and someone else's emotions. He may struggle to "step back" from empathic connections so as not to lose himself in others and would likely identify too closely with a choreographer's feeling body-state. The experience of strong AE can be confusing and upsetting. This dancer might be motivated to help (AE) but he could lack the prosocial insight (CE) to clarify what sort of help is appropriate. As a result, he might retreat from empathic connections, relying on avoidant behavior to try to prevent overwhelming

feelings from forming in the first place.

On the other hand, those individuals with high CE, low AE ability would not find the social world confusing and would have good or excellent social skills. They might appear to be charming people. They would have a good cognitive understanding of other people's mental states but minimal capacity to share the emotions of others. A male dancer with a CE-dominated empathic response may have narrow, narcissistic sense of self, reducing the capacity for resonance with others. He might be sensitive to other's emotions but not moved by them, which might limit the potential for the kind of expressivity and performativity needed for dance creation. He would be unlikely to be emotionally available for intimate collaboration. Indeed, the introduction to this essay quoted a female choreographer discussing her inability to connect and "resonate" with a male dancer. Their gender is likely purely coincidental, but maybe not. It is widely assumed in dance that kinesthetic and affective empathy are required for dance participation. The role of cognitive empathy and the need for balance may be even more important.

This essay is an exercise in exploratory theorizing, providing an account of resonance in dance that cites research literature, empirical data, and theoretical perspectives that are consistent with my hypotheses. But there is currently a lack of in-depth research. Essentially, I have synthesized observations from a variety of sources to posit some ideas and to make predictions, for example, about possible gender differences. Empirical research is needed to test these predictions. It is also important to extend the idea of a performativity of resonance into other areas of the arts and arts education. What does resonance look like in acting, music, visual arts? When we watch a play, why do we resonate more with some actors than others? Beyond skill, are some conductors more resonant with musical ensembles than others? Why do I resonate with the visual images of Picasso and not Manet? Can resonance be taught? What happens when arts teachers fail to resonate with students or vice versa? I hope researchers interested in performing arts cognition will find this article stimulating, perhaps even resonate with it, and most importantly pursue new lines of inquiry.

¹⁶important aspect of empathy in an evolutionary context is that it serves to bond individuals to one another, especially mothers to infants."

References

BLAIR, Rhonda. Cognitive neuroscience and acting: Imagination, conceptual blending, and empathy. *TDR/The Drama Review* vol. 53, no. 4, p. 93-13, 2009.

BLÄSING, Bettina, PUTTKE, Martin, and SCHACK, Thomas (Eds.). *The Neurocognition of Dance: Mind, movement and motor skills*. New York: Psychology Press, 2010.

BONINI, Luca, ROZZI, Stefano, SERVENTI, Francesca U., SIMONE, Luciano, FERRARI, Pier F., and FOGASSI, Leonardo. Ventral premotor and inferior parietal cortices make distinct contribution to action organization and intention understanding. *Cerebral Cortex* v. 20, p. 1372-1385, 2009.

BROWN, Steven, MARTINEZ, Michael J., and PARSONS, Lawrence M. The neural basis of human dance. *Cerebral Cortex* vol. 16, no. 8, p. 1157-1167, 2006.

BUTLER, Judith. Performative acts and gender constitution: An essay in phenomenology and feminist theory. *Theatre Journal* v. 40, n. 4, p. 519-531, 1988.

CHAFFIN, Roger, LOGAN, Topher R., and BEGOSH, Kristen T. Performing from memory. In HALLAM, Susan, CROSS, Ian, and THAUT, Michael (Eds.). *Oxford Handbook of Music Psychology*. Oxford, UK: Oxford University Press, 2008, p. 352-363.

CHARTRAND, Tanya L., and BARGH, John A. The chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology* vol. 76, no. 6, p. 893-910, 1999.

CSIKSZENTMIHALY, Mihaly. *Flow and the Psychology of Discovery and Invention*. New York: Harper Collins, 1996.

DAMASIO, Antonio, R. *The Feeling of What Happens: Body and emotion in the*

making of consciousness. New York: Houghton Mifflin Harcourt, 1999.

DeWAAL, Frans B., and FERRARI, Pier F. Towards a bottom-up perspective on animal and human cognition. *Trends in Cognitive Science* v. 14, n. 5, p. 201–207, 2010.

EISENBERG, Nancy, and STRAYER, Jane (Eds.). *Empathy and Its Development*. Cambridge, England: Cambridge University Press, 1987.

EMERY, Nathan. J., LORINCZ, Erica N., PERRETT, David I., ORAM, Michael W., and BAKER, Christopher I. Gaze following and joint attention in rhesus monkeys. *Journal of Comparative Psychology* v. 111, n. 3, p. 286–293, 1997.

EVANS, Jonathan S. Dual-processing accounts of reasoning, judgment, and social cognition. *Annual Review of Psychology* v. 59, p. 255–278, 2008.

FACCHINETTI, Livia D., IMBIRIBA, Luis A., AZEVEDO, Tatiana M., VARGAS, Claudia D., and VOLCHAN, Eliane. Postural modulation induced by pictures depicting pro-social or dangerous contexts. *Neuroscience Letters* v. 410, no. 1, p. 52-56, 2006.

FFAUCONNIER, Gilles, and TURNER, Mark. *The Way We Think: Conceptual Blending and the Mind's Hidden Complexities*. New York: Perseus Books Group, 2002.

FAUCONNIER, Gilles. Compression and emergent structure. *Language and Linguistics* v. 6, no. 4, p. 523-38, 2005.

GALLESE, Vittorio, and LAKOFF, George. The Brain's Concepts: The Role of the Sensory-Motor System in Conceptual Knowledge. *Cognitive Neuropsychology* vol. 22, no. 3-4, p. 455-479, 2005.

GENANGU, Elena, BENGA, Oana, STAHL, Daniel, and STRIANO, Tricia. Contagious crying beyond the first days of life. *Infant Behavior and Development* vol. 33, no.

3, p. 279-288, 2010.

GOODALL, Jane. *The Chimpanzees of Gombe: Patterns of behavior*. Cambridge, MA: Harvard University Press, 1986.

HARRISON, Neil A., WILSON, C. Ellie, and CRITCHLEY, Hugo D. Processing of observed pupil size modulates perception of sadness and predicts empathy. *Emotion* vol. 7, no. 4, p. 724-729, 2007.

HOGAN, Robert. Development of an empathy scale. *Journal of Consulting and Clinical Psychology* vol. 33, no. 3, p. 307-316, 1967.

HOLLIN, Clive. Forensic (criminological) psychology. In COLMAN, Andrew (Ed.). *Companion Encyclopedia of Psychology*. London: Routledge, 1994, p. 1231-1253

JEANNEROD, Marc, and FRAK, Victor. Mental imaging of motor activity in humans. *Current Opinion in Neurobiology* vol. 9, no. 6, p. 735-739, 1999.

KAUFMAN, James C., and STERNBERG, Robert J. (Eds.). *The Cambridge Handbook of Creativity*. New York: Cambridge University Press, 2010.

KIRSH, David. Thinking with the body. In OHLSSON, Stellan, and CATRAMBONE, Richard (Eds.). *Proceedings of the 32nd Annual Meeting of the Cognitive Science Society*. Austin, TX: Cognitive Science Society, p. 2864-2869, 2010.

McNEILL, William H. *Keeping Together in Time: Dance and drill in human history*. Cambridge, MA: Harvard University Press, 1997.

MELTZOFF, Andrew N., and MOORE, M. Keith. Imitation of facial and manual gestures by human neonates. *Science* vol. 198, no. 4312, p. 75-78, 1977.

NEAL, David T., and CHARTRAND, Tanya L. Embodied emotion perception amplifying and dampening facial feedback modulates emotion perception accuracy. *Social*

Psychological and Personality Science vol. 2, no. 6, p. 673-678, 2011.

PLUTCHIK, Robert. Evolutionary bases of empathy. In EISENBERG, Nancy, and STRAYER, Jane (Eds.). Empathy and Its Development. Cambridge, England: Cambridge University Press, 1987, p. 38-46.

PREMACK, David, and WOODRUFF, Guy. Does the chimpanzee have a theory of mind? Behavioral and Brain Sciences vol. 1, no. 4, p. 515-526, 1978.

PRESTON, Stephanie D., and DeWAAL, Frans B. Empathy: Its ultimate and proximate bases. Behavioral and Brain Sciences vol. 25, no. 1, p. 1-20, 2002.

RIBEIRO, Mônica M., LIMA, Isabela, MALLOY-DINIZ, Leandro, LAGE, Guilherme, PIMENTEL, Lucia G., and TEIXEIRA, Antônio L. Corporal Artistic Training Influences Attention: A Pilot Study. Perceptual and Motor Skills vol. 118, no. 3, p. 818-832, 2014.

SHEETS-JOHNSTONE, Maxine. The Corporeal Turn: An interdisciplinary reader. Exeter, UK: Imprint Academic, 2009.

STEVENS, Catherine, and McKECHNIE, Shirley. Thinking in action: thought made visible in contemporary dance. Cognitive Processing vol. 6, no. 4, p. 243-252, 2005.

VARELA, Francisco J., THOMPSON, Evan, and ROSCH, Eleanor. The Embodied Mind: Cognitive science and human experience. Cambridge, MA: The MIT Press, 1991.

WARBURTON, Edward C. Of meanings and movements: Re-languaging embodiment in dance phenomenology and cognition. Dance Research Journal vol. 43, no. 2, p. 65-84, 2011.

WARBURTON, Edward C., WILSON, Margaret, LYNCH, Molly, and CUYKENDALL,

Shannon. The cognitive benefits of movement reduction: Evidence from dance marking. *Psychological Science* vol. 24, no. 9, p. 1732-1739, 2013.

WHITEN, Andrew, MCGUIGAN, Nicola, MARSHALL-PESCINI, Sarah, and HOPPER, Lydia M. Emulation, imitation, over-imitation and the scope of culture for child and chimpanzee. *Philosophical Transactions of the Royal Society of London B: Biological Sciences* vol. 364, no. 1528, p. 2417-2428, 2009.

ZENTALL, Thomas R. Imitation: definitions, evidence, and mechanisms. *Animal cognition* vol. 9, no. 4, p. 335-353, 2006.