# Dance and Embodied Intelligence

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Think for a moment of a dancer in class who, when the tempo of the music is dramatically changed, flawlessly and seamlessly alters the execution of the movement by increasing or decreasing range of motion at multiple joints, adjusting the depth and width of locomotor movements, and sustaining or interrupting the duration of individual movements. Or think of another dancer who, upon learning an emotional impetus for a movement phrase, subtly alters the use of visual focus and the sense of weight behind each movement in order to best convey the emotional quality. Or think of the dancer who is able to quickly and accurately transfer all of the movements learned on the right side of the body to the left side of the body and vice versa.

For Howard Gardner, the psychologist who pioneered the concept of Multiple Intelligences, intelligence is defined as "the capacity to process a certain kind of information" in order "to approach a situation in which a goal is to be obtained and to locate the appropriate route to that goal" (2006). Letters and numbers, symbols that are traditionally used to assess intelligence, are one kind of information. We are, however, constantly interacting with other kinds of information inherent in the environment around and inside us. Somaesthetic philosopher Richard Shusterman divides this information into three modalities known as exteroception (perception of the outside world), proprioception (perception of bodily movement and orientation) and interoception



 

(perception of internal physical states) (Shusterman, 2008). The processing of information from each of these modalities toward the goal of navigating the physical and social world is reflective of a different type of intelligence than that traditionally assessed through language and mathematics. It is an embodied intelligence.

In the examples above, each dancer is processing information in order to achieve a goal. The dancer who adjusts to a new tempo must integrate proprioceptive information with novel exteroceptive information. The dancer with the added emotional quality integrates proprioceptive and interoceptive information, and the dancer who reverses sides transfers proprioceptive information between body halves. Embodied intelligence manifests when the dancers are making choices about how best to accomplish each goal. Importantly, this type of activity happens in dance classes across genres. While some dance classes offer more or less opportunity for problem-solving by the students, all classes include decision-making to some degree and thus afford an opportunity for the students to demonstrate embodied intelligence. In this paper, I will summarize several theories from cognitive psychology that clarify the structure and function of these embodied intelligences. I will then go on to consider why embodied intelligence might be marginalized in traditional education and how it could be intentionally developed in the dance classroom.

## Definitions

**Cognition, thought, intelligence.** These terms have varied uses depending on the discipline in which they are used. For this paper, I will be using them in the context of cognitive psychology. Generally defined, cognitions are higher order mental processes including attention, memory, learning, reasoning, problem-solving, and



 

decision-making (Ward, 2006). Thought is defined as the conscious use of cognitions to form connected ideas (Koziol, Budding, & Chidekel, 2012). And intelligence is the ability to apply thought towards the achievement of a goal (Piaget, 1950; Gardner, 2006). For this paper, cognition and thought will refer to mental processes that result in reasoning, problem-solving, and decision-making, and intelligence will be the manifestation, demonstration, or application of those abilities. Note that, because an activity is goal directed does not mean that there is a single pathway to achieving that goal. Creativity, adaptability, and novel ideas occur when multiple pathways to a goal are generated.

**Modal and amodal.** Sensory information is brought to the brain through organs which transduce or translate visual, aural, chemical, mechanical, etc. stimuli into electrical impulses to be processed in sensory areas of the cerebral cortex. Each organ and its resulting sensory pathway could be considered a mode for perception of the self and environment. Transduction of light at the eye, for instance, is one mode for perceiving the world and vision is the resulting modality (Ward 2006). Standard models of cognition tend to focus on amodal representations which are based on a second translation of modal experience into abstract semantic symbols which are stored in Long Term Memory. In the process of recoding information from sensory to perceptual to semantic codes, the links to the peripheral sensory systems, or original modalities, may be lost, thus the term amodal, without modality (Barsalou, 2008).

Models from a subfield in cognitive psychology, grounded cognition, though, either reject the idea of amodal representation, instead claiming that cognition is completely structured by modal representations, or, that if amodal representations do



 

exist, they are never fully separated from their modal origins (Barsalou, 1999). The modal/amodal paradigm brings into focus the distinction between language, for instance, as an amodal structure of thought and the processing of information from the three embodied modalities as modal structures of thought.

## Gardner and Multiple Intelligences

Over 30 years ago, Howard Gardner, a researcher in cognition and education, proposed the idea of Multiple Intelligences. He was dissatisfied with the definition of intelligence in relation to Binet's Intelligence Quotient (I.Q.) tests. I.Q. tests propose to quantify intelligence through verbal and mathematical reasoning skills. They, and tests derived from them, like SAT's, are a test of one's ability to manipulate abstract amodal symbols. Gardner had difficulty with such a narrow definition of intelligence and sought to broaden the definition by defining other ways in which intelligence might be demonstrated (Gardner, 2008).

In his original theory, Gardner proposed that there are seven intelligences, two of which are analogous to the amodal intelligences tested in the I.Q. tests: Logico-Mathematical Intelligence and Linguistic Intelligence. The other five intelligences are based on the processing of modal information and could be considered analogous to the embodied intelligences derived from exteroception, proprioception, and interoception. For instance Musical and Spatial Intelligences involve the processing and manipulation of sounds and sights drawn from the perception of the outside world, exteroception. Bodily-Kinesthetic Intelligence involves the processing and manipulation of information about the placement and action of the body, proprioception. Intrapersonal and Interpersonal Intelligences involve the processing and manipulation of



 

information about one's emotions and the emotions of others, interoception (Gardner, 1983).

The modal/amodal distinction is important, not to indicate that Spatial information (or Musical, or Interpersonal etc.) can never be subjected to abstract manipulation, but to indicate, that even if modal information doesn't reach the level of abstract representation it can still be processed for goal oriented decision-making, and thus reflective of intelligence. The embodied/abstract division of Gardner's Multiple Intelligences is also an attempt to shift some attention away from the prominence of Bodily-Kinesthetic Intelligence and introduce a more integrated approach to learning dance using all of the modal intelligences.

## Piaget and Sensori-motor Intelligence

Jean Piaget was a Swiss biologist who, in the mid-20th century, undertook a systematic psychological approach to understanding the development of intelligence. Piaget believed that intelligence was an evolutionary adaptation and therefore dependent on an individual's perception of, and action on, the environment (Flavell, 1963). Piaget's writings on the development of intelligence during the first two years of life directly address the structure of embodied thought. By carefully studying the behavior of infants, he was able to create a theory of how we come to understand and interact with the physical world before we have the language to describe it. This sensori-motor intelligence, according to Piaget, is structured by action not by language. Similar to Gardner, for Piaget, intelligence is demonstrated when multiple options to achieve a goal are anticipated, simulated, and evaluated (Piaget, 1950). This process of anticipation, simulation, and evaluation begins in infancy.



 

While in the sensori-motor stage, the filtering or modification of sensory information to existing expectations, or schemas, is called assimilation. The modification of schemas, which, at this stage, are restricted to motor-schemas, is called accommodation. In this period the child is trying all sorts of different actions on the environment and noticing the results. When a given action leads to a desired result and the action-goal relationship is remembered and repeated in the future, the child is manifesting intelligence. Through a continual process of assimilation and accommodation, perception and action are the modalities in which intelligence manifests (Piaget, 1952).

At the end of the sensori-motor stage, though, motor-schemas are internalized as mental representations (Piaget, 1954). The physical evaporates into the mental, the modal becomes amodal. The process of intellectual development, for Piaget, then continues through childhood until the child achieves formal operations, a stage at which knowledge can be represented as a logical construction of abstract symbols (Piaget & Inhelder, 2000). The transition from physical action to mental operation divides the modal from the amodal in Piaget's definition of mental representation.

Piaget's theory of cognitive development exemplifies the amodal model of mental representation in which semantic representations are decoupled from perceptual systems. Though his account begins with intelligence demonstrated through sensory and motor systems, maturity is achieved when actions transcend the physical plane and become operations in the mental plane (Piaget, 1950).



 

## Barsalou and Perceptual Symbol Systems

Instead of thought completely evaporating into mental operation, theories from grounded cognition propose structures of thought in which embodied experience is retained. Cognitive psychologist Lawrence Barsalou's Perceptual Symbol System (PSS), for instance, defines a cognitive structure for modal thought. In neuroscientific terms, a sensory experience (sight, sound, touch etc.) stimulates a sensory organ (retina, cochlea, touch receptor) where the experience is transduced, or translated, to electrical impulses to be processed in sensory areas of the brain (Ward, 2006). Instead of going through a second translation, similar to Piaget's evaporation, into amodal semantic symbols for storage in Long Term Memory, in PSS, subsets of features, or schematics of the experience are retained in their original modality. When, therefore, a memory is called forth for purposes of reasoning, problem-solving, or decision-making, it is not an amodal symbol that is recalled, but a schematized simulation of the original experience, in its original modality (Barsalou, 1999).

Think again of the dancer who has learned a phrase of movement and then is asked perform the movement with a specific emotional intention. The dancer has a proprioceptive schema of the learned movement. She also has interoceptive schemas of different emotional states and their associated movement and postural patterns. In the process of overlaying the two schemas, she selects features from the interoceptive schemas that are most appropriate to the given goal and creates a novel version incorporating information from the two sources. This is different than asking her to perform a dance as if she were happy, for instance, and having her only add a smile to the existing proprioceptive schema. This would, in most cases, be an automated



 

response and not one in which multiple pathways to achieving the goal were fully simulated and evaluated. This however is a difficult distinction to assess as it depends greatly on the student's understanding of the goal and the quality of her existing schemas. It is possible, though, to foster this kind of thinking in the dance classroom by offering contrasting experiences and explicitly indicating to the dancers the moments in which they are making choices.

**Hypocognition of Modal Intelligence**

With a heavy focus on language and mathematics in education, there is a diminishing of modal thinking. There are a myriad socio-cultural, and possibly biological, reasons why amodal intelligences have been what anthropologist Robert Levi calls *hypercognized* (Throop, 2005). Hypercognition occurs over time as social forces select a subset of cognitive processes and subject them to shaping and standardizing, thus making personal experience available to communal interpretation. When this happens, other cognitive processes are *hypocognized*, or left as part of private or inner experience, not easily communicated. It is not that they can't be communicated; it is that society has not shaped them, made them available to public explanation through conventionalized conceptualization and categorization. For instance, grammar is a conventionalized system widely taught to allow for the conceptualization of the structure of language. Movement analysis systems, such as LMA, are used to conventionalize the conceptualization of movement, but are not as widely taught and are thus conventionalized within a smaller population.

Phenomenologist C. Jason Throop (2005) offers an important distinction that helps us understand why some experiences are amenable to language and others are



 

not, that of *pre-objective* and *objective* experience. Objective experiences are those which culture has given the individual the ability to conceptualize, categorize and articulate: to name. Pre-objective experiences are those which exist prior to this level of conscious reflection. If I were to combine, then, the paradigms of modal/amodal intelligence, hypo/hypercognition, and pre-objective/objective experience, I would say that we exist in a culture where modal intelligences are hypocognized and tend to remain at the pre-objective level, while amodal intelligences are hypercognized and occupy preferential space in objective experience. This however does not mean that modal intelligences are incapable of achieving the conceptualization and categorization of objective experience, merely that our culture does not encourage such an endeavor.

**Formal instruction in affordance thinking**

Educational psychologist Lev Vygotsky (1962) theorized how formal curricula guide the structure of thought from pre-objective experience, or what Vygotsky called *everyday* concepts, to objective experience or *scientific* concepts. The former are the concepts we use to go about our everyday life without ever examining the structure of the concept. The latter differ in that their structure has been made explicit.

Again, as an example, you probably have a conceptual framework for the components of a sentence, but a dancer might have a conceptual framework for what, in the movement, was changed in order to accommodate a radically different tempo. You didn't always know the structure of a sentence, though; someone had to explain to you what the parts were. You were already speaking, and probably even writing by the time you learned, but in order to move from an everyday understanding of language to a scientific understanding of language, someone had to instruct you. This was probably



 

not the case for the dancer. She might suspect, and her teachers might have suspected, that there was some underlying structure or rules that facilitated dancing between two different tempi, but those rules might not have ever been made explicit and so the concept remained what Vygotsky would term everyday. Her embodied intelligence remained pre-objective due to cultural hypocognition.

### 5th stage and 6th stage intelligence

According to Piaget, there are three primary differences between physical action and mental operation, which are initiated during the transition from Stage 5 to Stage 6 in the sensori-motor period. As this is the transition for thinking though physical action to thinking through mental operation, I think they are worth considering. First by moving from physical activity to mental simulation, the speed of operation is increased. Second, knowledge of operations becomes declarative, not just procedural, allowing for greater consciousness of behavior. Third, operations on absent objects can be achieved through symbolic actions on symbolic representations. Together mental operations allow for increased speed of operations, awareness of operations, and distance from object (Piaget 1950).

It is the third of these differences that I am primarily interested in exploring further: a sign of amodal intelligence is that operations can be performed on an object even when that object is absent. If actions at Stage 5 become operations at Stage 6, the ability to execute mental operations grows directly out of the ability to perform physical actions. This, I believe is attended to in elementary school. For instance, as a child, I remember learning arithmetic with candy corn. By physically placing and counting groups of candy, I learned the physical action of joining, which then supported



 

the mental operation of joining called adding. The action at Stage 5 supported the operation at Stage 6. As I progressed through math classes, though, the operations became more complex, until I arrived at algebra, a curriculum which usually coincides with the formal operational period, and an often difficult subject matter for many students.

In algebra, the operations are no longer simply of joining, they are more complex operations like substituting, and balancing. These are novel mental operations, which are supported by previously learned Stage 6 mental operations and not by Stage 5 physical actions. In algebra the operations are dependent on the strength of other operations. It could be this abstraction of constructing novel mental operations out of other preexisting mental operations, of developing amodal intelligence from amodal intelligence that proves difficult for many students. It could be that, even in advanced levels of education, there is a benefit to returning complex abstract amodal concepts to their embodied grounded modal components. For instance, a movement lesson in which dancers explore spatial and temporal symmetry might help embody the concept of balancing equations in algebra. A movement lesson that explores how a small gesture can be used to represent and individual or an idea, could help embody literary concepts like metonymy or synecdoche. By adopting curricula that straddle the line between 5$^{th}$ and 6$^{th}$ stage, between action and operation, an opportunity is created for students to ground the learning of amodal concepts in embodied intelligences.

## Dance as a Tool for Cognitive Development

For this paper, cognition and thought were defined as mental processes that result in reasoning, problem-solving, and decision-making, and intelligence was the



 

demonstration of those abilities. Intelligence can manifest in both amodal thinking with letters and numbers as well as modal thinking with perceptual symbols from extero-, proprio-, and intero-ception. Physical action supports subsequent mental operations but physical action also continues throughout life as modal intelligence. Despite the fact that these intelligences are underdeveloped in education, they are still valuable as vocational skills: the exteroceptive intelligence of the engineer or architect, the proprioceptive intelligence of the athlete or the surgeon, the interoceptive intelligence of the counselor or the mother. Does it not make sense, then, to find ways to introduce explicit instruction in these modalities into the curriculum? My answer is, of course, YES, and I believe dance education is one opportunity to do so. Dance education, if properly constructed to address the cognitive components of human movement could foster the development of embodied intelligence. As an expressive art accomplished through space and time, it incorporates all three modalities of perception as part of its daily practice. It offers the educator an opportunity to reverse the devaluation of these modalities from cultural hypocognition and instruct students in an objective understanding of modal thinking.

## Exteroception

Exteroceptive intelligence involves the ability to anticipate, simulate and evaluate information from the world outside of your body. Whether professionally as an architect, engineer, or artist or personally as you navigate a busy street or pack your groceries, you are constantly making choices about how to interact with the world you perceive around you. Usually, though, this decision-making happens below the level of



 

conscious awareness and is not explicitly addressed by curricula. How can dance education help formally develop exteroceptive intelligence?

Exteroceptive intelligence is most often engaged in the dance class in the form of spatial and musical intelligence, when watching other bodies move through space and time. The students watch as the teacher executes movement, they also watch other students executing movement, both while waiting to dance and while actually dancing. The focus though is, frequently, simply watching in order to imitate. The outcome is improved performance not improved perception. A slight tweaking of the dance curriculum, though, could elevate this pre-objective awareness to an objective awareness. For instance, a common spatial awareness exercise used in dance classes is called flocking. In flocking, the dancers are asked to move like a flock of birds. This means that, as the group moves, each dancer must maintain a constant distance from other dancers. Depending on the pattern the movement traces on the floor (circles, spirals, sharp angles, advances, and retreats) this can be quite a complex task. Each dancer must visually or aurally track the other dancers in her group and make small adjustments to her own movement in order to maintain the configuration.

When accomplished well, this exercise can build spatial awareness, and afford an opportunity for demonstrating exteroceptive intelligence. As the group moves, the dancer must anticipate, simulate, and evaluate how the other dancers in the group are going to move while maintaining the designated pathway. Some dancers might be using the underlying rules that allow for successful completion of the task, even though they might not be aware of them. What I advocate, is making these rules explicit. This can be done in an embodied way by changing the parameters of the exercise and



 

indicating to students that the choices they make must change with the new parameters, for instance and change in the pathway on the floor, or a change in the proximity of group members to one another. Explicit awareness could also be addressed through asking questions: "Why do you think Suzie is getting ahead of everyone else?" "When you make the left turn, Greg gets closer to you, why do you think that is?" "Why did you speed up or slow down in a specific moment?" "How are the amount of space you use and the amount of time you take connected?"

By attempting to answer these, and other, questions, either in words or in movement, the rules of the exercise are made explicit. Its structure transitions from pre-objective to objective. The students are learning the components of movement through space and time and how they can and cannot be put together. They are exploring how the manipulation of space and time afford multiple pathways to the achievement of an established goal. Intelligence is demonstrated through consciously recognizing and selecting from one of those pathways. When the student, then, needs to traverse a busy square, or becomes an architect who is designing that square, her experiences in the dance classroom will provide at least the beginning of an understanding of how to structure her choices in those situations.

**Proprioception**

Proprioceptive intelligence involves the ability to anticipate, simulate, and evaluate information about the placement and movement of the body. This is the intelligence of the surgeon or the athlete, it is you as you learn to ride a bike or play ping pong. How does dance education help formally develop proprioceptive intelligence?



 

Proprioceptive intelligence in dance class is intentionally engaged when having to reorganize a movement pattern that has already been learned. Once you know how to ride a bike, for instance, you are simply executing a series of action plans; this is more akin to habit or reflex. Intelligence is demonstrated when that habit is interrupted and anticipation and evaluation are required. In the dance class, students could learn a movement phrase and then the teacher alter the spatial parameters of the movement phrase. Students could be asked to perform the phrase at a low level, or even lying on the ground instead of standing. They could be asked to perform the entire phrase as if they were inside a phone booth. In each case they must take proprioceptive schema and select which elements can remain the same and which must be changed to accommodate the new relationship to space.

This is an opportunity to make explicit the rules of proprioceptive intelligence. Just as some dancers in the exteroceptive intelligence exercise might have been quite adept at completing the task, some dancers in this exercise will easily anticipate, simulate, and evaluate the changes that must occur in order to adapt to the new task. This does not mean, though, that they are aware of those choices. Again, some guidance from the teacher can help make the rules that guide these choices subject to objective inquiry. "How does the change in spatial orientation affect your range of motion?" "How does gravity affect the movement differently when you are lying on the ground?" "How are the amount of space you use and the amount of time you use connected?" They are learning to consciously evaluate nuanced proprioceptive information in order to achieve a specified goal. Whether this manifests later as the ability to competently handle a scalpel in the operating room, or the ability to ride a bike,



 

in the dance classroom the student will have had a chance to explore how different proprioceptive information can be intentionally selected to achieve specific goals.

**Interoception**

Interoceptive intelligence involves the ability to anticipate, simulate, and evaluate information about embodied manifestations of emotions. This is the intelligence of the counselor as she helps his patients or the parent as he raises his child. How does dance education help formally develop interoceptive intelligence?

Interoceptive intelligence appears in the dance class, when the students are asked to recognize the emotional or expressive aspects of a dance. A simple way to accomplish this is to take a phrase of movement and ask the students to perform it as if they were happy, and then perform it again as if they were sad. As the intention behind the movement is altered, the students can be asked to notice how the quality of the movement itself changes in response. Another method would be to choreograph phrases of movement with drastically different qualities, (sharp versus smooth, heavy versus light) and ask students to pay attention to how they feel when performing the movement. Here the students are noticing how the quality of the movement might imply intention. Whether flowing from emotion to movement, or movement to emotion, the students are asked to be consciously aware of how their movements and their inner emotional states are connected.

Just as in the other two modalities, some dancers will be able to do this intuitively. Their performance of the happy movement will be drastically different than their performance of the sad movement. They will hone in, quickly, on how the different qualities of movement make them feel, but they might not be aware of why. Questions



 

from this modality that could make their experience explicit might be: “Where do you feel the different emotions in your body?” “Can you describe how you moved when you were asked to be happy? How was this different than when you were asked to be sad?” “How are time and emotion connected?” Students are learning how emotion structures movement and movement structures emotion. Whether the student becomes a professional counselor or an empathetic friend, the dance classroom has provided him with an opportunity to be more consciously aware of these connections.

## Conclusion

As we have seen throughout this paper it is often difficult to completely extricate the roles of exteroception, proprioception, and interoception. Questions about the use of time and space are answered through both exteroceptive and proprioceptive intelligence. Questions about movement quality and emotion are answered by proprioceptive and interoceptive intelligence. The whole person present in the environment becomes the object of study. *When I am excited* (interoception) *I move bigger* (proprioception)*, and bump into things* (exteroception)*. When the music is slower* (exteroception)*, I feel sad* (interoception)*, and my movements are heavy* (proprioception). We are constantly interacting with the environment, using perception, action, and emotion to intelligently navigate the physical and social world. Dance education offers an opportunity to make explicit the structures that underlie these forms of intelligence. As long as multiple pathways to a goal are anticipated, simulated and evaluated, embodied cognitive processes of exteroception, proprioception, and interoception are all potential modalities for the demonstration of intelligence. This is the wonderful thing about dance, it brings the whole body, all of our awareness, all of



 

our intelligence, our perceptions, our actions, our emotions into the room and provides a space and time for them to be integrated. Dance is a practice in which embodied intelligences manifest, with a framework for recognizing and developing the manifestation of those intelligences, the dance classroom becomes a laboratory for experimenting with our understanding of, and action on, the physical and social world.



 

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