Projection as a Way of Embodied Learning:
On Metaphor and Abduction

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1. Background

As Lemke (1990, pp. 5–11) shows, classical education implicitly presupposes the binary pattern that the teacher asks a question and then the student answers it and most students learn something via repeated turn-taking. Pesce (2013, pp. 761–763) suggests that three assumptions underlie this situation. First, "knowledge is defined from a scholastic perspective: the whole of knowledge is considered to be available and recorded in books." Second, this knowledge is considered from the viewpoint of its verbal aspects: knowledge is, essentially, verbal. Third, the function of learning is considered as psychological and mentalist: this standpoint is accompanied by a dualist view of the world.[1] Consequently, a curious mixture of neobehaviorial and cognitive information-processing psychology dominates most learning studies in educational psychology.

Under this type of transmission view, teachers come to have the illusion that they can predict and control the effects of their own speech, such as physical laws, and then messages of an ideological nature are carried through the choice of specific methods whether consciously or unconsciously. From another perspective, Freire (1990, chap. 2) also criticizes this view, which he refers to as the banking concept of education. Adapting this view turns the students into "containers" that are "filled" by the teacher. Consequently, the idea that a good student, as a container, meekly permits to be filled, while a good teacher fills the containers, is completely accepted, and this idea minimizes the students' creative ability and makes them obedient to their teachers or the oppressors. Finally, the mechanism of oppression is expanded and reproduced repeatedly.

However, other "scientific" learning studies that focus on embodied knowledge or skills (not verbal aspects of knowledge) are also problem. As Suwa (2019, pp. 169–170) writes, many of these studies are restricted to be "scientific," that is, they should be based on objective data and aim to find universal laws. Thus, "personal peculiarity" and subjective data are eliminated, and typical learning studies focus on "expert-novice differences," which are a static comparison. In contrast, Suwa (2019) applies the embodied metacognition method to give importance to the process of personal growth and learning. Embodied metacognition is "a method in which, as a person learns an embodied skill or knowledge, he or she verbalizes, typically writes down, what he or she thinks has occurred in body and mind" (p. 174). By using this method, subjective data are available in a complementary way with objective data and learning studies can involve "personal peculiarity." It is especially interesting for this paper that he uses onomatopoeia to express his bodily actions (Suwa, 2009, p. 24) and Suwa (2019) also considers the narrative-based learning[2] which the educational psychologist Jerome Bruner suggests.

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1 In relation to later discussion, using book metaphor as knowledge is interesting.

2 The narrative-based learning as a constructivist approach is often referred in the field of education (Monteagudo, 2011).

Based on the above-mentioned background, this paper suggests a new way of learning from the Peircean perspective and discusses how projection (abduction, metaphor) initiates a learning process.

2. The Theory of Learning Based on Process
2.1. The Theory of Learning and the Rhetorical Turn in Peirce and Science

Before examining abduction and metaphor, I will begin by confirming how Peirce thinks about learning, and how his ideas about learning link with the rhetorical turn he took in his later years. Peirce describes as follows:

> All flow of time involves learning; and all learning involves the flow of time...all apprehension of continuity involves a consciousness of learning. In the next place, all learning is virtually reasoning…In order to convince ourselves that all learning is virtually reasoning, we have only to reflect that the mere experience of a sense-reaction is not learning. That is only something from which something can be learned, by interpreting it. The interpretation is the learning (CP. 7. 536).[3]

De Tienne (2003, p. 41) suggests examining Peirce's five assertions in this passage: (1) that there is an essential relationship between learning and the flow of time; (2) that learning is a continuous process; (3) that learning is virtually reasoning; (4) that learning is interpretation; and (5) that learning is representation.[4]

Strand (2013) claims that Peirce's theory of learning is closely related to the rhetorical turn. As Colapietro (2007) writes, *the rhetorical turn* (and *Peirce's speculative rhetoric*) occurs in his later years. While Peirce's earlier logic of inquiry is a way of resolving doubts and fixing belief, in a sense, depending on psychological theories, after this turn, his later logic of inquiry becomes the following process: a surprise (which causes a doubt) starts an abduction, which creates new hypotheses (or the discovery of new ideas), and then, these hypotheses are developed by deduction and tested by induction.[5] If the hypotheses do not satisfy these induction tests, new hypotheses are created repeatedly until they do. Finally, the surprise is eliminated to obtain a new hypothesis (or idea) about the surprise (or doubt). This is also Peirce's method of science.

Furthermore, the aforementioned speculative rhetoric is related to communication (in the sense of community) because this process is not only a type of individual activity but also a type of cooperative activity performed in a scientific community. If the hypothesis that someone creates is not tested by a community, then it is not a true hypothesis (or idea) but rather just a result of imagination or speculation. Thus, communication is needed to create a true hypothesis (cf. Colapietro, 2007).

In this sense, Peirce's theory of learning is scientific enough, because it consists of three steps: abduction (making models), deduction (applying them in practice), and induction (verifying them) and its processes are subjected to professional scrutiny and critiques.[6]

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3 References in this format are to Collected Papers of Charles Sanders Peirce, by volume and paragraph number.

4 We can see that Peirce has already criticized the transmission view.

5 Deduction: All the beans from this bag are white (Rule) and these beans are from this bag (Case), therefore these beans are white (Result). Induction: These beans are from this bag (Case) and these beans are white (Result), therefore all the beans from this bag are white (Rule). Abduction: All the beans from this bag are white (Rule), and these beans are white (Result), therefore these beans are from this bag (Case) (CP 2.623).

6 Shavelson and Towne (2002, pp. 3–5) suggests the following six principles to underlie all scientific inquiry: 1. Pose Significant Questions That Can Be Investigated Empirically, 2. Link Research to Relevant Theory, 3. Use Methods That Permit Direct Investigation of the Question, 4. Provide a Coherent and Explicit Chain of Reasoning, 5. Replicate and Generalize Across Studies, 6. Replicate and Generalize Across Studies. See also Rodrigues (2011) about Peirce and science.

2.2. The Rhetorical Turn and Pedagogy

Based on the above-mentioned reasons, Strand (2013) claims that "the promise of a Peircean speculative rhetoric is how it highlights the power of signs to move agents and to change their habits" (p. 792) and "Peirce's later philosophy…invites a shift in perspective from the psychological processes of learning towards the semiotic processes that characterize the production of meaning and the growth of knowledge itself" (p. 800). And Pesce (2013) also claims that the integration of Peirce's speculative rhetoric (rhetorical turn) and institutional pedagogy (critical pedagogy) opens a new horizon for education that is "a way of replacing 'directive knowledge' with a 'dialectical mode of inquiry'" (p. 755).

In addition, Cunningham (1992) and Bergman (2005) claim the importance of integrating constructivism in education with Peirce's semiotics. As Olteanu et al. (2016) explains, the significance of the rhetorical turn in education is the assumption that "knowledge can only be developed upon knowledge and, therefore, an epistemological collaboration is possible" (p. 621), which Peirce and constructivism share. In both of them, knowledge is not transmitted but constructed or grows through learner's inquiry or his series of interactions with his environment, including his classmates, teachers, and/or his community.

In sum, "both semiotics and constructivism approach learning as interpretation" (p. 638) because we use previous understandings to adapt to a developing environment. At the onset of inquiry (learning), the learner has previous knowledge about the object and at least can refer to it. In that sense, he can adapt to his environment by using a combination of previous understandings, making a new hypothesis (as we will discuss regarding abduction later), and then modifying it repeatedly.

As a result, it is important for pedagogy to make the learner understand that he is in the stage of only referring to the object through surprise. Then, to facilitate or provide the environment for his inquiry is required. That is why we need to be careful about providing the environment in education because selecting the environment is strongly influenced by each culture or various situations, as we establish later.

3. Abduction and Metaphor as a Way of Learning
3.1. Abduction and Learning

What is abduction in the midst of rhetorical turn? Peirce changes the idea of abduction several times as we can see that "abduction" is called retroduction, hypothesis, or presumption by Peirce himself. Two especially important changes are from the justification for the belief to the method of discovery (the introduction of a new idea or hypothesis formation) and the introduction of prediction (i.e., the use of "would-be" or "would-do") (cf. CP.2. 102; 2. 774: c1902). In addition, the main point of abduction as a discovery or reasoning method is to create a new idea or an explanatory hypothesis with combining some ideas based upon what we already know (Rodrigues, 2011; Sako, 2018).[7]

In the context of the method of discovery, abduction as a first step of inquiry starts with a "surprise" (i.e., when a prediction is broken). Schurz (2008) classifies abductions into two categories: selective abductions, which choose an optimal candidate from a given multitude of possible explanations (the justification for the belief), and creative abductions, which introduce new theoretical models or concepts (the method of discovery). In addition, he classifies creative abductions into theoretical model abduction and second-order existential abduction. Although theoretical model abduction is

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7   Recently "abduction" is mainly developed in two directions; Inference to the Best Explanation which is characterized as the earlier abduction (selective abduction) and logic of discovery which is characterized as the later abduction (creative abduction) (Paavola, 2012; Schurz, 2008).

creative, its creativity is in its selection, and it does not create new concepts.[8] Therefore, this paper focuses on second-order existential abduction and its subclasses. He classifies second-order existential abduction as micro-part abduction, analogical abduction and hypothetical (common) cause abduction. Micro-part abduction "extrapolates from macroscopic concepts and laws to the microscopic domain to explain various observed empirical phenomena" (p. 216). For example, in ancient Greece advocates of atomic theory postulated that *atoms* obey the same mechanical laws as macroscopic bodies but are so small that they cannot be observed. They used this theory to develop their understanding of phenomena such as the dissolution of sugar in water.

The important process of analogical abduction is driven by analogy and "is a *conceptual abstraction* based on *isomorphic* or homomorphic *mapping*" (p. 217). Moreover, the point is to preserve only the relationship between the two structures but not the monadic properties. The structure of the atom in the Rutherford model is analogical to the solar system in that just as the sun is surrounded by the planets, the nucleus is surrounded by electrons. However, when comparing the nucleus with the sun, the atomic nucleus is different from the sun and electrons are different from the planets. In this sense, "finding an abductive analogy consists in finding the theoretically essential features of the source structure which can be generalized to other domains" (p. 218).

Finally, the case of hypothetical (common) cause abduction "is the most fundamental kind of conceptually creative abduction" (p. 218), but it has rather complicated subclasses. Thus, this paper focuses on the important points in relation to our discussion. This kind of abduction "postulates a new, unobservable entity (property or kind) together with new laws that connect it with observable properties without drawing on analogies to concepts with which one is already familiar" (p. 218) and is driven by "the pure search for unification, usually in terms of hidden or common causes" (pp. 218–9).

The reason why causal unification drives this type of abduction is that it has (at least) three virtues— (1) the intrinsic virtue of unification, (2) the virtue of leading to new predictions, and (3) the virtue of discovering new (unobservable) kinds or properties that enlarge our causal understanding (p. 226). For example, assuming causal unification among malleability, conductivity, luster and so on leads to introduce the concept of metal as a new natural kind and this concept enables us to predict many phenomena in a scientifically testable manner. In addition, it meets Ockham's razor in a scientific way in that a few principles can explain many elementary phenomena or statements, although it is certainly instrumentalistic.

Moreover, we often use this type of abduction outside of science. For example, Pegasus is a combination (unification) of horse and wing in a fictive way, and the smartphone is a combination (unification) of cellular phone and internet in a technological way. Further, the chimera is a combination (unification) of many animals. These unifications can also facilitate our understanding or thought although they are not done in a scientific manner and rather weak forms of it.

"Abduction" can be applied to the field of education, specifically science (Peker & Wallace, 2011), math (Reid, 2018), argumentation (Rapanta, 2018), and so on. In particular, Yunoki (2018, p. 77) suggests the three following strategies to facilitate students' abduction in science learning, based on the later sense of abduction (creative abduction): (1) to motivate students and organize their learning environments; (2) to have them acquire knowledge and experience (if possible, systematized knowledge is better) as much as they can; and (3) to utilize imitation practice regarding abduction and scientific inquiry.

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8   Theoretical model abduction is driven by an already established scientific theory. Its task consists of finding theoretical (initial and boundary) conditions to specify a theoretical model that explains a particular kind of phenomena within an already given theory. For example, in evolutionary theory phylogenetic trees of descendance (theoretical model) can be reconstructed from new empirical data.

Yunoki (2018, p. 85) also analyzes his students' reports containing their observations on a particular area's topography in an earth science class, with specific attention to the relationship between a waterfall and other geographical features and the students' thoughts about these. As a result, he highlights the following three guidelines for teachers: (1) to use surrounding nature as teaching materials; (2) to present a surprising fact (or a task to be solved) that arises from the observation of nature; and (3) to facilitate students' solving of such tasks by advising and guiding them properly after they have grasped the steps of Peirce's inquiry and the three modes of inference (i.e., abduction, deduction, and induction).

3.2. Metaphor and Learning

The relationship between conceptual metaphor (cognitive semantics) and embodied cognition has been receiving considerable attention, so much so that the aforementioned special issue published in *the International Journal of Science Education* has become a book (Amin et al. 2018) despite the fact that Peirce and abduction are not referred to. Though it seems that metaphor is only a form of rhetorical figure, why does metaphor gather attention in relation to learning? We can see the reason, considering the cognitive semantics that radically change the understanding of metaphor.

Johnson (1987), one of the advocates of cognitive semantics, writes that the classical objectivist view of knowledge has been turned down and knowledge always depends on the context. Thereafter, he suggests that instead of using the classical objectivist view, "any adequate account of meaning and rationality must give a central place to embodied and imaginative structures of understanding by which we grasp our world" (p. xiii). For the following reasons, a metaphor is not merely a linguistic expression but a cognitive mechanism and one of its main components:

> First, our bodily movements and interactions in various physical domains of experience are structured…and that structure can be projected by metaphor onto abstract domains. Second, metaphorical understanding is not merely a matter of arbitrary fanciful projection from anything to anything with no constraints (p. xv).

Summarily, we use metaphors to understand something, and at the same time, metaphors are restricted by our bodily interactions with the world and experiences. Thus, metaphors are closely related with our body and learning. For example, she devoured the book. This sentence is literally false because she does not eat the book itself. However, we can easily understand the situation where she reads it in an unusually enthusiastic way by using the comparison (metaphor) to the bodily movement (devouring) and get more information.

Under these assumptions, Fuchs (2015, p. 935) claims that the effects we are witnessing in learning science extend from the metaphorical to narrative and proposes "a hypothesis of narrative framing of natural and technical scenes." It is important to focus on three points in this hypothesis. First, the narrative provides a frame to organize various metaphors (our understanding of elements) to construct a large scale network (story). Second, using this large scale network (storytelling) develops our understanding of elements. Third, repeating these two steps facilitates the learning processes. Moreover, Fuchs (2015, p. 947) suggests that we can understand some models through narratives (as we would tell a story), even though mathematical models and simulations do not have any components in common with storytelling. As a result, the role of the teacher is important in that teachers can increase students' sensivity to everyday reasoning, which they already have and can use in any given situation (p. 951).

Uchinokura (2010) broadly examines previous works about metaphor and analogy in science

learning in Europe, America, and Japan, and summarizes them. As a result, he shows that instruction and learning strategies that utilize metaphor and/or analogy are very effective for both teachers and students respectively. Tobin and LaMaster (1995) report that by changing metaphors from a manager to a social director, class disruptions are improved, although the same teacher teaches the same classes. This is a case whereby changing the teacher's habit with changing metaphors improves her learning skills.

Furthermore, learning studies via metaphors show the influence of "culture." Buaraphan (2011) shows that pre-service teachers' beliefs are metaphorically rooted and culturally influenced; more concretely, we usually use metaphors of teachers as gardeners, tour guides, and so on, but in this research, we can see the teacher's metaphors of Buddha and the garland maker because this research is conducted in Thailand. Notably, these unique metaphors have influenced becoming teachers. In smaller "cultural" groups, the situation is almost the same. Strand (2011) shows the different ways of metaphorizing creativity among Norwegian nurses, teachers, auditors, and computer engineers and considers its influence of workplace learning.

3.3. Relationship Between Abduction and Metaphor Regarding the Medium of Projection

It may seem that this conceptual metaphor in science learning has no relationship with Peirce's thoughts. However, we can see them under a unified perspective as an extension of abduction and learning by considering projection, which links abduction together with metaphor. Though Peirce himself does not use the word "metaphor" so much, four main claims about metaphors in Peirce's studies are listed below:

(1) Metaphor in Peirce's thought is iconic. Thus, it is not limited to language but can cover other theories of metaphor, including the theory of conceptual metaphor (Lattmann, 2012).

(2) As Anderson (1984) writes, on the one hand, analogy is created based on the structural similarity that we have already known between two realms. On the other hand, we can see a common structure or point between two realms after a metaphor is created. In other words, in a sense, metaphor creates a common structure that we have been hitherto unnoticed.

(3) Mladenov (2006) sees Peirce's metaphor as a process whereby another new aspect of things emerges by casting unfocused light on "effete mind" (CP. 6. 25) as a layer of fixed experiences (i.e., comparing two things from another angle).

(4) Paying attention to the similarities between Peirce's thinking and cognitive semantics, Danaher (1998) and Sørensen, Torkild and Morten (2007) emphasize the importance of embodiment and space.

These claims share the common ground that metaphors ensue from abductions and its semiotic process is in the interactions between the body and the world. It is interesting that they pay little attention to projection. As aforementioned, Johnson (1987) focuses on the function of metaphor, especially projection, from a similar perspective of the interactions between the body and the world. Hence, this paper suggests considering Peirce's metaphor and abduction from this viewpoint of cognitive semantics (i.e., the projection to integrate them).

In cognitive semantics or semiotic process, briefly speaking, projection is to carry a structure from a source domain to a target domain, and as a result, our understanding is facilitated. For example, in the metaphor (metaphorical projection) THEORIES ARE BUILDINGS, the structures (e.g., "construct," "foundation," and "buttress") of the source domain (buildings) are projected onto the target domain (theories) and this projection can facilitate our understanding of theories using

these expressions (Johnson, 1987, pp. 105–106). In sum, we can use these expressions to think about theories and enlarge our understanding. Moreover, metaphor (metaphorical projection) is initially novel and explicit but sometimes becomes conventional and implicit (dead metaphor) as time passes. Nevertheless, in the context of the psychological process and learning the projection carries structure from a "source" we understand to a "target" we want to understand, like a parable, and improves our understanding (Turner 1996).

Moreover, Johnson (1987) writes, "Metaphorical projections. Metaphor is perhaps the central means by which we project structure across categories to establish new connections and organizations of meaning and to extend and develop image schemata" (p. 171). Taking this into consideration, a function of projection is to shift a grasp (or understanding) of a category or across categories and develop an understanding from the pre-linguistic (image scheme) to the linguistic stage and a way of embodied learning initiated by "surprise" as the aforementioned abduction.

Reconsidering the classification of abductions from the perspective of projection, this paper suggests a new categorization of learning. First, we can abapt "micro-part abduction" to metaphor. The point of micro-part abduction is to extrapolate from macroscopic concepts and laws to the microscopic domain and it is the same function of (metaphoric) projection in that a structure is projected from a source domain to a target domain. Further, according to Johnson (cognitive semantics), metaphor (metaphoric projection) is not necessarily constrained by the direction from macro to micro but rather this abduction can be extended to other directions or types.

Analogical abduction corresponds to analogy. In analogy, it is not a monadic property but a relationship among things that is projected. Moreover, considering Anderson's idea of analogy, it is suggested that we have already recognized the structure (relation) in both domains but using analogy or willing to use analogy brings to our notice that the structure is an essential feature of the source.

Hypothetical (common) cause abduction is the so-called "abduction." Although it has some subclasses, the shared feature is that some properties or structures are projected into one new concept or theory which is their combination. Sometimes, by this abduction, one new idea is guided by a single thing. In this case, his background knowledge is used and combined implicitly. A detective like Sherlock Holmes seems to identify a criminal from one clue, but he uses and combines his rich knowledge in his reasoning processes. What is important about these abductions is that they do not create a new idea but give rise to a new idea formulated from existing components or achieve the same by shifting applications from one to another.

Connected these and projection, one further classification can be proposed. That is, selective abduction corresponds to induction. Goodman (1983) explains the relation between induction and projection in his famous Grue Paradox.[9] The point of his answer to this paradox is that green is entrenched in habits of language and so the property green is projected with respect to emeralds. We need to be careful about the differences between Goodman and Johnson, but this paradox and his answer are very suggestive. Induction is defined as the reasoning from a body of observations (facts) to a general conclusion (rule). However, from Goodman's assertion and the perspective of this study, it can be proposed that the function of induction is not to come up with a general principle but to select one principle from other candidates which hypothetical (common) cause abduction proposes from our entrenchment in habits. In sum, induction should be considered in the context of selection or

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9 "[The predicate'grue'] applies to all things examined before t just in case they are green but to other things just in case they are blue. Then at time t we have, for each evidence statement asserting that a given emerald is green a parallel evidence statement asserting that emerald is grue. And the statements that emerald a is grue, that emerald b is grue, and so on, will each confirm the general hypothesis that all emeralds are grue" (Goodman, 1983, p. 74).

justification for the belief to select because to come up with a general principle is assumed to be the function of hypothetical (common) cause abduction.

Based on the above, the role of abduction and metaphor is to resolve doubts about an event or acquire a new meaning or knowledge. At that time, a learner actively makes a projection (creates a metaphor or makes an abduction) by using and combining the knowledge that they already have. In this case, as Yunoki (2018) suggests, the teacher's role is to tell his student what event he should be surprised by. Concisely, the role is not to tell the answer but to know what knowledge a student has and to advise that student on what knowledge he can project.[10]

4. Metaphor and Pretend Without Representation

As described above, it is not so surprising to us that abduction is an effective strategy of inquiry because in his early days, Peirce suggests four famous methods of inquiry (method of tenacity, method of authority, method of a priori, and method of science) (CP. 5. 378–386), and in addition, Peirce's father was a professor of mathematics. Therefore, Peirce could receive high-level scientific education in his age (Brent, 1998).

In this paper, to further develop these considerations on abduction and metaphor, I examine two ideas: enactive metaphor and pretend as sensorimotor engagement. First, I will elucidate "enactive metaphor" (Gallagher and Lindgren, 2015) and its application to a learning scene, and consider the importance of "whole body," which Gallagher and Lindgren emphasize. The first reason for this is that the research on cognitive semantics (cf. Johnson, 1987) is ground- breaking because it claims that metaphor is not merely a figure of speech but forms the basis of our cognition, which is rooted in our bodies. In sum, in metaphor, it is not a word itself but an emhodied image schema that is projected (Johnson, 1987). Another reason is that West (2015) focuses on lived experiences as the common ground between abduction and cognitive semantics. Furthermore, by this emphasis on "(whole -) body" we can think that abduction operates not only on the level of inferences manipulating propositions (language) but also on the level of pre-linguistic stages in relation to metaphor. I will go on to consider "pretend as sensorimotor engagement" (Rucińska 2014) because the sensorimotor theory of perception has the same tendency as the above-mentioned and provides us with new ideas from another angle.

4.1. Enactive Metaphor

Gallagher and Lindgren (2015) claim that "enactive metaphor" is based on cognitive semantics and enactive approach because they think that metaphorical cognition is composed of not only the physical body (sensorimotor) but also the full body, including emotions. In other words, considering their previous research, they claim that emotion and sociality have an influence on cognition. In addition, focusing on the difference between "pretend" (e.g., using a banana as a cell phone) and metaphor (e.g., "Time is money"), they contend that in considering metaphor, the important thing is not mere language and a physical body but rather a whole body.

They consider that "pretend" is important for their research because such "pretend" is evidence that children become able to see affordances (possibilities for action) in objects before cultivating adequate language (or using propositions). They also insist that we can see a sign of participatory sense-making, which is sociality, in that children develop their ability to play a make-believe game

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10 Although Peker and Wallace (2011) do not clearly write so, we can see that their thought is in the same line with Yunoki (2018).

through "pretend," and that they can learn others' affordances or perspectives by playing a make-believe game or taking the place of another metaphorically.

They confirm their claims about enactive metaphors in the realm of education (learning) by verifying the effect of enactive metaphors in a mathematics class, where they provide students with possibilities for action (gestures) as a first step, instead of occupying this first step with a traditional theory.

Their claims are interesting for this study. Though they do not refer to Peirce, the closeness of ideas is clear based on the above.[11] Instead, we can say that their research compensates for some shortcomings in this discussion concerning "projection." In other words, the insufficiency is that our discussion does not adequately consider that projections are based on the whole body (including actions and emotions).

In addition, before Gallagher and Lindgren (2015), Prawat (1999) points out that metaphors operate our language not only inside but also outside when we consider abduction as a metaphorical process in the context of learning and education, while referring to Peirce and Dewey. Based on them, we can grasp that the enactive metaphor develops Prawat's idea more concretely, and it is an extension of learning studies in Peirce or pragmatism.

4.2. Pretend as Sensorimotor Engagement

The interesting thing Rucińska (2014) suggests is that "pretend" is not offline imagination but rather a kind of online perception. She disagrees with the traditional view of pretend that playing pretend requires the ability of decentering (offline imagination), as it is defined as symbolic play. Depending on the sensorimotor theory of perception (SMTP) and the idea of "seeing-in," she assumes that there is a natural connection between perception and imagination.[12] She regards the ability of offline imagination as a surplus to play pretend, though she does not recognize the ability (imagination) itself.

What is the idea of "seeing-in?" This idea comes from Currie (2004). It is a phenomenon wherein one sees a woman in a picture or a face in the clouds and claims that "such seeing-in does not involve a woman, nor does it involve the perceptual illusion of seeing one; neither is it a case merely of judging that the picture represents a woman: it is genuinely perceptual phenomenon" (p. 220).

Her central assertion is that she understands seeing-in as seeing-affordances-in based on the SMTP, and this notion of perceptual seeing-in underlies the capacity to make imaginative transformation (seeing-as), although I cannot explain them in great detail here. Based on the above, she claims that playing pretend (e.g., using a banana as a cell phone) does not necessarily require representations (stand-in for absent objects, such as a cell phone) because it is certain that the object (a cell phone) is absent in the situation; however, we can use the same affordances (e.g., the property of being graspable) that the object (a cell phone) has by using other objects (a banana). In short, although the object itself is not present, in many cases, objects that have the same affordances are present while playing pretend.

Additionally, we should not forget that, in most cases, playing pretend requires some type of audience to respond. Proceeding from this point, playing pretend is a form of participatory sense-making (De Jaegher & Di Paolo, 2007), and it is a sign of social perception (or the perception of

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11 They consider Dewey's "reflective arc" (Gallagher & Lindgren, 2015, pp. 392–393).

12 Peirce writes that "our first premises, the perceptual judgments, are to be regarded as an extreme case of abductive inferences, from which they differ in being absolutely beyond criticism" (CP. 5. 181). And Atkins (2017) suggests the relationship between Peirce's theory of perception and SMTP.

social affordances).

It is also interesting that from the perspective of ecological psychology Dent-Read (1997) suggests that metaphor involves explanatory activity (i.e., perception) while pretend play involves performatory activity (i.e., action), while Szokolszky (2019) suggests that "novel metaphors are defined…as involving fresh insight, based on the focused perception of some pattern that remains invariant across two kinds of things" (p.19), though, again, I cannot examine these in detail here. In summary, we may consider the invariant as a type of projection.

5. Peircean Interpretation of "Seeing-as"

Midorima's (2003) research on seeing-as in infants and children from the Peircean perspective can connect these studies of metaphor and pretend with Peirce's semiotics. Midorima (2003) criticizes as follows: "The traditional interpretation of seeing-as emphasizes the conclusion that something is seen as another too much" (p.13) and claims that in nursery practices, we need to focus on the process in which seeing-as is reconstructed and take the Peircean semiotic stance (the concept of Firstness, Secondness, Thirdness) instead of Saussure's framework, which is a standard view in studies on infants and young children.

She considers "feeling" as Firstness, which refers to a pre-linguistic sensation; "naming" as Secondness, which only concerns differentiating an object as something; and "meaning" as Thirdness, which is in the stage at which something differentiated is contextualized. She then expresses her belief that proceeding from Firstness to Thirdness is a sign of transformation from individual sensuous cognition to social cognition. For example, we can look at the process of seeing a lump of mud as a rice ball. First, we feel fluidity when we get mud. This primitive feeling changes to a feeling of rigidity by pressing together or hardening. This lump of mud is then differentiated from the other lump of mud and is named a rice ball. Finally, it is contextualized in a shop where someone buys it and acquires its meaning. Although this case requires interaction via someone coming to buy the rice ball and is not a case of playing alone, the underlying principle applies.

Given that the Peircean semiotic perspective provides the nursery environment that invites the play of seeing-as and gives infants and children who are engaged in playing seeing-as proper instruction, Midorima (2003) underscores the merits that caregivers can have closer relationships with their infants and children with such practices. Though her research is mainly speculative and needs to be verified via nursery practices, we can expect results that are as positive as Gallagher and Lindgren (2015) obtain in education and learning.

6. Prospect

Kirsh (2011) researches on a theatrical technique of "marking" as a projection. "Marking" is a rehearsal method that reduces the consumption of energy by using fingers or parts of the body instead of practicing with the full body when performers confirm their choreography and positions. From our point of view, it is a synecdoche (e.g., the word "glasses" refer to eyewear), which is a type of metaphor where a term for a part of something refers to the whole of something or vice versa.

In addition, Pesce (2013) examines the significance of the rhetorical turn in education at three levels: a macro-level (e.g., culture), a meso-level (e.g., teacher and student), and a micro-level (e.g., individual inquiry). In the relation to Institutional Pedagogy (teaching trend in France), he suggests some effective methods from these perspectives. For example, in a macro-level 'research field trip'

where "students would explore the neighborhood, try to understand how things work and produce their own account" (p. 773) can provide a way of taking control of the world by producing knowledge about it. In a meso-level a type of group work, such as rituals,[13] helps students "to deal with problems and to do so in contexts within which debates about meaning and rules are essential" (p. 774) via speech acts and so on. Finally, in a micro-level he suggests: "The teacher's authority in such teaching move away from content authority to methodological authority" (p. 774). That is, he thinks that a teacher should become a kind of scaffolder.

Though further studies are needed to investigate the significance of the rhetorical turn (projection) in communication, education, and so on, this paper can show that the concept of "projection," which is based on the whole body, is important in learning in that its function develops our understanding through shifting our grasp of categorizations (projection), and that learners need to engage with practices actively and not passively in order to project. Projection as a method of bodily learning is the first step of inquiry from seeing-as or pretended play to workplace learning; in this sense, we can consider projection as a pre-hypothesis or pre-model to make a hypothesis or model and study the learning process to examine the changes of projections in addition to objective data (scientific observation).

As a result, I envisage that this paper contributes to embodied studies as follows. First. we can study the learning processes, for example, from a novice to an expert to consider the changes of metaphor (or other types of projection e.g., onomatopoeia, narrative, hypothesis, etc.) as Tobin and LaMaster (1995) show and then advice a novice on how to use a type of metaphor to learn a skill depending on the situation. Second, we can improve the learning processes to use projections as a pre-model or pre-hypothesis. Especially, we can change the metaphor in learning from one way or turn-taking patterns (e.g., bunking, container, transmission, etc.) to some types of interactive patterns which facilitate the growth of learners (e.g., scaffolding, gardener, etc.) for solving current educational problems. Third, the influences of "culture" in learning process can be considered from small groups (workplace) to so-called culture as Buaraphan (2011) and Strand (2011) suggest.

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13 Pesce (2013, p. 778 n74) writes that in this context "ritual" has the specific definition by Institutional Pedagogy though I cannot explain it in detail here.

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