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Deweyan Approaches to Abduction?

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1. Introduction

Apparently, Dewey never explicitly commented on Charles S. Peirce's notion of abduction; nor did he use the term in his own writings. Although there are clear differences in Peirce's and Dewey's logic and inquiry, this is still somewhat surprising. For Peirce abduction is a third main mode of reasoning, besides deduction and induction, which is about the process of forming hypotheses or suggestions. There are, in my view, interesting affinities between abduction as presented by Peirce and elements of reflective thinking presented by Dewey.

In the secondary literature on Dewey, there are different interpretations of the basic relationship between Dewey's and Peirce's overall conceptions of inquiry. Some researchers emphasize the differences between Peirce's and Dewey's conceptions, while others, like Prawat, seek to merge Dewey's and Peirce's conceptions by developing a new interpretation of abduction (Prawat 1999, 2001; see also Sleeper 1986). This latter project has been criticized as based on misinterpretations (Garrison 2001; Koschmann 2003). Other researchers emphasize the overlaps and continuities between Dewey's and Peirce's conceptions, while also acknowledging that there are differences between them (see e.g. Burke 1994; Colapietro 2002). My interpretation is closest with this last group.

In this paper, I focus on Dewey's formulations of aspects (or phases) of reflective thought (or pattern of inquiry), and I will investigate whether abductive elements can be found from these formulations. Both Dewey's analyses of reflective thought and Peircean notions of abduction are, so to speak, moving targets. Dewey developed his notion of inquiry or reflective thought over many years. Peirce, too, developed his conception of ab-

duction throughout his entire academic life, and after Peirce, others have formulated new notions of abduction. There are, then, many interpretations on abduction that may be used for the comparison. In this paper, I am not attempting to undertake any comprehensive comparison of abduction and Dewey's notion of inquiry. Instead, I wish to concentrate on an analysis of what we may call abductive elements in Dewey's writings on reflective thought. My aim is not just to discuss whether Peircean notions of abduction can be found lurk in Dewey's thought, but also to use Dewey's work to give resources for developing the notion of abduction further.

First, I present some main interpretations of Peircean abduction and how it has been interpreted by later thinkers. Next, I present Dewey's conceptions of reflective thought (or pattern of inquiry), and point to some abductive elements within it. Finally, I return to the question of the continuity between Peirce's and Dewey's conceptions of inquiry.

2. Peircean formulations on abduction and phases of inquiry

Peirce's own formulations of the notion of abduction leave room for different interpretations (Paavola 2012, 21–55). This is not so surprising given the fact that Peirce discussed abduction (or, with alternative names, *à posteriori reasoning*, *hypothesis*, *presumption*, or *retroduction*) over almost fifty years (see Bergman & Paavola 2014). He consistently maintained that abduction is a third main mode of reasoning besides the more generally acknowledged *deduction* and *induction*. What makes Peirce's conception of abduction interesting, but also controversial, is the fact that he developed abduction in close to (using modern terms) "cognitive" topics not just a part of "pure" reasoning. For Peirce, abduction is reasoning, but also, at the same time, it comes close to (or in some formulations even the same as) sensations and emotions (e.g. CP 5.291–2, 1868), conceptions (w 1, 516, 1866), guessing (CP 7.219, 1901), instinct (CP 7.220, 1901), insight (CP 5.173, 1903), perception and perceptual judgments (CP 5.180–94, 1903), or pure play, and musement (CP 6.455–69, 1908). Abduction is for Peirce thus hypothetical, "weak" reasoning to tentative suggestions and provisional adoption of an explanatory hypothesis, which comes close to perception and/or ways of seeking conceptual unity on the basis of observations.

It is customary to discern two main periods in Peirce's conception of abduction. In his early formulations, Peirce treated abduction syllogistically (or as an evidencing process) (Burks 1946; see e.g., Peirce CP 2.623,

1878): abduction is a way of reasoning backwards (retroductively) from an effect to a cause. Peirce's example was that if we find fossils of fish in the interior of a country we can (tentatively) explain this finding with the help of an abductive hypothesis that the sea once washed over this land (EP1: 189, 1878). Or, if we have documents and monuments referring to a man called Napoleon Bonaparte, it is basically a hypothesis that this person has existed (*ibid.*). Abduction is, though, weaker than basic forms of induction: we use abduction not to infer what is directly observed, but rather to explain what is observed (EP1: 198, 1878).

In his later formulations of abduction (Burks 1946; see e.g., Peirce CP 7.202–19, 1901), Peirce did *not* abandon a syllogistic approach to abduction, but he began to describe abduction as a part of a broader methodological process of inquiry. Inquiry starts with observation, in particular when there are some surprising or anomalous phenomena which go against some habits of expectations, and the anomalies make the inquirer ponder the phenomena and search for ways of coming to terms with the wonderment (EP2: 440–1, 1908). The inquirer seeks a solution, that is, a conjecture or an hypothesis that can plausibly dissolve the puzzlement. Abduction (or retroduction as Peirce named it at that time) is a characteristic form of reasoning at this "first stage of inquiry", that is, "reasoning from consequent to antecedent" (*ibid.*). Abduction is a weak form of reasoning in the sense that it does not lead to certainty: its results must be tested, which occurs in the second and third stage of inquiry. The testing starts with a deductive process that clarifies the conditional, experiential consequences of the hypothesis (EP2: 441–2, 1908). *If* things are as the hypothesis asserts, what kind of consequences should follow concerning other relevant things? The third stage is the actual testing, where inductive reasoning is prevalent (see EP2: 442, 1908). It is about ascertaining how far consequents (expected on the basis of the hypothesis) accord with experience, and deciding if the hypothesis requires some modifications or should be rejected (*ibid.*). In sum, then, we can say that abduction is central in the first stage of inquiry where hypotheses are generated and provisionally adopted, made clearer with deduction in the second stage and tested through induction in the third (see also CP 7.218, 1901).

In his later conception of abduction, Peirce maintains that abduction is close, or even the same, as a "guessing instinct" we use to find fruitful hypotheses. While still maintaining that abduction is essentially a form of reasoning, he was wondering how human beings have been so successful in coming up with fruitful hypotheses when all they have is this basically

very weak mode of inference (Peirce CP 7.220, 1901). He ended up postulating that human beings possess a guessing instinct which is an important part of abduction. This instinct is fallible, but still strong enough to explain how people come up with so many good guesses. Peirce offered various kinds of support for this hypothesis (see Paavola 2005).

In his later conceptions, Peirce also maintains that abduction is close to perception or perceptual judgments. In one famous passage he writes that:

abductive inference shades into perceptual judgment without any sharp line of demarcation between them; or, in other words, our first premisses, the perceptual judgments, are to be regarded as an extreme case of abductive inferences, from which they differ in being absolutely beyond criticism. The abductive suggestion comes to us like a flash. It is an act of *insight*, although of extremely fallible insight. It is true that the different elements of the hypothesis were in our minds before; but it is the idea of putting together what we had never before dreamed of putting together which flashes the new suggestion before our contemplation. EP2: 227, 1903

Then Peirce offered, as a further illustration of the relationship between perception and abduction, an example of visual illusions (nowadays called reversible figures) where the same data can be interpreted in two different ways (as a serpentine line or as a stone wall) (EP2: 228, 1903; see also Hanson 1958). Under certain circumstances, abduction comes very close to being a form of (perceptual) insight, especially when the insight (or hypothesis) arranges phenomena, which we have been puzzling about, in a novel and promising way. On the other hand, even if perception is something which is so to speak forced onto the observer, there is still an interpretative element in it. This means that abductive and hypothetical elements can be found in perception. This latter point has been treated subsequently in discussions on theory-ladenness of observations (Hanson 1958). Actually Peirce here emphasizes the "observation-ladenness" of theories (or hypotheses) as well as the theory-ladenness of observations (which is not often noted in discussions on theory-ladenness of observations). Hypotheses are seen as closely related to observations, and they have their origins in this close relationship.

One interesting question in Peirce's conceptions of abduction which relates to Dewey's conceptions of inquiry is what role Peirce's doubt-belief formulation of inquiry should play. In his influential article "Fixation of Belief" (EP1: 109–23, 1877) Peirce maintained that the goal of inquiry is the settlement of opinion. The process of inquiry can be described with

the help of the notions of belief, doubt, and habit. Beliefs "guide our desires and shape our actions" (EP1: 114). The feeling of believing is an indication that there is an established habit determining how we will act. Doubt, on the other hand, is "an uneasy and dissatisfied state". The irritation of doubt causes us to inquire. Peirce maintained that to initiate an inquiry, it is not enough to just utter a question: there "must be a real and living doubt" (EP1: 115). In this same article, Peirce presents his famous four methods to settle opinion: 1) the method of tenacity, 2) the method of authority, 3) the a priori method, and 4) the scientific method. Peirce presents these methods in a certain order, so that the next method is always answering to some problems which made the former unsatisfactory. The scientific method is the one where our beliefs are caused by some external permanency, and this permanency does not affect merely some individuals, but is such "that the ultimate conclusion of every man shall be the same" (EP1: 120).

It is a bit curious that Peirce did not clarify the relationship of his doubt-belief theory to his conceptions of abduction, or to the cycle of abduction, deduction, and induction. In general terms, these two seem to be parallel ways of describing the cycle of (scientific) inquiry, the doubt-belief theory having more "psychological" connotations. It might be asked if the settlement of opinion is the same as the testing of hypothesis with deductive and inductive phases. Abduction is connected to the irritation of doubt, although the doubt-belief cycle is not saying much on the details of the abductive phase.

Given the purpose of this paper, newer developments (after Peirce) on abduction are also worth considering. In the 1950s and 1960s, N. R. Hanson argued for a logic of discovery based on Peircean abduction (Hanson 1958). The kind of abductive search for hypotheses based on data is, according to Hanson, an alternative to both to the inductive and to the hypothetico-deductive model of inquiry. In the late 1960s, Gilbert Harman argued that the inference-to-the-best explanation (IBE) should be seen as a basic model for inductive reasoning. Nowadays IBE is often also called "abduction". Peircean abduction and IBE are closely related, but they have a different focus and strength. Peircean abduction concerns more the process of generating promising hypotheses while IBE is more about evaluating and selecting best from existing hypotheses (Minnameier 2004; Paavola 2006; Campos 2011). In the 1980s abduction started to attract interest from the point of view of semiotics, and it was interpreted as a "detective methodology" (Eco & Sebeok 1983). Nowadays

there are also new developments on abduction which are interesting related to Dewey's conception of inquiry such as practical syllogism interpreted abductively (Hilpinen 2007), or abduction related to distributed cognition (see Magnani 2001, Paavola 2006), or manipulative abduction which "happens when we are thinking through doing and not only, in a pragmatic sense about doing" (Magnani 2004, 229).

In summary there are several overlapping interpretations on Peirce's conceptions of abduction (and inquiry) relevant if compared to Dewey's conceptions, like

- a) a weak mode of reasoning (besides deduction and induction) on searching explanatory hypotheses on the basis of observations and anomalies,
- b) a first phase of inquiry where tentative and testable hypotheses are formed,
- c) a guessing instinct, or insight, close to perceptual judgment,
- d) a part of the irritation of doubt starting the doubt-belief cycle and process of inquiry,
- e) (potentially) starting a change of practices as a part of distributed cognition (in newer formulations of abduction).

3. Different formulations by Dewey on reflective thought

Now, I will turn to Dewey's conception of the phases or aspects of reflective thought. Dewey formulated these aspects in different ways in his writings (see Miettinen 2006). In this paper, I will mostly use the general term "aspects of reflective thought", although on the basis of Dewey's writings, they could also be called "analysis of process of thinking" (MW 6, 234), "general features of a reflective experience" (MW 9, 157), "phases of reflective thought" (LW 8, 199), or "pattern of inquiry" (LW 12, 105). In this chapter I will list these formulations in Dewey's writings briefly and point out some abductive elements in them.

Dewey did not use the term abduction in his writings, but I will concentrate on issues surrounding the "abductive puzzle". By that term, I refer to the question of how people have found good or successful hypotheses and ideas, given that there are aspects of reasoning or inference involved in the answer (even if as a weak form of reasoning). My aim is not

to answer the question whether Dewey had exactly similar conceptions as Peirce did, but rather point out abductive themes in Dewey's formulations.

3.1 Stages of logical thought (1900)

A first version of these aspects of reflective thought can be found in Dewey's article "Some Stages of Logical Thought" from 1900 (MW 1, 151–74; see Burnett 1976). Here, Dewey formulates "stages of thinking" which concern "both the race and the individual" (MW 1, 151). They are not yet about phases or aspects within the process of inquiry, but rather some kind of historical overview of earlier approaches (Burnett 1976, xv). There are, though, many similarities to Peirce's treatment of inquiry in the "Fixation of Belief". Dewey discusses doubt-inquiry processes caused by questioning and doubt aiming to establish a new equilibrium, or fixed ideas. Both Dewey and Peirce discuss the method of scientific inquiry as a last stage in these historical processes.

Dewey does not name (or categorize) these stages clearly, but the initial stage is one where "the doubt is hardly endured but not entertained" and "beliefs are treated as something fixed and static" (MW 1, 152). The second stage brings ideas subject to change, and involves comparison, compromise and modification, and contains conversation of thoughts, that is, discussion (MW 1, 157–61). The third stage is where there is a "transformation of discussion into reasoning, of subjective reflection into method of proof" (MW 1, 161), and it involves such things as reflection and the bringing of different ideas into relation, developing suggestions, testing, and experimenting (MW 1, 160–7). But inquiry is still limited and fixed. The fourth stage covers an inductive and empirical science. Thought then "takes the form of inference instead of proof" which "goes from the known to the unknown" (MW 1, 168; see 1, 166–9). The model of this fourth stage is modern experimental science, and Dewey maintained that existing theories of thinking, that is, Aristotelian logic, empiricism, and rationalism (Dewey does not use these latter terms but the meaning is quite clear) are insufficient. He seems to set a program for himself by maintaining that "scientific procedure, as a practical undertaking, has not as yet reflected itself into a coherent and generally accepted theory of thinking, into any accepted doctrine of logic which is comparable to the Aristotelian" (MW 1, 172).

As I see it there are many abductive elements present, although in a quite general manner, in the last stage, that is, the stage of experimental science. This stage aims at *discovery* rather than proof, and at "pushing out the frontiers of knowledge", and "making friends with facts and ideas hitherto alien" (MW 1, 168). It means "the importance of noting apparent exceptions, negative instances, extreme cases, anomalies" because they stimulate inquiry (MW 1, 169). Inquiry is, here, clearly oriented towards the future. Dewey maintained as Peirce had done in the "Fixation of Belief" that the method of scientific inquiry was not properly understood in existing conceptions.

In the "Studies in Logical Theory" (1903) Dewey makes a similar distinction though with a different emphasis. According to it, scientific inquiry passes historically through at least four stages: 1) in which scientific inquiry does not take place at all, 2) an empiric stage with crude and unorganized facts, 3) a speculative stage with guessing, with making ideas and framing ideas but later on condemned only as ideas, and 4) "a period of fruitful interaction between the mere ideas and the mere facts" with experimental inquiry (MW 2, 306–7).

3.2 *How We Think* (1910)

In the first edition of *How We Think*, Dewey presents formulations which come close to Peirce's formulations of three phases of inquiry (abduction, deduction, and induction). Dewey distinguishes between "five steps or elementary constituents" within an "analysis of the process of thinking" (MW 6, 234): 1) a felt difficulty, 2) its location and definition, 3) suggestion of possible solution, 4) development by reasoning of the bearings of the suggestion, 5) further observation and experiment leading to its acceptance or rejection; that is, the conclusion of belief or disbelief. (MW 6, 236–7).

Dewey describes simple examples of this kind of a process, and also how this process starts. The difficulty (the first step) can be a conflict between conditions at hand and intended results (like, in Dewey's example, how to get to another part of a city in time), or an incompatibility between suggested belief with some other facts (like when we start to wonder what the function of a strange looking part of a ship might be), or some oddly behaving natural phenomena that we become aware of (like bubbles appearing outside of the mouth of the tumblers washed in hot soapsuds and placed downward on a plate).

Dewey says that the first and second step (that is, a felt difficulty and the attempt to define it) often fuse into one another. He describes this stage:

In cases of striking novelty or unusual perplexity, the difficulty, however, is likely to present itself at first as a shock, as emotional disturbance, as a more or less vague feeling of the unexpected, of something queer, strange, funny, or disconcerting. MW 6, 238

I think this is a very good description of the basis for abduction understood as a kind of methodology of detectives. There is some kind of problem or anomaly, something that goes against what we would have expected. Sometimes this anomaly is nothing more than a vague feeling of disturbance which instigates the process.

The third step is "suggestion" which comes also very close to abduction:

Suggestion is the very heart of inference; it involves going from what is present to something absent. Hence, it is more or less speculative, adventurous. Since inference goes beyond what is actually present, it involves a leap, a jump, the propriety of which cannot be absolutely warranted in advance, no matter what precautions be taken.

MW 6, 239

Dewey also says that if the suggested conclusion is not accepted but only tentatively entertained, it constitutes an idea (or supposition, conjecture, guess, hypothesis, or in elaborate cases: theory).

Dewey's formulations of the fourth and the fifth step come quite close to Peirce's formulations of deduction and induction respectively, at least as formulated within Peirce's later theorizing. In the fourth step, the idea is elaborated by the use of reasoning, and particular attention is paid to what we should expect to follow given the suggestions at hand. The fifth step is "some kind of experimental corroboration, or verification, of the conjectural idea" (MW 6, 240).

In the first edition of *How We Think* there is a separate chapter for "systematic inference: induction and deduction". This shows that Dewey does *not* consider abduction to be a separate form of reasoning, at least not in this book. Instead, he calls "the movement toward building up the idea" "induction" (MW 6, 243). Ideas are built in different ways depending on who we are and what background we have:

Just what is suggested to a person in a given situation depends upon his native constitution (his originality, his genius), temperament, the prevalent direction of his interests, his early environment, the general

tenor of his past experiences, his special training, the things that have recently occupied him continuously or vividly, and so on; to some extent even upon an accidental conjunction of present circumstances.

MW 6, 246

He continues:

These matters, so far as they lie in the past or in external conditions, clearly escape regulation. A suggestion simply does or does not occur; this or that suggestion just happens, occurs, springs up *ibid.*

These formulations might seem to be in opposition to the general idea of abductive reasoning. But in actual fact, Dewey is, even here, quite close to certain conceptions of abduction. It must be remembered that Peirce made similar remarks of abduction:

The abductive suggestion comes to us like a flash. It is an act of *insight*, although of extremely fallible insight. Peirce, CP 5.181

Even if Dewey discusses factors that are more “psychological” than “logical” as the basis for suggestions—such as a person’s temperament, interests, past experiences, special training, etc.—I do not see these factors as opposed to abductive reasoning. Dewey is making a difference between *reasoning* and *inference*, and saying that even if *reasoning* is either inductive or deductive, there can definitely be *inference* from facts: “As an idea is inferred from given facts, so reasoning sets out from an idea” (MW 6, 239). This “inference from facts” is quite close to what is happening in abduction.

Dewey is also otherwise giving descriptions of how to use facts as clue-like signs:

To inventory the facts, to describe exactly and minutely their respective traits, to magnify artificially those that are obscure and feeble, to reduce artificially those that are so conspicuous and glaring as to be distracting,—these are ways of modifying the facts that exercise suggestive force, and thereby indirectly guiding the formation of suggested inferences. MW 6, 246–7

3.3 *Democracy and Education* (1916)

In *Democracy and Education*, Dewey once again analyzes thinking as a process of inquiry (see especially chapter 11 “Experience and Thinking”). Here, again, many abductive elements are invoked. Dewey emphasizes that inquiry is about “seeking, a quest, for something that is not at hand”,

it "involves a risk", and the "conclusions of thinking, till confirmed by the event, are, accordingly, more or less tentative or hypothetical" (MW 9, 154–5). Dewey points out that the deficiency of the classic *Meno paradox* is that it assumes either complete knowledge or complete ignorance. It overlooks what is central to inquiry and learning, that is, the possibility of hypothetical conclusions, of tentative results, and the process of "forming conjectures to guide action in tentative explorations" (MW 9, 155–6). According to Dewey, inquiry is more elaborate than the trial and error situation, but still, it is not wholly beyond it (MW 9, 157–8). This is clearly an abductive kind of a solution to the *Meno paradox* (in contrast to traditional inductive or deductive solutions) (see Paavola & Hakkarainen 2005). Dewey presents a distinction of "general features of a reflective experience" (MW 9, 157):

- (i) perplexity, confusion, doubt, due to the fact that one is implicated in an incomplete situation whose full character is not yet determined;
- (ii) a conjectural anticipation—a tentative interpretation of the given elements, attributing to them a tendency to effect certain consequences;
- (iii) a careful survey (examination, inspection, exploration, analysis) of all attainable consideration which will define and clarify the problem in hand;
- (iv) a consequent elaboration of the tentative hypothesis to make it more precise and more consistent, because squaring with a wider range of facts;
- (v) taking one stand upon the projected hypothesis as a plan of action which is applied to the existing state of affairs: doing something overtly to bring about the anticipated result, and thereby testing the hypothesis.

These five features are in line with the distinctions made in *How We Think*, although it seems that the second and third features are ordered differently here. I think that this variation shows that for Dewey, the order (or the content) of these features is not fixed. A conjectural anticipation might, for instance, help clarify the problem, or another way around.

3.4 *How We Think* (1933)

In 1933, Dewey published a substantially revised version of *How We Think*. The analysis of reflective thinking is, here, somewhat different compared to the 1910 version. He presents a distinction between five "phases" or "aspects of reflective thought" but the list is different to the earlier formulations:

- (1) *suggestions*, in which the mind leaps forward to a possible solution;
- (2) an intellectualization of the difficulty or perplexity that has

been *felt* (directly experienced) into a *problem* to be solved, a question for which the answer must be sought; (3) the use of one suggestion after another as a leading idea, or *hypothesis*, to initiate and guide observation and other operations in collection of factual material; (4) the mental elaboration of the idea or supposition as an idea or supposition (*reasoning*, in the sense in which reasoning is a part, not the whole, of inference); and (5) testing the hypothesis by overt or imaginative action.

LW 8, 200; Dewey elaborates these phases in LW 8, 200–6

A difference compared to Dewey's earlier versions is that already the first stage is called "suggestions", while in the earlier versions, the first phase was a felt difficulty or perplexity. This is not, however, a major difference since Dewey is also stating, in the 1933 edition, that reflective thinking involves "(1) a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates, and (2) an act of searching, hunting, inquiring, to find material that will resolve the doubt, settle and dispose of the perplexity." (LW 8, 121). It seems that in the 1933 edition, Dewey is treating the difficulty or perplexity that arises as a part of *pre-reflective* phase that sets the problem (LW 8, 200). That is why it is not an element of *reflective* thought.

There is also an addition to the earlier formulations about the third phase (the use of one suggestion after another). Dewey says that the first suggestion occurs spontaneously, and that there is nothing intellectual about its occurrence (phase 1) (LW 8, 202). Here, Dewey is repeating the idea that the first suggestion "springs up, it "pops" . . . "into the mind"; it flashes upon us" (ibid.). But now, he is emphasizing that the trained person does not stop here, but treats the suggestion tentatively, as a guiding idea, or a working hypothesis (LW 8, 203). What is interesting from the point of view of abduction, is that the guiding ideas, or hypotheses can also be modified:

The facts or data set the problem before us, and insight into the problem *corrects, modifies, expands the suggestion* that originally occurred
LW 8, 202; *emphasis SP*

The hypothesis is tentative, it is a working hypothesis, partly because it has to be tested, but partly also because it can be corrected, modified, or expanded during the process of inquiry. Peirce did not have this kind of an idea of working hypotheses (to be modified or expanded during the inquiry) which I think would be an important addition to the conception of abduction (cf. Hanson 1961).

There are many other formulations in this book which are abductive as I interpret the term (even though Dewey is not using the term here either). For example,

[t]he suggested solutions for the difficulties disclosed by observation form ideas. Data (facts) and ideas (suggestions, possible solutions) thus form the two indispensable and correlative factors of all reflective activity. LW 8, 198

Dewey also makes a remark that is important for the sake of interpreting his distinctions between phases of reflective thought. He emphasizes that the five phases, or aspects of thought that he is discerning, do not follow upon another in any strict order (LW 8, 206). Each aspect might affect all the others. For example, "[t]he elaboration of the hypothesis does not wait until the problem has been defined and adequate hypothesis has been arrived at" (ibid.). Dewey also states that it is possible to discern a sixth phase or aspect of reflective thought, as an addition to the five aspects discerned earlier in the book:

Again, it has been suggested that reflective thinking involves a look into the future, a forecast, an anticipation, or a prediction, and that this should be listed as a sixth aspect, or phase. LW 8, 208

This also shows that Dewey did not take the five phases to be the only way in which reflective thought can reasonably be analyzed.

3.5 *Logic: The Theory of Inquiry* (1938)

Dewey's *Logic: The Theory of Inquiry* is a large volume where Dewey embeds inquiry within a framework of biological and cultural operations. Dewey reiterates a Peircean cycle of doubt, inquiry, and belief. He states that he prefers "warranted assertability" to "belief" because of the way in which the former emphasizes the continuing process of inquiry rather than the settlement of beliefs (LW 12, 14–6). Dewey makes his famous definition of inquiry in line with this:

Inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole. LW 12, 108

Dewey states that inquiry (and logic) is autonomous, but still there is a clear continuity between operations of inquiry and biological and physical operations on the one hand, and social and cultural processes on the

other hand (LW 12, 26–9). There are many affinities to Peirce's broad conception of inquiry here. Peirce also sought for continuities between inquiry and biological and social aspects of life. One clear difference between them is Dewey's emphasis on cultural factors: "every inquiry grows out of a background of culture and takes effect in greater or less modification of the conditions out of which it arises" (LW 12, 27). Peirce emphasized development and change, as well as social aspects of inquiry, but not cultural aspects. On the other hand, it has been argued that although Dewey recognized the significance of cultural issues, he never offered satisfactory means for analyzing historical and cultural dimensions of human activity (Miettinen 2006). Both Peirce's and Dewey's approach could be developed further in these respects.

In *Logic*, Dewey does not clearly list phases or aspects of inquiry, but still, he is making a similar kind of an analysis. He maintains that inquiry, in spite of diversity of applications and subjects, has a common structure or pattern, which he seeks to explicate (LW 12, 105). There is a number of sub-chapters which are close to previously formulated aspects of reflective thought (except last two of these chapters): i) The antecedent conditions of inquiry: The indeterminate situation, ii) Institution of a problem, iii) The determination of a problem-solution, iv) Reasoning, v) The operational character of facts-meanings, vi) Common sense and scientific inquiry (LW 12,109–20).

There are many affinities with abductive puzzle solving especially in the institution of a problem and in the determination of a problem-solution (i.e. first two sub-chapters). Dewey maintains that the "indeterminate situation comes into existence from existential causes" and does not start intellectually or cognitively (LW 12, 111). Problems grow out of actual situations. Institution of a problem means that constituents of a given situation are sought and settled in observation (LW 12, 112–3). In Dewey's model, problems and tentative solutions develop together and have their basis in prior inquiry. It is an important part of Deweyan abduction here that Dewey emphasizes that problems do not arise by themselves, or intellectually, or even as a specific phase of inquiry, but from an actual situation and as a part of the entire inquiry. This has affinities with ideas of distributed cognition and the emphasis on practices in relation to abduction.

Dewey maintains that ideas have their basis in observation, but at the same time, an idea is "an anticipation of something that may happen; it marks a possibility" (LW 12, 113). This kind of an interaction between ob-

servations, ideas, and anticipations is at the heart of abductive processes. Dewey emphasizes that “[s]uggestions” have received scant courtesy in logical theory” (LW 12, 114). He is developing an alternative to both traditional empiristic and rationalistic schools. Like Peirce, Dewey denies the possibility of immediate knowledge, and he points out mediational and inferential aspects of knowledge (LW 12, 143; Peirce EP1: 11–27, 1868; Peirce EP1: 28–55, 1868). For Peirce, this alternative to both traditional empiricism and rationalism can be seen also in his analysis of a simple perception involving interpretative and abductive elements (see Peirce EP2: 226–33; and above).

The interaction between observed facts and ideas is a continuous process that works both ways in Dewey’s characterization of inquiry. An important point related to abduction is Dewey’s holistic and relational emphasis: “no fact in isolation has evidential potency” (LW 12, 117). Dewey says that “[s]ome observed facts point to an idea that stands for a possible solution. This idea evokes more observations” (ibid.) and then again “[t]he new order of facts suggests a modified idea (or hypothesis)” (ibid.). The role of a number of observations is not always appreciated when Peirce’s basic formulation of abduction starting with “the surprising fact” is emphasized (see Peirce EP2: 231). But there are also formulations of abduction in Peirce that emphasize this kind of a holistic process. Abduction then “consists in the introduction into a confused tangle of given facts of an idea not given whose only justification lies in its reducing that tangle to order” (Peirce MS 831: 13–4, nd.; see also Peirce PPM 282–3, 1903).

One difference to Peirce’s abduction seems to be that Dewey does not classify abductive elements within forms of *reasoning*. He classifies only induction and deduction within scientific method also in this book (LW 12, 415–36), while issues that can be taken to lie closer to abduction are classified in terms of psychology. For instance, Dewey maintains that suggestions “are not logical” when they just “pop into our heads” (LW 12, 114). In Dewey’s model, reasoning elaborates further and examines those ideas and hypotheses that are produced with psychological means. This is not, however, a clear-cut distinction in Dewey’s formulations either. Some of the issues related to hypothesis formation are, for instance, treated as a part of induction. While discussing inductive phases of inquiry he, for example, points out that data is a basis for suggested solutions and possibilities (LW 12, 423). He states that this comes close to seeing “scientific inquiry as hypothetical-deductive” but it is not still the same; one difference is the role of “observational determinations in order to indicate a relevant hypothesis” (LW 12, 423).

In summary, there are many abductive elements in Dewey's different formulations of reflective thought. Dewey (like Peirce) has brought forward several elaborate descriptions and formulations on how problems and tentative suggestions originate and how they are developed further. They have clear affinities with different interpretations on Peirce's abduction and give opportunities for further development.

4. Discussion

In this paper I have characterized, first, some basic ways in which Peirce formulates his idea of abduction, and, second, presented Dewey's formulations of phases, or aspects of reflective thought or inquiry. I have not aimed at making a full-fledged comparison between Dewey's and Peirce's conception of inquiry. There are differences in Dewey's and Peirce's overall view of the aims of inquiry and also in those subject areas of research on which they targeted their analyses. Dewey emphasizes practical problem solving, action, the situated nature of idea generation, the material settings (Koschmann 2003, 8–9; Miettinen 1998) and cultural factors, while Peirce more clearly emphasized (formal) logic, scientific hypotheses and explanations, and semiotic processes (Bernstein 1971, 201; Turrisi 1990; Miettinen 2006; Brogaard 1999; Garrison 2001; Koschmann 2003, 8–9). My paper seeks to show that nevertheless, there are clear continuities and overlaps between both their interests and interpretations, especially when it comes to the area of abduction formulated by Peirce, that is, issues concerning processes of discovery and the formation of hypotheses. I have pointed to abductive elements in Dewey's formulations of aspects of reflective thought which could also enrich Peircean formulations of abduction, and vice versa.

I call this common area an "abductive puzzle" to emphasize that both Peirce and Dewey provided various kinds of elements (or working hypotheses) to make sense of these first phases where problems are formulated and solutions take shape. During their long career, they provided different kinds of formulations of these aspects of inquiry. Both of them offered comprehensive discussions of inquiry. A contentious nature of processes of discovery has probably also contributed to different interpretations concerning their approaches. It is hence difficult to compare Dewey and Peirce. Advocates of Dewey's approach might easily give a skewed picture of Peirce's, and vice versa. Some researchers have argued that Dewey provides a clearer and more comprehensive picture on

the formation of hypotheses (Roth 1988, 136; Talisse 2002) while others have made similar claims about Peirce (Turrisi 1990 476; Brogaard 1999). According to Turrisi (1990, 476), one problem with Dewey's account of the hypothesis formation is that it has its basis in pre-reflective, emotional and psychological processes which just appear or do not appear. But the same problem occurs with some of Peirce's formulations that highlight flashes of insight or a guessing instinct as the basis for abduction. I think then that this problem is related to the nature of the hypothesis formation more than to Dewey's or Peirce's formulations as such.

The similarity or at least the continuity between Dewey's and Peirce's understanding of abduction is often recognized (Anderson 1986; Prawat 1999, 2001; Marcio 2001; Martela 2015). According to Miettinen "Peirce calls the inference that proceeds through hypotheses, an abduction. Dewey further elaborated this logic and applied it to the social practice" (Miettinen 2000, 64; see also Elkjaer & Simpson 2006, 4). According to Marcio (2001, 112): "the concept of abduction was actively at work in Dewey's thought, though the term itself was absent". In this paper I have sought to analyze in some detail these abductive elements in Dewey's formulations.

In a way, Dewey had reasons for not talking about "abduction" in his writings. Dewey understood reasoning to encompass (traditionally) deduction and induction. Abductive elements in Dewey's formulations, or those elements that can be interpreted as abductive, were understood by Dewey as being non-logical, or inferential (see above). This does not, however, mark a clear difference to Peirce. The nature of abduction was a constant question for Peirce, and his formulations of abduction were often close to many "psychological processes" like perception, instinct, guessing or insight. On the other hand, Dewey's ideas about the role of hypotheses, suggestions, or ideas as a part of processes of inquiry are quite close to Peirce's.

Both Peirce and Dewey aimed at broadening the conception of inquiry to encompass elements that are important for understanding the dynamics of inquiry. This broadening means taking into account biological, material, practical, situational, perceptual, esthetic, ethical, social, and cultural aspects as a part of inquiry. I have not analyzed all these aspects in Dewey's and Peirce's formulations in this paper. They were, in any case, both developing an epistemology and methodology that would be different from traditional rationalism (with its emphasis on deductive reasoning) and traditional empiricism (with its emphasis on inductive reasoning) by emphasizing pragmatistically mediated processes of inquiry

where interaction between, for example, observations, hypotheses and action is central. Here, abductive processes play a central role, whatever name these processes are given. I hence agree with Bernstein that the basic differences between Peirce and Dewey have a creative influence and can lead to a richer conception of the nature of human action and thought (see Bernstein 1971, 200-1; cf. Elkjaer & Simpson 2006, 4). Both Peirce and Dewey were constantly developing their accounts on the processes of inquiry and logic. They both gave new means for developing these accounts further.¹

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