PEIRCE'S CONTRIBUTIONS TO CONSTRUCTIVISM AND PERSONAL CONSTRUCT PSYCHOLOGY: II. SCIENCE, LOGIC AND INQUIRY

Harry G. Procter

Department of Clinical Psychology, University of Hertfordshire, UK

Kelly suggested that it was useful to consider anyone as functioning as a scientist, in the business of applying theories, making hypotheses and predictions and testing them out in the practice of everyday life. One of Charles Peirce's major contributions was to develop the disciplines of logic and the philosophy of science. We can deepen and enrich our understanding of Kelly's vision by looking at what Peirce has to say about the process of science. For Peirce, the essence of science was the application of the laws of inference. He developed a much broader concept of logic, elaborating the processes of deduction and induction and adding to these the logic of hypothetical inference, or 'abduction', even as Kelly broadened it further in his "departure from classical logic". Examining the implications of these three forms of inference allows us to elaborate the dynamics involved in the process of construing, ordinacy and the cycles of experience, creativity and decision making. This is the second of a three part series examining the relationship between the work of Peirce and Kelly. The third will include a look at phenomenology, bipolarity, the self, dialogical process and sociological considerations.

Keywords: Peirce, Kelly, pragmatism, personal construct psychology, constructivism

> *Each man has his own peculiar character. It enters into all he does… it enters into all his cognition, it is a cognition of things in general. It is therefore the man's philosophy, his way of regarding things; not a philosophy of the head alone - but one which pervades the whole man[1].*
>
> *Our beliefs guide our desires and shape our actions[2]*
>
> *All modifications of consciousness are inferences[3]*
>
> (Charles S. Peirce)

> *There is no difference of kind between the methods of science and those of the plain man* (Dewey, 1916)[4]
>
> *The whole of science is nothing more than a refinement of everyday thinking…the physicist…cannot proceed without considering critically a much more difficult problem, the problem of analyzing the nature of everyday thinking* (Einstein, 1936)
>
> *I can't say I disapprove of such efforts to reach a terminal point in human inquiry;it is only when someone claims to have arrived that I get that restless feeling again* (Kelly, 1960)[5]

CONTENTS

INQUIRY: THE PERSON AS SCIENTIST

In a lecture given to school psychologists in 1966, a year before his death, George Kelly explores his idea that a person is like a scientist. He argues that the metaphor is most revealing and that it is "a marvellously enlightening way of looking at man…we cannot hope to grasp the potentialities of man without paying attention to the most adventuresome things he does" (Kelly, 1970a: 257-9).[6]

For Kelly, we are constantly involved in a process of *inquiry*. We cannot understand a person's choices and actions without knowing "what experiment is being performed, what hypotheses are being tested". He regards behaviour as a *question*. An act "releases a flood of unexpected answers" which in their turn transform themselves into further questions (Op. cit. 260-1). He gives a lovely example of a teacher working with a wild four-year-old's "difficult" behaviour. The boy has been climbing dangerously, in an area of the classroom that is 'out of bounds'. Both boy and teacher are involved in testing out hypotheses. She connects with him and moves things on by playfully joining in with his fantasies. The "genius of the scientific method", Kelly says, is that in making hypotheses, "we don't have to believe in them" (Op. cit. 258). We can hold contradictory hypotheses at the same time; we do not have to be consistent. The idea that we are testing hypotheses in our on-going behaviour, Kelly says in 1955, has its origin in the principles of *pragmatic logic* (Vol. 1: 17). We do not know if he was referring to Peirce's work but Peirce is above all responsible for elaborating a new broader system of "pragmatic logic". Peirce regarded his "Pragmatic Maxim", which we compared with Kelly's Fundamental Postulate[7] in Part I of this series, as a logical, not just a psychological principle. We will be examining Peirce's version of logic, with a view to enriching our understanding of, and tracing the history of Kelly's innovative path in psychology, a path which leads, according to Paris and Epting (2006), to "our only pragmatic theory of personality and psychotherapy".

People who tend to see Kelly's emphasis on 'scientist', 'inquiry' and 'hypothesis' as something dry and over-intellectualising, would do well to read Miller Mair, who describes the thrill of his first encounter with Kelly's volumes when he was training as a clinical psychologist along with Don Bannister in London in the late 1950's. (Mair, 2003, Procter, 2011b). He describes how he and Don hated almost everything in the 'scientific' psychology they were being taught (by the likes of Hans Eysenck). In contrast to 'research method', 'experimental design' and people as 'subjects', he found Kelly questioning the very nature of *personal inquiry,* an examination of "how people go about the business of *searching* for meaning and understanding in the first place" (2003: 408-9). Mair says how he was

"given something of himself as a treasure to explore…everything could be other than we imagine it to be…with sufficient imagination, courage and determination" (Op. cit. 410). Mair's hatred of mainstream psychology was *aesthetic,* to do with beauty in contrast to the ugly, unconvincing and hard-edged material that he was being offered. This emphasis on *aesthetics*[8] is interesting in relation to Peirce, who put aesthetics higher up even, in his hierarchical classification of disciplines, than ethics and logic (Hookway, 1985: 78).

In 1971, Don Bannister and Fay Fransella brought out their popular introduction to Kelly's psychology, entitled "Inquiring Man". Kellyan scholars tend to look to Dewey for the source of the central concept of inquiry in Kelly's work (e.g. Butt, 2005, 2006; Novak, 1983 and Warren 1998, 2003, 2010). However Dewey himself writes:

> *As far as I am aware, he (Peirce) was the first writer on logic to make inquiry and its methods the primary and ultimate source of logical subject matter (Dewey, 1938: 9).*

Peirce's central critique of Kant was to replace the latter's fixed set of 12 categories, based on Aristotle's logic, with "hypothetical inference" or a "semiotic logic of inquiry" (Apel, 1981: 22, 111), a process in which our knowledge is continually changing and increasing but nevertheless fallible. Drawing on Francis Bacon, Peirce contrasts Kant's view of science as a *body of knowledge* organised by principles, with an emphasis on *method:* "Science is inseparably bound up with a life devoted to single-minded inquiry" (Peirce, 1902). He contrasts here the *process* with the *content*: "That which constitutes science, then, is not so much *correct conclusions*, as it is a *correct method*"[9] (Peirce, 1893, 6.428). He gives an example here of Ptolemy, who although wrong in his geocentric view of the planets as a set of nested spheres, nevertheless approached the problem in a genuinely scientific way. For Peirce, the scientific method involves *conformity to the laws of inference* (Gallie, 1952, p. 89). As we shall see, this apparently naïve position is put into an entirely new light when we understand that these "laws" belong, for Peirce, to a much expanded conception of logic

and inference to include, not just deduction and induction, but a third method which he called *abduction.* Abduction describes what is involved in the imaginative processes of conjecture, supposition, making guesses and hypotheses – these are central to what in personal construct psychology we call *construction*. Peirce also broadened logic by including in its increased range of convenience processes often filed under the heading of psychology – for example, thought, belief, doubt, reasoning and inference.

LOGIC AND PSYCHOLOGY

Before proceeding further with an account of Peirce's broadened logic, we need to look at how he conceived the relationship between the disciplines of *logic* and *psychology*. Peirce maintained, even before Frege, Husserl and Wittgenstein[10], a vigorous *anti-psychologism*[11], castigating those who saw logic as dependent on psychology in some way. Peirce had maintained since the 1860's that the logician studies publicly available products of thought, and not only can but should dispense with the study of the mind (Kasser, 1999, § 26). "Logic, in the strict sense of the term, has nothing to do with how you think" (Peirce, 1892a: 143). For Peirce, psychological information for logic was "perfectly insignificant" (Hookway, 2012: 95). The same applies to mathematics. "Mathematicians neither know, nor pretend to know, nor care, by what psychological machinery their hypotheses were thought" (Peirce, op. cit. 145). He was critical of thinkers such as John Stuart Mill, William James and even Dewey[12] who tried to derive logical principles from psychological patterns of thought (See Colapietro, 2002, 2003, Hickman, 1986, Hookway, 2012 and Kasser, 1999, for a full discussion of this topic).

Logic is the science for Peirce that distinguishes between good or strong and bad or weak arguments. Although we can respond with pleasure to an argument that is a good one in logical terms, Peirce objected to the idea that a proposition has logical validity *because of* feelings of pleasure or satisfaction, as the German logician Sigwart specifically had argued (Hookway, 1912). Likewise logic could not rest on the study of how people typically reason. The contemporary pragmatist philosopher, Hilary Putnam lists

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as one of the five principles that have been upheld in pragmatism since Peirce as: "Whether a statement is warranted or not is independent of whether the majority of one's cultural peers would say it is warranted or unwarranted"[13]. The practices of reasoning may vary but the laws of logic, relatively speaking, do not (Hookway, 2012: 99).

Confusion also arises because the very terms used in each discipline are often the same. Words like concept, thought, belief, reasoning, proposition, argument and inference are used within logic but when they comprise the content of a person's experience and functioning, they appear in psychology. Hookway explains:

> *In logic, we are not concerned with a thinking but, rather with 'that which thinking brings before the mind'. It is what philosophers call a* proposition*, an abstract object or content which can be entertained or* grasped *in thought, but which is objective in the sense that the existence or being of a thought does not depend upon anyone thinking or grasping it (2012: 100).*

For Peirce, a proposition is that which remains the same, even if it is translated into another language; it is independent of whether it is believed, doubted or subject to any particular associations or emotions (Hookway, 2012: 100): we might say how it is *construed*. Peirce uses the analogy that a boat sailing on water propelled by the wind does not depend on the chemistry of the water or air involved (Op. cit.: 90). Another example would be that the image displayed in a painting in no way depends on the chemical composition of the paints used.

For Peirce, logic is "the study of the essential conditions to which signs must conform if they are to function as such"[14]. Peirce saw logic as a branch of *semeiotic* (sic)*,* his name for the study of signs in general, not of psychology, as John Stuart Mill had done (Colapietro, 2003:145). As we saw in Part I, the word *sign* for Peirce covers a tremendously broad and pervasive range of entities which straddles the traditional divide between the mental and the physical. Thus it includes natural and cultural phenomena, events, objects, symbols, diagrams, gestures and thoughts. It includes words, arguments and propositions whether these are occurring "inter-

nally" in thought or "externally" in the material form of sounds or written text. As we have just heard, for Peirce, the logician focuses on *publicly available products of thought.* Hookway writes:

> *Like Karl Popper[15], Peirce insists that a book stored in a library constitutes knowledge even if no one currently believes the propositions that it contains (CP 2.54). Second, Peirce argues that computing machines (for example) perform inferences, but they may not* think *in any psychological sense at all. And even if the drawing of inferences sometimes does involve thinking, this fact is not relevant to the logical question of whether the conclusion follows from the premises. Psychology may help us to understand* how *someone is led to reason badly (for example), or why we find it difficult, or easy, to perform different kinds of inference, but it has no relevance to an inquiry into whether the reasoning is bad[16].*

The construct *normative*[17] (which may be contrasted to *descriptive),* was used by Peirce and Frege (Hookway, 2012, 87). Peirce described three *normative sciences* that included aesthetics, ethics and logic. The normative disciplines' function is to lay down rules which *ought*[18] to be followed, but need not necessarily be[19], crucially allowing for the ability of people to reflect on their own thinking and make free choices about its validity[20]. Thus, logic is "the science of principles of how thought *ought to be controlled*, so far as it may be subject to self-control[21], in the interest of truth" (Peirce, 1910, cited in Hookway, 1913: 110)[22].

The effect of this view is to put the disciplines of logic and psychology into a hierarchical relationship with each other, with logic higher in the hierarchy than psychology and other special sciences (such as biology, sociology or linguistics). This is part of a wider hierarchy that Peirce proposed, calling it his *architectonic*. As we see in *Figure 1*, his hierarchy of disciplines, starting at the top, are listed as Mathematics, Phenomenology[23], Aesthetics, Ethics, Logic, Special Sciences, including Psychology (Hookway, 1985, p. 78). For the postmodernist, the architectonic may smack of foundationalism. However, we saw in

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Part I that for Peirce, a critique of foundationalism was central to his concerns (Procter, 2014a, 13 – 14). Short (2007: 62) argues that the architectonic is not foundational – sciences are self-organising and their right ordering grows out of discoveries made. They are subject to fallibilism and revision as inquiry proceeds.
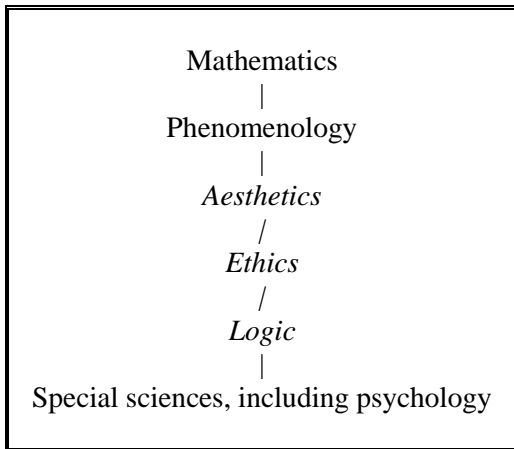
Mathematics
|
Phenomenology
|
Aesthetics
/
Ethics
/
Logic
|
Special sciences, including psychology

Figure 1: *Peirce's architectonic, or hierarchy of disciplines (Normative disciplines in italics)*

Interestingly, Peirce's Architectonic here received very clear support from Edmund Husserl[24]:

> *Husserl's early phenomenology owes a great deal to his concerns about Theodor Lipps's* psychologism. *At its most basic level, psychologism is the view that all logical laws (explanations) are reducible to psychological processes...Famously, Husserl rejects psychologism while attempting to develop a non-reductionist account of experience...in his Logical Investigations (1900). In that early text, Husserl challenges attempts to reduce logical laws to the specific contingent approaches of natural science (specifically those of psychological inquiry) (Hackett, 2013, 197, my emphasis).*

Husserl is concerned about inverting the relationship between logic and the sciences:

> *The tragedy we currently face, laments Husserl, is that the sciences have inverted the original relation between logic and science. The sciences have made themselves autonomous; in mystifying self-sufficiency and groundlessness they have become splintered in relation to each other[25]; and in this process, logic has been transformed into a sub-discipline of the sciences...becoming a limited theoretical instrument brushed aside with scorn (Steinbock, 2001).*

Psychology for Peirce was in particular need of logic[26], perhaps in response to the spectacular growth of the new discipline during his lifetime, including dynamic psychology with its particularly controversial arguments[27]. The most serious threat for Peirce of basing logic on psychological criteria lies in the problem of a circular argument. How can psychology rely on logic if the latter itself depends on psychology? "If we ground logic in psychology, then the psychological theory is placed above logical criticism, or, at any rate above logical support" (2.210, cited in Hookway, 2012: 96).

Peirce's insistence on establishing logic as a discipline fully independent of psychology highlights a crucial difference between his theorising and that of Dewey. In Part I of this series, we looked in detail at the relationship between these two philosophers and the indebtedness that Dewey felt towards Peirce. But Dewey, as usual, was concerned to overcome dualisms and wanted to "make peace" between logic and psychology (Hookway, 2012, 103). He was intolerant of "all superstition of necessity"…he opposed "hard and fast distinction between pure thought and its application" (Sleeper, 1986: 65). Although he agreed with Peirce's worries about psychologism, he was uncomfortable with Peirce's insistence on logic involving necessary and universal laws governing all circumstances, preferring instead to allow different patterns of reasoning to serve particular problems in particular contexts. For Peirce, this limits the application of logic to the critique of ideas in current use. He strove rather for a normative logic which could be applied to any *possible* ideas or hypotheses, not just those in current use (Hookway, 2012). This is no doubt a difference that the postmodernist Richard Rorty (1982, 61) seized

upon in discriminating so strongly between the two thinkers in favour of Dewey. Colapietro (2002) concludes that Dewey was offering not so much a rival logic as a complementary part of what Peirce himself sketched and that Peirce did not eschew naturalism and Dewey did not eschew normativity.

Very early in his career, Peirce was arguing that, "Everybody uses the scientific method about a great many things, and only ceases to use it when he does not know how to apply it[28]" (Peirce, 1878a: 133). The process of inquiry involved is a struggle to appease the irritation of doubt and attain a state of belief. Its sole object is the settlement of opinion (op. cit. 126). "Our beliefs" (cf. hypotheses, construals) "guide our desires and shape our actions" (op. cit. 125). When a "firm belief is reached we are entirely satisfied, whether or not the belief be true or false". Kelly talks more here of validation and invalidation of anticipations[29], but these statements are deeply redolent of Kelly's claim that persons are like scientists and even prefigure Kelly's *credulous approach*, that we should *respect* in a person what he or she *believes* to be true or false. The *process* of inquiry for Peirce is *valid,* even if the content to us, as observer, is false: He claims, "All modifications of consciousness are inferences…all inferences are valid inferences" (7.580). This seems to be in line with Kelly's assumption that a person's views have validity from their point of view – it is "reasonable and rational in their circumstances" (Hookway, 1985: 32)[30].

But do not these points about the role of doubt and satisfaction indicate Peirce contradicting his own insistence on not falling into the trap of psychologism? Kasser (1999) argues that Peirce maintained a consistent antipsychologistic stance throughout his career. Peirce's contribution was to radically reconceptualise logic as a semiotic science of signs. He extended its "range of convenience" to treat thought, inquiry, inference and belief as primarily *logical* processes including, as we shall see, hypothetical reasoning or *abduction.* Kasser thinks that commentators mistook this broadened logic for psychologism. Colapietro (2003) says that Peirce was "quite aware that (his) conception of logic appeared to be psychologistic" but that he took this appearance to be deceptive (p. 140). Peirce clarified this in later years. In 1903, he shifted the emphasis from the *belief* to the *proposition underlying that belief*. He came to see the meaning of a proposition as more fundamental than beliefs, judgements or assertions. We can perform these acts because we can *grasp* the proposition. We can understand arguments without believing them or asking anyone to be persuaded by them (Hookway, 2012). In personal construct terms, we can *construe* something without necessarily *believing* in it[31].

Does this anti-psychologism mean then, that Peirce is not a psychologist, but only a logician or philosopher of science? In spite of implying that logicians should dispense with studying the mind, Peirce in fact contributed very significantly to the discipline of psychology. Psychology was a "central interest" for Peirce throughout his life and he "wove psychology into all his interests" (Cadwallader, 1975: 167). Cadwallader argues that, "a key to the understanding of Peirce's obviously enormously complex and changing systems of thought is the understanding of his psychological views" (op. cit.). He even suggests that Peirce should be regarded as America's first modern psychologist and first experimental psychologist rather than James. Peirce's studies with Joseph Jastrow on *just noticeable differences* (Peirce and Jastrow, 1884) are still regarded as classic[32]. Cadwallader writes:

> *Peirce's major influence on Jastrow was to turn him from philosophy to experimental psychology. Peirce…was, among* many *things, the first 'modern' American psychologist. It was he who introduced the 'new' psychology to the United States in 1869, who conducted and published the first psychophysical experiment in this country in 1877 and who was first responsible for psychology at Johns Hopkins University (Cadwallader, 1987).*

Although Peirce was insistent that logic should not rely on psychology, this does not mean he was averse to developing the implications of his views for psychology. Indeed, Colapietro argues that:

> *Peirce anticipated not only behaviorism but also the present movement beyond the reductionist forms of behavioristic psy-*

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*chology. It may even be that Peirce's view
of psychology anticipates a paradigm shift
that still awaits this experimental science
(Colapietro, 1989, p 56).*

We could say that his achievement was the elaboration of a *non-psychologistic psychology.* Peirce's revised definition of where the boundary between the two disciplines lay actually cleared the space for him to elaborate a psychology too. As we proceed with this series, covering topics such as habit, the self, the dialogical and Peirce's Law of Mind, we will see how richly psychological Peirce's work is. Cadwallader (1975) says how much remains to be done in researching and establishing Peirce's overall contribution to psychology. Hopefully the present work will contribute in a small way to this project.

What would Kelly make of this discussion about the relationship between the disciplines of logic and psychology? He does not address the issue directly, though he has interesting things to say about disciplines as construing systems, arguing that the events or 'facts' that they deal with do not *belong* to disciplines – they "hold no institutional loyalties" (Vol. 1: 10). The idea of a construct system being hierarchical and of ordinal relationships between constructs is an essential element of his views, but he does not address the issue of whether one discipline can be superordinate to another.

I believe this whole debate allows us to evaluate Kelly's achievement in writing the Psychology of Personal Constructs in a deeper and more profound way. Suppose, as an experiment, we re-label Kelly's entire system as not the 'Psychology' but as the 'Logic of Personal Constructs'? That Kelly conceived of his system as a *logic* is implied in his statement that the Fundamental Postulate is "an assumption so basic in nature that it antecedes everything which is said in the logical system which it supports" (Vol. 1, p. 47). Certainly, the whole way that his theory is written, with a fundamental postulate and corollaries, is logical and his concepts of *construing, dichotomy, construct, element, ordinality,* can be seen interestingly as *logical* in Peirce's terms. We saw in Part I of this series, how the Fundamental Postulate is intimately related to Peirce's Pragmatic Maxim, which Peirce insisted was a logical proposition (Hookway, 2012). I

have certainly regarded PCP over the years much more as a *methodology* for encountering and accessing the psychology of individual and interpersonal situations. It is in itself 'open' – it does not provide a *content* or a system of psychology in the way that, for instance, psychoanalysis claims. Rather it provides us with tools to discover the psychologies inherent in local situations. This may explain why PCP has not caught on in the mainstream popular imagination where people are seeking "what makes people tick" – a question that for PCP cannot be answered in the general – we always need to find *how people in a situation are construing* in order to explain their actions, experiences and emotions. People are like scientists, and to understand them we need to know what logic and psychological theories, hypotheses and beliefs, as Peirce says, "are guiding their actions and shaping their desires".

As we shall see, the nature of construing in Kelly's view has absorbed Peirce's broadening of classical logic to include *abduction.* Later we will see that Kelly broadened logic even further than Peirce with his insistence on *dichotomy* and the bipolar nature of the construct, calling this move his own "departure from classical logic" (Kelly, 1955: 60-61). To psychologists, logic can seem dull and arid. It is only dry and academic, I believe, because it has been divorced from the processes of interpretation and construing which form our life-blood as human beings. By enhancing logic and appropriating areas into it typically treated as being in the realm of psychology, Peirce reinvigorates logic. The application of the narrower logic of Aristotle, Kant and Russell only leads to a dry and rationalist psychology and psychotherapy in which individual difficulties and problems are seen as the result of 'faulty reasoning' and 'irrational thoughts' which need correcting by an expert.

For Susanne Langer (1957), "meaning has both a logical and a psychological aspect…both aspects… are always present, and their interplay produces the great variety of meaning-relations" (p. 53). In practice, it is difficult to tease apart this complex mix. To approach this, we can apply a newly clarified construct – *logical* versus *psychological* – with its poles in dialectical relationship with each other. The logical pole covers the normative aspects of the construing allowing an evaluation of the inferences being made in terms of public criteria of good and bad argu-

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ments. The psychological pole covers the personal or local meanings as lived in a particular context and situation. Constructive Alternativism would lead us to expect there are many different ways of making good and bad arguments. Peirce's insistence on the independence and superordinacy of logic over psychology prevents Constructive Alternativism from sinking into a total relativism. But logic itself is open to revision since for Peirce all laws, even the laws of physics, are subject to evolutionary change (CP 6.13; Brent, 1993, p. 174).

INQUIRY AND THE FORMS OF INFERENCE

We can now summarise Peirce's vision of inquiry and inference, the central processes involved in this thing called *science,* which Kelly describes as a marvellously enlightening way of looking at the way human beings function. Peirce "rejected the traditional philosophical conception of the nature of inference", replacing it with an "unusually extended conception of inference and the laws of logic" (Gallie, 1952, pp. 94, 91). Seeing logic as part of *Semeiotic*, the study of how signs in general function and relate, gave Peirce a much broader view than one restricted to just language. *Inquiry* becomes a word "used to cover any activity, physical as well as mental". This includes "the actual physical operations which are involved in experiment" (op. cit. p. 92), a view reminiscent of Kelly's claim that *behaviour* is an "experiment" and a "question" (Kelly, 1970). Readers will recall that for Peirce, thought and even persons are signs (Procter, 2011a). In Part I of this series (Procter, 2014a), in looking at change and the stream of consciousness, we noted that these signs are subject to continual change and development in a process called *semiosis*. At any point in time, "there are a hundred things in our mind to which but a small fraction of attention or consciousness is conceded" (Peirce, 1868: 99; 5.284). This view sees semiosis as a creative process that continues all the time and lifelong, including not just logical argument in the traditional sense but thinking, feeling, action and behaviour, play, exploration, imagination, dreaming, and as we shall see in Part III of this series, in discussing the dialogical: interaction and conversation be-

tween people or between internalised voices, positions and selves. It is most clearly stated in his *Law of Mind:*

> *Ideas tend to spread continuously and to affect certain others which stand to them in a peculiar relation of affectibility. In this spreading they lose intensity, and especially the power of affecting others, but gain generality and become welded with other ideas (6.104; Peirce, 1892c, 192).*

Peirce added to the two traditional forms of inference, deduction and induction, a third form which he called *abduction. Figure 2* (p. 219) shows the three forms of inference. All can be described with the tripartite form of the *syllogism.* The syllogism, described by Aristotle in *Prior Analytics,* consists of an argument containing three propositions, a major and a minor premise and a conclusion. In deduction we can draw the conclusion with certainty, once we have accepted the truth of the premises – it is the only one of the three forms of inference that involves *necessity.* As the form of syllogism known as 'Barbara' states, if we know that all men are mortal and that Socrates was a man, we can deduce that Socrates was mortal.

The other two forms of *ampliative* inference, induction and abduction[33] both involve *hypotheses* of different kinds and can only lead to conclusions which are *probably,* or *possibly,* but not *necessarily* true. Induction involves *extrapolation* or *generalisation* from a particular sample to all possible examples which we might encounter. If, in a sample of swans, all are white, we can hypothesise and anticipate that, in the absence of any contrary evidence, that any new swan encountered would probably be white. This form of argument is central to empirical science as well as to our everyday lives where we anticipate characteristics of members of a class[34] on the basis of past experience. Abduction (earlier called simply *Hypothesis*), involves making a judgment or hypothesis about a particular case. If all Frenchmen have a set of characteristics and we encounter a particular person with these characteristics, then we can guess that he or she is plausibly[35] or at least *possibly* French. Again this is only a possibility and depends on the individual meaning given to the term. To a Corsican nationalist, Napoleon was certainly not French

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but Corsican – for them, Corsica is not, or should not be, counted as part of France!

Another way of comparing and distinguishing these three forms is in terms of a *rule* (or *law),* a *case*, and a *result.* In deduction, we *obtain a result* by applying a rule to a case. With induction, in the case of swans, we can *infer a rule* that they are always white from the result that these ones are all white. In abduction, we *make the case* that Napoleon is French from the evidence or results that he is P1, P2 and P3 and the rule that these properties or attributes imply being a Frenchman. Peirce writes: "So, to Induction corresponds the conception of a Law, to Hypothesis the conception of a Case under a Law, and to Deduction the conception of a Result" (Wl: 302, cited in Forster, 1997). If we take the example of deduction, if we know both the premises, we can draw a conclusion from them. If we know the minor premise and the conclusion and we make an assumption about the major premise: that is *induction*. If we know the major premise and the conclusion and hazard a guess about the minor premise, that is *abduction*. We will now look at each type of inference in more detail.

DEDUCTION: DIAGRAMMATIC THINKING AND THE PREVERBAL

In considering the syllogism Barbara (All men are mortal, etc.), Hegel[36] remarks, "At the approach of this kind of syllogism we are at once seized with a feeling of boredom"! Logic, taught in the traditional way, can certainly feel dreary, especially deduction which apparently takes us no further in its conclusion from what we knew already in the premises. However Peirce reinvigorates deduction in a surprising way by equating it with the iconic, specifically in diagrammatic reasoning.

Here we see vividly the implications of Peirce's view that logic is much broader than language, that it is *semiotic,* or about the behaviour of signs in general. He divided signs into three basic types – icons, indices and symbols[37]. The last includes linguistic, mathematical and logical symbols which largely signify through convention. Icons, which signify objects through their *similarity,* are divided into the subtypes, *images, diagrams* and *metaphors*[38]. To Peirce, deduction and mathematical reasoning are one and the same (Stjernfelt, 2011: 306):

> *It has long been a puzzle how it could be that, on the one hand, mathematics is purely deductive in its nature, and draws its conclusions apodictically, while on the other hand, it presents as rich and apparently unending a series of surprising discoveries as any observational science (Peirce, 1885, 3.363).*

Type of Inference	Major and Minor Premises	Conclusion
Deduction	All men are mortal *(rule)* Socrates was a man *(case)*	∴ Socrates is mortal *(result)*
Induction	X, Y and Z are all swans *(case)* X,Y and Z are all white *(result)*	∴ (probably) All swans are white *(rule)*
Abduction	All Frenchman are P1, P2, P3 *(rule)* Napoleon is P1, P2, P3 *(result)*	∴ (plausibly) Napoleon is a Frenchman *(case)*

Figure 2: *The three forms of logical inference. X, Y and Z are individuals or elements. P1, P2 and P3 are properties or constructs.*
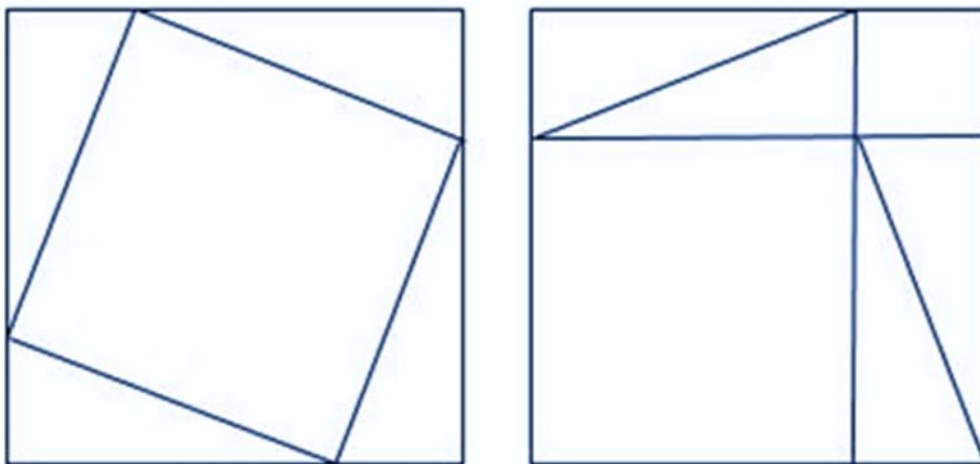

Figure 3: *Diagrammatic proof of Pythagoras (from Stjernfelt, 2000)*

A diagram, a sketch of a set of objects representing the relations between them, is capable of revealing unexpected truths through a process of deductive reasoning (Stjernfelt, 2000). A nice example is given in *Figure 3*, a diagrammatic proof of Pythagoras' theorem. The theorem states that length of the hypotenuse (z) is related to the lengths of the other two sides (x and y) of a right-angled triangle in the formula $x^2 + y^2 = z^2$. Literally, the square on the hypotenuse has an equal area to the sum of the squares on the other two sides.

The triangle in question appears four times in each of the two above figures. In the left hand figure, the smaller square (on the hypotenuse) together with the four equal triangles make up the area of the larger square. In the right hand figure, the two squares made from the other two sides of the triangle, plus the four triangles make up the right hand large square. If we take four triangles away from both the large squares, we are left with z^2 and $x^2 + y^2$ respectively. Note that this *verbal explanation*[39] involves a lengthy series of steps. With the aid of the diagram, the truth of the theorem, once grasped, can be observed almost immediately upon presentation. It is also realised that its validity will hold for a figure of any actual size (Stjernfielt, 2000), demonstrating Peirce's claim that it is possible, in diagrams, to directly observe *generality* (Stjernfelt, 1999).

Although language is still often involved in making this deduction, in the sentences, "these triangles are the same size", "those squares add up to the same area", etc. the role of the visual or iconic is vastly underestimated in approaches that claim the complete primacy of language. We could not function without the aid of diagrammatic icons such as maps, and plans, or their imagined equivalents, in performing manipulations with real objects, such as arranging furniture in a room or remembering where things are. This kind of thinking is evident in the play of children as they explore the nature of the physical world well before language develops. This goes a long way to confirm Kelly's belief that many constructs are *preverbal:* "A large portion of human behaviour follows nameless channels which have no language symbols, nor any kinds of signposts whatsoever" (1955, Vol. 1: 130). Constructs such as *here/there, left/right, large/small, up/down* or *hard/soft* can be argued

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to govern the behaviour even of animals, where language as a set of conventional symbols clearly plays no role whatever (even though *we* have to use language to discuss them!). Again, observing preverbal children's ability to recognise, imitate and generate facial expressions and make visual inferences from these in social interaction, for example in "reading" disapproval, pleasure or surprise in another person's reactions, evidences the importance of the iconic in the social sphere[40].

But perhaps the most important point about Peirce's *emphasis* on diagrams is that they are capable not only of representing the relationships between objects or parts of a whole, but that they can facilitate the production of entirely new ideas. Plans and drawings are of course vital in design, from furniture to whole cities, from a pharmacologist designing molecules to an astronomer calculating orbits. In looking at a map or a landscape painting we can imagine walking a new route and estimating the time and distance involved. We can go back to a photograph and recognise something we had entirely missed in earlier observations (Stjernfelt, 2000). In 1909 Peirce wrote:

> *I do not think I ever reflect in words. I employ visual diagrams, firstly, because this way of thinking is my natural language of self-communion, and secondly, because I am convinced that it is the best system for the purpose.[41]*

Einstein famously said that his thoughts did not come "in any verbal formulation…I very rarely think in words at all" (Miller, 1987, p. 204, cited in Prawat, 1999, p. 65). Einstein developed his revolutionary concepts of the observer's *standpoint* and *frame of reference* after reading Faraday's use of the idea of a *reference point* in examining electromagnetic induction. These crucial concepts in contemporary understanding as we shall see in discussing the dialogical concept of *position* are iconic in nature and argued by Prawat (1999, p. 65) to lie *outside of language*[42]. This takes us into the realm of *metaphor,* which although most commonly linguistic, is classified by Peirce as iconic. We will look at metaphor later in discussing abduction.

It is important, of course, not to assume that this emphasis on the visual and the iconic (the

other sensory modalities, particularly the auditory[43], tactile and kinaesthetic[44] also include iconic aspects) is not a return to empiricism (or Peirce's 'intuition') in which a direct rather than a constructed apprehension of the world is claimed. No doubt the infant in developing constructs of the world is always already immersed in the social context, and iconic construing is no less prone to the influence of social interaction and culture than development in the realms of the symbolic and linguistic. Peirce himself insisted that diagrams, like language, are *conventional:* "All diagrams, nay all pictures, depend upon convention" (CP 4.530, cited in Hookway, 1985: 191). This is exemplified by the lines drawn in a diagram which may be said to signify the edge or border, the shortest distance between two points or the path travelled by an object (Stjernfelt, 2000). Peirce went on to develop a series of new conventions in his 'existential graphs', described by Dipert (2004: 311) as "fiendishly clever", which are now being recognised as important contributions to logic. Peirce claimed that they gave us "a moving picture of the action of the mind in thought".[45]

Peirce distinguished two forms of deduction, *corollarial* and *theorematic:*

> *I draw a distinction between Corollarial consequences and Theorematic consequences. A corollarial consequence is one the truth of which will become evident simply upon attentive observation of a diagram…A theorematic consequence is one which only becomes evident after some experiment has been performed upon the diagram, such as the addition to it of parts not necessarily referred to in the statement of the conclusion (Lowell Lectures, Ms. 456, cited in Stjernfelt, 2011).*

Corollaries flow directly without surprises from the initial premises or definitions, just as in the syllogism Barbara. In theorematic deduction, an experiment is performed upon the icon or diagram, a new element, idea or perspective is added which, like a catalyst, may not even appear in the conclusion (Hookway, 1985, Stjernfelt, 2011). In the diagrammatic proof of Pythagoras' theorem (figure 3) extra triangles are added which then make it quite clear how a valid conclusion flows from the proposition. When we

trace a route through a map or measure its distance with a ruler, we are constructing propositions, performing theorematic deductions. Peirce claims that this is the method by which genuinely new theorems and ideas are generated and uses it to explain the puzzle of mathematics mentioned by him in the quote above. A diagram contains unnoticed or hidden relations among its parts (Peirce, 1885, CP 3.363). This requires of course the selection of the right new ideas which will reveal these possibilities. This depends on an inventiveness or ingenuity which we will return to in considering the process of *abduction*[46]. Peirce claimed that corollarial deduction could be performed by a computer or "logic machine", whereas theorematic deduction lies beyond mechanisation in its requirement of creativity and ingenuity[47].

Peirce described the corollarial versus theorematic distinction as his "first real discovery" (Hintikka, 1980), although the idea of working on a figure to derive proofs can be found in Kant (1787: A716, B744), who gives the example of prolonging a line and adding a parallel line to prove the angles of a triangle add up to two right angles. The radical originality of Peirce's contribution will become clearer when we consider abduction. But first we will consider induction.

INDUCTION: HABITS, RULES, INDUBITABLES AND SUPERORDINACY

Now we will consider the next form of inference, induction. Peirce defines it[48] as follows:

> *Induction is where we generalize from a number of cases of which something is true, and infer that the same thing is true of a whole class. Or, where we find a certain thing to be true of a certain proportion of cases and infer that it is true of the same proportion of the whole class[49] (Peirce, 1878, CP 2.624).*

He comments:

> *How magical it is that by examining a part of a class we can know what is true of the whole of the class, and by study of the past can know the future[50]; in short, that we*

*can know what we have not experienced!
(Peirce, 1869)*

This stress on "knowing the future" is a core theme in pragmatism and it is reflected in Kelly's emphasis on *anticipation* in his fundamental postulate.

Induction plays a central role in inquiry and scientific method: "It is the particular function of induction to produce universal and necessary propositions" (Peirce, 1968: 73). But in estimating from a part to the whole, "we can never know how great a part of the whole of nature we have discovered" (Peirce 1869, 5.343). "No amount of inductive evidence can ever give us the *slightest reason…*that an inductive law (is) without exception" (Peirce, 1992: 284-5). The problem with induction is that we depend on it so much and yet "it is liable at any moment to be utterly shattered by a single experience" (Peirce, CP 2.757). Newton's laws of motion were judged to be utterly established and valid as universally true and yet the discovery that the speed of light seemed always to remain constant led Einstein to predict that the Newtonian laws, so apparently certain and set in stone, themselves had to be adjusted and to 'bend', when considering velocities much higher than those we are used to in everyday life[51]. This is the essence of Peirce's central notion of *fallibilism*, which as we saw in Part I of this series was taken over wholeheartedly by Kelly (Procter, 2014b, p. 11). We can always be wrong. For Kelly, even PCP itself will be replaced in ways that we cannot yet anticipate.

Induction was described by Russell (1961: 641) as "a large and difficult subject". Peirce called the problem of the validity of synthetic inference as the "lock on the door of philosophy" (Peirce, 1869: 5.348). Can induction ever be validated or justified? This was Hume's challenge. Hume concluded that we cannot validate induction, and along with it causality, seeing any inductive or empirical justification of it as "viciously circular" (Körner, 1969, 11 – 12, 88). Induction has been seen in the classical literature on logic as a poor relation to deduction because of its fallibility. The problem has been the use of deduction as the standard against which to critique it. The truth and necessity of deduction immediately shows, achieved and apparent the moment a deductive judgement or assertion is made. Peirce's contribution to the justification of *induction* lay in his seeing it as a process occurring *over time*. Its justification lies in its being *self-corrective* (Rescher, 1978, 1):

> *The justification of its conclusion is that that conclusion is reached by a method which, steadily persisted in, must lead to true knowledge in the long run of cases of its application, whether to the existing world or to any imaginable world whatsoever (Peirce, 1901, 7.207).*

Rescher (1978) writes that "no part of Peirce's philosophy of science has been more severely criticised" (p. 2). He convincingly tackles and refutes these critiques and concludes that, "the Peircean theory of science may be controversial in many respects, but the core of its doctrine that science is self-corrective (that is autonomous and not admitting any external correction) is a view that is inexorably pressed upon us…and one that is surely right" (1978, 16).

Induction and habit

Induction for Peirce is the basis of a central concept in his philosophy, that of *habit.*

> *Induction proceeds from Case and Result to Rule; it is the formula of the formation of a habit or general conception (Peirce, 1883, 2.712)*

> *By induction, a habit becomes established. Certain sensations, all involving one general idea, are followed each by the same reaction; and an association becomes established, whereby that general idea gets to be followed uniformly by that reaction…Thus, by induction, a number of sensations followed by one reaction become united under one general idea followed by the same reaction (Peirce, 1892c, 6.144, 6.146).*

The word *habit* for Peirce is broader and more fundamental than its use now in everyday language with its emphasis on behavioural routines. It is elevated from a psychological or physiological term (as it was in William James[52]) to a *logi-*

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cal term. It is, or involves, as he says, a *general conception*. The *meaning* of a proposition *is* a habit of action (Hookway, 2012, p 15). He changed his emphasis over his career, initially emphasising the role of *belief* more ("Our beliefs guide our desires and shape our actions" (1877, 5.371); "the essence of belief is the establishment of a habit" (1878, 5.398)). He came to see his earlier formulation as too psychologistic (see earlier discussion) seeing the meaning of a *proposition* as more fundamental than beliefs, judgements and assertions. These are acts which can be performed because we *grasp* a proposition (Hookway, 2012, 15). We do not need the implication of *assent*[53] involved in the concept of *belief*. As in Kelly we can entertain a notion without committing ourselves to its validity.

This brings close this notion of habit/meaning to Kelly's fundamental idea of a construct used in construing and making a judgement. A proposition is something that contains a subject and a predicate (Peirce, 1903, 2.316) or in Kellian terms, it assigns *element* to a *construct*. This identification may seem to give too much emphasis to *language,* but for Peirce, propositions are *signs* (specifically a *"dicisign" or" dicent"*[54]), entities much wider than words or language, including pictures, diagrams, gestures etc. A map for example "has a Predicative part (map shapes) and a Subject part (index indications such as names, grid references) making it possible for the map to make true (or false) claims as to the properties of the landscape portrayed (Stjernfelt, 2014, 3).

We will recall from Part I of this series that Dewey, after undergoing his "Peircean Turn" (Edel and Flower, 1985, Prawat, 2001) wrote: "Concrete habits do all the perceiving, recognizing, imagining, recalling, judging, conceiving and reasoning that is done" (Dewey, 1922, p 124). We thus arrive at a conception very close to what Kelly meant by 'construing'. Indeed, the very idea that constructs are 'channels' that structure the way we anticipate events (as in the fundamental postulate) emphasises their role as *habits of expectation*[55]. In Part I, we saw how the fundamental postulate and Peirce's *pragmatic maxim*[56] are closely related by their emphasis on future events and effects. We can now see that *induction* holds a central place in the work of both Peirce and Kelly. Indeed Carolyn Eisele (1979) writes that, "Peirce's Pragmatic Maxim is

but a first-cousin to his logic of induction" (p. 258). We see it in Kelly in his *Construction Corollary*: "We anticipate events by construing their replications…Each person attunes his ear to the replicative themes he hears and each attunes his ear in a somewhat different way" (Kelly, 1955, Vol. 1: 50, 58).

Induction, rules and choice

Induction is an essential process in science and therefore, with our Kellian metaphor of people as scientists, in everyday life. We depend in so many ways on the 'fact' that physical objects, and the people around us, will continue to behave in the ways that they typically have. The brilliant philosopher Frank Ramsey (1903 – 1930), was "imbued with the pragmatism of Peirce"[57] and was a significant influence on Wittgenstein and his turn towards pragmatism in the *Philosophical Investigation*s (1953) and *On Certainty* (1969)[58]. Ramsey writes:

> *The human mind works essentially according to general rules or habits. Induction is such a useful habit, and so to adopt it is reasonable...We are all convinced by inductive arguments, and our conviction is reasonable because the world is so constituted that inductive arguments lead on the whole to true opinions…We are not, therefore, able to help trusting induction. A man who did not make inductions would be unreasonable…This is a kind of pragmatism, we judge mental habits by whether they work. (Ramsey, 1926, 29, 31, my emphasis).*

We are unable to live without making inductive inferences. The habits and constructs associated with them begin to be formed in the earliest weeks of our existence building up our system of constructs. We cannot help trusting our inductions in spite of their fallibility and it is therefore *reasonable* to do so. Hume, in spite of his scepticism about induction and causality says, "None but a fool or madman will ever pretend to dispute the authority of experience, or to reject that guide to human life"[59]. 'Reasonable' is a term that Ramsey draws from Peirce[60]. It seems to be for Peirce a superordinate construct in his sys-

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tem, higher than logic, in the realm of ethics and aesthetics, a principle that regulates the excesses of science and logic: "Logic came about for the sake of reasonableness, not reasonableness for the sake of logic" (Peirce, 1902, 2.195):

> *One cannot well demand a reason for reasonableness itself...Reasonableness consists in association, assimilation, generalization, the bringing of items together into an organic whole (Peirce, 1900, 621).*

Reasonableness is sound judgement, fair and sensible, looking at things 'in the round'; in Law it is equated with the opinion of "the folk on the Clapham omnibus", the yardstick of the hypothetical average reasonable person. Reasonableness is open-mindedness, open to nature and to the reasons of others (Colapietro, 1987, cited in Nubiola, 2009). Ramsey (1926) outlined different senses of the word, but concluded that "there is no point in fixing on a precise sense of 'reasonable'" (p.32).

Induction for Peirce then is the source of *rules* based on cases and results, of universal and necessary propositions and laws. The term 'rule' is central in Peirce and Ramsey in their discussion of induction and habit. "A belief involves in our nature the establishment of a rule of action, or, say for short, a habit" (Peirce, 1877, 5.397). Peirce says:

> *When we think, we are conscious that a connection between feelings is determined by a general rule, we are aware of being governed by a habit (Peirce, 6.20).*

The concept of 'determination' raises a crucial distinction made by Wittgenstein between *causal* and *logical* determination[61]. In the former, the word rule is used to refer to cause-effect connections such as the impact of billiard balls in Newton's laws of motion. In contrast, logical determination, as Rorty (1961) explains, is what goes on when we *follow a rule* (p. 213). Rorty and Crocker (1998) have written two important papers comparing Peirce and Wittgenstein, showing clearly that both philosophers were clear in their rejection of a reductionist causal determinist view of rule following and indeed Peirce anticipated Wittgenstein in this. Crocker writes:

> *One acts in accordance with rules (although one's actions are not determined by rules)...One's action may be brought into accord by a rule but not determined by a rule (Crocker, 1998, 480 – 1).*

Both insist that we have *discretion*[62], that we decide[63] or *choose* to obey or disobey a rule.

Peirce writes:

> *We hold the act of inference, which we approve, to be voluntary. That is, if we did not approve, we should not infer...these are voluntary acts which our logic, whether it be of the natural or the scientific sort, approves. Now, the approval of a voluntary act is a moral approval. Ethics is the study of what ends of action we are deliberately prepared to adopt (Peirce, 5.130).*

Of course habits allow us to execute a whole sequence of actions without the need for conscious attention at every step. Crocker writes:

> *Habits allow one to act without consciously and laboriously having to provide evidence and arguments to justify each action...they regulate human action, but do not determine action...and are always revisable through a change in practice or through further inquiry (Crocker, 1998, 484-6)*

To describe this Wittgenstein says, "When I obey a rule, I do not choose. I obey the rule *blindly*...This is simply what I do"[64]. Nevertheless we know at some level what acts and steps are involved. We have responsibility for these choices when we decide to execute the habit at the moment of initiating it and we are capable of reflecting on these, even if we are often thinking of something entirely different during its execution. But once we have made a choice we are confronted by its implications and consequences. We have some capacity to modify habits through *self-control* though clearly we are not entirely free to do so:

> *How Feeling, Conduct and Thought, ought to be controlled, supposing them to be subject, in a measure, and only in a*

measure, to self-control, exercised by means of self-criticism, and purposive formation of habit, as common sense tells us they are in a measure controllable (Peirce, 1910, MS 655, cited Colapietro, 1989, xviii)

We will return to the topic of self-control in Part III of this series.

For Kelly, with his choice corollary[65], it is clear that we have free choice to choose one or the other pole of a construct, though we are also limited in that we cannot just choose to change our construct system. Trevor Butt writes:

The importance of the dichotomous personal construct is now defined behaviourally, in terms of the action carried out in contrast to what the person might have done (Butt, 1998, 272).

But our free choices are *constrained* by the superordinate structure within which the constructs lie. We are subject to the dialectical relationship between freedom and determinism. Kelly writes:

Determinism and freedom are then inseparable, for that which determines another is, by the same token free of the other. Determinism and freedom are opposite sides of the same coin – two aspects of the same relationship (Kelly, 1955, 21). The subordinate systems are determined *by the superordinate systems into whose jurisdiction they are placed (ibid, 78, my emphasis).*

Noaparast[66] (2000) discusses causal versus logical determination in relation to PCT and concludes convincingly that Kelly, with his teleological, future oriented, account of choice, is unambiguously speaking of logical determination as opposed to the causal reductionism of both cognitive and linguistic determinism:

Constructs imply and make psychological responses sensible, rather than causing them…the word 'explanation' must be confined to causal relationships, and that what is suitable to be used in PCT is the concept of 'justification' (Noaparast, 2000, 65).

He argues that, "This makes a construct system work according to a rule-following model. The person shows his psychological responses in the 'range of convenience' of the higher rules (ibid, 66). Earlier, Mischel (1964) had argued the same point[67]:

The construct functions as a rule in terms of which I can decide what I should do…The construct 'governs' [Kelly, 1955, 132] my behaviour because it is a rule I use in deciding what the right thing for me to do is…the construct is the rule I followed in making these decisions (Mischel, 1964, 185).

Trevor Butt emphasises this:

Construing is about reasons, not causes, and human conduct calls for understanding not explanation (2007, 13). We should be content with a psychology of understanding rather than causal explanation (2013, 223).

It is so easy to see patterns and regularities in human behaviour and to assume that these must be operating as causes, motives or rules. In a way the whole mission of PCP is to caution against this. The PCP therapist learns to be very wary of 'interpretations' made from outside, having its origin in an extraneous construct system such as the theory of psychoanalysis and all the countless models of explanation developed since. This is the subject of Wittgenstein's so called paradox of rule following:

This was our paradox: no course of action could be determined by a rule, because every course of action can be made out to accord with the rule (PI 201).

Shaw and Gaines (2003) in discussing the limitations of artificial intelligence in modelling 'expert systems' capture the issue clearly. In actual situations, human decisions are generated 'on the spot', not by the application of causal rules previously stored in the brain:

Kelly developed personal construct psychology from a perspective that was consistent with that of Wittgenstein, and did

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not introduce rules in his psychological model. For him construing was all that was necessary to account for human behaviour, and anticipation was a by-product of construction. That is, construction intrinsically supported anticipatory processes without the storage of anticipatory 'rules' but, at a particular stage in the construction of experience, these anticipations might have a regularity that an observer could ascribe to 'rules of behaviour'... The Wittgenstein paradox presents no problems to personal construct psychologists because there is no assumption that human behaviour is rule-governed (Shaw and Gaines, 2003, 137).

In practice, the decisions that we make are based on both the demands of the unique and fresh situation that faces us together with the continuous holistic appraisal of this situation in the light of all the experience we bring to bear, with all its constructs, rules, customs and precedents. As Ransdell (1976) says, in his comparison of Peirce and Wittgenstein:

*Any act of continuation of the custom is necessarily a creative act. That is, **every** act in accordance with a rule or custom is to some extent creative...each speech act is, in some measure, a creative act, whereby the speaker seeks to **determine** by speaking in accordance with it. Every speaker is always in the process of **making** the rule as he (sic) speaks (Ransdell, 1976, 419 – 20).*

In PCP terms, a construct is recreated anew each time it is used. In this way, we as individuals and as communities are a *form of motion,* in continuous growth and change. John Shotter (2014) argues strongly that we must beware of applying interpretations based on 'after-the-fact' analysis (for example clinical formulation, questionnaire or repertory grid assessment) to people's 'before-the-fact', action guiding anticipations. Similarly Trevor Butt says:

We act first and reflect later. But the actions are intentional. People choose between those alternatives that they see open

to them and not between those that a third person might see (Butt, 1998, 275).

In clinical situations, we know that the best formulations we make are often left far behind by clients who, as Kelly says, have meanwhile marched ahead with new initiatives and understandings. In every interview, we must catch up with clients' latest experiences before making any assumptions based on past pictures. We will focus on the issue creativity when we discuss abduction in section 6.

Regulative assumptions, hinge certainties and superordinate constructs

Induction then, in spite of its logical fallibility, leads to a vast body of anticipations that we trust, or hope to trust, about which we feel a sense of certainty, if indeed we are even aware of the assumptions we are making. Subsequent experience may demand the need for revision or replacement but this leaves a large core of assumptions that are dependable and, at least for the time being, effectively valid and that we construe as true. Peirce called these the *bedrock* of shared *regulative assumptions* or *indubitables* of common sense (Hookway, 1985, 229 – 231). They are an intrinsic part of inquiry or indeed any practice or action that we perform. Cheryl Misak writes:

A regulative assumption makes a claim about a practice and what those engaged in that practice must assume in order for the practice to be comprehensible and able to be carried out...If we want to succeed in these endeavours, we need to make assumptions—assumptions that allow the practice to go on in the way that is desired...We must assume that, in general, our observations can be explained and that there are real things whose characters are both independent of our beliefs about them and can be discovered through empirical investigation (Misak, 2011, 266, 265).

Descartes can doubt everything but the reality of his own doubting self, but only as long as he remains in his armchair. Peirce castigates him

for making doubts that are not *genuine*. He says, "let us not pretend to doubt in philosophy what we do not doubt in our hearts" (CP 5.265, 1868). As soon as we even walk across the room we are making many presuppositions: for example, we are assuming the floor will hold us up, that our body will carry us and respond for us in the appropriate way. Andrew Howat (2013) writes:

> *Peirce famously objects[68] to a different set of epistemological claims (made by Descartes) on the grounds that one cannot properly claim to doubt certain propositions...some propositions are immune from both rational support (and thus genuine claims to knowledge) and rational criticism (and thus genuine claims to doubt), by virtue of the epistemological role they play in our lives and practices (Howat, 2013, 456).*

There is a body of assumptions that have *special epistemic status*[69] in that there are propositions[70] that are both *fallible* and *indubitable* (Johanson, 1994).

There is a remarkable correspondence here with Wittgenstein's very late thinking, decades after Peirce wrote, leading to speculation that the latter actually read Peirce[71] rather than merely learning about him through Frank Ramsey[72]. Wittgenstein (1969) describes how some assumptions are necessary for others to function, using the metaphor of an axis or a hinge:

> *I do not explicitly learn the propositions that stand fast for me. I can discover them subsequently[73] like the axis around which a body rotates. This axis is not fixed in the sense that anything holds it fast, but the movement around it determines its immobility (OC 152).*

> *The questions that we raise and our doubts depend on the fact that some propositions are exempt from doubt, are as it were hinges on which those turn (OC 341).*

> *We just **can't** investigate everything, and for that reason we are forced to rest content with assumption. If I want the door to turn, the hinges must stay put (OC 343).*

Howat (2013, 457) describes three features of these so called *hinge certainties*: (1) one cannot claim to *know* them, because (2) there are no grounds for hinge propositions that are more certain than the propositions themselves. (3) Since they play a 'supporting role' in our belief system, they are, other things being equal, indubitable. To doubt a hinge proposition, one would have to doubt most or all of one's other beliefs at the same time.

We come up against the limitations of terminology here. The assumptions are not propositions. "'Hinge propositions' is actually a misleading expression…(they) are not propositional but profoundly *action based*" (Pihlstöm, 2012). Danièle Moyal-Sharrock writes:

> *(Wittgenstein) comes to see that such certainties are really animal or unreflective ways of acting which, once formulated (e.g. by philosophers), look like empirical propositions. It is this misleading appearance that leads philosophers to believe that at the foundation of thought is yet more thought. But though they may often look like empirical conclusions, our basic certainties constitute the ungrounded, non-propositional underpinning of knowledge, not its object. In thus situating the root of knowledge in non-reflective certainties that manifest themselves as ways of acting, Wittgenstein has found the place where justification comes to an end (Moyal-Sharrock, 2013, 10 – 11).*

Johanson (1994) explores how the thinking of Peirce and Wittgenstein come into close correspondence in this area, although there are also differences between the two of them. They both agree that in what Peirce called 'practical infallibility'[74], that indubitables are part of a basic, primitive system of action in the world and that we could not live without believing them. In spite of this, they both reject foundationalism, that there is any grounding or justification for these certainties. We do not 'know' them, belief in them is not a cognitive activity based on reasons or truth. They are part of a "background[75] system of what is believed" (Wittgenstein[76]), "an integral unbroken part of the great body of truth" (Peirce[77]). Peirce says, "We have an occult[78] nature of which and of its contents we can only

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judge by the conduct that it determines, and by phenomena of that conduct" (5.441).

So, the problem comes when we try and put these assumptions into words. When we do so, they *look like* empirical propositions[79]. Wittgenstein suggests that they are more like grammatical rules than judgements or propositions and as such cannot be deemed true or false[80]. He says:

> *The same proposition may get treated at one time as something to test by experience, at another as a rule of testing (OC 98). I cannot doubt this [latter] proposition without giving up all judgement. But what sort of proposition is it?...It is certainly no empirical proposition. It does not belong to psychology. It has rather the character of a rule (OC 494).*

When a hinge certainty is operating in our actions, it is not verbalised (echoing Kelly's insistence that a construct is not the same as the words that are used to symbolise it). We do not learn them through being taught them through language, we learn them implicitly like "the rules of a game; the game can be learned purely practically, without learning any explicit rules" (OC 95):

> *Children do not **learn that** books exist, etc. etc. – they learn to fetch books, sit in armchairs etc. etc. (OC 476)[81].*

It is consistent with Wittgenstein's lifelong statement, first appearing in the Tractatus in 1918 that there are things that can be *shown* but not *said*: "There are, indeed things that cannot be put into words. They make themselves manifest" (Tractatus, 6.552). We can put them into words, but then they are changed into something different, what Moyal-Sharrock has called a *doppelgänger*:

> *"A sentence made up of the same words as a hinge, but which does not function as a hinge...only the descriptive and expressive doppelgänger of a hinge can be meaningfully said, not the hinge...(which) enables, but does not belong to the game...The hinge: 'I am here' is an artificial expression of the silent certainty that underpins the sense of such sentences as 'I'll be go-*

> *ing now' or 'I'll stay if you want me to' – it does not itself bear saying" (Moyal-Sharrock, 2003, 135-6).*

As Joseph Rychlak puts it, "An assumption is not itself subject to targeted examination, as it need not be remembered as thought unfolds. Assumptions are considered self-evident and thus serve as silent frameworks" (1994, 285).

We can tell that something odd happens when we put the hinges or indubitables into propositional form by what happens when we try and doubt them or assert their opposites. Wittgenstein gives the example of a friend who one day asserts that he has never lived in a place where he has clearly been living for a long time. We would not say he is making a *mistake* but that he was suffering a *mental disturbance* (OC 71) or that he was *demented* (OC 155). As Moyal-Sharrock writes:

> *Our objective certainty can only be enacted. And in the same way that our adherence to a rule of thought can only meaningfully manifest itself in our acting, so too, our nonadherence. A mere verbal rejection of a law of thought is not logically valid (Moyal-Sharrock, 2003,138).*

This has led to a discussion that an understanding of this bedrock or background of certainty and indubitables may throw light on the occurrence of *delusions,* such as the statement "I am dead", or "I am Jesus", the belief in thoughts being inserted in one's mind by others or having been abducted by aliens. Rhodes and Gipps argue that these involve a *deformation* or *deterioration* of the subject's bedrock or "background canvas" of hinge certainties that "reside not in our representational knowledge, but rather in those abilities, capacities, tendencies and dispositions that provide the foundation for our system of empirical (non-bedrock) beliefs"[82]. They argue for a very clear demarcation between the background and the "system of internal representations". Bortolotti (2011) strongly critiques this, citing that even Wittgenstein himself argues for a fluidity between them and Peirce would seem to agree when he talks of consciousness not being divided from an unconscious region by a skin (see earlier note). It may be that PCT could help in the debate about whether hinge certainties are

rules or propositions. Kelly's *constructs* could be seen as superordinate to both – discriminations/alternatives which underlie both propositions *and* rules, as we have seen above.

How much does this bedrock (a metaphor used by both Peirce and Wittgenstein), change? Wittgenstein writes using the metaphor of a *riverbed* of thoughts:

> *I distinguish between the movement of waters on the riverbed and the shift of the bed itself; though not a sharp division of the one from the other…And the bank of the river consists partly of hard rock, subject to no alteration or only an imperceptible one, partly of sand, which now in one place and now in another gets washed away or deposited (OC 97, 99).*

Peirce, in discussing the bedrock of shared assumptions seems to have changed his view about the extent of change that occurs. Hookway writes:

> *In earlier writings, he had held that "there is no definite and fixed collection of opinions that are indubitable, but criticism gradually pushes back each individual's indubitables, modifying the list, yet still leaving him beliefs indubitable for the time being" (5.509). By 1905, he thought that there was "a fixed list, the same for all men" (5.509) (Hookway, 1985, 229).*

How do we relate all this talk of indubitables, regulative assumptions and hinge certainties to Personal Construct Psychology? Looked at broadly, it seems to correspond to what Kelly covered in his *organisation corollary*[83]. He envisages that all our knowledge and experience is governed by a hierarchical construct system in which *superordinate constructs* give overall guidance in making choices in terms of the general direction taken in life through to particular decisions. They help transcend contradictions[84] and potentially link and coordinate particular areas and domains in a vast hierarchy of subsystems and sub-subsystems of constructs. People differ not only in the *content* of their construing but in the way they *organise* their constructions of events (Kelly, 1955, 56).

Superordination is seen as a *logical* process. Dennis Hinkle, who derived methodologies for establishing the ordinal relationships between constructs with his *implications grid* and the popular interviewing method of *laddering*, has perhaps done as much work in this area of PCP as anyone since Kelly's original writing. He writes:

> *The Organisation Corollary simply points up that constructs are* logically organised. *(But) logical relationships need not be limited to the set-subset form, nor, in fact, to the restrictive principles of classical logic (Hinkle, 1970, 104, my emphasis).*

The subordinate construct, or one of its poles, *implies* a position on the superordinate:

> *If sphere includes ball together with certain other objects, then to say that something is a ball is also to imply that it is a sphere (Kelly Vol. 1, p. 156).*

> *In an implicative relationship between two constructs, that construct which implies polar positions on the other construct is called the subordinate construct; that construct whose polar positions are implied by the other construct is called the superordinate construct (Hinkle, 1965, 11).*

Butt gives an example:

> *A person's superordinate structure is a necessary guide to his or her subordinate construing.* Acting reasonably – behaving irrationally *is superordinate to* talking quietly – shouting. *The decision to act reasonably will entail talking quietly (Butt, 1995, 228, my emphasis).*

The relationship between superordinate and subordinate constructs is therefore asymmetrical, involving *directionality*[85]. There is some ambiguity[86] in the words we use to describe the upward and downward relation in the hierarchy here. I would suggest, following Hinkle and Butt, that we use the work *imply* for the upward direction and *entail* for the downward *(see Figure 4)*. The superordinate construct covers a greater range of convenience and has a govern-

ing or guiding role, helping a person "to order his constructions in ways which will establish priorities in action" (Mair, 2015, 115).

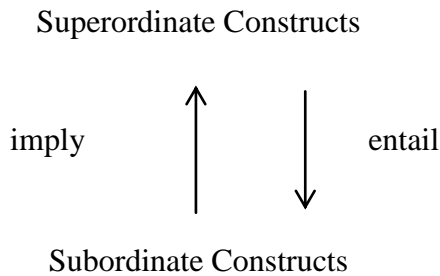Superordinate Constructs

imply ↑ ↓ entail

Subordinate Constructs

Figure 4: *The logical relationship between superordinate and subordinate constructs*

We can find the same logic in Peirce's early writings in his discussion of what he calls *prescision*:

> *I can prescind…space from color (as is manifest from the fact that I actually believe there is an uncolored space between my face and the wall); but I cannot prescind color from space…Prescision is not a reciprocal process[87] (Peirce, 1867)*

We might say space is *superordinate* to colour, it entails colour or colourlessness. "Coloured", however, implies space. We cannot imagine colour without the prior construct of space. A red point is still in space.

Clearly, there is an overlap here between Kelly's theorising and what Peirce and Wittgenstein are arguing for in their discussions of regulative assumptions and hinge certainties. Perhaps a difference though is that Peirce and Wittgenstein emphasise that action is carried out in the light of a whole network or system of assumptions rather than as in Kelly who, reflecting his vision of a pyramidal hierarchy of constructs reaching an apex, tends to point to a small number or even a single superordinate construct governing choices and decisions. Rosenthal (1994, 14) cites Peirce as arguing that, "we test beliefs, not in isolation, but as parts of a whole set of claims". Wittgenstein says, "Bit by bit there forms a system of what is believed, and in that system some things stand unshakeably fast…what we believe is not a single proposi-

tion, it is a whole system of propositions. It is not single axioms that strike me as obvious, it is a system in which consequences and premises give one another *mutual* support. What I hold fast to is not *one* proposition but a nest of propositions"[88].

All three agree that the assumptions higher up the hierarchy (using Kelly's metaphor) are less prone to change than the subordinate structure, as so well illustrated in Wittgenstein's metaphor of the slow change in riverbed compared to the flow of the waters. A change or doubt at the level of superordinate structure or in a hinge assumption has devastating consequences[89] for our whole way of understanding things: "We know the earth is round. We have definitely ascertained that it is round. We shall stick to this opinion, unless our whole way of seeing nature changes" (Wittgenstein, OC 291). Perhaps the clearest view of a conceptual system of this kind before Kelly and Wittgenstein is to be found in C. I. Lewis, who was one of the first people to start studying Peirce's manuscripts in the early 1920's and which gave Lewis the final building blocks for his mature epistemological position which he would call conceptual pragmatism[90]:

> *The whole body of our conceptual interpretations form a sort of hierarchy or pyramid with the most comprehensive, such as those of logic, at the top, and the least general such as 'all swans are birds' etc, at the bottom…With this complex system of interrelated concepts, we approach particular experiences and attempt to fit them, somewhere and somehow, into its preformed patterns. Persistent failure leads to readjustment. . . .The higher up a concept stands in our pyramid, the more reluctant we are to disturb it, because the more radical and far-reaching the results will be (Lewis, 1929, 305 – 6, cited in Misak, 2011).*

Earlier, in 1923, Lewis had written in a Peircean spirit:

> *Our categories and definitions are peculiarly social products, reached in the light of experiences which have much in common, and beaten out, like other pathways, by the coincidence of human purposes and*

the exigencies of human coopera-tion...Conceptions, such as those of logic, which are least likely to be affected by the opening of new ranges of experience, rep-resent the most stable of our categories; but none of them is beyond the possibility of alteration (Lewis, 1929, 177).

Lewis was well known at that time for his re-spected and pioneering 1918 textbook on sym-bolic logic[91]. How much he was an influence on Wittgenstein and on Kelly in this crucial vision will probably remain unknown. Something of Lewis' vision can be found in the work of his student Quine in his holism and his vision of a "convenient conceptual scheme"[92]:

The totality of our so-called knowledge or beliefs, from the most casual matters of geography and history to the profoundest laws of atomic physics or even of pure mathematics and logic, is a man-made fabric...A conflict with experience at the periphery occasions readjustments in the interior of the field...Re-evaluation of some statements entails re-evaluation of others, because of their logical intercon-nections...Any statement can be held true come what may, if we make drastic enough adjustments elsewhere in the sys-tem (Quine, 1951, 39 – 40).

Kelly considers the matter of how construct sys-tems develop in the context of the superordinate – subordinate relationship of construct systems:

The subordinate systems are determined[93] by the superordinate systems into whose jurisdiction they are placed. The superor-dinate systems, in turn, are free to invoke new arrangements among the systems which are subordinate to them...The changes that take place, as one moves to-ward creating a more suitable system for anticipating events, can be seen as falling under the control of that person's super-ordinating system...so can one's personal constructs be changed only within subsys-tems of constructs and subsystems changed only within more comprehensive systems (Kelly, 1955, p. 78, cited in Castiglioni, 2011).

Cromwell (2010, 173) argues that superordinate constructs are not *learned* but are formed spon-taneously, when an overlap in sets of elements construed by two constructs is detected: "As various elements of thought are juxtaposed in symmetric fashion...various overlapping or par-tial matchings are detected. As these are detect-ed, the person converges toward an asymmetric (hierarchical) structure" (p. 175). This ties in intriguingly with Wittgenstein's claims that hinges are not *learned* by the child, they are pre-sent implicitly[94]. This process would of course take place within, and be radically influenced by the social context. Whether this model is capable of dealing with the internalisation of social and cultural values and discourses is outside the scope of the present discussion (see Procter, 2016). Comparing Kelly, Peirce and Wittgen-stein may help us to throw light on the formation of superordinate constructs, which Rue Crom-well describes as "one of the most important unsolved and misunderstood questions in not just PCP, but also in all of human psychology" (ibid). What Kelly was able to provide, perhaps more clearly than any of the other thinkers we have mentioned, is a proposal of how construct systems, as a version of "webs of belief", are structured and organised in terms of bipolar con-structs which subsume subsystems of such con-structs in various ways. We will be examining the nature of his core proposal of *bipolarity* in Part III of this series.

This section on induction has taken us into some complex issues in philosophy. We have considered the relevant philosophical literature of the last 150 years which forms the context to the development of Kelly's Personal Construct Theory. This has cleared the space and enriched our understanding of Kelly's radical notion of ordinacy: the relationship between superordinate and subordinate constructs. We have linked this to the vital but fallible inferential process known as induction and seen how this can be seen as the source of our regulative assumptions and certain-ties which form the background to our function-ing as "personal scientists". Now we must turn to the next of Peirce's three types of inference, Abduction.

ABDUCTION: THE SOURCE OF NEW IDEAS

And so we come to the third form of inference, abduction[95]:

> *Abduction is the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea; for induction does nothing but determine a value, and deduction merely evolves the necessary consequences of a pure hypothesis. Deduction proves that some-thing* must *be; Induction shows that some-thing* actually *is* operative; *Abduction merely suggests that something* may be *(Peirce, 1903, 5.171).*

Peirce controversially insists that the process of *forming,* not just selecting or validating a hypothesis is a *logical* matter. This has been described as "a highly original investigation" (Fann, 1970: 5) and as a "revolutionary claim" Gallie (1952: 94). Peirce (ibid) goes on to put it in a more formal, logical form:

> *The surprising fact, C, is observed.*
> *But if A were true, C would be a matter of course.*
> *Hence, there is reason to suspect that A is true (5.189)*

Hanson (1958, 1960a, 1960b) has taken up this issue of "the logic of scientific discovery". He wants to defend Peirce that the process of proposing a hypothesis, not just accepting it, is a logical matter. He tackles the philosophers who advocate the "hypothetico-deductive method" (1960b). For Hanson, they describe the "logic of a finished research report[96]" (1960b: 92) rather than addressing the *discovery* of a hypothesis: "they have said nothing about the *conceptual context* within which such a hypothesis is initial-ly proposed" (ibid, my italics). Reichenbach and Braithwaite criticised Peirce as confusing logical with psychological or sociological issues in this (1960a: 188). Popper (1959: 32) says that there is "no such thing as a logical method of having new ideas, or a logical reconstruction of this process".

Nicholas Rescher (1976) compares Peirce's and Popper's accounts of the logic of scientific discovery in detail. Popper's famous emphasis on *falsifiability* of hypotheses was anticipated by Peirce, though for the latter this was a prelimi-nary rather than the central process as in Pop-per's approach. For Peirce it is good to first dis-pense with the falsifiable hypotheses that can be refuted in order to clear the ground for "the main struggle"[97]. Both recognise that there are a po-tentially *infinite number* of possible explanations to any phenomenon, the puzzle being, how are these ever reduced to two or three plausible hy-potheses?

Popper believes this is a purely chance, blind affair like a Darwinian process of random genet-ic mutations, a "shot in the dark" (Merrell, 2000: 1, Rescher, p. 52). He denies that we have a ca-pacity for discriminating good from bad hypoth-eses and sees the success of science as "some-thing fortuitous, accidental, literally miraculous and totally unintelligible" (Rescher, p 54). Pop-per says, "no theory of knowledge should at-tempt to explain why we are successful in our attempt to explain things" (Popper, 1972, p. 23). Rescher comments:

> *The model of the growth of scientific knowledge along Popperian lines – through the falsification of hypotheses ar-rived at by blind trial and error – is thus crucially deficient; it is…unable to ac-count for the reality, let alone the rate of scientific progress (Rescher, p. 56).*

By contrast, Peirce, also applying evolutionary theory, believes that our species has evolved a talent, insight, instinct, a habit or power of guessing right:

> *Nothing is so unerring as instinct within its proper field…[These] beliefs that ap-pear to be indubitable have the same sort of basis as scientific results have. That is to say, they rest on experience – on the to-tal everyday experience of many genera-tions of multitudinous populations (5.521, cited in Rescher, p. 49).*

If this appears to give too much weight to the phylogenetic evolution of this talent at the ex-pense of it being an achievement also of cultural and individual development, Peirce does say that:

Since it is difficult to make sure whether a habit is inherited or is due to infantile training and tradition, I shall ask leave to employ the word "instinct" to cover both cases" (2.170).

But just to say we have this instinct or talent is to risk an empty explanation that Bateson called a *dormitive principle*[98]. The question is still, how does this talent actually operate to produce genuinely new and original hypotheses and ideas? We do so by putting together elements already known into a new configuration:

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 (5.181).*

Herbert Simon says, "We have some kind of generation of alternatives – some kind of combinatorial process that can take simple ideas and put them together in new ways"[99]. Simon (1973) convincingly argues, using everyday examples, against Popper, that a normative logic of discovery is possible and we do not have to rely on fuzzy explanations of "intuition" or "creativity". He argues clearly how discovering laws only involves detecting patterns in existing data. Discovery of a pattern doesn't claim a unique or even the most parsimonious solution. It makes no claims yet of predicting further examples, which constitutes a second stage in which the idea is tested. He suggests that Popper rejected a logic of the discovery process itself because of confusion between these two stages and that it seemed to rely on the fallible process of induction, which of course only comes back into play in this second stage.

For Peirce, pragmatism itself is "nothing else than the question of the logic of abduction" (5.196). For him, abduction holds an absolutely central place in the process of science: "Every single item of scientific theory which stands established today has been due to abduction (5.172). Even as a 15-year-old boy he wrote, "Man's truth is never absolute because the basis

of fact is hypothesis" (Peirce, 1854) and later, "the truth is that the whole fabric of our knowledge is one matted felt of pure hypothesis" (MS 692, cited in Eco and Sebeok, 1988: 16). Of course, having said this of abduction, in practice, as we will address later, the three forms of inference are all used together in intimately interconnected chains and steps in the process of inquiry and discovery. The recent identification of abduction with "Inference to the best explanation" (Harman, 1965) is therefore a misunderstanding of Peirce's view of abduction, since establishing an idea as the *best explanation* requires the trio of inferences (Nesher, 2001, 43).

Abduction then is seen as a central process in science, in making sense of phenomena and forming potential new explanations for them. But it is far more than this "first stage of a deliberately conducted form of scientific inquiry" as John Shotter says, limits it to "quite the wrong sphere of concern" (2009: 240 – 1). Shotter implies that Peirce's view of abduction was limited to a conscious and deliberate process. Nubiola (1997) writes, "Abduction is the process with which we engender new ideas, explanatory hypotheses and theories, both in the field of science *and in everyday life* (my italics). Shotter misses that, for Peirce, abduction is not only about the practice of science but is a pervasive and continuous part of our ongoing functioning. For example, it is an essential part of perception, our apprehension of the world at all times:

Abductive inference shades into perceptual judgment without any sharp line of demarcation between them; or, in other words, our first premises, the perceptual judgments, are to be regarded as an extreme case of abductive inferences (Peirce, 1903: 5.181).

Peirce considers the case of visual illusions in which "a certain theory of interpretation of the figure has all the appearance of being given in perception" (5.183). Consider the well-known drawing of the cube described by Necker (1832) (see *Figure 5*). Our perceptual system struggles to interpret the ambiguous figure. Peirce says, "Some unconscious part of the mind seems to tire of putting that construction[100] upon it" (ibid) and it appears to switch to the other configuration and then back again. Visual illusions are for

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Peirce, "true connecting links between abductions and perceptions" (5.183). Although apparently quite unusual phenomena, in fact they expose the processes of perception occurring in us all the time[101]. Richard Gregory[102] (1980) writes about perceptions as hypotheses, arguing that "all sensory and instrumental data are, strictly speaking, ambiguous" (1980: 183) (and therefore in Kellian terms always open to reconstruction).
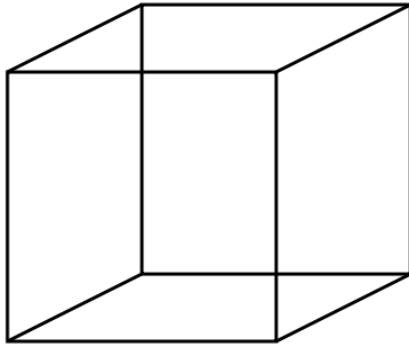

Figure 5: *The Necker Cube*

As we saw, Peirce refers to the abduction utilised to make sense in perception as a *perceptual judgment*[103] (PJ). Though there is some ambiguity in his theorising here[104]; if we take the Necker cube, the PJ interprets the *percept*, the form of the sensory given, making a construction of it as a cube in three dimensions, judging it to be *this way* or *that way*. He later introduced the term *percipuum* to denote the perception resulting from the action of the PJ on the percept, here an image of the cube in the particular orientation, as we briefly experience it. The percipuum is the fusing of the percept and the PJ into a single whole[105] (Hookway 1985, 166). It is an *unconscious process*: we are not aware of the percept or the PJ, but the result "brings us face-to-face with the brute 'thereness', the obtrusiveness, of external existence" (Gallie, 1952, 104):

> *The percipuum, then, is what forces itself upon your acknowledgment, without any why or wherefore, so that if anybody asks you why you should regard it as appearing so and so, all you can say is, "I can't help it. That is how I see it." (Peirce, 1903, 7.643, cited in Bergman, 2007).*

Other examples given by Peirce are the illusory perception of motion as we sit in a stationary train and the "filling in" of the blind spot:

> *"Why do I have the idea that that train is at rest and that we are moving? There is no answer except that such is the percipuum, and I cannot help it" (7.643)*

> *(We) often think that something is presented to us as a picture, while it is really* constructed *from slight data by the understanding (5.302).*

> *The same thing is shown by our not being able to perceive that there is a large blind spot near the middle of the retina. If, then, we have a picture before us when we see, it is one* constructed *by the mind*[106] *at the suggestion of previous sensations (5.303) (my emphasis).*

But abduction is central not just in *perception* but operates in all areas of psychological functioning, in action, emotion, memory, language and social interaction. All the time in our *actions* and when we move, we are consciously or unconsciously making hypotheses and guessing: when we walk along a stony path, we are judging where next to put our foot (and this, of course, applies also to animals). The fallibility of the judgment is only too clear when we miss a step at the bottom of a staircase. Bateson (1980) draws on Peirce's concept of abduction, giving the example of the act of shooting a flying bird involving a judgment on the basis of the "aggregate of information taken in through the senses" (p. 211).

Peirce explores the *emotional side* of abduction[107]: "emotion is essentially the same thing as an hypothetic inference, and every hypothetic inference involves the formation of such an emotion" (2.643). *Memory* involves huge selection and creative reconstruction on the basis of a hypothesis: "We are led to believe that we remember the occurrences of yesterday from our feeling as if we did so"[108]. And when we try and remember a word or name, we often have a hypothesis about its acoustic sound and form before it pops into our mind. Nubiola (1997) suggests that naming and indeed all speech, writing and communicating, involve abduction. Nesher

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(2001) argues against Chomsky and Fodor for their reliance on closed formal deductive systems in their explanation of language development. In learning language the child continuously generates abductive hypotheses and "elaborates her linguistic competence and performance by controlling, criticizing, and correcting her previously learned expressions and rules of language" (p. 33). He concludes that Chomsky seriously underestimates the extent to which linguistic structures and rules develop out of their pre-linguistic and sensorimotor precursors. This fits in with PCP, where Kelly argues for a well-formed system of preverbal constructs well before the appearance of language. Shotter (2011) sensitively explores many examples of abduction as we engage in *social interaction* and emotional expression, suggesting that abduction is thoroughly *embodied* and that a study of this constitutes a new realm of inquiry.

We are clearly describing here what, for Kelly, is the process of *construing* itself, although for him, it is a mistake to divide functioning up into compartments of thinking, emotion, action, perception etc. We are from the start whole beings. Indeed he suggests that, "there is something in stating a new outlook in the form of a hypothesis that leaves the person himself intact and whole" (Kelly, 1964, 156).

The Necker cube and other visual examples show abduction as not involving *language* at all, even though it is claimed that an *inference* is taking place. The cube switches between appearing "this way" and "that way" but these alternatives do not seem to have verbal labels attached to them[109]. This is a lovely example of what Kelly means by a construct. In claiming the possibility of *preverbal constructs,* he argues that construing should never be confounded with verbal formulation (Kelly, 1955, 51). Nevertheless, it is clear that much abduction does involve language:

> *Looking out of my window this lovely spring morning I see an azalea in full bloom. No, no! I do not see that; though that is the only way I can describe what I see.* That *is a proposition, a sentence, a fact; but what I perceive is not proposition, sentence, fact, but only an image, which I make intelligible in part by means of a statement of fact. This statement is*

> *abstract; but what I see is concrete. I perform an abduction when I so much as express in a sentence anything I see (Peirce, MS 692: 29–30, cited in Eco and Sebeok, 1988: 16).*

The perceptual judgment is here clearly in words, in the form of a proposition. There is a potential confusion in this example of the azalea between *perception* and *reflection upon that perception.* Both clearly involve abduction or for PCP, construing. But abduction involves something broader and more fundamental than words. Peirce refers clarifies this in his reference to a *conception* or an *idea*:

> *Quality seems at first sight to be given in the impression, but such results of introspection must not be trusted. We judge one* conception *to be applicable to another, more directly experienced…and that idea, brought from my previous reflections, is applicable to this thing I see before me – that is not seen, but is rather a theory to account for what I see. The same thing is true in the case of every judgment. It is not given in sense; it is a theory of the sense-impression. This is the case even with what are called qualities of sensation. I look at a black stove. There is a direct sensation of blackness. But if I judge the stove to be black, I am comparing this experience with previous experiences. I am associating the sensation with a familiar* idea *derived from former black objects. When I say to myself the stove is black, I am making a little theory to account for the look of it (Peirce, 1867, my emphasis).*

Peirce and Kelly are one here in inviting us to consider the profound and radical view that we human beings, whether we acknowledge it or not, are *scientists.* It goes back to the first assumption made by both Kelly and Peirce discussed in Part I of this series (Procter, 2014a, 11) in which all cognition, in Peirce's (1868) words, is based on previous cognitions. Both writers were concerned in this to critique the empiricism of John Locke, for whom sensations are *given.* In an important paper, Kelly (1964) distinguishes his position from both empiricism and phenomenology, critiquing the "objective language":

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If I say, "The floor is hard," I employ a language system in which the subject-predicate relationship inheres in the subject itself. It is the floor which is hard, and is its nature, regardless of who says so. The statement stands, not because the speaker said it, but because the floor happened to be what it is. The sentence's validity stems from the floor and not from the speaker (Kelly, 1964, 148).

He describes this language as committing a "*subject-predicate error* of so-called objective speech" in which we can find ourselves trapped (p. 155). He contrasts this with a second use of language, in phenomenology, in which such a statement only portrays the state of mind of the speaker[110]. Rather, he argues for a third possibility which he labels "*the invitational mood*" as opposed to the *indicative mood* of objective speech. Here, we would say, "Suppose we regard the floor as if it were hard". Language is here used as a device for *anticipating events* in line with his fundamental postulate, which we compared earlier to Peirce's pragmatic maxim (see above and in Procter 2014a, 26).

Just like Peirce, he insists that hypothesising is essential to scientific inquiry:

Make-believe (is) an essential feature of science...Probably nothing has contributed so much to the adventuresome development of scientific thinking as the understanding of hypothetical reasoning[111] (Kelly, 1964, 150, 152).

Kelly sees the activities of the scientist as very similar to the *novelist*, both rely on "make-believe"[112]. But the former is ashamed to admit the use of fantasy in fitting in with the dominant notion of the way scientists think. The received ideology that scientific theory is derived only inductively from 'findings' causes the scientist to deny his or her own creativity and secretly to wait until evidence to support the idea has been accumulated. "He (sic) can then:

claim that he was simply a careful observer and that, being a careful observer, he 'discovered' something. But unless he had been willing, at some point in the sequence, to open his mind to possibilities

contrary to what was regarded as perfectly obvious, he would have been unable to come up with anything new" (Kelly, 1964,150).

The process of abduction

But how does this creative process of abduction, this important way in which new ideas are created, occur? To attempt to grasp this adequately, we must first return to the visions of growth and change to be found in the work of both Peirce and Kelly, discussed under the seventh assumption examined in Part I of this series (Procter, 2014a, 21 – 25), which provides a crucial context within which to consider how abduction and the generation of ideas occur. Summarising this briefly here, Peirce sees in the universe everywhere spontaneity and growth, leading to increasing complexity and diversity. The mechanism for this is *semiosis* or *sign-activity* in which symbols grow in use and experience. This is largely unconscious in us (though potentially accessible – "a sufficiently energetic effort of attention would bring it out" (5.441)): As quoted earlier, there are "a hundred things" or trains of thinking in our minds at any time, only a small fraction of which we are aware. An idea progressively splits into special cases, though this is guided by a "parent conception", a view which we connected with Kelly's view of superordinate constructs governing the development of a hierarchical construct system. For Kelly, we are always actively changing; movement is an essential property of our being. The construct system elaborates more and more constructs and subsystems, through cycles of experience and creativity, with the superordinates broadening and deepening as it does so. All this of course is description, but an important assumptive *context* for the explanation of the process of abduction.

In 1861, Frances Longfellow, the wife of the poet, well-known to the Peirce family, died after her dress caught fire, her husband receiving serious burns in trrying to save her[113]. Peirce recalls:

I well remember when I was a boy and my brother Herbert...was scarce more than a child, one day, as the whole family were at table, some spirit from a 'blazer' or 'chafing-dish,' dropped on the muslin

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dress of one of the ladies and was kindled; and how instantly he jumped up, and did the right thing, and how skilfully each motion was adapted to the purpose. I asked him afterward about it; and he told me that since Mrs. Longfellow's death, it was that he had often run over in imagination all the details of what ought to be done in such an emergency. It was a striking example of a real habit produced by exercises in the imagination. (5.487 n. 10)

For Peirce, one of the most important abilities we have, as humans, is our use of the *imagination,* in which we can conduct *mental experiments,* create scenarios and plan and prepare ourselves for any eventuality, to the extent that we can anticipate it:

Concepts are mental habits, habits formed by exercise of the imagination. Human instinct[114] is no whit less miraculous than that of the bird, the beaver, or the ant. Only, instead of being directed to bodily motions, such as singing and flying; or to the construction of dwellings, or to the organization of communities, its theatre is the plastic inner world, and its products are the marvellous conceptions of which the greatest are the ideas of number, time, and space (Peirce, MS 318, 44; cited in Colapietro, 1989, 114)

In this "plastic inner world", a "theatre of the imagination", we can exercise mental *self-control* but we can also surrender our control. As a young man, Peirce was inspired by the German poet Schiller, who talked of the drive to free play, or *Spieltrieb*[115], which Peirce called 'the play of musement'. Hanson (1960a, 187) called it 'pre-reflective inquiry'. When attempting to solve a problem, Peirce advises us to:

Enter your skiff of musement, push off into the lake of thought, and leave the breath of heaven to swell your sail. With your eyes open, awake to what is about or within you, and open conversation with yourself; for such is all meditation (6.461)[116].

This state of "reverie" was used by Dupin, the hero of the first detective story writer[117] Edgar Allan Poe, whom Peirce mentions several times in the collected works (Harrowitz, 1988). Dupin entered this state in order to solve the puzzles with which he was confronted:

Dupin's mind works by association…It partakes of the irrational, and is therefore the highest kind of ratiocination, since it is not captive of its own premises. What Dupin is so adept at looks to me very much like what 'analysts' in our own day call the pre-conscious mind. *Dupin can surrender to the associative linkages of preconscious thought…his mind working by metaphoric analogies (Hoffman, 1973, cited in Harrowitz, 1988).*

Gregory Bateson, who used Peirce's concept of abduction quite extensively in his writings, makes a great deal of the power of comparing two or more different views or bringing together apparently unrelated phenomena. This appears in various guises – the *pattern which connects, double description* and his analogy of *binocular vision* in which the comparison of information from two views adds a third dimension of depth, both literally and metaphorically: "the aggregate is greater than the sum of its parts" (Bateson, 1980, 99). His definition of abduction elaborates Peirce's and extends it. For him abduction is the "lateral extension of abstract components of a description" (ibid, 157). The phenomenon for Bateson is:

Enormously more widespread than he or she might, at first thought, have supposed. Metaphor, dream, parable, analogy, the whole of art…science, religion, totemism…the organisation of facts in comparative anatomy…Newton's analysis of the solar system and the periodic table…all thought would be totally impossible in a universe in which abduction were not expectable (Bateson, 1980, 157).

Both Von Glasersfeld (1998) and Prawat (1999), tackle what is known as the *learning paradox*, which ponders how we are able to learn anything new, given that more complex learning develops out of less complex learning. The former, critiquing Fodor, sees it as a pseudo-problem based on seeing *induction* as the main mechanism in

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learning. Both writers draw on Peirce's notion of abduction to address the issue. Peirce saw abduction as primarily a *metaphoric process* (Prawat, 1999, 62). Metaphor is often taken as linguistic[118] but Prawat demonstrates that both abduction and metaphor are wider than and outside language, although it is a vital process in the formation of words in a language:

> There is no possibility of framing words, or conceptions either, unless it be in the most scanty and insufficient supply, otherwise than by metaphors founded on human conduct *(Peirce, 1994, cited in Prawat, 1999, 62).*

It will be remembered from our discussion of deduction that Peirce classified metaphor as primarily falling under the *iconic*[119]. Prawat gives a lovely example of metaphor in teaching children about photosynthesis in which the processes in a leaf are compared to a food factory. Once students are captivated by this image, they can themselves develop new learning by applying further attributes of the factory to the leaf – supplies as food for the plant, the energy required, smoke from the chimney as respiration and so on. Bateson would say that we can see *patterns which connect* the two previously unrelated domains.

Abduction for Bateson involves a *search* or "seeking other cases which will be analogous…in the sense of belonging under the same rule" (1979, 153). This often involves going outside the area of concern to something apparently entirely unrelated. Prefiguring Kelly's idea of the creativity cycle of loosening and tightening construing[120], in 1935 Bateson writes, "advances in scientific thought come from a *combination of loose and strict thinking*, and this combination is the most precious tool of science" (Bateson, 1972, 75). Milton Erickson (1976), who always emphasised that we have the resources in the 'vast storehouse of our unconscious minds' to solve our problems, deliberately stimulated the process of *unconscious search* in his clients by using trance states, metaphor, analogies, stories, puns and jokes, creating expectancy, surprise and confusion to help create new perspectives and thereby disrupting rigid dysfunctional patterns of construing (see Procter and Brennan, 1985).

We will recall from the beginning of our discussion of abduction, that Hanson critiqued the hypothetico-deductive approach for failing to address the *conceptual context* of the discovery process. Maddalena explains how Peirce identified two sources of knowledge which act as a resource of material available for abduction to generate new hypotheses and perspectives:

> When we face an ambiguous sign that can be interpreted in many ways we have to use what Peirce calls 'collateral observation' (8.179), that is a knowledge obtained from other previous experiences of the same object…Beside it Peirce discerns also a kind of knowledge obtained 'by acquaintance with the general system of signs' This latter is the precomprehension of the general order of signs without which we could not put the object (even the object known by collateral observation) within a significant pattern *(Maddalena, 2005, 251).*

Peirce gives an example of collateral knowledge. If someone includes in a sentence a name we have not heard before, for example *Napoleon,* "the sentence will mean no more to him than that (there is) some person or thing to which the name "Napoleon" has been attached" (8.178). But in the course of our lives, our education and exposure to countless examples, a "habit has been established in him by which that word calls up a variety of attributes of Napoleon the man. Much the same thing is true in regard to any sign" (ibid). This is how Kelly's vision of *personal construing* arises. Every single word that we have learned is imbued with the memory of the personal experience of a myriad of occasions in which we heard it or in which we used it, building up in each of us Erickson's 'vast storehouse' of knowledge and abilities. For Kelly each of us evolves a personal construct system which constitutes a much richer resource than is usually acknowledged, containing as it does the results of the history of our entire struggles to deal with the world and solve the continuous train of puzzles and challenges that it presents us with. Peirce reminds us of "the inexhaustible intricacy of the fabric of conceptions, which is such that I do not flatter myself that I have ever

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analyzed a single idea into its constituent elements" (1.523).

The second kind of knowledge against which this more specific collateral knowledge exists, we might refer to what Popper called a vast amount of traditional or *background knowledge*[121]. Popper himself introduces this term with a warning of it as a source of uncritical acceptance, but we can easily reinterpret it more positively as an infinite resource of potential examples, analogies and metaphors for explaining the phenomenon we are faced with. Bonfantini and Proni summarise this vision as follows:

> *When men (sic) have to guess, they find themselves guided by systematic and complex visions of reality, philosophical conceptions, of which they are more or less distinctly aware but which anyway shape their cast of mind, their deep habits which determine the bearings of judgment. These philosophies synthesize and organize, by processes of generalization, analogy, and hierarchical ordering, the knowledge and cultural acquisitions deposited in the course of the centuries and derive from extensive social practices…these philosophies possess (obviously with varying degree) their force of truth, including the capacity to inspire new and valid scientific hypotheses (Bonfantini and Proni, 1988, 134).*

We have looked at particular, discrete examples of abduction but it is clear that it is a process that is going on continuously as we live our lives and interact with others and our environment. "We do not confront a discrete series of percepts (or percipua[122]) but we are aware of a continuous flow of experience" (Hookway, 1985, 165). Perception involves a "continuous series of what discretely and consciously performed, would be abductions" (5.187). Even in an unchanging situation, for example perceiving a chair, we are "keeping contact with it and judging that it is (still) a chair" (Hookway, loc. cit.). It becomes clear that Peirce's process of abduction comes close, maybe identical, to what Kelly called *construing* or *construction*.

The term abduction has a wide range of application from this *continuous construing*, to

immediate 'flashes' or *epiphanies* of a new connection, through to the deliberate application of a series of steps in the process of problem-solving or scientific inquiry. The Necker cube orientation suddenly appears to us; Archimedes' "eureka moment" when he realised about the displacement of water, or Kekulé's solution of the ring structure of benzene when he dreamt of a snake biting its own tail are examples of epiphany. Which came first for Kekulé, the construct of *cyclic* (versus *chain*) or the image of the snake? It could have been either – he could have thought of a cyclic structure with the construct then generating the dream image of the snake; or he could have had the image which he then construed as 'cyclic'. Probably they occurred simultaneously or so rapidly as to be effectively simultaneous. Such is the experience of 'epiphanies'. (Of course, if we recall the earlier discussion that logic is distinct from and lies outside psychology, from a logical point of view the actual mental process involved is not relevant). The other end of the scale is illustrated by Kepler's painstaking discovery of the elliptical orbit of the planet Mars. Peirce (1.72) recounts the painful steps and great labour that Kepler undertook in deciphering and proving this, describing it as the "greatest piece of retroductive reasoning ever performed" (1.74).

Whilst new ideas may be generated interpersonally, in a team of collaborators, each act of abduction typically occurs in the *individual*, although no doubt also the result of internal dialogical processes. As Peirce scholars Floyd Merrell and Sandra Rosenthal put it, "the process of hypothesis formation is put into play by an individual act of abduction" (Merrell, 2000) and "there is a creative element in perceptual awareness, an interpretive creativity brought by the perceiver (Rosenthal, 2004, 193). For PCP, this ties in with the emphasis put on *personal construing*, however much we as individuals are also subject to the pervasive influence of the social construction of the societies, cultures and discourses in which we are thrown (Procter, 2016). For Kelly indeed our uniqueness and creativity is central to what makes us into a person. As we quoted earlier, "there is something in stating a new outlook in the form of a hypothesis that leaves the person himself intact and whole" (Kelly, 1964, 156).

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To summarise, we have seen how for both Peirce and Kelly, abduction or making hypotheses is a central process in science and indeed, in everyday life. Peirce argues that it occurs in our very perceptual judgments as well as in a range of other psychological functions. For Kelly, the metaphor of *people as scientists* throws a great deal of light on how we function as human beings all the time. Central to Kelly's psychology is the spirit of 'make-believe', imagination, experiment, playfulness, enactment. For Kelly (1970a), we can only understand a person's behaviour and experience if we know what questions they are asking, what hypotheses they are testing. Even the way we dress including the use of costume, masks, uniforms, badges and the like, are ways people have of posing hypotheses about who they are and how they might be judged (Kelly, 1964, 158). This is the basis for one of his favourite metaphors, "try a new way of looking at things on for size" – an essential aspect of his psychotherapy, involving encouraging clients to ask new questions, including enacting different roles to discover new perspectives and understandings. As we saw, Kelly talks of the 'invitational mood', in which we "suppose looking at something in the following way". Peirce argues that this process of abduction, the initial generation and selection of hypotheses, is a *logical* process, not just a chance affair or a matter for psychology or sociology. Kelly's system complements Peirce's and provides another language which may help us to see more clearly and perhaps establish how abduction works.

ABDUCTION–DEDUCTION–INDUCTION: THE CYCLES OF INQUIRY

We are now in a position to gain an overview of the broadened logic that Peirce spent his life developing and elaborating. As early as 1865, at the age of 26, Peirce had decided that the three forms of inference, deduction, induction and abduction were distinct and independent of each other (Seibert, 2005) and were combined together in the process of inquiry.

Deduction

Deduction establishes *necessary* conclusions, things which *must be*. As we have seen, deduction for Peirce is a form of logical inference that is performed in the realm of the *iconic*. Pietarinen (2012) claims that, "Peirce was motivated in his diagram logic by finding an iconic basis for all reasoning, especially necessary (deductive) reasoning" (p.259). *Similarity considerations* are central to iconicity[123]. This is for us of central importance because in Kelly's vision, *similarity* (or *resemblance*) versus *difference* (or *contrast*), is the main construct which underlies and governs the process of all construing itself.

Peirce divides the iconic into *images, diagrams* and *metaphors,* which rest on a continuum of increasing complexity[124]. The iconic itself is one of a trio of types of signs, the *iconic, indexical* and *symbolic*[125]. Only in the last does *language* fully appear, defining the iconic as largely *outside of language,* or better *preceding* or *prior* to language: in Kelly's terms, *preverbal.* Although discussions of deduction usually rely on examples given in language (including logical symbols) such as in the various forms of *syllogism*, Peirce insists,

> *All deductive reasoning, even simple syllogism, involves an element of observation; namely, deduction consists in constructing an icon or diagram, the relations of whose parts shall present a complete analogy with those of the parts of the object of reasoning (Peirce, 3.363).*

We are in the realm here of the *spatio-temporal.* In our interactions with the physical world, from a young child manipulating physical objects, solving jigsaw and other puzzles, to finding how things fit together in construction or engineering, deductive reasoning is in evidence. Through the iconic process of *metaphor,* the spatio-temporal constructs of *close-distant, up-down, in-out* (inclusion v. exclusion) and, *before-after*[126], amongst many others, turn out to be central in the realm of the social too, in understanding human relations as well as in the realm of objects in the physical world[127]. The underlying constructs begin to govern functioning in these apparently separated domains. We will have more to say about this when we discuss dialogical

processes and intersubjectivity in Part III of this series.

Induction

Induction is the process whereby we establish a *rule, law* or a *general conception.* This allows us to anticipate events on the basis of perceived regularities in our experience. It always remains *fallible* although judgements relying on induction are subject to *self-correction* and over time a bedrock of assumptions is built up which are dependable enough for it to be *reasonable* for us to rely on them. For Peirce it leads to the generation of *habits of expectation* which we may equate with Kelly's notion of *channelization.* Our anticipations channelize our processes, forming constructs. We may use the word *rules* to describe these habits, but we are talking here of *logical determination,* not *causal determination.* The rules are normative guidelines which, in any particular circumstance, with discretion we *choose* to follow, but only if indicated by the appraisal of the new situation in the light of its uniqueness and its particular context.

Over time this leads to a hierarchical system of conceptual structure or for Kelly a unique system of constructs in which there is an *ordinal relation* between wider more enduring *superordinate constructs,* which entail and govern the *subordinate constructs* which they subsume. Although these superordinates can be put into *propositional form*, they are deeply action based and function, in Wittgenstein's terms like *hinges* or *axes* about which our processes rotate. They can only be *discovered subsequently* (Shotter's *after-the fact)* and are *learned implicitly*, perhaps through a process that Cromwell describes, in which superordinates are formed from the overlap or redundancy in the occurrence of parallel simultaneous constructions.

Abduction

Abduction is the form of inference that proposes what *may be*, what is *possible*. By establishing a *hypothesis*, it allows sense to be made of the *manifold* (Kant) or *aggregate* (Bateson) of disparate sensations and data that confront us, allowing them to be reduced to *unity*[128]. It is the only source of genuinely *new ideas*, which of course whilst new, are generated within a framework of existing cognitions and traditions, the *collateral* and *background knowledge* of elements which are combined in a new and original way. The process of abduction is not necessarily deliberate or conscious and indeed comprises the mechanisms of *perceptual judgement,* in which for instance the *perceptual constancies* of *size, shape* and *brightness* are automatically calculated whatever distance away or angle an object might be presented to us.

Likewise, in coming up with creative new ideas in arts, science or everyday life, they are often formed, apparently autonomously, in the *theatre of the imagination*, in *mental experiments.* A process of *search* occurs, either automatically or deliberately conducted, with the source of material sometimes being in areas far removed from the subject of concern. The new idea may emerge gradually over a period of time, but is often experienced in a *flash* or is present when we wake up in the morning. Whilst new ideas may be generated interpersonally, in a team of collaborators, abduction most typically occurs in the *individual*, although no doubt also the result of internal dialogical processes (see Part III of this series). Kelly emphasised that there is nothing to stop us holding several contradictory hypotheses at the *same time*. We conduct this in the *invitational mood* as we "try them on for size" in the process of inquiry.

Whilst we can divide the process of inference and inquiry into the *three separate forms,* in reality they are part of a continuous complex process: "Though inference is thus of three essentially different species, it also belongs to one genus[129]" (Peirce, 1868, 5.278). Gallie writes:

> *Thought at all levels – the perceptual, the inquisitive, the deliberate, the scientific – displays, in Peirce's view, the same fundamental pattern: it is the matter of the* mutual interplay, *the continuous mutual support, of inferences of the three types we have distinguished (Gallie, 1952, p. 99, my emphasis).*

The three categories "incessantly find themselves in an interrelated swirl of interdependent interaction" (Merrell, 2000, p. 1). Whilst in practice it is hard to disentangle them, it is still useful

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to distinguish them for the purposes of discussion and understanding. They can be seen as *stages* in the process of inquiry:

> *Abduction invents or proposes a hypothesis; it is the initial proposal of a hypothesis on probation to account for the facts. Deduction explicates hypotheses, deducing from them the necessary consequences which may be tested. Induction consists in the process of testing hypotheses (Fann, 1970, p.10)*
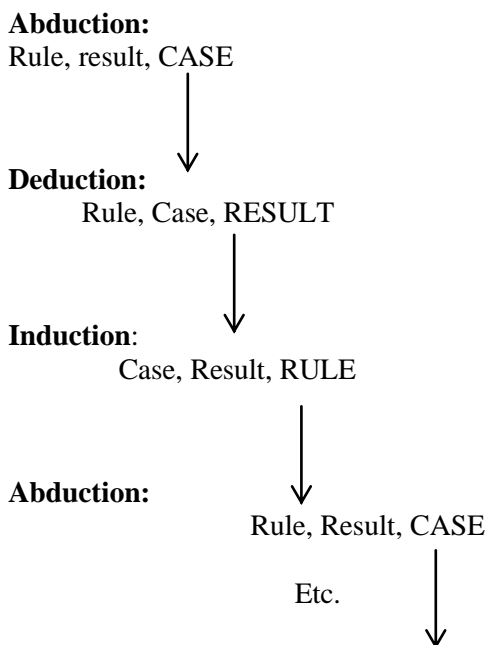
Abduction:
Rule, result, CASE

Deduction:
Rule, Case, RESULT

Induction:
Case, Result, RULE

Abduction:
Rule, Result, CASE

Etc.

Figure 6: *The stages in the cycle of inquiry*

Figure 6 shows one way in which the chain of inquiry might occur. We can place abduction at the beginning of the sequence, but of course it is stimulated by an encounter with a *surprising phenomenon*,[130] an event we have been unable to anticipate within our existing understandings, an exception to the predictions that induction has generated. We are therefore considering the inquiry process as a *cycle,* or better, a *spiral,* reminiscent of the concept of the *hermeneutic circle* (Riemer, 1996), in which the interpreter of texts alternates between the *parts* and the *whole*, a part only gaining some meaning in the context of a provisional whole, and the understanding of the whole only making more sense as the meanings of the parts are better clarified. Ines Riemer ar-

gues that hermeneutics unites the natural and human sciences and that Peirce's trio of inferences, "can give us a precise idea about the methodology of the kind of spiral in question" (ibid, p. 391). She quotes Peirce:

> *(Pragmatists') method of ascertaining the meanings of words and concepts is no other than that experimental method by which all the successful sciences…have reached the degrees of certainty that are severally proper to them today (5.465).*

Kepler and the orbits of the planets

At the other end of the scale from the immediate interpretation of texts and utterances, let us look at an example of extended inquiry in the work of Johannes Kepler's (1571 – 1630) who spent years struggling to work out the orbits of the planets. We can identify aspects of the trio of inferences in his inquiry into the orbit of Mars, which Peirce praised so highly[131]. Already in 1596, with an epiphany that geometry was relevant to planetary orbits, Kepler was experimenting with polygons and polyhedrons to explain, for example, the conjunction of Jupiter and Saturn[132]. Ptolemy (AD 100 – 170) had proposed circular orbits around the earth, but these did not fit exactly. Copernicus had presented his heliocentric theory, with the sun at the centre of the orbits fifty years before.

> *But Kepler did not understand the matter quite as Copernicus did. Because the sun was so near the centre of the system, and was of vast size (even Kepler knew its diameter must be at least fifteen times that of the earth), Kepler, looking at the matter dynamically, thought it must have something to do with [the sun] causing the planets to move in their orbits. This retroduction (abduction) vague as it was, cost great intellectual labor, and was most important in its bearings upon all Kepler's work (Peirce, 1.72).*

Tycho Brahe did not accept the heliocentric theory, but had accumulated vast amounts of detailed observations of the planets' paths. Kepler

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worked with Brahe in the last months of his life, but long enough to understand his data.

In his quest, Kepler started with the assumption of circular orbits, but observations suggested that the orbit was compressed. He was confronted by a surprising fact: Mars moved at a non-uniform speed[133], moving faster at the points nearer the ends of the elongated circle. He struggled through a complicated pathway of painstaking inquiry, including dealing with some of the observations being mistaken. Peirce writes, "he obtained a theory of Mars which satisfied the longitudes at all the oppositions observed by Tycho and himself, thirteen in number, to perfection. But unfortunately, it did not satisfy the latitudes at all and was totally irreconcilable with observations of Mars when far from opposition" to the sun.[134] He went through a further series of hypotheses, including orbits as oval, before culminating in the correct result of an elliptical orbit for Mars (Kiikeri, 2001, Ma and Pietarinen, 2015). This became known as Kepler's First Law.

The path of Kepler's inquiry followed a complex interplay of abductions, deductions and inductions, too extensive to do justice to here.

But examples of each form of inference can be identified as steps in the cycle. His *abductions* were based on a keen background knowledge of the work of his predecessors, the accumulated historical and current observations and measurements and, crucially, his fine grasp of geometry. Peirce writes, "Kepler's discovery would not have been possible without the doctrine of conics" (1.72). He realized that he needed a detailed understanding of the conic sections as he was working on his treatise on optics as well as on his astronomy.[135]

Figure 7 shows the series of curves that result from slicing a cone at different angles. This was known to the ancients, but Kepler was the first to understand it *dynamically*, seeing that the circle, ellipse, parabola and hyperbola form a *family of curves* which morph into each other in a continuity[136], as the angle of slicing increases. Kepler similarly saw the circle as a special case of the ellipse. The latter has two points, first named as *foci* (F_1 and F_2 in *Figure 7*) by Kepler in 1604.[137] The circle is the shape that results when the foci are moved towards each other, so as to coincide.
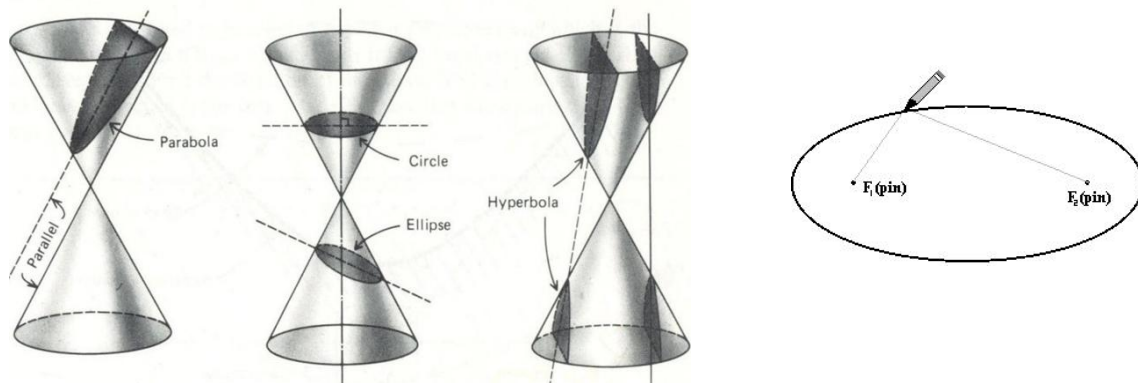

Figure 7. *The family of curves from conic sections;[138] The two foci (F_1 & F_2) of an ellipse*[139]

This background knowledge and his ability to visualise the morphing of curves enabled Kepler, in an extraordinary abduction, to postulate that the sun is positioned at one of the foci of Mars' elliptical orbit, the other focus remaining emp-

ty[140]. He realised that the sun positioned at this point would simplify the description and the equations considerably, but had to encounter innumerable problems in working it out, such as that the earth, by *induction,* also moves in an

ellipse, (but one in which the line connecting the foci was not parallel to Mars' ellipse). All the calculations had of course to allow for the point of observation (the earth) moving in this curve all the time, not a fixed and stationary viewing point, as Ptolemy had envisaged.

Deduction was operating in all the working out of the implications of the different possible models postulated, using the equations of triangulation and of the conic sections. He used deduction cleverly to work out the best times to take the observations for determining Mars' orbit, when it was nearest to the sun. *Induction* is involved in the predictions arising from and testing of each hypothesis culminating in the discovery of Kepler's three laws themselves. The generalisation to the orbit of Jupiter and the other planets (induction) was confirmed similarly to be elliptical. It also exposed many false leads, where the data did not fit, such as where the equations could predict Mars' longitudinal (N – S) but not latitudinal (E – W) positions.

It was by deduction that Newton was able to use Kepler's laws to derive the inverse square law of universal gravitation[141]. Peirce writes:

> *Kepler's discovery rendered Newton possible, and Newton rendered modern physics possible, with the steam engine, electricity, and all the other sources of the stupendous fortunes of our age...There was the future of the human race almost trembling in the balance; for had not the geometry of conic sections already been worked out in large measure, and had their opinion that only sciences, apparently useful, ought to be pursued, the nineteenth century would have had none of those characters which distinguish it from the* ancien régime. *(Peirce: CP 1.76).*

Kepler's work gives us a supreme example of the process of scientific inquiry in action, allowing us to examine the complex interplay of abduction, deduction and induction. But the inquiry process does not just belong to the province of extraordinary figures such as Kepler. As Kelly and Peirce insist, we are all involved in undertaking these processes all the time as we live our everyday lives. The idea of *cycles* of inquiry find their versions in Kelly's *experience, creativity* and *CPC cycles*. I believe the two descriptions of

the cycles complement each other well, and there is ample room for further study in comparing and cross-fertilising the two approaches. The experience cycle with its five stages seems to cover the same ground as Peirce's description of the interplay of the trio of forms of inference. Kelly (1970b) describes the stages as anticipation, investment, confirmation or disconfirmation and constructive revision, followed by new anticipations (p. 18). Kelly's psychological terms can be clearly related to the underlying logic provided by Peirce. For example, *anticipation* and *confirmation/disconfirmation* clearly relates to induction, *investment* to deduction and *construct revision* to abduction. Future research and study could reveal whether this is a fruitful field of investigation. Similarly with the CPC and creativity cycles, many potential fruitful comparisons can be made. The creativity cycle, the process of how people come up with new ideas through a process of *loosening* and *tightening* constructs, clearly relates and throws light on the examples given earlier in our description of abduction. The process of *circumspection* in the CPC cycle describes searching in the fields of collateral and background knowledge for constructs relevant to situations and *pre-emption* relates to the phase of abduction in which the most plausible hypothesis is selected. The *control* phase links to Peirce's central concept of self-control, a topic we will be exploring in Part III of this series.

In an article on psychological assessment in the Annual Review of Psychology, Kelly (1958) opened with the following remarks:

> *It may take a while for it to happen, but surely someday scientists will be able to rid themselves of the notion that, while things can be invented, ideas can only be discovered. It would be far better to believe that all ideas are sheer fabrications and that it is only the palpable things that sit around waiting to be discovered. Such a view would help to* advance creative thinking to its proper phase in the cycle of scientific reasoning. *It would also cast empiricism in its proper role – the discovery of what things ensue from the courageous application of invented ideas (Kelly, 1958, 323, my emphasis).*

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LOGIC, SYSTEMS AND CONSTRUING: TOWARDS SEMIOTICS

In this final section, we will sketch the vision that we will be elaborating in the Part III, the next paper in this series, having laid some foundations in this paper. We saw at the beginning of this paper that Peirce sought to clarify the relationship between logic as a normative discipline and psychology as one of the special sciences. Logic (along with ethics and aesthetics) is seen as superordinate to and governing the formulations and practices of psychology and is not dependent on psychology in its own formulations. Kelly might be seen to respond to such an asymmetry of disciplines by providing us with *both* a logic *and* a psychology in one unified system. He is unusual amongst psychologists in putting a fundamental emphasis on logic and placing it at the core of his theorising: The Fundamental Postulate is an "an assumption so basic in nature that it antecedes everything which is said in the logical system which it supports"[142]. But what we might call his *personal construct logic* is a departure from classical logic in being "nearer representing the way people actually think"[143]: He talks of relying on the principles of a *pragmatic logic*[144] and regards formal logic as being "too shackled by words"[145].

Peirce set out to critique and considerably broaden logic in several important ways. Taking a central place in his system of logic are his three forms of inference, in which he adds *abduction* (or *retroduction*) to the two existing well-established forms of deduction and *induction*, placing the creation of *hypotheses* into a position of equal importance in relation to the other two and seeing the process of inquiry as cycles comprising the three forms working in concert. We saw how the abduction of new hypotheses corresponds very closely to what Kelly envisaged as the process of *construing* itself. His deconstruction of *deduction* involves, as we have seen, a reliance upon *iconicity*, in the form of images, diagrams and metaphors[146]. In our discussion of *induction*, we saw that it plays its part in contributing to the background of *regulative assumptions*, which we associated with Wittgenstein's *hinge certainties* and with Kelly's *superordinate constructs*. Another crucial innovation which Peirce introduced in logic, which we have not yet discussed, is his *logic of relations*, or

relatives. We will be examining this in more detail in Part III of this series, where we will see that it involves a critique of traditional logic's reliance on *class* and the introduction of the concept of a *system*:

> *Thus, the ordinary logic has a great deal to say about genera and species, or in our nineteenth century dialect, about* classes. *Now, a* class *is a set of objects comprising all that stand to one another in a special relation of similarity. But where ordinary logic talks of classes, the logic of relatives talks of* systems. *A* system *is a set of objects comprising all that stand to one another in a group of connected relations. Induction according to ordinary logic rises from the contemplation of a sample of a class, to that of the whole class; but according to the logic of relatives, it rises from the contemplation of a fragment of a system to the envisagement of the complete system (Peirce, 4.5, cited in Raposa, 1984, 151, my emphasis).*

The logic of classes was a dominant discourse in the twentieth century literature on logic, following Russell and Whitehead's enormously influential *Principia Mathematica* (1910). This description of a *system* and its vision of a set of dynamic inter-relating parts is an early appearance of a concept which has come to dominate thinking over the succeeding century across many disciplines. Peirce does not seem to have elaborated it much although, as we have seen, it is developed in the work of Lewis, Wittgenstein and Quine and of course in the notion of a *personal construct system* in Kelly. For Peirce there is a real and continuous relationship between members or fragments of a system[147], underlining that, when we try and describe systems or parts of systems, it is discriminations using *constructs* that distinguish and identify them as we form 'cleavage lines'[148] between the parts, in order to make sense of how they function together. The vision is in strong contrast to any type of reductionist, atomistic or 'building block' approach to meaning such as may be found in British empiricism, in Russell (1919) or in the early *Tractatus* phase of Wittgenstein's work.

Perhaps Peirce's greatest achievement was to elaborate a new discipline out of this broadened

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logic, whose unit of analysis was a category of sufficient generality to embrace a tremendous variety of phenomena and concepts: *The sign*[149]. This idea, which crops up in isolated places in philosophy throughout the centuries is used to create a new vision and methodology – *semiotics,* or a logic of sign action. Through this, he is able to transcend many dichotomies and polarisations including the *natural/cultural, body/mind, internal/external, realism/idealism* and *verbal/nonverbal.* The term 'sign' thus applies to natural signs such as smoke or deer tracks, through to words, gestures, images and cultural products of all kinds. For Peirce, our *thoughts* are signs; our mental activity is a semiotic sign process (Delaney, 1979). Even we, as persons, are signs![150]

Dewey, the intermediate figure between Peirce and Kelly, continues this semiotic vision, expanding vastly what can be included under the term 'language'.[151] He writes:

> *If language is identified with speech, there is undoubtedly thought without speech. But if 'language' is used to signify all kinds of signs and symbols, then assuredly there is no thought without language; while signs and symbols depend for their meaning upon the contextual situation in which they appear and are used (Dewey, 1931, 21).*

I believe this touches on the underlying vision in Kelly's work, which has barely as yet been spelt out. He sees *construing* as much broader and more fundamental than language used in its usual verbal, linguistic sense. Intriguingly, Kelly actually uses the word *semiotic* in several places, in four of which he uses Peirce's idiosyncratic spelling, "semeiotic".[152] His theory of symbolism, in which a word or other symbol is attached to the pole of a construct, in order for it to be referred to and communicated, is a clear example of semiotic thinking[153] comparable to Peirce's triadic structure of the sign.[154]

Peirce suggests a variety of classifications of the sign[155] (see Short, 2007), for example, *terms, propositions* and *arguments.*[156] Whilst these words are usually used to refer to items in language, as we have seen, Peirce extends them to the iconic, indexical and non-verbal too. Frederik Stjernfelt writes:

> *The Peircean idea that all thought is in signs implies that thought signs are* propositions *which connect by means of logical inferences – even what is usually, by psychologists, called "associations" is analyzed as* inferences, *importantly broadening the Peircean concept of inference to encompass thought processes using non-linguistic sign types like images, gestures, diagrams, etc. (2012, 42, my emphasis).*

We have already seen how propositions may merely be *grasped* or *understood*, or alternatively, actively used to make judgements, assertions and hypotheses, or held as beliefs.

The idea that the meaning of a sign depends on the contextual situation, in the quote from Dewey above, is fundamental and expresses clearly what Peirce meant by introducing the word *system.* Signs occur within vast semiotic systems. Thus in Peirce's tripartite ordinal scheme *term-proposition-argument,* a term (for example a subject or predicate) only gains meaning through its position in a proposition. As Raposa (1996) quotes, "subjects are not intelligible apart from their predicates. Rather, the proposition is the foundation for the intelligibility of subjects and predicates"[157].

For Kelly, if we see subjects as *elements* and predicates[158] as *constructs* (they are not exact equivalents, of course), the above logic means that an element is not intelligible apart from the constructs used to construe it. The construed element and the constructs used to construe it are a *single whole at the moment of construing*, not separated in a linear fashion as they are in a proposition expressed linguistically in a sentence used to represent the construction. This is no doubt part of the warning that Kelly gives us about subject-predicate logic[159] and may be a reason for him choosing the new terms of *element* and *construct* to express his vision.

In its turn, a proposition only has meaning in the context of an *argument.* An argument is built up from a series of linked propositions. The early Italian pragmatist Giovanni Vailati (1863-1909), influenced by Peirce[160], wrote: "to speak of the meaning of a proposition is only sensible in relation to that ensemble constituted by other propositions and conceivable situations[161]. The three forms of inference – deduction, induction and abduction – expressed as they are in the form of

syllogisms, are important types of argument. Delaney (1979), in his discussion of Peirce's account of mental activity, writes:

> *Not all pieces of language are equally obviously instances of thinking; the clearest instance of thinking is the process of drawing inferences, the argument, the syllogism. And for Peirce it is important that we conceive this process holistically rather than as built up from atoms of independent meaning. In language, the* unit of significance *is not the individual word or even the sentence but rather the* argument. *Words have significance only in terms of their roles in sentences and the significance of individual sentences is a function of their roles in inferential structures…Our basic mental unit is not going to be the concept (the mental word) or even the judgment (the mental sentence) but rather the process of reasoning (the mental syllogism) (p. 30, my emphasis).*

Seeing the argument, as opposed to the terms or the propositions, as the unit of significance emphasises how the same argument can be expressed in many different ways; it maintains its identity even if an entirely different set of terms and propositions are used to express it. But what is the next level in the system within which different arguments reside? This is where the notion of *position* comes in. Arguments do not exist in isolation, without a context. The positions that we arrive at on things exist within an array of alternative positions within *dialogical space.* The position that a person takes when he or she believes or asserts an argument, exists always in relation to a contrasting or alternative argument presented by another person, group or indeed by the person themselves. We will spell this out in the Part III of this series. *Figure 8* summarises the hierarchy outlined in the last two pages.

But Delaney (ibid, p.31) asks, "does it really make any sense to think of the internal activity of the mind as being that of the syllogistic process?" Peirce writes:

> *It is certainly very doubtful whether a conclusion – as something existing in the mind independently, like an image – suddenly displaces two premises existing in*

the mind in a similar way. But it is a matter of constant experience, that if a man (sic) is made to believe in the premisses, in the sense that he will act from them and will say that they are true, under favourable conditions he will also be ready to act from the conclusion and to say that that is true. Something, therefore, takes place within the organism which is equivalent to the syllogistic process *(5.268, my emphasis).*

Positions

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Arguments
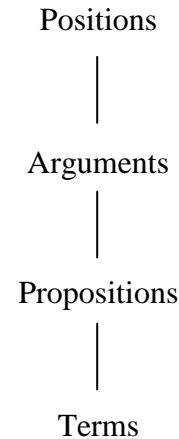
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Propositions

|

Terms

Figure 8: *The hierarchy of terms, propositions, arguments and positions*

It is clear that these inferential processes occur quite unconsciously and seemingly "automatically"[162]. The good example of this, as we discussed earlier, is the *perceptual judgement* or abduction in general. As Shotter (2014) has been at pains to emphasise, our after-the-fact conceptualizations in language are different from the way in which we actually function. Shotter (2017) writes in reference to Kelly's discussion of mathematical reasoning:

> *Something else is at work in us shaping our conduct* before *all our more deliberate thinking occurs. Indeed, as Kelly (1955, 55) noted: "What we are saying is that when a person anticipates events by construing their replications, he lays the ground for mathematical reasoning. All mathematical reasoning is utterly dependent upon the* pre-mathematical construing process *which gives it something to enumerate" (Shotter, 2017, his emphasis).*

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In this paper, Shotter (2017) critiques a Cartesian approach based on definitions, concepts and models claimed to *correspond* with process in favour of an approach based on Kelly and Wittgenstein in which comparisons, differences and similarities take the place of correspondence. I have long seen PCP as a *method* of teasing out how people construe rather than a *model* of how people function, thereby avoiding the so called *correspondence problem*[163] (Rorty, 1979, Stam, 1998). This links with Peirce's insistence, mentioned earlier, that science is not so much about correct *conclusions*, but correct *method*. He "wants a logic that will alert us to *new possibilities*, not to their current uses" (Hookway, 2012, 107)[164].

By applying the method to find out more closely what similarities and contrasts people are actually using in their construing and practices, we hope to get closer to Shotter's (2014) "immediate before-the-fact living meanings". This basic construct, though, of *similarity* versus *difference*, crucial for Kelly's conception of how construing works, has been strongly contested in the last hundred years by writers from both the Analytical and Continental traditions in philosophy, even though these are otherwise strongly opposing camps (Stjernfelt, 2007). We will return to these matters in the next paper in this series.

CONCLUSION

We have been examining PCP, with its core metaphor of the person as scientist, in the context of C.S.Peirce's philosophy of logic and science. Kelly's theory was a radical mid-twentieth century departure. Does trying to fit it into what looks like an older-fashioned framework arising from a hundred years previously not constrain and cramp its style? This would be true if Peirce's approach were truly of its time. But what is emerging in what Stjernfelt (2007) calls the *Peirce Renaissance*, is that he was a man well ahead of his time who made developments and formulated an overall approach that is relevant to, and still informs the most contemporary debates and understandings in philosophy. My approach here has been to use Kelly's *invitational mood* (see section 6): "Let's see where this comparison takes us. If it throws light, all well

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and good. If it exposes limitations in either approach, we can learn from that too".

But our task is not yet done. Kelly was revolutionary in bringing in to the core of his approach an emphasis on the *personal* as a crucial part of human meaning-making and *bipolarity,* a dialectical vision of this process, themes which are relatively undeveloped in Peirce, though their seeds are already present there. The next step, in Part III of this series, will be to delve into *phenomenology*, a vital development in modern philosophy, well-known in the hands of the Europeans Husserl, Heidegger, Merleau-Ponty and others. But Peirce himself had been pioneering phenomenology independently and in parallel to Husserl's earliest studies. We will see that Pierce claimed for phenomenology a place high up in his Architectonic hierarchy of disciplines (see figure 1), higher and superordinate even to the normative sciences, and this vision is given substantial support in the work of the Continental writers. Personal Construct Theory itself is now claimed as a vital movement in, and a major contribution to phenomenology (Butt, 2005; Armezzani and Chiari, 2014a, 2014b). Knitting these strands together will enable us to open up a rich consideration of *subjectivity*, the *nature of construing* and the vital matters of *intersubjectivity, relationality* and *dialogicality.* We will see that the underlying enhanced logic and semiotic allows us to embrace a much broader *science of experience*. This will deepen further the meaning we can make of Kelly's "person as scientist" and open doors to artistic and cultural life, politics and sociology, ethics and aesthetics.

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AUTHOR'S NOTE

ABOUT THE AUTHOR

Harry Procter, PhD has developed and continues to elaborate Personal and Relational Construct Psychology which is based in PCP and more generally Systemic Constructivism. Whilst focussed on families, the approach can be applied to understanding and working with individuals, groups and organisations. He worked for thirty years as a clinical psychologist with the NHS in the West of England. He specialised in the areas of both child and adult mental health, childhood learning disabilities and autism. He has published over 40 papers and chapters on the theoretical, methodological and practical aspects of his approach. Recently he has been devoting his time to research the work of Charles S. Peirce in relation to PCP, phenomenology and dialogical process.

Contact: harryprocter20@gmail.com

REFERENCE

ENDNOTES

[1] Peirce (1866) Lowell Lecture XI, CP 7.595

[2] CP 5.371

[3] CP 7.580

[4] Dewey, 1916, p. 86.

[5] Kelly, 1978, p. 221 (original, 1960).

[6] Kelly uses the term "man" and "he" etc consistently with his generation. It is anachronistic to judge this as particularly sexist. I believe the overall spirit of PCP with its emphasis on the "person" is already part of the thrust to overcome the phallocentrism of earlier psychologies.

[7] A person's processes are psychologically channelized by the ways in which he anticipates events (Kelly, 1955).

[8] For me, this word brings forth a related word: *Grace.* See Bateson's *Style, Grace and Information in Primitive Art* (1967, reprinted 1972) where he says, "For the attainment of grace, the reasons of the heart must be integrated with the reasons of reason (p.129).

[9] Compare also: "It is not *knowing*, but the *love of learning*, that characterizes the scientific man" (1.44, my italics).

[10] "Psychology is no more closely related to philosophy than any other natural science" (Wittgenstein: Tractatus 4.1121). Hacker (1984) discusses how the later Wittgenstein developed a form of philosophical anthropology in which full justice was done to psychological concepts and their roles in the web of concepts surrounding the notions of linguistic representation, without lapsing into psychologism.

[11] Husserl, like Peirce, critiqued psychologism and its "attempts to reduce logical laws to the specific contingent approaches of natural science (specifically of psychological inquiry)" (Hackett, 2013, 197).

[12] Peirce critiqued Dewey for taking a *naturalist* approach to logic. He saw Dewey's logic as insufficiently recognising a *normative* component vital for guiding self-control in inquiry. Dewey saw logic as tools appropriately chosen for a specific task or end-in-view rather than something that is present guiding inquiry all the time. Later, Quine would take this position even further, seeing logic as already contained in natural science and merely as a "chapter of psychology" (Quine, 1969). "Quine's naturalistic project *par excellence* claims that philosophy should essentially 'dissolve into' science" (Laudisa, 2015, 22).

[13] Putnam (1992: 4) cited in Bernstein (2004: 826)

[14] Peirce, 1903, cited in Hookway, 1912: 109.

[15] "(W)e take the word 'knowledge' in the objective or impersonal sense, in which it may be said to be contained in a book; or stored in a library; or taught in a university" (Popper, 1972).

[16] Hookway, 2012: 100 – 101.

[17] Kelly uses the term *normative* (Kelly, 1955, Vol. 1, p. 455; Vol. 2, pp. 777, 779 et seq) but in the way more usual within psychology, referring to the norms and standards of behaviour of society.

[18] Similar views in relation to ethics are expressed in G.E.Moore's *naturalistic fallacy*. The *is-ought* problem was subject of Hume's "guillotine": "For as this *ought*, or *ought not*, expresses some new relation or affirmation, 'tis necessary that it should be observed and explained; and at the same time that a reason should be given, for what seems altogether inconceivable, how this new relation can be a deduction from others, which are entirely different from it…(I) am persuaded, that this small attention would subvert all the vulgar systems of morality, and let us see, that the distinction of vice and virtue is not founded merely on the relations of objects, nor is perceived by reason" (Hume, 1739).

[19] Hookway, 2012: 87.

[20] We hold the act of inference, which we approve, to be voluntary. That is, if we did not approve, we should not infer...these are voluntary acts which our logic, whether it be of the natural or the scientific sort, approves. Now, the approval of a voluntary act is a moral approval. Ethics is the study of what ends of action we are deliberately prepared to adopt (Peirce, 5.130).

[21] Self-control, an important Peircean idea will be discussed in Part III of this series in relation to freewill and the self.

[22] Elqayam and Evans (2011) critique normativity and "logicism" from an empiricist perspective. See the many commentaries following on this article, including Achourioti et al (2011) who point out that norms define the very questions we ask in research and that pure descriptivism is neither desirable or obtainable in psychology or elsewhere in science.

[23] We will see later that a similar separation for Peirce applies to *phenomenology:* "Phenomenology is one science and psychology a very different one. Phenomenology has no right to appeal to logic…on the contrary, logic must be founded on phenomenology" (Letter to W. James October 3, 1904, cited in Spiegelberg, 1956: 168).

[24] This is an intrinsic part of the new discipline of *phenomenology*. Husserl was developing phenomenology separately and in parallel with Peirce at the turn of the century, as we will examine in detail in Part III of this series.

[25] Compare with Kelly's concerns about "accumulative fragmentalism" (Kelly, 1964a, 125-6)

[26] EP2: 412, cited in Hookway, 2012; Kasser, 1999.

[27] Evidence that Peirce was aware of Freud may be found in his reference to *transference* and *projection* in What Pragmatism Is (1905, 270).

[28] In the "Fixation of Belief", Peirce (1878a) outlines four methods in which opinion can be settled. The method of *tenacity* involves dogmatically sticking to a chosen belief in a way somewhat reminiscent of Kelly's *hostility*. The method of *authority* involves deference to a doctrine or ideology for example a religion or school of psychology. (Kelly (1962: 173) also discusses this use of authority in his analogous discussion of four ways of coping with the construct of good and evil, including it amongst Law, Conscience and Purpose. Here, we "hang on to the coattails" of somebody else, or an institution, to distinguish the good from the evil. Obedience itself may become identified

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with the good). Peirce's third method, the *a priori,* involves adherence to a rationale or principle. This may be superior to the first two, but ultimately rests on approaches or discourses (for example a "behavioural" or "psychodynamic" set of assumptions) which turn out to be mere conventions or fashions of thinking. The fourth, most satisfactory method for Peirce, is, of course, the *scientific.* Peirce does argue, however, "that each method has a peculiar *convenience* of its own" (Peirce, 1978: 135). (We are bound to ask, did Kelly not draw from Peirce, in this popular published paper, this word in using the term "range of convenience"?)

[29] Perhaps an even more analogous theme in Kelly to Peirce's satisfaction and doubt is the *choice corollary,* where a person chooses that course that appears to lead to more extension and definition of the construct system. This may be accompanied by a feeling of satisfaction, but not in the case of an anticipation of something unfortunate or bad. Kelly achieves here a greater adherence here to a non-hedonistic standard of inquiry.

[30] We may ask, "surely someone with psychosis makes invalid inferences?" Rychlak (1994) writes, "Even psychotic people are logical in their thought…It is in their premised meanings that we find their insanity. It is the *content* – what they think about – that stamps them as psychotic (p. 37, my italics).

[31] This is a vital distinction to make with implications for therapeutic practice. I talk about *family construct systems* rather than family *belief systems.* People will often take positions on things, not because they are particularly invested in them, but because they have been told that is the way things are (for example a psychiatric diagnosis) and alternative ways of construing have simply not yet been considered.

[32] This work showed that, "it was possible to identify correctly more often than not the greater, for example, of two values even if they were less than the least perceptible difference" (Cadwallader, 1975: 175). This is notable in itself in connecting with the process of forming a discrimination or *construct* from continuous variables and possibly links with Peirce's statement that we tend to be right more often than might be expected in generating hypotheses: see later.

[33] Classified as *synthetic* or *ampliative,* because they enlarge conception by adding to that which is already known. "Ampliative inference is the only kind that can lead to new ideas" (Misak, 2004: 19)

[34] The meaning (intension) and membership (extension) of the class and predicate terms used in the propositions are of course given identity and differentiation through the application of webs of constructs. Constructs will be examined in Part III of this series.

[35] Plausibility, "the degree to which a theory ought to recommend itself to our belief independently of any kind of evidence other than our instinct to regard it favourably" (8.223, 1910) is central in Peirce's logic of abduction – (see Rescher, 1978, 44 – 51). At the abduction stage of inference, it is not possible yet to estimate the likely *probability* of the hypothesis being correct. This only emerges in the cycle of Abduction-Deduction-Induction when the hypothesis is tested in practice (see later).

[36] Hegel, G.W.F. (2010) p. 593.

[37] Here I repeat a footnote from Part I of this series: Peirce has many subdivisions defining types of signs (see Short, 2007) but this set of three is "the most fundamental division of signs" (CP 2.275). *Icons* serve to represent their objects only in so far as they *resemble* them in themselves (for example a picture or map). *Indices* represent their objects independently of any resemblance to them, only by virtue of real connections with them (e.g. a finger or signpost *pointing* at the object). *Symbols* represent their objects, independently of any resemblance or any real connection, because dispositions or factitious *habits of their interpreters* (including conventions) insure their being so understood (from Commens, 2013). In practice, a sign tends to contain elements of all three of these types of signification.

[38] CP 2.277, cited in Stjernfelt, 2000: 358

[39] A look at the Wikipedia article on the Pythagoras Theorem will show that the various proofs given there involve elaborate arguments of at least four steps, 14 steps in the case of Euclid's!

[40] There seems to be the assumption in much post-modernist writing that the iconic and visual are necessarily *asocial*, a judgement that need not obtain (eg Potter, 1983, p.17).

[41] MS 619: 8, 1909, "Studies in Meaning. The Import of Thought: An Essay in Two Chapters; Cited in Pietarinen (2012).

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[42] Note that even this phrase, relying on the construct of *inside* versus *outside,* is an iconic metaphor. The iconic ideas of *range, hierarchy* and *position* are central to PCP and its relational extensions developed by the author (Procter, 2014b). Diagrams such as family maps, bowties and qualitative grids are essential tools in this approach, although they were developed before the author's awareness of Peirce's work.

[43] "Such a diagram has got to be either auditory or visual, the parts being separated in the one case in time, in the other in space" (Peirce, 1892b: 3.418). Speech, with its existence in time, may be regarded as a kind of diagram (see Ketner, 1985).

[44] Peirce uses the phrase "muscular imagery" (2.778, cited in Rosenthal, 2002: 256)

[45] (1905, MS298, cited in Pietarinen, 2012)

[46] Production of experiments within theorematic reasoning, on Peirce's view, is done through abduction, the kind of reasoning that results in generation of a hypothesis for future test (Ketner, 1985, 411).

[47] Stjernfelt, 2011, footnote 10.

[48] Peirce's treatment of induction underwent evolution through his career. See Bacha (2004)

[49] Mill had hoped to validate induction by basing it on uniformities that exist in nature, but Peirce rejected this, arguing that the irregularities of nature far outweigh any laws and regularities (Peirce, 1869, 5.342 – 3). Peirce rather follows the statistical route, arguing that all probable inference, including induction, is inference from parts to a whole and is therefore essentially the same as *statistical inference*. The validity of induction depends simply upon the fact that the parts make up the whole (op. cit. 5.349). In practice, "all that induction can do is *to infer the value of a ratio* and that only approximately…no definite probability attaches to the inductive conclusion…but we can calculate how often inductions of a given structure will attain a given degree of precision" (Peirce, 1992: 139, 141-2). Peirce was a recognised pioneer in developing methods of calculating error and optimising confidence intervals and the degree of trustworthiness in measurement that forms the basis of so much modern science from physics through to polling public opinion.

[50] Induction involves anticipating the future from the past, although this description is too narrow as Peter Alexander (1969: 56) points out: for example, the archaeologist or historian generalises from evidence to estimate general characteristics of peoples in the past.

[51] But see Polanyi (1958, 10 - 11) who reports that the Michaelson-Morley experiment about the constancy of the speed of light had no role in the foundations of Einstein's theory, which he uses to argue for the primacy of theory over observation in the development of science.

[52] William James writes in his chapter on habit in the *Principles of Psychology: "*A simple habit, like every other nervous event - the habit of snuffling, for example, or of putting one's hands into one's pockets, or of biting one's nails - is, mechanically, nothing but a reflex discharge; and its anatomical substratum must be a path in the system" (1890, p 107).

[53] See Maddelena (2010) for a thorough review of the concept of assent in Peirce.

[54] A dicent is "a sign represented in its signified interpretant *as if it were* in a Real Relation to its Object" (Peirce, letter to Lady Welby, 12th October 1904, cited in Commens, retrieved from http://www.commens.org/dictionary/term/dicisign

[55] Kelly himself treats habit in a similar way to James: "A habit may be construed as a convenient kind of stupidity, which leaves a person free to act intelligently elsewhere". This to me is disappointing in the light of our discussion and massively underestimates the vital importance of habit, even at a behavioural level, for example its role in the development of high level skills which take a lifetime of practice to acquire.

[56] "Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object" (Peirce, 1878a)

[57] Sahlin, 1990, cited in Nubiola, 1996.

[58] There is an extensive literature discussing Wittgenstein's relation to Peirce and pragmatism: See Rorty, 1961, Nubiola, 1996, Crocker, 1998, Pihlström, 2012, Boncompagni, 2013, 2014, 2016a & b, Misak, 2015.

[59] Hume, 1894, section 4, part 2: 36.

[60] Like Peirce, Ramsey is concerned to envision a "larger, human logic" that goes beyond the insufficient formal "logic of consistency" of Russell and Wittgenstein's early work in the *Tractatus,* which give no justification to induction, seeing this logic as the "fundamental way of acquiring knowledge…a *logic of discovery"* (Ramsey, 1926, p. 25[60]). For Ramsey,

Induction "is a human logic…its business is to consider methods of thought[60]". (Ramsey, 1926, pp. 30 – 31). Even though induction has "no formal justification…this does not make its use any the less reasonable, as its reasonableness is pragmatic" (Nubiola, 1996).

[61] *Philosophical Investigations* (PI), para 220.

[62] Rorty, ibid, p. 214.

[63] "A new decision was needed at every stage" PI para 186.

[64] PI paras 219 and 217.

[65] "A person chooses for himself (sic) that alternative in a dichotomized construct through which he anticipates the greater possibility for extension and definition of his system" (Kelly, 1955, 64).

[66] See also Rychlak (1994, Chapter 4) and Castiglioni (2011).

[67] The late Fay Fransella (2016) argued vociferously against Mischel, although unfortunately does not provide us with the reasons for her critique, saying that it is "too complex and cannot be covered with justice within this talk" (p. 2)

[68] In *Some consequences of the four incapacities,* Peirce (1868) presents his seminal critique of Descartes' *Cogito ergo sum.*

[69] Howat (2013).

[70] We will see shortly that it may not be correct to label these assumptions as *propositions*.

[71] There is one definite reference to Peirce in Wittgenstein concerning how or whether we can justify inductions – see Anna Boncompagni (2016a).

[72] For writings on Peirce and Wittgenstein here, see Boncompagni (2013, 2014, 2016b), Fabbrichesi Leo (2004), Johanson (1994), Moyal-Sharrock (2003, 2013), Nubiola (1996), Pihlström (2012).

[73] We can note this in relation Shotter's point about before-the fact and after-the-fact views outlined above.

[74] The only exception to fallibilism being part of action and practices: CP 1.661

[75] Wittgenstein uses this word in OC 94. Background is taken up and developed by John Searle (2003) – see Rhodes and Gipps (2008) and Gipps and Rhodes (2011).

[76] OC 144

[77] CP 4.71

[78] 'Occult' here means *hidden from view.* He goes on to say that consciousness is not divided from an unconscious region by a skin: "the difference is only relative and the demarcation not precise" (5.440).

[79] Moyal-Sharrock, 2013, 2.

[80] See Moyal-Sharrock (2003)

[81] Cited in Moyal-Sharrock, 2003 with her italics.

[82] See Rhodes and Gipps (2008, 305) and Gipps and Rhodes (2011, 89, 94).

[83] "Each person characteristically evolves, for his (sic) convenience in anticipating events, a construction system embracing ordinal relationships between constructs" (Kelly, 1955, 56 – 59).

[84] Kelly, 1955, Vol 1, p56.

[85] This meta-construct, *symmetrical* versus *asymmetrical* becomes central in Rue Cromwell's intriguing development of PCP (2010, Chapters XXXI and XXXIII).

[86] Richard Bell (2004) has reviewed the literature in this area, demonstrating various theoretical and methodological problems in this area of PCT. There are ambiguities in Kelly's and others' attempts to classify and operationalise the relationship between superordinate and subordinate constructs and a re-examination of Hinkle's original data casts doubt on whether the method of *laddering* reveals more superordinate constructs (Bell, 2014, see also Butt 1995 and 2007). He concludes that the issues need further work and that "it would seem more useful to extract the underlying principle of hierarchical organisation of constructs and attempt to find ways of realising this (2004, 283).

[87] Peirce (1867) On a New List of Categories, CP 1.549)

[88] OC 144, 141, 142, 225.

[89] Or, we could add, sometimes an inspirational consequence in cases of a breakthough in understanding or flash of insight involving revision at a superordinate level.

[90] Clarence Irving Lewis in Internet Encyclopaedia of Philosophy. Retrieved, Sept 2015, from http://www.iep.utm.edu/lewisci/

[91] Alexander (1969, 273)

[92] Quine (1951, 43).

[93] See discussion of logical versus causal determination above.

[94] Cromwell suggests that there may be evidence for this in reaction time studies: "A person's use of a highly abstract (elaborated) construct seems to take no more time than a very concrete construct usage. In other words, the superordinate construction is implicit (immediately available) and does not require increased time with increased level of hierarchy utilized" (Personal Communication, 29th Sept. 2015).

[95] Abduction literally means 'carrying away', connecting an item with a different apparently unrelated item. Peirce also used the term *retroduction* as a synonym for abduction, meaning *bringing back* or *returning* from the second to the first item (Olshevsky, 1993, 407). Rescher (1978) uses *abduction* as the process of generating, and *retroduction* as eliminating competing alternatives and testing hypotheses.

[96] This is reminiscent of Heidegger's criticism of a logic which "limps along after" science in order to discover its method, rather than one that "leaps ahead" disclosing possibilities available to sciences in their inquiry (*Being and time,* 1962, 30 – 31). This correspondence between Peirce and Heidegger will be explored in Part III of this series.

[97] "The best hypothesis, in the sense of the one most recommending itself to the inquirer, is the one which can be the most readily refuted if it is false. This far outweighs the trifling merit of being likely. For after all, what is a *likely* hypothesis? It is one which falls in with our preconceived ideas. But these may be wrong. Their errors are just what the scientific man is out gunning for more particularly. But if a hypothesis can quickly and easily be cleared away so as to go toward leaving the field free for the main struggle, this is an immense advantage" (Peirce, 1.120, c. 1896).

[98] This comes from Molière's *Le malade imaginaire:* Opium puts us to sleep because it contains a 'dormitive principle' – see Bateson (1980, p. 98).

[99] Cited in Nesher, 2001, p. 47 from Simon (1983, 40).

[100] NB Peirce uses the term *construction* here. See note 106.

[101] This seems to conform with what Husserl (2001) describes as 'passive synthesis': The realm of passivity describes those acts that occur within the subject without the ego acting on them, that is, without consciously taking them up. This is in contrast to the realm of activity, in which the subject knowingly directs its egoic regard to a particular object or purposively intends a particular act (De Roo, 2013, 80).

[102] Gregory, in looking at the similarities and differences between perception and scientific hypotheses seems to draw much from Peirce, including the very Peircean term 'collateral knowledge' (1980: 183), though without referring to the earlier work. He concludes, "Causes and inferences link hypotheses and perception to the world" (184); "It

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is reasonable to suppose that a very great deal of perception is in this sense fictional: generally useful but occasionally clearly wrong, when it can be an extremely powerful deception. No doubt this holds also for science" (183). "If nothing is sensed or perceived directly - if all perception and all scientific observation, however instrumented, involve inference - then it seems that there are no purely concrete objects. This is indeed a major conclusion from the thesis that perceptions are hypotheses" (196).

[103] Peirce draws from Kant here: "All our judgments are first of all perceptual judgments: they have validity solely for us, i.e. for our subjectivity, and only afterwards do we give them a new reference to an object, and want them also to be valid for us at all times and equally so for everybody else" (Kant (1783): Prolegomena to every future metaphysic, p. 298, cited in Körner, 1955, p. 48).

[104] See Hookway, 1985, ch. 5; Rosenthal, 1969, 1994 and Bergman, 2007.

[105] In terms of Peirce's theory of the categories and semeiotics (See Procter, 2011a) the percept is a *firstness*, of which we "know nothing about otherwise than by the testimony of the PJ" (7.643); the PJ is a *secondness,* an *index* of the percept (Hookway, 1885, 161) and the resulting percipuum, the conscious image, is a *thirdness,* the interpretant of the original sign which materially existed in the drawing. The image is of course a new sign.

[106] Peirce again uses the term *construction* here: another example is "The science of psychology assures me that the very percepts were *mental constructions*, not the first impressions of sense" (2.141).

[107] It is interesting to see that the way Peirce approaches the emotions is reminiscent of Kelly's treatment: "If a man is *angry*, he is saying to himself that this or that is vile and outrageous. If he is in *joy*, he is saying "this is delicious." If he is *wondering*, he is saying "this is strange"…The emotions, as a little observation will show, arise when our attention is strongly drawn to complex and inconceivable circumstances. *Fear* arises when we cannot predict our fate; *joy*, in the case of certain indescribable and peculiarly complex sensations. If there are some indications that something greatly for my interest, and which I have anticipated would happen, may not happen; and if… I find myself unable to come to any fixed conclusion in reference to the future, in the place of that intellectual hypothetic inference which I seek, the feeling of *anxiety* arises. When something happens for which I cannot account, I *wonder.* When I endeavor to realize to myself what I never can do, a pleasure in the future, I *hope.* "I do not understand you," is the phrase of an *angry* man (5.292).

[108] 2.625.

[109] Intriguingly, although the figure seems to 'flip' autonomously, we do have some measure of voluntary control – a beautiful example of our constrained freedom in choosing poles of a construct.

[110] It is worth saying here that Kelly's understanding of phenomenology was compromised by his reliance on contemporary secondary sources. This is discussed by Armezzani and Chiari (2014a) who argue that PCT is a prime example of phenomenology in the tradition of Husserl's project of a *rigorous science* (Armezzani and Chiari, 2014b). We return to this in Part III of this series.

[111] Evidence may indicate that Kelly was *not aware* of Peirce's abduction as logical may come from his discussion of where hypotheses come from: "There are roughly three ways of coming up with a testable hypothesis: (1) one may *deduce* it from explicit theory; (2) one may *induce* it from observation for example, from clinical experience; (3) one may eschew *logical procedures* and go after it with a statistical dragnet" (1955, Vol. 1, p. 32, my italics).

[112] Kelly, 1964, 150 – 151.

[113] Menand, 2001, 158

[114] Peirce, uses the term instinct, describing abduction as the "loftiest of our merely instinctive powers" (7.48, see Ayim, 1974). The term for us may imply innateness, which would greatly underestimate the extent to which leaning is involved, for example learning to construe depth in the Necker cube. As quoted earlier though, Peirce makes it clear he is not committing himself to a position here: "But since it is difficult to make sure whether a habit is inherited or is due to infantile training and tradition, I shall ask leave to employ the word "instinct" to cover both cases (2.170).

[115] See Friedrich Schiller *On the aesthetic education of man,* 1794, especially Letters XVIV, XXV.

[116] Maddalena summarises four characteristics of Peirce's conception of play: 1) It is a living exercise of our powers 2) It has no rules except the law of freedom 3) it blows where it wants 4) It does not have a purpose but its only purpose is a recreational one (2005, p. 247).

[117] Dupin was used by Doyle to model Sherlock Holmes, whose "deductions" are usually *abductions:* Holmes says to Watson, "In solving a problem of this sort, the grand thing is to be able to reason backwards. That is a very useful accomplishment, and a very easy one, but people do not practise it much. In the every-day affairs of life it is more useful to reason forwards, and so the other comes to be neglected. There are fifty who can reason synthetically for one who can reason analytically...There are few people, however, who, if you told them a result, would be able to evolve from their own inner consciousness what the steps were which led up to that result. This power is what I mean when I talk of reasoning backwards, or analytically (Doyle (1887) A Study in Scarlet, Chapter 14). See the entertaining book of papers on this topic by Eco and Sebeok (1988)

[118] Miller Mair (1976), in his important paper on metaphor draws on I. A. Richards who makes the same point.

[119] Frederik Stjernfelt (2007) writes that "iconicity is…based on similarity"(p. 49) and "similarity plays a seminal role" in hypothesis generation (p. 77). Indeed he argues that "the very form of inferences depends on it being an icon" (ibid), including all the inferences and syllogisms inherent in reasoning.

[120] It is interesting to compare Kelly's concept of *loose construing* with Peirce's emphasis on *vagueness.* This will be a subject of discussion in Part III of this series.

[121] Popper (1963, p. 238).

[122] The percipuum is of course not a discrete entity but part of the continuity of experience. Peirce insists that memory and anticipation are intrinsic to any percipuum, introducing the terms ponecipuum and antecipuum as constituents of the percipuum to aid analysis of this process (7.649, see Rosenthal, 1994, 51 – 60 for an explication).

[123] Pietarinen, 2008, 1.

[124] Pietarinen, 2008.

[125] Indices and symbols of course contain the iconic, just as more generally, the categories of Secondness and Thirdness contain Firstness. We will discuss the Peirce's categories when we look at his *phenomenology* in Part III of this series.

[126] A nice example of how "time is metaphorically conceptualised in terms of space" (Lakoff and Johnson (1980, 135).

[127] This will of course vary from one culture to another (Lakoff and Johnson, 1980). The appearance of the spatial dimensions in construing social interaction can be found in three of Valeria Ugazio's *semantic polarities* – see Ugazio, 2013, Procter and Ugazio, 2017 and also Dallos and Procter, 1984).

[128] Peirce writes, "The function of hypothesis is to substitute for a great series of predicates forming no unity in themselves, a single one (or small number) which involves them all, together (perhaps) with an indefinite number of others. It is, therefore, also a reduction of a manifold to unity" (1868, CP 5.276)

[129] As Bateson and Jackson (1964) would say, we can "punctuate" a continuous sequence in various ways: see Watzlawick et al, 1967, pp. 54 – 59. This is a similar idea to Kelly (1955) saying that a construct forms a "cleavage line" across a domain, p. 57).

[130] 5.591

[131] Peirce's account of the role of abduction in inquiry and Hanson's account of it have been criticised, for example by Kiikeri (2001) and others. However, Kiikeri assumes wrongly that Peirce was using abduction in isolation to explain Kepler's discovery process, instead of the trio of inferences acting in combination, thereby casting it as simplistic. See also Nesher, 2001.

[132] This is particularly important if it is true, as Peirce claims, that "contemporaries of Kepler – such penetrating minds as Descartes and Pascal, were abandoning the study of geometry (1.75).

[133] Ma and Pietarinen, 2015.

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[134] Peirce, 1.72.

[135] Katz, 2009, p. 431)

[136] The continuity found in nature is a central doctrine in Peirce's work (See Part I of this series, p. 21 and Llarregui and Nubiola, 1994). It enabled Leibniz and Newton to go forward and develop Calculus.

[137] Katz, p. 122.

[138] Retrieved, 4th February 2016 from: https://www.andrews.edu/~calkins/math/webtexts/numb19.htm

[139] The pencil indicates how an ellipse can be drawn with a loop of string. The sum of the distances of the pencil point to the 2 foci is constant. Newton's inverse square law of gravitation was deduced from the mathematical properties of the ellipse.

[140] He "most ingeniously inferred that (one focus of each orbit of Mars and the Earth) probably intersected in the sun" (1.72)

[141] Kepler understood something of what we call gravitational force, but was still understanding it as occurring within the plane of the ellipse (two dimensionally) rather than in three dimensions

[142] Vol 1, p 47.

[143] Vol 1, p 61. This comment refers to the dichotomy corollary and will be taken up in Part III of this series.

[144] Vol 1, p 17.

[145] Vol 1, p 63.

[146] We will see the importance of iconicity in its reliance on the fundamental construct of *similarity* versus *difference:* "The judgement 'this is similar to that' is the simplest form of iconic interpretation" (Sauli, 2008). This distinction lies at the heart of Kelly's formulation of the process of construing.

[147] Raposa, 1984.

[148] Kelly, Vol 1, p 57.

[149] Peirce gives many definitions, for example: "A sign, or *representamen*, is something which stands *to* somebody *for* something in some respect or capacity. It addresses somebody, that is, creates in the mind of that person an equivalent sign or perhaps a more developed sign" (2.228, my italics).

[150] "The fact that every thought is a sign, taken in conjunction with the fact that life is a train of thought, proves that *man is a sign*; so, that every thought is an external sign, proves that man is an external sign. That is to say, the man and the external sign are identical" (Peirce, 1868, 5.314). There is an equivalent in Kelly when he talks of 'figure symbolism', for example where "my mother" is used as a symbol for a construct or a client talks of the "Mary-ness behavior of his friends" (Vol 1, pp. 139 – 140).

[151] Wittgenstein also makes it clear that *language games* include not just language, but "the actions into which it is woven" (1953, §7); "the term language-game is meant to bring into prominence the fact that the speaking of language is part of an activity" (1953, §23).

[152] "Semeiotic" in Vol 1, pp. 180, 464; Vol 2, p. 644, 803; "Semiotic" in Kelly, 1962a, p. 165; Kelly, 1962b, 198, 200.

[153] Kelly (1955), Vol 1, chapter 3, section 9, pp. 138 -140. See also Faidely and Leitner, 2000, Procter, 2011a.

[154] A 'symbol' in Kelly's sense is a *sign vehicle* or *representamen. An element* (often, another sign) is equivalent to Peirce's *object* and the implied 'construing' is the *interpretent.* Kelly develops this, building in his central concept of *bipolarity* into this structure as will be discussed fully in Part III of this series.

[155] We have already mentioned the triadic groupings images, diagrams, metaphors and icons, indices and symbols.

[156] Stjernfelt (2015) adds this important way in which Peirce broadened logic in his *Syllabus* (1903)*,* that the trichotomy *term-proposition-argument* "generalises to cover all signs, giving his semiotic a vastly extended extension" (p. 155).

[157] Raposa (1996, 721) is here quoting from Stephen Daniel's study of the philosophy of Jonathan Edwards, pp 69 and 161.

[158] The term *predicate* in Peirce's logic of relatives is a broad term including adjectives, nouns and verbs which may have several 'subject slots', for example "gives" which has a 'valency' of three: _gives_to_ (See Stjernfelt, 2007, 76, Paolucci, 2008). More on this in Part III of this series.

[159] "The subject-predicate form of our Indo-European languages has led us to confound objects with what is said about them" (Kelly, 1969, 68).

[160] Harris (1963, p. 328).

[161] Vailati, G. (1972) *Scritti filosofici*: 759, cited in Pietarinen 2008, p 8.

[162] Though guided by logical rather than causal determination.

[163] Stam (1998) writes: How does a system have any access to what it is that corresponds to its representations? To know what it is that is being represented, a system must already have some knowledge of the object represented. But this is precisely what the representation is supposed to provide in the first place" (p.188).

[164] Intriguingly, as we shall see in the next paper, Heidegger is in agreement here: "Heidegger thus focused upon science as something people *do,* rather than scientific knowledge as acquired and assessed retrospectively. Understood existentially, science is not the accumulation of established knowledge, but is always directed ahead toward possibilities it cannot yet fully grasp or articulate" (Rouse, 2005, 6, my italics).