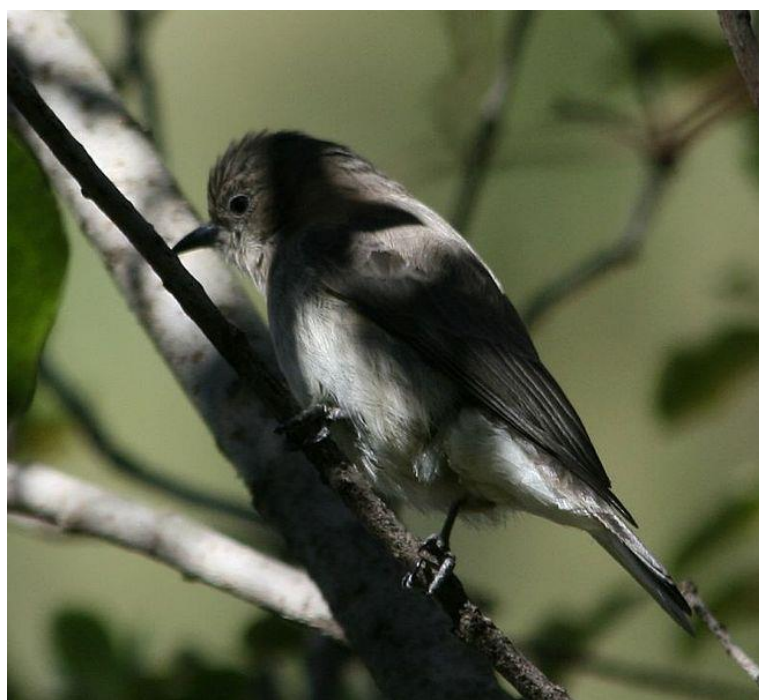European
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Elements for a comprehensive assessment of public indicators

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Abstract
There is no shortage of discussions and even criticisms of prominent indicators such as the Global Competitiveness Index, the Environmental Performance Index, or the Human Development Index, nor of proposals for supposedly better indices of prosperity, environmental sustainability or human progress. We certainly need them and probably others more. However, one cannot help thinking that a theory is missing that would offer a conception of indicators in general, and of social indicators in particular. Such a framework should recognize the complex and hybrid nature of these measures, and help assessing their quality. In other words, what we need is comprehensive assessments that considers indicators altogether as pieces of knowledge, instruments of governance and socially communicated signs; a perspective that combines the knowledge requirements of governance and the political dimension of public knowledge. We believe that such a perspective can be found at the juncture of three discourses or perspectives. The first one is Peirce's theory of signs, or semiotics for short, that highlights the communicative nature of indicators, their role in the survival and reproduction of all living organisms and their link with action and behavior. In particular, Peirce's classification of signs and notably his distinction between icons, indices and symbols is especially relevant here.
Our second source of inspiration is John Dewey's pragmatic theory of the public and of social inquiry which help conceptualizing the connection between indicators and public policy and understanding their role in the management of public problems. We underline the connection between Dewey's conception of the public and more recent advances in cognitive politics, which highlights the importance of the way public problems are framed and the role of indicators in such framing.
We find our third source of inspiration in the analysis by Gibbons, Limoges, Nowotny and their colleagues of the "Mode 2" of production of knowledge which can be looked at as an updating and empirical confirmation of Dewey's theory of social inquiry. We conceive of the production of indicators as a typically "mode 2" activity, which is therefore to be assessed against the social robustness criteria. We attempt to show how Peirce's distinction between the iconic, the indexical and the symbolic dimension of signs on one hand, and Dewey's theory of democracy, on the other hand, provide us insightful tools for conducing comprehensive evaluations of the social robustness of indicators and designing more robust alternatives to the existing ones.

Contents

Preface

While working on composite indicators in the past ten years our team at the Joint Research Centre of the European Commission in Ispra (IT) was mostly confronted with a polarized audience. On one side enthusiastic supporters, mostly from advocacy groups developing their own indices to advance a cause; on the other skeptical economists and official statisticians concerned by the subjective nature of the variable selection, aggregation procedure and weights selection.

A minority group took as its objective to come to term with this growing reality and to try to agree on some principles of good practice which would at least allow the users of these new statistical artifacts to gauge their quality. After some preliminary seminars held since 2002 with the Statistics Division of the OECD, at the time lead by Enrico Giovannini, a first joint JRC-OECD handbook was eventually drafted in 2003, and in 2008, after five years of iteration and revision with the OECD High Level Statistical Committee, the work was finally endorsed (OECD & JRC, 2008).

Since then we have multiplied our efforts to provide a theory for these measurements, engaging with academia and practitioners (Saisana, et al., 2005), (Paruolo, et al., 2013). But it is only with the present illuminating insight provided by Paul Marie Boulanger, a social scientist active at the Institut pour un Développement Durable, Ottignies, Belgium, that we can finally claim to dispose of a coherent intellectual framework to situate composite indicators in the complex landscape between analysis and advocacy. Paul Marie Boulanger's intuition to anchor composite indicators to Charles Sanders Peirce's Semiotics, to John Dewey's Theory of Social Inquiry, and to modern Science and Technology Studies (STS) scholarship offers a uniquely elegant solution to the predicaments of these 'measurements without a theory'. Does an existing composite indicator provide an 'interpretant', i.e. does it suggest a direction to take? Does it contribute to the process of framing an emergent problem? Does it contribute elements of transdisciplinarity? Does it facilitates a process of extended participation to the framing of an issue?

It is thanks to the work of Paul Marie Boulanger that these questions have now become relevant to our daily practice. A realization this which will force us to revise and extend our 2008 work, and for which we remain grateful to this original and engaging thinker.

Andrea Saltelli, Ispra, October 13, 2014

1. Introduction

Indicators are nowadays everywhere: in administrative practices, in public policies, in NGO's discourses and, of course, in the media. The upsurge of indicators is a rather recent phenomenon even if we have already witnessed a first wave of activity in the domain during the seventies. Until around 2001, there was only one scientific journal devoted to social indicators, "Social indicators Research" founded in 1974, during the first wave. Since then, several publications mainly focusing on indicators of quality of life and well-being on one hand, and on environmental and sustainability indicators on the other hand have appeared, such as "The Journal of Happiness Studies" (2000), "Ecological Indicators" (2001), "Applied Research in Quality of Live" (2006), or "Child Indicators Research" (2008). Furthermore, the number of articles on indicators in more generalist journals (notably in "Ecological Economics") has also grown exponentially, not to speak of the "grey" literature and websites devoted to them.

The increasing importance of indicators in public life deserves some critical attention from statisticians, epistemologists, sociologists, social and political philosophers and more importantly all concerned citizens. However, hitherto, one cannot say that those professions, let alone the public have taken the measure of the phenomenon.[1] More precisely, the critical activity has been so far restricted to the evaluation of such or such individual indicator, much less to indicators in general as instruments of governance and as (supposed) pieces of scientific knowledge. The GDP, for example, has been since almost half a century the target of devastating (and somewhat repetitive) critiques from different sources as legitimate index of well-being and also for its lack of sensitivity to the crucial question of sustainability but seldom have we heard about more fundamental interrogations on the necessity of indicators of wellbeing and on the pros and cons of using indicators in general in a democracy[2].

Of course, indicators have not been protected from epistemological and methodological scrutiny, especially from statisticians and mathematically-oriented sociologists but they have been analyzed more as scientific objects than as hybrid objects, the outcome of a mix of scientific and practical concerns. The methodological discussion about indicators has focused either on the general questions about measurement and quantification in social and human sciences or on the technicalities of the construction of indices, especially linked to the aggregation, normalization and weighting processes. The statistical assessment of indices is of course necessary and would even be absolutely indispensable were indices to be taken at their face values by policymakers and used in a rational-utilitarian way. It is indeed frightening to imagine a world in which political decisions could be mechanically influenced by the kind of compensations and tradeoffs implied by the naïve weighting and aggregation procedures used in most indices, not speaking of the

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[1] « [Yet] the increasing use of indicators has not been accompanied by a systematic study of and reflection on the implication, possibilities and pitfalls of this practice. As a result, little attention has been paid to question such as 'What social process surround the creation and use of indicators?... » (Davis, et al., 2012, p. 4).

[2] J.E. Innes (2004 [1975]) is a precocious exception to this.

possible simply cynical manipulations of these parameters. The drawbacks of such indices and indicators with respect to the implicit implications of their normalizing, aggregating and weighting procedures have been and are still regularly highlighted by authors such as Saltelli and the statisticians at JRC (Saisana & Philippas, 2012), Ravallion, Slottje, Wolff (Wolff, et al., 2010), etc. Fortunately, we are not there yet and composite indices are still and for a while, being used mainly in a discursive-interpretive way[3].

What is perhaps missing is more advances in a perspective that considers indicators altogether as pieces of knowledge, instruments of governance and communication signs and which, therefore, ties the knowledge requirements of governance to the political dimension of public knowledge.

We argue that such a perspective can be found in the conjunction of three discourses or perspectives. The first one is Peirce's theory of signs, or semiotics for short, that highlights the communicative nature of indicators, their role in the survival and reproduction of all living organisms and their link with action and behavior. The second is John Dewey's pragmatic theory of the public and of social inquiry which help conceptualizing the connection between indicators and public policy and understanding their role in the management of public problems. We find our third source of inspiration in the analysis by Gibbons, Limoges, Nowotny and their colleagues of what is since known as the "Mode 2" of production of knowledge which can be looked at as an updating and empirical confirmation of Dewey's theory of social inquiry.

In what follows, we give a short account of each of these three approaches focusing on the tools they can provide us in order to undertake comprehensive assessment of public indicators. And now, let us start our journey in indicators' land, guided by an intriguing little African bird whose scientific name will put us on the track of the communicative and pragmatic nature of indicators.

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[3] For a discussion of these different ways to use indicators, see (Boulanger, 2007)

2. Incursion in a natural world of signs

We read in a 1822 book titled "The indicator" : «There is a bird in the interior of Africa, whose habits would rather seem to belong to the interior of Fairy-land: but they have been well authenticated. It indicates to honey hunters where the nests of wild bees are to be found. [...] This is the Cuculus Indicator of Linnæus, otherwise called the Moroc, Bee Cuckoo or Honey Bird.» (Hunt, 1822)

« *Indicator indicator* » is the scientific name of this African bird discovered in Mozambique in 1569 whose current ordinary name is "Great Honeyguide". As this designation suggests, it has developed a very idiosyncratic behavior that consists in guiding humans and some animals (monkeys, baggers, etc.) toward nests of wild bees. When the bird discovers a hive, he looks for a human in the vicinity, fly towards him and start an elaborate audiovisual display whose aim is to pilot him to the hive.

"A guiding bird attracts a person's attention with wavering, chattering "'tya' notes compounded with peeps or ipes", sounds it also gives in aggression. The guiding bird flies toward an occupied hive (Greater Honey-guides know the sites of many hives in their territories) and then stops and calls again. As in other situations, it spreads its tail, showing the white spots, and has a "bounding, upward flight to a perch", which make it conspicuous. If the followers are native honey-hunters, when they reach the hive they incapacitate the adult bees with smoke and open the hive with axes or pangas (machetes). After they take the honey, the Honeyguide eats whatever is left. »[4]

It certainly cannot be haphazardly that this interesting animal bears the same name than, for example, the Human Development Index, the Ecological Footprint (and this one especially with such a name) or the GDP, and that it bear it twice. Indeed, it personifies a property all kinds of indicators share (or are supposed to): they direct attention to their object. We will return to this later but before, let us look at two other examples – amongst a host of others – of what we call "indicators" in the animal kingdom.

Example 2: The active space of the alarm pheromone of the ant *Pogonomyrmex Badius* has a maximum radius of 6 cm which is reached in about 13 sec and shrink to 0 if not fed again in about 30 sec, characteristics judged ideal for an alarm signal by (Wyatt, 2003, p. 229): quick rise time, short range and rapid fade. Indeed, if the danger is momentary, the signal quickly fades and "leaves the bulk of the colony undisturbed; conversely if it persists the substance spreads, involving an ever-increasing number of workers." (Sebeok, 1999, p. 30). Note that if alarm pheromone of *Pogonomyrmex Badius* has only one component, many social insects have multi-components alarm pheromones so that they can communicate more complex messages than alarm only.

Example 3: The African vervet monkey (*Cercopithecus aethiops*) possesses a sophisticated repertory of vocal signs for signaling the presence of a predator. More precisely, the alarm-call is different whether the predator is a terrestrial stalking one such as a leopard, an aerial raptor such

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[4] Wikipedia: « Greater Honeyguide ». Consulted on 02/19/2014.

as an eagle or a ground predator such as a snake. Each specific alarm-call triggers an appropriate reaction from the whole group. If it corresponds to "terrestrial predator" all the troop climbs at the top of the higher trees in the surrounding; if it says "aerial attack", the monkeys hide under the trees and if it says "Beware, snake around" it causes rearing on the hind paws and scrutinizing the surrounding terrain. Interestingly, infant vervet monkeys babble these calls in response to a variety of animals without adults paying much attention to them when no predator is in view. Thereby, young monkeys learn progressively to associate the right alarm-call to the right kind of predator.

These examples are just three manifestations of the semiotic possibilities of living creatures and, more fundamentally, an illustration of the importance of what Peirce called "semiosis", i.e. the emission and interpretation of signs in nature. As Kenneth Burke, the famous American literary critic put it "All living things are critics" (Burke, 1984, p. 5), all living organisms interpret signs. And of course, as is the case in the three examples above, they are particularly attentive to "vital signs", signs linked to the perpetuation and transmission of existence: food, predation and threats and of course mating and reproduction also, though they are not evoked in our examples. Actually, the biosphere offers a plenitude of examples of communication between living entities linked to the reproduction function. In examples 2 and 3, the "semiosis" takes place between members of the same social group and *a fortiori* of the same species. This is the most common case but as example 1("*indicator indicator*") illustrates it is far from being the only possibility. The honey-guide shows that "semiosis" is not restricted to members of the same social group or even to con-specifics and that members of different species can collaborate in a mutually beneficial enterprise through the transmission and understanding of signs. Moreover, it is noteworthy that in this case, the initiative of the communication is not taken by the most evolved animal! What is important for our discussion is that the sign is expected to trigger a specific behavior. Following Hoffmeyer (Hoffmeyer, 2007), we can call "semiotic causation » this fact of "bringing about effects through interpretation". In the vervet monkey example, the process of semiotic causation can be decomposed as follow: 1) a predator is perceived by a member of a community; 2) the predator is associated to a specific category of threat; 3) a signal corresponding to that category is emitted at destination of the others members of the group; 4) the sign is interpreted by members of the group which finally 5) adopt the appropriate behavior.

Stated otherwise, the sequence is as follow:

1) An observation is made…
2) That gives rise to a communication event…
3) Which triggers a predetermined action or behavior.

The observation is already a semiotic operation since it consists of forming an "interpretant" of an object through a given sign according to its characteristics as sign (which we will discuss below).

The communication event is obviously also a semiotic process since it consists of the utterance of a new sign (or the deliberate repetition of the observed one) and its interpretation by the audience of the utterer. Note that though the resulting action or behavior is not primarily a sign

for the agent, it can become so for an external observer. Just think at the predator in the vervet monkey example.

We submit that such a pattern is constitutive of the kind of signs we call indicators and that it must (or should) be the case also for our social and political indicators which are kinds of functional equivalents (at a higher level of complexity) of the signs in our three examples. Before entering in this discussion, there is still something to say about our three examples, this time not anymore on what they have in common but, on the contrary, on how they differ. For doing so, a summary of Peirce's theory of signs is needed.

3. The semiotic nature of indicators

Charles Sanders Peirce is the founding father of both the pragmatic turn in philosophy and the modern theory of signs called "*semiotics*". Contrary to Saussure and his followers who put forward a conception of the sign consisting of two elements (the signifier and the signified) Peirce developed a triadic conception of the sign as structure connecting three elements: the sign properly said or "*representanem*" (S), an object (O) and an "interpretant"(I).

"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. That sign which it creates I call the interpretant of the first sign. The sign stands for something, its object. It stands for that object, not in all respects, but in reference to a sort of idea, which I have sometimes called the ground of the *representamen*." (Peirce, 1955, p. 99).

Drawing on his conception of the representational relation as involving three elements, he showed that there are also three different lenses for looking at it, all of them expressed as trichotomies. The first trichotomy "*Qualisign-Sinsign-Legisign*" refers to what makes a sign what it is. It is a monadic relation since it links the sign to itself. A "*Qualisign*" is a quality which is a sign. A "*Sinsign*" is an actual existent thing or event which is a sign and a "*Legisign*" is a law (generally established by men) that is a sign. Another trichotomy refers to the relation between the sign and the interpretant, more exactly to what the sign tells about the object to the interpretant and how it orients its representation of the object. Here Peirce distinguishes the "*Rheme*" , the "*Dicent*" and the "*Argument*". The first refers to a possibility, the second to a fact and the third to a reason. The most useful for us of the three relations Peirce distinguished is its now classical distinction between icons, indices and symbols. An *icon* is a sign whose relationship with its object stands in some resemblance and in some quality they share together. Because of that resemblance, S evokes the quality of O in I. Examples of icons are pictures, schemas, diagrams, metaphors, etc. The *index* and its object are linked by an existential, dynamical connection. Examples of indices are the weathercock, the sundial, the footprint of an animal on the ground, the smoke produced by a fire, etc. Finally, *symbols* are linked to their object through a law, a habit or a convention. For instance, the wedding ring is a symbol of marriage because of a tradition. Words, whose meaning rest upon conventions or habit are symbols. Table 1 illustrates the main differences between the three classes but we have not finish with them. There is more to tell about them and this will be done below.

Table 1. Differences between signs with respect to their object.			
Examples of signs	INDEXICAL	ICONIC	SYMBOLIC
REPRESENTAMEN	Smoke	A drawing of a dog	Red roses
OBJECT	A Fire	A dog	Passion
RELATIONSHIP	Contiguity	Resemblance	Convention

The combination of the three trichotomies is expressed in the figure 1.which shows how the different dimensions are nested and articulated. For instance, because it can be a sign only through its qualities, a "S*insign*" involves at least one "*Qualisign*"; a "*Rhematic Indexical Sinsign*"

involves necessarily an "*Iconic Sinsign*" which in turn includes a "*Qualisign*", etc. The "*Qualisign*" itself being a quality that "functions" as a sign can never stand alone but must be carried by or embodied in a "*Sinsign*" which is an actual event or thing (a statue, a photography, a symptom of a disease are examples of "Sinsigns"). The "*Legisign*" being a rule or a law that is a sign cannot be a single object but a general type which is significant by convention or agreement. Therefore it signifies always through an instance of its application, what Peirce called a "replica" and which is necessarily a *Sinsign*. For instance, the class of all weathervanes is a "*Dicent Indexical Legisign*" but one of its *replica*, an existing moving weathervane is a "*Dicent Indexical Sinsign*". A typical case of *Rhematic Indexical Sinsign* is the arrow which directs to a specific place such as the exit of a building or the endpoint of a hiking trail. It is only thanks to a convention of habit that what the interpreter retains of the sign is only the direction as indicated by the tail of the arrow without paying any attention to its color, length, width, etc. Almost all traffic signs are of this kind.
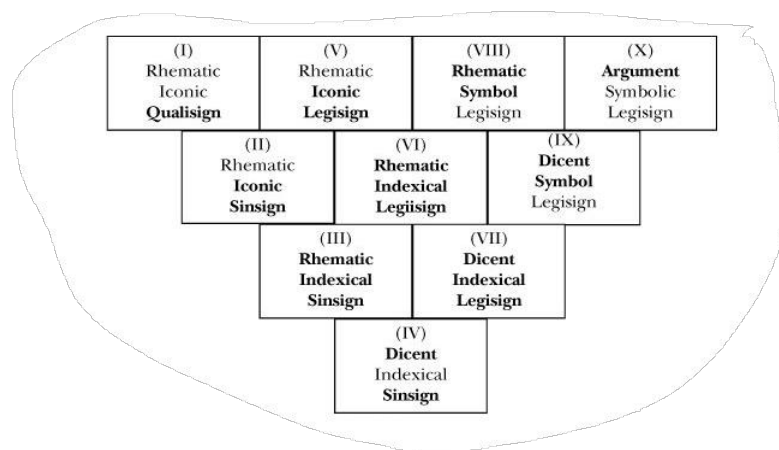
(I) Rhematic Iconic **Qualisign**	(V) Rhematic **Iconic Legisign**	(VIII) **Rhematic Symbol** Legisign	(X) **Argument** Symbolic Legisign
	(II) Rhematic Iconic **Sinsign**	(VI) **Rhematic Indexical Legiisign**	(IX) **Dicent Symbol** Legisign
	(III) **Rhematic Indexical Sinsign**	(VII) **Dicent Indexical Legisign**	
	(IV) **Dicent** Indexical **Sinsign**		

Fig.1. Peirce's lattice of signs

However, the most interesting distinction for our present discussion is between the index, the icon and the symbol.

Indexical signs

According to Peirce, indexical signs:

1. Have a real, existential relation with their object like the weathervane with the wind, the smog with the fire, a footprint in the sand with someone (through which Robinson got aware of the presence of Friday), etc., in other words are really affected by their object, or…
2. Have a spatial connection or contiguity (whatever the distance) with their object, like Polaris with the north pole, or the index finger directed towards something or someone;
3. Have these characteristics independently of any actual interpretation,

4. Refer to an individual ("this" fire, "this" wind, "this" person…) which may be a collection or a class provided it is considered in its singularity; ("For instance, a news network's traffic helicopter hovering above a major road is an index of a single traffic jam, but not an index of each separate stationary car…" (Atkin, 2005, p. 166)).
5. **Have the property of directing attention to their object**.

The honey-guide behavior is clearly indexical since it satisfies criteria 2, 3, 4 and 5. The varieties of indexical indicators are numerous (Sebeok, 1999, p. 71): symptom, cue, clue, track, mark, and vestige. They play a fundamental role in a lot of inquiries such as police investigations, medical diagnosis and prognosis, archeological or historical researches, and so on.

Iconic signs

As already explained, iconic semiosis evokes the object for the "*interpretant*" through a common quality or resemblance between the sign (the "*representanem*") and the object. Despite what the term "icon" suggests, it is important not to restrict it to some visual likeness or resemblance. Peirce distinguished three kinds of icons: image, diagram and metaphor but didn't give much importance to metaphors, whilst he gave some attention to diagrams (he was above all a mathematician and a logician). Maybe did he anticipate what (Lakoff & Johnson, 2003) were to show much later: that metaphors are not based on similarities but on cross-domains correlations in experience which give henceforth rise to perceived similarities between the two domain. This should not come as a surprise when dealing with social and environmental indicators: it suffices to pause a moment on what the "ecological footprint" evokes and its fundamental metaphor of "global hectare".

According to (Sebeok, 1999) iconicity can even be olfactory as our example 2 shows. The alarm substance that *Pogonomyrmex badius* secrete as long as the nest is in danger so that the number of con-specifics informed increases in proportion to the lasting of the threat " is iconic inasmuch as it varies in analogous proportion to the waxing or waning of the danger stimuli" (Sebeok, 1999, p. 30). This remark is very important because it can drive us to a usually unsuspected way to look at numerical indicators, as we will see later on.

Symbolic signs

A sign is symbolic when it refers to the object through a convention a law or a habit. The class of symbols is therefore enormous since almost every linguistic sign is included in it but also conventional signs like the flashing lights on the road, car directions flashes, etc. Allegories, badges, brands, emblems, marks are all symbolic signs as well. However, except for most linguistic signs, many real, actual symbols have also a significant iconic dimension that, nevertheless, doesn't constitute the prime determinant of their meaning.

The alarm-calls of our example 3 are clearly symbolic but, as figure 2 shows, before an alarm-call can be emitted a first semiosis must have taken place in the mind of the whistleblower. The sight of the predator must have induced the object "this kind of threat" which evoked the interpretant "this alarm-call". For the members of the group who hears the alarm-call, the relation to the

object "kind of threat" is purely conventional, hence symbolic, but it is also somewhat indexical or at least associated to an indexical sign (a gesture for example) that directs its attention to the actual predator. Finally, the figure illustrates an important character of semiosis: its open-endedness. Since every interpretant is itself a sign, the process of semiosis is virtually infinite.
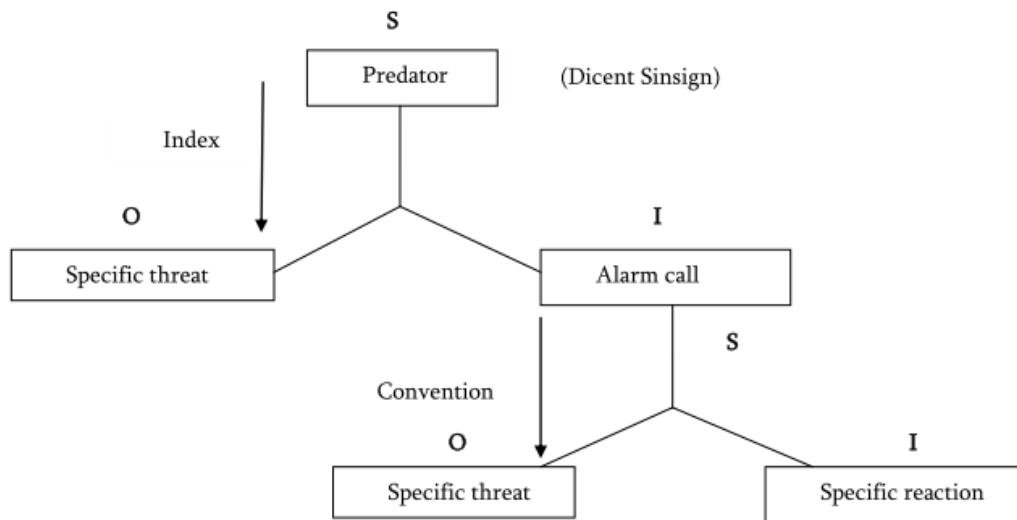
> The predator is a *Dicent Indexical Sinsign* because 1) it directs attention toward an object (threat) AND 2) it gives some information about it (the kind of threat), in which it differs from *Rhematic Indexical Sinsigns*. On the other hand, the alarm-call is a Rhematic Indexical Legisign.

Fig 2. Diagram of the semiosis process in the vervet monkey alarm-calls

Summary

Indicators are "vital signs" about their environment that living organisms perceive, understand and communicate and according to which they orient their conduct. In order to qualify as an indicator, any sign must at least present a clear indexical character. This means it must direct attention to an existential singular object or event, with which it has a causal or spatial connection independently of being actually interpreted or not. This last requirement means that it has necessarily an objective character. In addition, it can present iconic or symbolic properties. The iconic or symbolic properties are necessary for the sign to do more than just indicating the existence of its object but conveying additional information about it. If the information is communicated symbolically, only the organisms that know the underpinning language or convention will be able to form an interpretant for it. This is less the case with iconic signs or dimensions since they signify through a kind of imitation, an image, model or metaphor of the object. However, it is clear that even iconic signs presuppose a common ground or internal disposition enabling the perception of resemblance between the sign and its object. As (Deacon, 1997, p. 471) stresses:" When we apply these terms to particular things, for instance, calling a particular sculpture an *icon*, a speedometer an *indicator*, or a coat of arms a symbol, we are engaging in a sort of tacit shorthand. What we usually mean is that they were designed to be interpreted that way, or are highly likely to be interpreted that way."

4. A semiotic paradigm for indicators?

According to (Pape, 2008, p. 2):"…Peirce's theory of indices provides us with a general account of indexical signs and the epistemic role of the indexical relation by which theoretical concepts are confronted with experience of individual entities, whether in texts, in highly technical experiences or in our daily experience of identifying perceptual objects." This raises the following questions:

1) Is there a specific model of inquiry based on the indexical relation?
2) Provided such a model exists, is it the model that governs our construction and uses of social and political indicators?

In an oft-cited article[5], the great Italian historian Carlo Ginzburg, coined the Italian expression "*paradigma indiciara*" to characterize what he identified as a very ancient epistemological perspective which re-emerged at the end of the XIXth century in the work of writers as different as Giovanni Morelli, Sigmund Freud and Arthur Conan Doyle.

"Towards the end of the nineteenth century - more precisely in the decade 1870-80 - a presumptive paradigm began to assert itself in the humane sciences that was based specifically on semiotics. Its roots, however, were much older." (Ginzburg, 1992, p. 102).

Much older they certainly must be if, as Ginzburg suggests, this paradigm originates in the hunting practices of the first hunters-gatherers where the art or the science of reading the tracks, traces and footprints of animals was a condition for survival.

"Paradigma Indiciara" has been translated in French as "Paradigme indiciaire". In English, the official translation is "Evidential Paradigm" but it is also known as the "Conjectural Paradigm". Both are somewhat unsatisfactory because they hide the reference visible in the Italian and French version, to the linguistic root "indice" which gives a clue (we are here precisely in what Ginzburg is talking about) to its meaning. Indeed, "indice" comes from the Latin word *indicium* which means precisely "sign", "indication" and its Greek equivalent is *semeion* from which comes semiotics, semiology, etc. As a matter of fact, Ginzburg himself points out the semiotic character of this paradigm and sometimes refers to it as the "semiotic paradigm" as the following quotation shows: "Though reality may seem to be opaque, there are privileged zones - signs, clues - which allow us to penetrate it. This idea, which is the crux of the conjectural or semiotic paradigm, has made progress in the most varied cognitive circles and has deeply influenced the humane sciences. " (Ginzburg, 1992, p. 123).

The three authors mentioned by Ginszburg, whilst being very different in many respects, have at least two things in common. The first is the importance they confer in their work to seemingly insignificant, trite, mundane details that ordinary people don't even mention but that turn out to be *in fine* more significant for those who can decipher them than what is obvious for all.

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[5]The original article was published in 1979 in Italian in (Gargani, 1979), and reprinted in a collection of Ginzburg's articles titled "*Miti, emblemi, spie : Morfologia e storia*" ; Torino: Giulio Einaudi as "Spie. Radici di un paradigma indiciara. Here, I am referring to the English edition entitled, "*Clues. Roots of an Evidential Paradigm*", in (Ginzburg, 1992). It is also available online at: www.princeton.edu/~ereading/Ginsburg%20Clues.pdf.

Everybody knows how cigarette ashes, footprints, traces and others minuscule indices speak to Sherlock Holmes and how Freud enlisted *lapsus linguae*, jokes and other minuscule symptoms to disclose his patients' unconscious. Actually, both Conan Doyle and Freud were directly inspired by Morelli's method to attribute unsigned or mistakenly attributed paintings of old masters to their authentic creator by focusing on "the most trivial details that would have been influenced least by the mannerisms of the artist's school: earlobes, fingernails, shapes of fingers and of toes." (Ginzburg, 1992, p. 97). Indeed, Morelli's work was known to both Freud and Conan Doyle and they make reference to his method in some of their writings.

The second thing they have in common is their practice or at least education as medical doctors so that they were acquainted with "medical semiotics" the art and practice of diagnosing diseases from symptoms. Their model of inquiry finds its roots in medicine as a practice of interpretation of physical and behavioral signs. "In each case, infinitesimal traces permit the comprehension of a deeper, otherwise unattainable reality: traces - more precisely, symptoms (in the case of Freud), clues (in the case of Sherlock Holmes), pictorial marks (in the case of Morelli)… In each of these cases the model of medical semiotics is evident: that discipline which permits the diagnosis of diseases inaccessible to direct observation based on superficial symptoms, sometimes thought to be irrelevant in the eyes of the layman." (Ginzburg, 1992, p. 102).

According to Ginzburg, the conjectural paradigm departs from what he calls the "Galilean" paradigm of the natural sciences, on three major characteristics.

1) As a hermeneutics, i.e. a practice of deciphering and interpreting signs of various kinds (not restricted to language and written materials) its logical model is what Peirce called abduction more than the hypothetic-deductive and experimental model underpinning the Galilean epistemology.

2) Contrary to natural sciences, it deals with individual cases; with the particular not the universal.

3) It is intrinsically qualitative.

However, we submit that the most important feature of the semiotic paradigm consists in its fundamental distinction between the visible and the invisible. The symptoms, clues, tracks etc., are visible manifestations of something hidden either because it is intrinsically invisible, not visible anymore, or still to come. A footprint or a trace is the manifestation of the fact that something or someone has been here at some moment that is not here anymore and the semiotic quest consists in finding who or what it was, where it is now, what it did here, etc. Likewise, a symptom is the observable manifestation of a trouble or a disease which is hidden but can be revealed to those who know how to interpret the signs. Here only does the concept of indicator conform to its epistemological definition as an observable variable standing for an unobservable reality (thing or event). If we take this definition seriously we must re-qualify many variables or data presented as indicators but which are actually measurements or codifications of observable things, events or properties. It is only when the measurement or the codification is supposed to

indicate something behind or beyond what is observed and that it do so through the logical process Peirce called abduction that it can rightly be called an indicator.

An example: weather reporting and forecasting

A universal example of the semiotic paradigm is the way people across time and space observe and interpret signs such as the direction and strength of the wind, the color of the sky, the number, color and shape of clouds, the behavior of animals, etc., in order to predict the weather to come. In the rural and village community, people used to confront their own interpretation of these signs and debate together so as to come to a common position. They also had at their disposal a vast repertory of local sayings and proverbs transmitted from generation to generation in which the experience and knowledge of their ancestors was stored. It was generally a strictly local knowledge enabling to help interpret natural signs taking account of the specificity of the local context.

This information was of course vital for the planning and scheduling of economic activities such as plowing, sowing, harvesting, hunting, fishing, traveling, shipping, fighting, etc. This information is still demanded and highly praised today and the range of activities depending on accurate weather forecasting has greatly increased including all sorts of leisure and entertainment activities so that it could rightly be said that the most widely consulted set of indicators in the world is the one related to weather.

What is striking when one look at this semiotic activity is its conjugation of universalism and idiosyncrasy. Indeed, besides the general weather report you find in almost every news bulletin, you can also find a host of specialized reports specifically targeted to some professions (farmers, fishermen, sailors, airplane pilots…) or communities (pigeon fanciers, mountain climbers, parachutists…) that use a close but somewhat different language and gives information directly linked to the kind of activity of concern.

The figure 3 below is a capture of the BBC weather report of Tuesday 03/18/2014. It can be read as composite sign composed of a mix of symbolic, iconic and indexical signs.

Fig 3. A weather report on BBC's web site. Source: BBC

The iconic signs are easy to identify (a cloud, a shining sun, a quarter of moon…). Things are less clear for indexical ones. Actually "London" and "Tue" whilst being symbolic as words and abbreviations have an indexical function since they direct the interpretation to an individual existential entity: the city of London at a specific moment. Without these indications, the whole table would not be meaningless (for instance as a general sign of what a weather report could look like in which case it would be a *rhematic iconic legisign)* but would be of no use for those who want to know what is the weather today in London and how will it evolve. The sign used for expressing the wind speed is interesting since it is a mix of symbolism (the number in the circle) and of indexicality (the direction of the arrow) which, by the way, is the reverse of what is indicated in the row below (wind direction). The wind direction is expressed as where the wind is coming from (WSW) but the arrow on the row above indicates where it is going to (ENE). They are purely symbolic signs so that it is necessary to have been learned in interpreting them to understand what they mean. The different scales and units used are also noteworthy; percentages, thousands of Millibars, codification symbols for visibility, mph for wind speed. These are conventional signs since they rely on conventions of measurement. However, they have also an iconic dimension as soon as there is some isometrism between the object and the sign.

Latest observations — 0900 UTC on 18 Mar 2014: East & North coasts

Location	Weather	Temperature			Humidity	Wind		Vis	Pressure	Wave	
		Air	Dew Pt	Sea		Dir	Speed			Period	Height
		°C	°C	°C	%	deg	knots	n miles	hPa	seconds	metres
K7	N/A	6.0	4.4	N/A	89	80	12	N/A	999.5	N/A	N/A
Lerwick	☁	4.5	4.2	N/A	98	140	2	4	1000.0	N/A	N/A
Foula	N/A	N/A	N/A	N/A	N/A	120	6	N/A	1000.1	N/A	N/A
Sule Skerry	N/A	7.1	6.1	N/A	93	220	8	N/A	999.5	N/A	N/A
Kirkwall	☁	6.9	6.9	N/A	100	220	11	5	1000.1	N/A	N/A
Wick Airport	☁	6.9	6.0	N/A	94	180	7	5	1000.2	N/A	N/A
Lossiemouth	☁	8.1	4.6	N/A	79	210	5	14	1000.4	N/A	N/A
Dyce	☁	7.3	4.2	N/A	81	190	12	10	1001.8	N/A	N/A
Leuchars	☁	7.3	5.4	N/A	88	230	18	10	1002.7	N/A	N/A
Boulmer	☁	7.7	4.5	N/A	80	150	8	15	1005.8	N/A	N/A
Donna Nook	N/A	9.3	6.0	N/A	80	N/A	N/A	11	1011.4	N/A	N/A
Weybourne	☁	8.4	5.2	N/A	80	230	15	21	1012.9	N/A	N/A
Shoeburyness	☁	9.4	6.1	N/A	80	250	10	6	1016.0	N/A	N/A
Manston	☽	9.6	5.5	N/A	76	250	11	10	1016.5	N/A	N/A

Fig 4. A weather report for marine activities

Turning to the specialized report for marine activities (Fig. 4), we remark striking differences with the general weather report. In general it is more precise and the units can be different. The wind direction is in degrees not in codes labels (SSW) and its speed is expressed in knots, not in mph; the pressure also is a bit more precise with one more digit, etc. Additional information is (or expected to be) reported concerning the temperature of the sea, and the periodicity and height of the waves. All these data have a direct meaning for sailors or yachtsmen in terms of shipping maneuvers, sails to host, and so on. Noteworthy also is the less uses of iconic signs and the greater use of symbolic ones. We can hypothesize that the more specialized the audience the more symbolic signs with respect to iconic ones. However, this hypothesis must probably be qualified by taking into account the context. It is likely that the more the signs to monitor and urgent the reaction in case of significant change, the more iconic signs will be used.

The following figure shows the weather report the same date for London but targeted towards farmer this time.
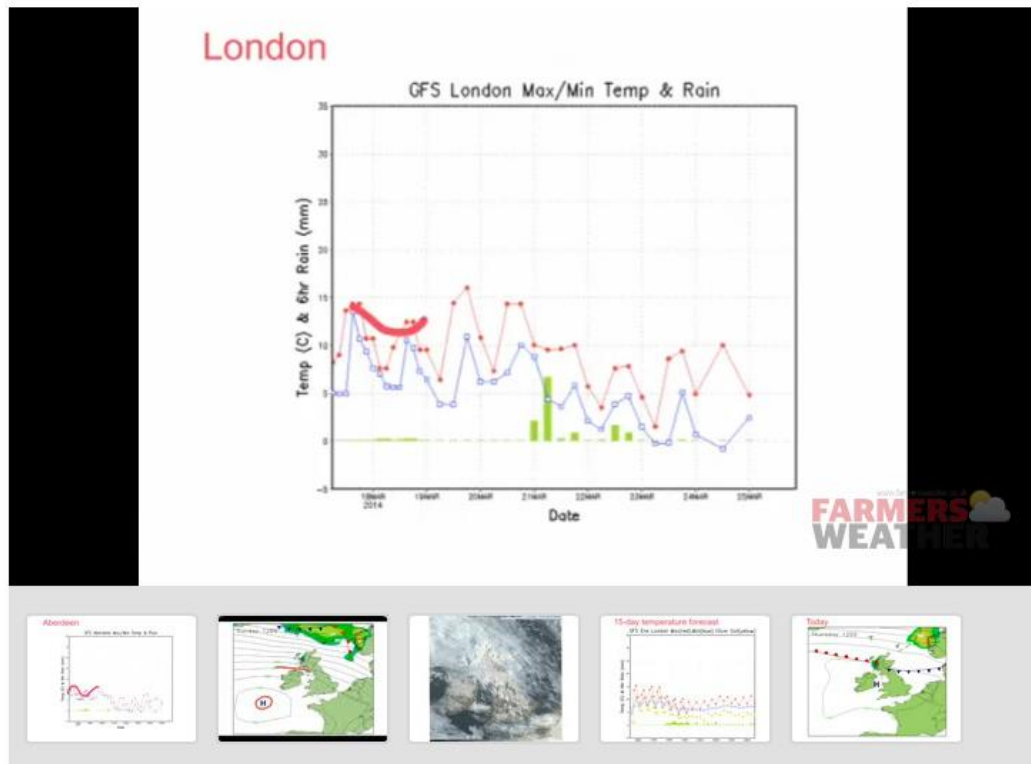
Fig 5. A weather report for farmers.

The indications here are different from the general report and from the marine one. Though referring to the same date of 02/18/2014 and the same physical environment than the BBC general weather report, the signs reported here are those that matter only for farmers and they know how to interpret them. The "interpretant" they form is probably the sign of a specific activity to engage in or, on the contrary, to postpone.

There is not much difference between the way our ancestors dealt with the weather according to their activities and the way our contemporary farmers or sailors contemplate it today. The information they get now is timelier, more accurate and more precise because they can make use of timelier, more accurate and more precise information thanks to more sophisticated technologies.[6]. We can speak here of co-evolution taking place between technologies and information, between practices and indicators. The technologies of observation and interpretation of meteorological signs and the technologies of activities in need of meteorological information have developed hand in hand.

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[6] If the vervet monkeys had to protect themselves from an additional kind of predator and an additional escape or coping strategy, they would probably have also an additional specific alarm-call. They don't because they don't need it**.**

I think the meteorological case is illustrative of the best practices in the building and communication of indicators. For the following reasons:

- The connection between the information provided and the needs of the different publics is as close as possible.
- The communication is diversified according to these different needs; form the general weather report to specialized ones in direction of different communities of practice. Not only does the information vary accordingly but the modes of communication (kinds of signs used) also: the less specialized the audience the more directly interpretable signs are used.
- The information is available at different levels (Country, regions, local places…) so that no one feels excluded of the benefit of the public service.
- The data and their communication are the outcome of the collaboration of different institutions (scientific, administrative and the media) and of the public itself who contribute to the production of information thanks to the many volunteers who take meteorological measures at home and broadcast them on a daily basis to the scientific and technical institutions that use them as inputs into their forecasting numerical models.

Is it also the case in other domains, and more specifically, in the policy domain? Can we detect in the policy domain the same kind of co-evolution that the one discussed here above about the weather between the techniques of observation and the practices that could make use of the information gathered?   More fundamentally, what is the connection (if any) between observations, communication and action in the public policies domain? Though there is a vast and important literature on the general relations between science and policy, little attention has been paid to the production of knowledge undertaken explicitly for the sake of public decision making and intimately interlocked with the policymaking process.

As far as I know the first philosopher of some importance to have addressed the question is John Dewey in two important books. The first, published in 1927 is "The Public and its Problem", the second "Logic. The Theory of Inquiry" published in 1938. The former introduces the notion of "social inquiry" which was to be more elaborated in the latter. Interestingly, the latter makes no reference to the former and gives a quite different account of the justification of the social inquiry.

5. Public problems and social inquiry

5.1. The public and its problem

Dewey's theory of the State and politics takes its point of departure "from the objective fact that human acts have consequences upon others, that some of these consequences are perceived, and that their perception leads to subsequent effort to control action so as to secure some consequences and avoid others. Following this clew, we are led to remark that the consequences are of two kinds, those which affect the persons directly engaged in a transaction, and those which affect others beyond those immediately concerned. In this distinction, we find the germ of the distinction between the private and the public. When indirect consequences are recognized and there is effort to regulate them, something having the traits of a state comes into existence." (Dewey, 1927). Contrary to a long tradition of political philosophy, the state and politics in general are not ascribed to any transcendental principle, attribute of human nature or inaugural decision but simply to their function in the context of human association, which is to control and regulate the consequences that private activities can have for people external to them. In modern words, we would say that the mission of public institutions is to care for externalities. It means that, in some way, the public is second with respect to the private. It comes out when private activities generate settled, uniform, recurrent and far-reaching in space or in time consequences affecting people who share no responsibility in their happening. It is those people that Dewey calls the "public": "The public consists of all those who are affected by the indirect consequences of transactions to such an extent that it is deemed necessary to have those consequences systematically cared for" (Dewey, 1927, pp. 45-6).

The existence of externalities is not sufficient in itself for a public to be constituted; they must also be perceived and understood. In fact, the constitution of a public is a three stages process. The first one is the passive fact of being jointly affected by private activities; the second stage, an active one, is the fact of becoming conscious of a common interest in dealing with the problem and therefore looking for a solution, and the third stage is the designation of representatives for managing the problem. The second stage is crucial. It is the constitution of a community of interests between individuals hitherto only concerned with their personal, private activities and objectives. It is also the most problematic in modern, complex and technological societies. When Dewey was writing "The Public and its Problem", the Western world and especially the USA were witnessing an upsurge in the development of technological innovations, the extension of the industrial system of production and the acceleration of globalization so that more and more people were getting adversely affected by the consequences of private transactions in which they had no part. But, on the other hand, the consequences of individual or collective behaviors had become so diffuse and remote in time that it was no longer possible to perceive them without what Dewey called "social enquiry", i.e. the scientific investigation of social matters. In other words, whilst more and more people were affected by more and more pervasive and far-reaching externalities; it was, at the same time, more and more difficult for the concerned people to understand the processes affecting them so as to identify their common interest and organize themselves in order to achieve it. At least, this had become impossible without the help of

scientific procedures and methods. "…the machine age has so enormously expanded, multiplied, intensified and complicated the scope of the indirect consequences, has formed such immense and consolidated unions in actions on an impersonal rather than a community basis, that the resultant public cannot identify and distinguish itself. And this discovery is obviously an antecedent condition of any effective organization on its part. Such is our thesis regarding the eclipse of the public….There are too many public and too much of public concern for our existing resource to cope with. The problem of a democratically organized public is primarily and essentially an intellectual problem in a degree to which the political affairs of prior ages offer no parallel." (Dewey, 1927).

Since Dewey's times, all the factors that he identified as leading to the eclipse of the public have kept on strengthening and increasing: industrialization, capitalism, the development of increasingly powerful – and for some of them, potentially harmful – techniques whose consequences can extend so far in space and time that they cannot be assessed without the help of specialized knowledge and experts, not speaking about the "increase in the number, variety and cheapness of amusements"[7]. These objective conditions entail that we are more and more likely to be negatively affected by the indirect (and often un-voluntary) consequences of private activities and transactions in which we had no part but also of public policies undertaken without our informed consent notably, but not only, in foreign countries[8]. Moreover, as climate change and other environmental issues testify, we know now that our own private behaviors have also significant consequences for people remote from us in time and space, including future generations. Recently also, millions and millions people have been very negatively affected by the consequences of private financial activities that have necessitate expensive interventions of states which have mitigate somewhat the problem without however solving its causes. It follows that there is potential global (and even trans-generational) public to be constituted around environmental, financial and probably others problems. However, even if more and more citizens become aware of these problems, a genuine public in the Deweyian sense has yet to be created that would be active enough to create the global state and institutions apt to tackle them effectively.

Let us summarize Dewey's arguments:

a) We have a public problem when private transactions are producing settled, uniform, recurrent and far-reaching consequences for people not directly involved in these transactions. In a complex, technological and globalized world, private activities are likely to harm or benefit indirectly but seriously more and more people including foreigners and future generations. There are therefore more and more public problems to address.

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[7] « The members of an inchoate public have too many ways of enjoyment, as well as of work, to give much thought to organization into an effective public. Man is a consuming and sportive animal as well as a political one. What is significant is that access to means of amusement has been rendered easy and cheap beyond anything known in the past. » (Dewey, 1927).

[8] "The consolidation of peoples in enclosed, nominally independent national states has its counterpart in the fact that their acts affect groups and individuals in other states all over the world." (Dewey, 1927)

b) For a public problem having a chance to be alleviated, the people affected must be aware of it, and conscious of their common interest in having it properly managed. In Dewey's words, they must constitute themselves as a public (or a community).

c) However, the nexus of causes and consequences has become so intricate and complex that most problematic situations cannot be properly identified and understood without the use of scientific methods and procedures ("social inquiry") and the interventions of experts in their use.

d) The results of "social inquiry" have to be communicated so that the public opinion can be formed.

It is only in subsequent works and notably in "Logic. The Theory of Inquiry" that Dewey developed his conception of the needed social inquiry.

5.2. The nature of social inquiry

As already remarked, there is a small difference between Dewey's presentation of the social inquiry in its political work in 1927 and in its logical one in 1938. There is no more reference in 1938 to indirect consequences of private transactions but more generally to a "confused situation". Inquiry is now defined as "the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the original situation into a unified whole." (Dewey, 1938, p. 108). If in more advanced sciences, the original indeterminate situation can be a purely cognitive one[9], in social inquiry it is an actual, practical social situation: "In social inquiry, genuine problems are set only by actual situations which are themselves conflicting and confused. Social conflicts and confusions exist in fact before problems for inquiry exist. The latter are intellectualizations in inquiry of these 'practical' troubles and difficulties." (Dewey, 1938, pp. 498-499).

Or: "In fine, problems with which inquiry into social subject-matter is concerned must, if they satisfy the conditions of scientific method, (1) grow out of actual social tensions, needs, 'troubles'; (2) have their subject-matter determined by the conditions that are material means of bringing about a unified situation, and (3) be related to some hypothesis, which is a plan and policy for existential resolution of the conflicting social situation." (idem p. 499).

1) What Dewey calls the "institutionalization of the problem" is the first stage of the social inquiry. The initial situation is not by itself problematic, it becomes so by being subjected to inquiry. The inquiry starts with the transformation of the existential, pre-cognitive situation into a cognitive problem.

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[9] For instance, in contemporary theoretical physics, the indeterminate situation consists in the lack of consistency between quantum field theory and general relativity. The inquiries in string's or higher spin's theory aims at coming to a unified situation where both high energy and low energy systems can be explained by the same set of concepts and relations.

2) The second stage of the inquiry consists in the "determination of a problem-solution". It begins with the transformation of the completely indeterminate situation into a problem having definite constituents. This means identifying the constituents of the situation that are settled.

"When an alarm of fire is sounded in a crowded assembly hall, there is much that is indeterminate as regards the activities that may produce a favorable issue. One may get out safely or one may be trampled and burned. The fire is characterized, however, by some settled traits. It is, for example, located somewhere. Then the aisles and exists are at fixed places. Since they are settled or determinate in existence, the first step in institution of a problem is to settle them in observation. There are other factors which, while they are not as temporally and spatially fixed, are yet observable constituents: for example the behavior and movements of the other members of the audience. All of these observed conditions taken together constitute the 'facts of the case'. They constitute the terms of the problem, because they are the conditions that must be reckoned with or taken account of in any relevant solution that is proposed" (Dewey, 1938, pp. 109-110). In social situations the identification of the constituents of the problem has necessarily an historical aspect. The social inquiry is historical because the means and measures through which the problem at hand could be solved and the situation transformed must be aligned with the causes and past behaviors which have generated the extant situation. As the fire alarm example illustrates, the determination of facts is entirely driven by the search for a solution to the problem at hand and therefore in reference to an end-in-view which is the unified situation. This means that the facts are determined in their dual function as resources and as obstacles. "Realistic social thinking is precisely the mode of observation which discriminates adverse and favorable conditions in an existing situation, 'adverse' and 'favorable' being understood in connection with the end proposed (id. p.499).The definition of an end-in-view and the weighting of facts as adverse or favorable imply that evaluation judgments are intrinsic to social inquiry. However, and this is of utmost importance, the values employed must be determined inside the inquiry and on basis of the particular situation. In other word, the determination of the end-in-view is informed by the means available which are fixed by the adverse or favorable character of the established facts about the problem. In a back and forth movement, the adverse or favorable character of the facts is assessed according to a hypothetical end-in-view.

"The evils in current social judgments of ends and policies arise….from importation of judgments of value from outside of inquiry. The evils spring from the fact that the values employed are not determined in and by the process of inquiry for it is assumed that certain ends have an inherent value so unquestionable that they regulate and validate the means employed, instead of ends being determined on the basis of existing conditions as obstacle-resources." (p.503).

3) The third stage of the inquiry consists in the formulation of ideas of possible solutions, "anticipated consequences (forecasts) of what will happen when certain operations are executed under and with respect to observed conditions." (id.,p.110). Because they focus on possible solutions, the ideas referred to by Dewey differ from how the traditional psychology and epistemology understand ideas, i.e. as impressions and perceptions induced in mind by the extant reality. Far from being representations or copies of an existing reality, ideas in inquiry and

especially in social inquiry are fundamentally prospective and anticipatory. In contemporary language we would call them "scenarios" that are simulated and analyzed as for their likelihood and anticipated consequences.

The process of inquiry is of course a back and forth process until a feasible and satisfactory end-in-view has been defined and endorsed by the public. It can happen that successive ends-in-view are hypothesized and rejected, each time triggering the search for new additional facts which lead to a new end-in-view and so on. There is however something special in hypothesis concerning social ends: they must include as part of themselves the ideas and activities of all the people involved in the problem, those who have some responsibility if it, as well as those who have a role to play in its solution. This has special relevance with respect to the definition of the public discussed here above. The solution to the problem cannot ignore the actors whose private (or public but extraneous) transactions have the consequences at the origin of the problem. The final situation that must come out of the social inquiry and of the action of the public must be comprehensive enough to include the activities at the origin of this public. We see there is nothing in the social inquiry that differentiates it fundamentally from commonsensical applications of practical reason, except that it is fundamentally a collective and participative process. This is not surprising: the inseparability of rationality from experience and of the intellectual from the practical is indeed the main feature of pragmatism, a standpoint that the three main representatives of this approach, Peirce, James and Dewey shared, beyond all their differences. The scientific character of the social inquiry – if any – comes from the fact that the experimental and logical nature of the scientific inquiry has become necessary to uncover the relevant facts and to assess their favorable or unfavorable character with respect to the possible ends-in-view.

5.3. Main lessons of Dewey's approach

5.3.1. Data vs. objects

There is, for Dewey, a fundamental difference between the "data" and the "object" of the inquiry; a difference which is constitutive of science. The "data" are the immediate, pre-reflexive perceptions or impressions which demand further elucidation and elaboration. They characterize the "practical troubles and difficulties" that triggers the process of inquiry. In "The Quest for Certainty" Dewey stated very clearly their status as indicators: "By data is signified subject-matter for *further* interpretation; something to be thought about. *Objects* are finalities; they are complete, finished; they call for thought only in the way of definition, classification, logical arrangement, subsumption in syllogisms, etc. But data signify "material to serve"; they are *indications, evidence, signs, clues* (my emphasis) to and of something still to be reached; they are intermediate, not ultimate; means, not finalities (Dewey, 1929, p. 99). The fallacy of empiricism lies precisely in taking these data as scientific facts while they can only be the materials upon which scientific facts or objects are to be build. With respect to Peirce's triadic conception of the sign where the object seems to preexist to the sign and its interpretant and remains the same in the interpretant[10], Dewey seems to consider that in the scientific inquiry, the object that the interpretant points to lives in the future, as a transformation of the initial object. This is because the inquiry consists in the constitution of a scientific object by the transformation of the existential situation which is experienced as chaotic, inharmonious, into a meaningful concept or model. The object is the conclusion of the inquiry. It stems from the reorganization and selection of the data subjected to the development and the verification, by experimental procedures, of ideas through which meaning is ultimately given to them. We will see later on that this reorganization implies **re-framing** the issue so that it can be cleared of the stereotypes, prejudices and others pre-conceptions that block the inquiry. *Since the construction of the object is correlative to the transformation of the situation into a unified totality, it is possible to consider the construction and the collective acceptance of indices (aggregate or composite) for characterizing the situation as the manifestation that a formerly indeterminate situation has been effectively transformed into a determinate one and that the existential "data" have been assigned an objective meaning.*

5.3.2. Two kinds of problems

We have pinpointed at the beginning of this section devoted to Dewey's theories that there was a difference between his positions in 1927 and in 1938 with respect to the goal and to the starting point of the social inquiry. In "The public and its problem" the objective of the social inquiry is to allow the constitution of a public around a problem stemming from the spillovers of private transactions on people not involved in them. What is expected from the inquiry it that it reveals the private transactions at the origin of the trouble, help the concerned people to define their

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[10] Actually, this is totally exact. Peirce introduced the distinction between « immediate » and « dynamic » to account for such a difference.

common interest and work out a solution that satisfies it. While the perspective in the 1927 text is mainly focused on particular problems which could be characterized as short-term, the outlook is much more comprehensive and structural in "The Theory of Inquiry". There is no specific problem to address here but a general situation which is lived as incoherent, indeterminate, and contradictory. It is tempting, even if it may be stretching the point too far, to liken the Deweyian indeterminate situation with the kind of problems we characterize today as "wicked" (Rittel & Webber, 1973), ill-structured (Dunn, 1988) or "un-structured" (Hisschemöller & Hoppe, 1995, p. 6). Compared to what could be the case with, let us say "problems of the first category" (those of "The public and its problems" even if Dewey didn't underestimate their complexity in the "age of the machine"), problems of the second category cannot be subsumed under simple, individual, (even if aggregate) indicators such as the unemployment rate, or the GDP as well. Only composite indicators would be able to convey the complexity and the indeterminate character of the situation. It can be guessed that it is precisely because the situation they indicate has not been render harmonious that many of these "mashup" indices – as (Ravallion, 2010) calls them – remain so unsatisfactory.

5.3.3. The importance of framing

When writing "The public and its problem" Dewey was taking stance with Walter Lippman who had recently published two important books ("Public Opinion" in 1923 and "The Phantom Public" in 1925) in which he maintained that it was not anymore possible for the public to play a positive and significant role in policy-making in the "big society" America had become, which was entirely different from the primitive, communal, society the founding fathers of America had witnessed. With the withering of the traditional town and village democracy, so had vanished the public as conceived by the theorists of the American democracy. According to Lippmann, the citizens had become only spectators of a political game they were not able to play for several reasons. Amongst them was the fact that they could not get informed of the relevant facts and knowledge but through news media which could only provide superficial and sketchy information.

If in the debate between Lippmann and Dewey we wholeheartedly stand on the latter's side, there is a point in Lippmann's argument that Dewey may have overlooked. It has to do with the importance of stereotypes in politics and their vulnerability to manipulation. By stereotype, Lippmann meant value-laden conjectures about the world, preconceptions that govern the whole process of perception. This is how he talked of it: "The subtlest and most pervasive of all influences are those which create and maintain the repertory of stereotypes. We are told about the world before we see it. We imagine most things before we experience them. And those preconceptions, unless education has made us acutely aware, govern deeply the whole process of perception."

Stereotypes, although they play a cognitive role in driving perception, are all but rational. On the contrary, they are mainly emotional and passionate and as such resists to the confrontation with even apparently undeniable hard facts as long as they contradict them. Lippmann observed that politicians were more concerned with manipulating the public's stereotypes in order to promote their own conceptions and preferences than with appealing to the public's judgment. And, indeed, building public judgment meant overcoming stereotypes, something Lippmann thought especially difficult, if not plainly impossible.

The role of framing and its vulnerability to manipulation has been recently highlighted in an outstanding way with a kind of experience related to the Basic Income Guarantee (BIG) proposal. The story is told by Karl Wilderkist in the Basic Income News[11]? It goes this way. First time: the BIG proposal is been presented together with four others social reforms in an article (from Jesse A. Myerson) in the "Rolling Stone Magazine" entitled "Five Economic Reforms Millennials Should Be Fighting For". The other reforms in the list are a guaranteed job, a land value tax, a sovereign wealth tax and a public bank. As expected from a journal like the "Rolling Stone Magazine", all these reforms are presented as liberal, progressive ideas.

Second time: a bit later, Dylan Matthews take the five proposals over and reframe them as conservative ideas in "The Washington Post". What can be expected happened: Democrats resisted them and Republicans tend to support them, though Democrats and Republicans who had read the "Rolling Stone Magazine" had the opposite reactions.

Third time: Ezra Klein writes an article in "The Washington Post" attributing the inconsistencies between the reactions to the two papers to the importance of framing (the way ideas are couched) and thrust (people react differently according to who is presenting the idea).

Stereotypes are linked to frames which are data-structure for representing a stereotyped situation and "framing" is the process of "selecting and highlighting some facets of events or issues, and making connections among them so as to promote a particular interpretation, evaluation and/or solution" ((Entman, 2004, p. 5), cited by (Castell, 2009, p. 158)).

Therefore as (Lakoff, 2004, p. XV) argues, frames"…shape the goals we seek, the plans we make, and what counts as a good or bad outcome of our actions. In politics, our frames shape our social policies and the institutions we form to carry out policies. To change our frame is to change all of this. Reframing is social change".

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[11]http://binews.org/2014/02/opinion-the-basic-income-guarantee-becomes-a-rorschach-test-in-the-u-s-media/

5.3.4. How public problems are framed

We have seen that according to Dewey, public problems are typically generated by the indirect consequences of private transactions on people not involved in them but nevertheless impacted by them. A similar perspective has been developed in a very oft-cited article on the sociology of social problems by (Spector & Kituse, 1973). They define the first stage of their « natural history » of social problems as: « The attempts by some group (s) to assert the existence of some condition, define it as offensive, harmful, and otherwise undesirable, to publicize the assertions and stimulate controversy and to create a public or political issue over the matter. » (Spector & Kituse, 1973, p. 147). Generally, there is an attribution of causal responsibility to some actors or institutions deemed at the origin of the problem. It is indeed natural if the framing of the problem, in view of its management by those who are possibly harmed or constrained in their own activity will be couched in the language of action, of agents, motives and responsibilities. As (Stone, 2002, p. 209) has shown, the uses of the causal argument in policy consists generally in assigning blame and responsibilities to some actors or institutions, identifying others actors as victims to be protected or compensated and legitimizing certain actors as « fixers » of the problem and giving them power, authority and resources. Actually, the blame is most often put on one or two elements of Burke's pentad of action which comprises the 5 following items:

1. Act: What took place (in thought and deed)?
2. Scene: What is the context in which it occurred (the background, the situation)?
3. Agent: Who performed the act?
4. Agency: How was it done (means and instruments)?
5. Purpose: Why was it done?

Admittedly, this is quite commonplace but what is interesting is the type, number and relative weight of elements used in the framing of a public problem. More precisely, what is significant is the kind of balance (or lack of) between the different elements, what Burke called the ratio between them. For instance, as Burke remarked: "Insofar as men's actions are to be interpreted in terms of the circumstances in which they are acting, their behavior would fall under the heading of a 'scene-act ratio'. But insofar as their acts reveal their different characters, their behavior would fall under the heading of an 'agent-act ratio'. (Burke, 1968, p. 446). Therefore, the ratio is likely to be different according to what Dewey called one's "occupational psychosis". For instance, sociologists will privilege the "scene-act ratio" with an emphasis on the scene while hiding the agent behind an action understood as dictated by the role. The psychologist would highlight the "agent-purpose ratio", the engineer the "act-agency ration" and so on.

This is of course not indifferent for a discussion on indicators because the choice of indicators can vary widely according to the perspective adopted. For example, in a sociological analysis of the "natural history" of a social problem which is now considered a classic of the field, (Gusfield, 1981) shows how the "dramatic" framing of the road safety issue in USA drove the collect and communication of statistics: "The character and conceptualization inherent in the symbolic categories we utilize deeply influences our experiences of reality and our actions. In the field of auto-safety, the categories influence the data collected and the attributions of responsibility

which emerges. The emphasis on driver attributes and driver performances in the attribution of responsibility for auto safety has been the characteristic and dominant mode in auto solutions." (Gusfield, 1981, pp. 40-41).

Accordingly, the statistics on road accidents collected and published gave some details about the driver (age, gender, speed, alcohol or drugs intake, etc.) but none about the vehicle (age, make and model) or about the road where the accident took place. In other words, the institutions put the emphasis on the "agent-act ratio" excluding implicitly the importance of others elements of the drama such as the scene (road and traffic) and the agency (hazardousness of the vehicle).

The five items of Burke's pentad are elements that structure some simple narratives of social dramas likely to give rise to public problems. There are others narratives or frames for social life but almost all of them are structured around roles, relations between the roles and scenarios carried out by those playing the roles (Lakoff, 2008). It follows that the relation between indicators and frames is twofold: like every sign, their interpretation depends upon the frames of the interpreters, and these can vary according to the social and cultural context in general and the position each interpreter occupies in it. On the other hand, as shown in (Boulanger, 2007), building indicators contributes significantly to the framing of social problems. This is confirmed by (Davis & Kingsbury, 2011, p. 9) who write: "Indicators inescapably frame problems – they make statements about the existence and nature of a problem, as well as about how to measure the problem or aspects of its solution". Dewey was conscious that his defense of the scientific approach to public problem-solving had the implications that scientists would have to come down from their ivory tower and participate actively in the collective management of social problems, and that this entailed some risks for democracy. But, contrary again to Lippmann, Dewey was fiercely hostile to a government by experts. He maintained that, though experts were indeed indispensable, their role should be limited to the delivery of the facts necessary to an informed and enlightened debate. "*The essential need, in other words, is the improvement of the methods and conditions of debate, discussion, and persuasion. That is the problem of the public. We have asserted that this improvement depends essentially upon freeing and perfecting the processes of inquiry and the dissemination of their conclusions. Inquiry, indeed, is a work which devolves upon experts. But their expertness is not shown in framing and executing policies, but in discovering and making known the facts upon which the former depend.... It is not necessary that the many should have the knowledge and skill to carry on the needed investigation; what is required is that they have the ability to judge of the bearing of the knowledge supplied by others upon common concerns.*" (Dewey, 1927, pp. 208-209). There is some naivety here in Dewey's belief that the process of discovering and communicating facts by experts could be immune to the influence of stereotypes, or, in more modern language, frames. This is particularly surprising from a philosopher who adamantly insisted on the social and cultural embedded character of science.

As a consequence, the framing of problems requires the cooperation of experts, political leaders and the public. This collaboration is necessary because each actor is likely to address the problem from a specific standpoint not necessarily understood – let alone shared – by the others. As a matter of fact, on many issues, experts, political leaders and the public have different grounding

ideas and interpret differently the data and figures. On some issues, the gap between experts and the public's frames can be wide and deep. For instance, concerning the treatment of the water problem in America, (Yankelovich, 1991, p. 97) observed that: "The citizens of the western states had their consciousness raised about the threat of a water shortage. But they are presented with an unacceptable solution – rationing by price – which enrages them rather engaging them constructively in debate about how to solve a communal problem. The western water problem symbolizes a larger conflict of values with many forms of expression. It is the conflict between communal and market-based values. Should everything have a price tag on it? Where do you draw the line?   How do you strike the balance? […] In a democracy, striking the right balance between communal and market-based values is a task that cannot be delegated to experts. The fundamental judgments must be made by the citizenry or the very idea of democracy is mocked**."**

Indeed there is a big problem here with the domination of economists in the indicator-building industry. Because of their "occupational psychosis" they are naturally inclined to monetize everything. In an otherwise outstanding book on indicators of well-being and sustainability, (Fleurbaey & Blanchet, 2013) don't even discuss the alternative between monetized versus non-monetized indicators but only the alternative between the "monetary" approach and the "equivalent-income" one! Both, of course are expressed in monetary units, something to which many people want to resist. Yet, (Fleurbaey & Blanchet, 2013, p. 243) argue that: "Monetary evaluation does not have to be rejected per se. As a matter of fact, whatever one does, aggregation implies putting relative values upon different items, and doing so in monetary units is no less respectable than the apparently dimensionless valuations implicit in composite indexes." [12] Though they can be right from a technical point of view, they are wrong from a more encompassing one (let us say, an anthropological or cultural point of view) knowing that the public can be very reluctant to express in monetary units (or in "income-equivalent ") things they consider pertaining to a different domain of reality which they find indecent to monetize.

This is typically a framing problem. Most economists have what Veblen called a "trained incapacity" to accept another way of framing social problems than their own framework. It is avowed with some ingenuity by Fleurbaey and Blanchet when they write: "The design of good indicators of social performance should ideally be the collective endeavor of social scientists from many disciplines and should rely on the views of the population whose well-being is to measured. First of all, it involves addressing hard ethical issues about distributive justice"(*xii*). After which they go on arguing that welfare economics is the right way to formulate the problem: "In a nutshell, while the economist cannot answer the ethical question, 'welfare economics' …now provides a useful array of concepts that help *formulate[13]* such questions." (*idem*).

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[12] Likewise, (Ravallion, 2010, p. 9) maintains that : « The fact that a welfare indicator is in monetary units cannot be objectionable *per se*. »

[13] Their emphasis. Formulating is another word for framing…

5.3.5. Indicators and measurement

The framing issue is particularly acute with quantitative indicators. Not all social indicators are or even should be quantitative[14]. Actually, because they are linked to behavior and action, it suffices that indicators categorizes events or states in categories relevant for action or behavior to meet their objective. The problem with measurement is that it implies several additional operations and assumptions to the indication hypothesis. This appears clearly in the comparison between fig. 6 and fig. 7.
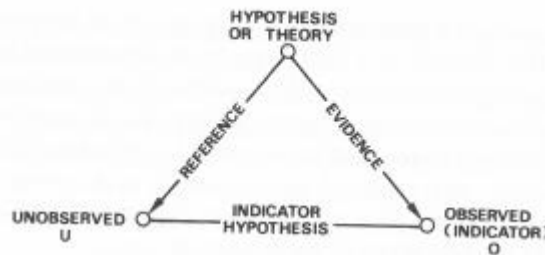

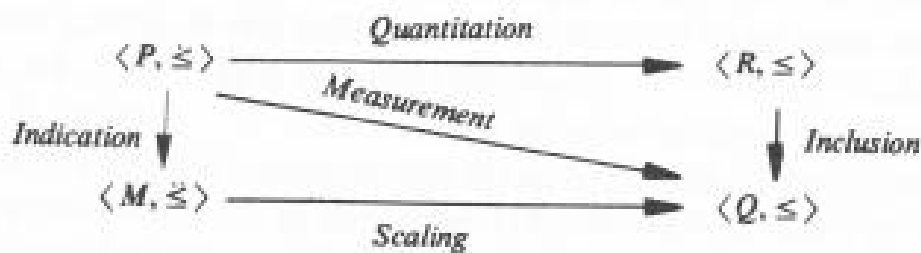Fig. 6. The indicator hypothesis. Source (Bunge, 1983, p. 87).

Fig. 7. Measurement as the union of quantitation, indication and scaling. Source: (Bunge, 1983, p. 94)

In addition to the "indication" hypothesis, that is the assumption that the observed variable is actually a "proxy" for the unobserved one, measurement adds a quantitation or quantification operation and a scaling decision. In measurement, the "indication" hypothesis refers to the relation between the property to measure (P) and the measurement device (M) which, in our discussion context, can be some book keeping, accounting or interviewing device. Quantification consists in a mapping of the property P to an arithmetic set (R: rational numbers) which implies defining the units in which the property can be formulated. Scaling is a mapping between values of the indicator and some subset Q of R (inclusion relation). *The metric used in scaling should be in correspondence between 1) the real variability of the measured property; 2) the accuracy of the measuring device; 3) the needs of the problem at hand and the instruments available to act on the property; 4) the cognitive equipment of the users of the measure. These conditions are seldom met in public indicators and especially in composite indices.*

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[14] Things are different for scientific indicators. For this distinction see (Boulanger, 2008). http://www.surv-perspect-integr-environ-soc.net/1/issue1.html.

As Aristote put it "Our discussion will be adequate if it has as much clearness as the subject-matter admits of, for precision is not to be sought for alike in all discussions, any more than in all the products of the crafts…for it is the mark of an educated man to look for precision in each class of things just so far as the nature of the subject admits; it is evidently equally foolish to accept probable reasoning from a mathematician and to demand from a rhetorician scientific proofs." (Nicomedian Ethics. § 3.).

Often a ratio scale is artificially imposed on properties that are not naturally fully quantitative only for technical reasons (because they allow easy aggregation) or for rhetorical ones, because it looks more scientific. This practice can be deeply misleading because quantification and scaling contribute to the framing of the problem or the situation. It can give rise to what could be called the "isometric fallacy". The example of the Blood-Alcohol-Level (B.A.L.) in the imputation of responsibility in cars accidents as analyzed by (Gusfield, 1981) is exemplar in that respect. The B.A.L. is almost universally used as indicator of the level of the fact that a person is or not under the influence of alcohol and used as evidence by the police and courts. However, as Gusfield remarks: "The object of concern is not alcohol in the blood, but the effect of alcohol on driving ability. In other words, a physiological-chemical condition is transformed into a behavioral one. B.A.L. is considered isometric, similar in measure, to the psychic state of 'being influenced'» (p.64)

It is indeed well known that with the same level of alcohol in the blood, driving performances can greatly vary according to gender, age, weight, habits, health and so on. At any rate it would be surprising if there were a term to term correspondence between B.A.L. and a measure of driving ability for which it is doubtful that a ratio scale could be built up.

6. Social Inquiry as Mode 2

What gives Dewey's thoughts on the social inquiry its actuality and relevance is that in fact, it has become reality. This is what (Gibbons, et al., 1994) have described as the development of a specific mode of knowledge production. "Mode 2" is the concept coined by (Gibbons, et al., 1994) to account for the new practices and institutions in knowledge production and communication that emerged gradually during the second half of the twentieth century and which contrast sharply with the "traditional" Newtonian model ("Mode 1") of science and technology dominant from the nineteenth century onwards. There are many differences between the two modes but they mainly depart from one another on four crucial attributes we discuss now.

6.1. The context of knowledge production

The first difference between Mode 1 and Mode 2 is that in the former the problems on which research focus come from inside the academic and scientific community. They are set and solved in a context governed by the mainly academic interests of a specific, restricted community. On the contrary, mode 2 knowledge production grows in response to problems set and articulated outside the community of researchers and scientists. This means that while the distinction between pure and applied research makes sense in the Mode 1 model, it is not the case anymore in the Mode 2 model. Mode 2 is from start shaped by the context of application, by the demands for knowledge and design coming from industry, governments, stakeholders or society in general. As a consequence, knowledge produced under the Mode 2 regime is more widely socially distributed than the academic knowledge of mode 1.

More fundamentally, the ethos of Mode 2 science is different from the one of Mode 1. The fundamental goal in Mode 1 is the discovery of general, universal principles (general theories, covering laws, causal mechanisms). Practitioners of Mode 2 believe that the real natural and social world is too complex to be apprehended by universal, general principles, theories or laws. In some way, they believe that only local, contextualized knowledge is possible and useful.

6.2. Transdisciplinarity vs. disciplinarity

While Mode 1 is essentially disciplinary, Mode 2 is not just multi or inter disciplinary but transdisciplinary. There is more in transdisciplinarity than the mixing or the blurring of academic disciplines.

"In transdisciplinary contexts, disciplinary boundaries, distinctions between pure and applied research, and institutional differences between say, universities and industry, seem to be less and less relevant. Instead, attention is focused primarily on the problem area, or the hot topic, preference given to collaborative rather than individual performance and excellence judged by the ability of individuals to make a sustained contribution in open, flexible types of organization in which they may only work temporarily." (Gibbons, et al., 1994, p. 30).

The important fact is that while in a disciplinary regime, the framework is developed independently of the problem at hand and applied to it afterwards, generally by others people than the one who developed the framework, in a transdisciplinary regime, framework used for driving the problem solving enterprise is generated and sustained from within the context of

application. Therefore, the solution (if any) of the particular problem doesn't come from already existing knowledge as the application of an pre-determined model or framework imported from outside but from new knowledge explicitly produced for solving the problem at hand. Of course, this doesn't preclude the use of elements of existing disciplinary knowledge but the final result is an original piece of new knowledge which cannot easily be classified in a particular existing academic specialty. It is important to stress that despite its character of "problem solving capability on the move", transdisciplinary research creates new knowledge. It develops its own theoretical structures, research methods and modes of practice, though they may not be located on the prevailing disciplinary map. The effort is cumulative though the direction of accumulation may travel in a number of different directions after a major problem has been solved. Yet the communication of results, indispensable in order to make transdisciplinary knowledge cumulative, uses different channels than in disciplinary research. In the latter, scientific results are communicated and widely diffused through institutional channels such as academic journals, scientific conferences and so on, and only after the production phase has ended. In mode 2, communication takes place in the same time than production but is somewhat restricted to those who participate in the problem solving process, which however includes stakeholders as well as scientists and technicians. On the other hand, subsequent diffusion occurs each time the participants move to another context and another site of mode 2 knowledge production.

Another important property of transdisciplinarity is the implication of "barefoot experts" and stakeholders in the inquiry. This is a natural consequence of the highly contextual nature of the approach and of the pragmatic objective of the researches.

6.3. Homogeneity vs. heterogeneity

While Mode 1 research units are usually homogeneous, composed of people with mostly identical education, skills and experiences, Mode 2 production of knowledge is heterogeneous in terms of skills and competences people bring in it. Furthermore, Mode 2 sites of production are also more heterogeneous. It is no longer only in universities that scientific or technological knowledge is nowadays produced but also in non-university institutes, private research centers, government agencies, consultancy groups, think-tanks, NGO, etc.

Also, research groups are less institutionalized in mode 2 regime than in mode 1. Research groups are temporary, being constituted for the time of a research project or program after which they break down, their participants moving to others and different issues, organizations and even sometimes, countries. Nevertheless, they keep more or less in touch with each other, hence forming expanding networks of highly experienced and competent practitioners. As a consequence, Mode 2 is a much more flexible and transient context than Mode 1 and Mode 2 practitioners are more likely than Mode 1 scientists to move frequently from one issue domain to another and from one organization to another, all along their career.

6.4. Social Accountability and reflexivity

The growth of Mode 2 knowledge production is associated to the growth of public concern with the environment, health, and risks in general. Because these risks and issues are largely the outcome of scientific and technological innovations, it comes as no surprise if more and more groups want to influence the agenda and the products of the research activities. This puts a pressure on Mode 2 scientists in favor of more accountability and reflexivity. The exploration of the ethical implications (and legitimacy) of the possible scientific and technical innovations is more and more often part of the research activities. Therefore and also because of the multi-dimensional character of such social problems, the composition of research teams in the Mode 2 area is as a matter of fact more diversified than in Mode 1. In Mode 2, it is not rare to see social and natural scientists, engineers, lawyers, even philosophers, etc., working together on the same research topic.

6.5. Quality control

Necessarily, the criteria of quality in Mode 2 cannot be the same than in Mode 1. While in the latter, quality is assessed exclusively by peers and through academic channels and institutions, in Mode 2 research, additional criteria are taken into account: cost effectiveness, social acceptability, marketability, etc. Mode 2 is supposed to generate not only reliable but also socially robust knowledge. What does this mean?

"...socially robust knowledge has three aspects. First, it is valid not only inside but also outside the laboratory. Second, this is achieved through involving an extended group of experts, including lay 'experts'. And third, because 'society' has participated in its genesis, such knowledge is less likely to be contested than that which is merely 'reliable' ". (Gibbons, 1999, p. C82)

The example given by (Gibbons, 1999) for distinguishing "socially robust" knowledge from "merely reliable" one is the scientific knowledge on the health consequences of GMO. Though scientifically reliable, it cannot be considered socially robust as long as it doesn't take into account the perspective and concerns of a much wider section of the society than the groups of peers in the scientific community.

Another attribute and consequence of Mode 2 is the blurring of the frontier between science and technology. This has also to do with the importance of design not only as a production technology but also as a research strategy. In Mode 2 the object is often known through the design of artifacts intended to reproduce, simulate, control or replace things. This is true also of composite or aggregate indexes that can be considered as artifacts.

6.6. The social inquiry as Mode 2

It is important to stress that the authors of the Mode 2 concept seems to have been unaware of Dewey's theory of inquiry and of social inquiry in particular. At any rate Dewey's works are not referred to in their main publication (Gibbons, et al., 1994). Yet, for those familiar with the most important works of the philosopher, it is almost impossible not to make the connection with what is described by the Mode 2 production of knowledge and its conception of science and inquiry. Things have gone over as if there had been a deliberate plan of implementation of the pragmatic approach. Whilst the "Mode 2" thesis has been often blamed for lacking empirical confirmation (see (Hessels & van Lente, 2008)) for a critical survey of the reactions to the Mode 2 concept), we think, on the contrary, that the numerous initiatives in environmental and socio-political indicators as well as the multiplication of assessments and evaluation researches are bringing much evidences in favor of Gibbons & al.'s diagnostic and therefore on the prescience of Dewey's conception of scientific (especially in social matters) inquiry.

7. Conclusions

Not all indicators are public indicators. Public indicators are signs that are built and communicated in the process of articulating, analyzing and managing public problems. Democracy, as Dewey conceived of it, is a social and intellectual system whereby individuals address their problems through the application of scientific methods and the use of public deliberation. Indicators and indices are elements in the toolbox of the social inquiry as Dewey anticipate it and which has developed since then to the point of being categorized as a "Mode 2" of knowledge production different from the classical, modernist and universalist "Mode 1". They play an important role in public policy as contributing to the framing of the problems to address and objectifying the policies designed therefore.

The innumerable reference to indicators and indices in policy discourses, the media and scientific research, and the semantic connotations implied by the linguistic root common to the different uses of "index", "indice", "indication" in ordinary language justify taking a semiotic look at them. As all complex signs, we can analyze them (and therefore evaluate them) as the unions of altogether symbolic, iconic and indexical attributes. From a symbolic point of view, the assessment will be attentive to the socio-cultural habits and conventions that, often unknowingly, determine their construction at the conceptual level and, therefore their interpretation. Sociology, discourse analysis, cultural studies and hermeneutics are the kind of disciplines that can be enlisted in such an analysis. The iconic dimension refers to the resemblance between the indicator and its objet. There are at least two aspects in this. The first, and most important, concerns the representation of the problem or of the situation given by the index. Is it faithful or deceptive? Does it help identify the causes of the problem or the contradictions in the situation? All representation is a kind of metaphor but some metaphors are more grounded than others. This is where the different substantive disciplines have their word: economics, psychology, medicine, environmental sciences, etc.

The second aspect of indicators as icons lies in the way they are communicated, notably through the media. The graphics, diagrams and images used in the communication process are not innocent in terms of interpretation. Because the iconic dimensions triggers the idea of resemblance, people transfer to the problem the image they see in the media. In others words, the image they will form of the problem in their mind will tend to resemble the one transmitted in the media. Communication sciences, semiotics and marketing are at home here.

The indexical dimension is probably the most important since it gives them their very name. Here again there are two aspects in indication. The first one is the function of "directing the attention". Indices and indicators are expected to direct the attention of the public (and of the governments) to the problem, to maintain them on the public agenda as (Kingdon, 1984) has shown. The second one is the dynamical connection they must have with their object. The two taken together implies that the index must be sensitive to any significant change in its object's state or trajectory and direct attention to it. From a statistician point of view, the indexical requirements lead to scrutinize the sampling procedures (is the sample representative of the population?), analyze the

co-variations between different indicators of the same unobserved variable, and the sensitivity of the figures to changes in normalization, aggregation and weighting decisions (OECD & JRC, 2008).

A comprehensive assessment of public indicators should pay a balanced attention to these three dimensions since they jointly determine the role they can play in the democratic analysis and resolution of public problems.

Acknowledgement

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