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## Introduction

*Iconicity* and *metaphor* have become central concepts not only within linguistics and epistemology, but also in other areas of the science of communication and cognition, such as the cognitive psychology of illustration (Macdonald-Ross 1979) or 'cognitive ergonomics' and interface design (van der Veer, Wijk, and Felt 1990; Andersen 1995; Knuf 1995). All of these disciplines deal, in more or less theoretical aspects, with 'knowledge representation' (Jorna 1990).

Between and within these disciplines there is a great variety in the use and 'meaning' of the term *icon(icity)*. In some authors it is restricted to cases of perceptual similarity between representation and represented. Some logical pictures and also metaphors are described as iconic though there is nothing like perceptual similarity with the represented. And at other times the transparency of syntactical structure and word order (e.g., Haiman 1985; Givón 1995) is called iconic. Already in Peirce there is sometimes talk of the *icon* in the sense of a special quality, function, aspect, or component of a sign ('An *icon* can only be a fragment of a completer sign,' Peirce 1976, IV: 242) and at other times in the sense of a special class of signs: 'I will here say that the division is into, 1st, *Icons*, which represent their Objects by virtue of resembling them ... 2nd into *Indices*, which represent their Objects by virtue of being in fact modified by them ... and 3rd into *Symbols*, which represent their Objects by virtue merely of the certainty (or probability) that they will be so interpreted; as any noun represents the thing for which it stands' (Peirce 1976 [1908], III/2: 887). Figure 1 corresponds to the view of special classes of sign.

According to Sebeok (1976), the 'notion of the icon — that is ultimately related to the platonic process of *mimesis* which Aristotle then broadened from a chiefly visual representation to embrace all cognitive and epistemological experiences — has been subjected to much analysis in its several varieties and manifestations, yet some seemingly untractable theoretical question remains' (1976: 128). The present article points out the

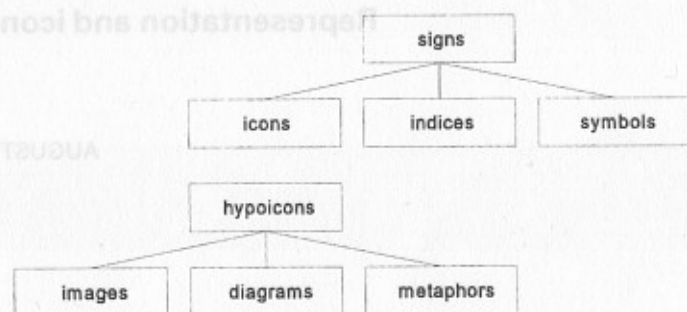


Figure 1. Peirce's subdivision of 'signs' and 'hypoicons' (adapted from Fenk 1994: 53)

insufficiencies of some common conceptualizations and makes an attempt to develop a simple and sound concept of *iconicity* which is fit for a consistent use in the field of knowledge representation. One might reply first, that the explication of a term may well vary from case to case and second, that simplicity is not the relevant goal in concept formation. On the other hand, though we may produce different and arbitrary names for a certain concept, all signs, including linguistic signs, are autonomous in a certain respect (Ransdell 1986: 56), and concept formation itself is closely connected with cognitive process and scientific progress (e.g., Oeser 1976). Science has, according to Posner (1980: 4), the permanent task of developing and choosing concepts in such a way as to make its descriptions, explanations, and forecasts 'accurate, simple and plausible'.

### Preconditions for a firm and productive concept of *iconicity*

#### *The term sign is reserved for special cases of 'external' representation*

We meet the term *sign* either used synonymously with *representation*, and, if not so, in a more specific way. In contemporary texts that sometimes make a difference between *sign* and *representation*,

—*representation* is not only applied to external phenomena, but also to mental 'phenomena' such as percepts and cognitions (cf. 'mental' or 'internal representations')

—*representation* is, even when reserved for 'external phenomena', more abstract than *sign* (*sign* is subsumed under *representation*)

—*representation* is, if a distinction is made regarding the complexity of a configuration (e.g., written text > sentence > word > grapheme), preferred as the appropriate term for the more complex configuration, i.e., for the 'super-sign'.

For our purpose the following three commitments are sufficient:

(a) If a distinction is made between *representation* and *sign* regarding the dimension abstractness/concreteness, then *sign* is the *immediate* subsumption of *representation*.

(b) If a distinction is made between *sign* and *symbol* regarding the dimension abstractness/concreteness, then *symbol* is the *immediate* subsumption of *sign*. One of the implications of (a) and (b) taken together: any condition necessary for *representation* is also necessary for *sign* and for *symbol*.

(c) If a distinction is made between internal (i.e., mental) and external world, *sign* is reserved for external representations and/or elements of external representations.

Point (c) is our first restriction of the broad meaning of 'sign' in Peirce. According to Peirce, any imagination and any thought (cf. Ransdell 1986: 52, 59) becomes a sign as soon as it becomes the subsequent thought's *object of interpretation*. 'Consequently, says Peirce, just as we say that a body is in movement and not that the movement is in a body, we should say that we are in thought and not that thoughts are inside us' (Ponzio 1985: 23).

Regarding thoughts as sign-candidates is a logical consequence of the equation 'sign = object of interpretation'. Since we will have to abandon this equation at any rate (see the following section) we avoid its implications and a number of difficult questions. For instance: if we accept perceptual similarity between sign and referent as a necessary (though not sufficient) condition for *iconicity* and if we place thoughts in the immaterial mental world, how could we then ascertain a thought's iconic character? We can, of course, imagine forms, and maybe we cannot even think anything without thinking of forms. But should we regard the forms we imagine as the forms of our thoughts? In order to avoid such problems we had better remain with the division internal/external world, placing thoughts in the internal and signs in the external world. But to view signs as external representations and/or elements of complex external representations is also possible from a radical constructivistic position: if it is my consciousness which constructs a world divided into internal and external world, this is without any consequences as to my thinking and monologizing about the 'external' world.

*Neither indexicality nor 'causal' similarity is accepted as a sufficient condition for sign*

*Indexicality is inevitable, but not constitutive for sign.* To equate *sign* with 'object of interpretation' makes the concept of *sign* empty: it would



not leave any non-signs, because any 'object' is (at a meta-level of interpretation) already the result of perceptual and cognitive mechanisms and activities interpreting (or constructing?) the world. And any object (any configuration, any event) perceived is the object of further interpretations regarding its causes, correlations, and consequences, or, to be more general, its contingencies. Thus, all things and events work as indices. In the perceiver's mind all these things, without exception, indicate some contingencies or are associated with them.

In Keller (1995) there is — instead of 'indices' — talk about 'symptoms' in the sense of phenomena which are interpreted as a part of something more complex or as a part within a causal nexus. In order to avoid an 'inflation of signs' (Keller 1995: 119) or an 'overpopulation' of symptoms in our world (Keller 1995: 122) he restricts the term 'symptom' to those cases (of 'symptom occurrence') where an object actually becomes interpreted. This is one of a number of aspects in which symptoms, according to Keller (1995: 123), differ from icon and symbol, giving them a very special position within signs.

My arguments go along similar lines, but are more radical in the premises and consequences: If we talk about indices (such as black clouds indicating a storm) in the way we talk about a sign (the clouds 'mean' or are a 'sign' 'telling us' that there will be a storm), this is a case of metaphorical speech (Martinak 1993 [1901]: 8). *Sign* in its *literal sense* becomes empty if it encloses indices.<sup>1</sup> So we should make a clear cut and eliminate indices and indexicality from signs or sign-functions respectively. But if all things work as indices, this is also true for those things we still regard as a sign. Thus, and only in this sense, indexicality is a 'necessary' and inevitable feature of symbols and icons.

If one, in contrast, adheres to the broad definition of 'sign' as anything which 'refers' to something else, and if one calls 'reference by similarity' iconic, then the photo is an icon and is a sign 'per definitionem' (Boeckmann 1991: 37, 1994: 42). Then one has to classify each case of 'causal' similarity as a case of iconicity: The imprints in the snow ought to be classified not only as indices, but as icons, too — because it is a similarity-relation which indicates that the depressions in the snow are a track and a track rather of a bear than of a deer, or a rabbit, or a skier. Should we really regard the imprint in the snow as an icon of the grizzly's paw, and the tree's shadow or its reflection in the water as an icon of the tree?

Peirce would, as far as I understand him, classify such an imprint or reflection 'being really and in its individual existence connected with the individual object' (Peirce 1906: 495) first of all as an index and probably as an 'index involving an icon' ('a symbol, if sufficiently complete always

involves an index, just as an index sufficiently complete involves an icon', Peirce 1976, IV: 256). And as to the photo he explicitly says:

Photographs ... are very instructive, because we know that they are in certain respects exactly like the objects they represent. But this resemblance is due to the photographs having been produced under such circumstances that they were physically forced to correspond point by point to nature. In this respect, then, they belong to the second class of signs, i.e. indices, those by physical connection. (CP 1.281, quoted from Macdonald-Ross 1979: 228)

The *similarity* between photo and scene is achieved, without any doubt, by 'physical connection'. This is true despite all the creative possibilities of the photographer (Fenk 1987: 20) and independently of whether the photo is produced by intention of the photographer or by inadvertence, whether or not the owner of the camera knew in advance what it would catch, and whether or not he intends to use the photo when communicating with other people. Intentions of communicative use are sometimes considered as additional criterion of *sign* (see the following section). But if we regard results or phenomena of 'physical connections' as indices and if we decide to eliminate indices as a subclass of sign, we have to do this with the photo as well.

*Similarity is neither necessary nor sufficient for sign.*

Similarity is neither necessary for *sign* — most of our words are not similar to the objects falling under the encoded concept — nor is similarity, as already substantiated in Martinak (1993 [1901]: 13), sufficient to make something a sign or an icon. In this respect there seems to be a convergence of the arguments presented, for instance, by Goodman (1968), Pelc (1986: 11, referring to Dambska 1973: 40), Jorna (1990: 21), Smythe (1990: 50), Goel (1991: 41), and Keller (1995). According to Sebeok (1989 [1979]), 'everyday spatial images' like 'a man's shadow cast upon the ground, his shape reflected in water, his foot imprinted in sand ... attain semiotic status only under special circumstances' (1989 [1979]: 123).

How can I proceed, if I agree, on the one hand, with the argument that mere similarity is neither necessary nor sufficient for *sign*, and if I want, on the other hand, to leave open the possibility that similarity is an essential condition for *iconicity* and for the *iconic sign*? I can either retire into the only function which is without any doubt sufficient for *sign*, and regard similarity as an occasional attribute of signs making these signs *iconic*. (I will investigate this possibility in a later section, 'Iconicity is established ...'). The other possibility is that I can search for some specifications of similarity qualifying similarity as an essential of a

second and independent sign-function and class of signs. We will start this search by eliminating specifications which are inappropriate or too weak:

Nobody will maintain that in every case where two objects ('objects' in the broadest sense) are perceived and interpreted to be similar to some degree in some respect, this makes one of them a sign of the other one: 'ski' sounds in some respect similar to 'knee' or 'tea' but is not a sign of them — despite the fact that it works as an index in many ways. (E.g., if we hear the word 'ski', this indicates that there is somebody who has spoken the word; and if we hear it within a poem created at the end of a ski course, it may indicate that the following line will end with 'knee' or 'tea'.)

Even among cases of similarity where we interpret similarity as an effect of natural laws and more or less common 'blueprints' (first specification), there are instances where we would not say that X (a certain grizzly; a certain crystal; a certain cloud) is a sign of Y (the grizzly's brother, or a polar bear; another crystal of the same mineral; another cloud of the same 'type') or that Y is a sign of X — despite the fact that similarity may again work as an index. (A higher degree of similarity may, for instance, indicate a higher degree of genetic relationship.) A further specification (second specification) might be the postulate that X and Y are — in the interpreter's mind — connected in such a way that the similarity between them is a more or less direct effect (of the appearance, the genotype, etc.) of one of them: For instance, the similarity between the grizzly's paw and its imprint in the snow, between the grizzly and its reflection in the water of a lake or in a mirror, between the grizzly and his son. All these are instances of *sign* if and only if we subsume 'indices' or 'symptoms' under *sign*. I have refuted this precondition in the preceding section; even if the 'similarity' interpretation ('this looks like the paw of a grizzly') coincides with the 'indexical' interpretation ('a grizzly must have passed this place'), no sign is established.

This restrictive use of semiotic concepts will not meet with unanimous approval. According to Sebeok (1989 [1979]), the 'dynamics of semiosis is the criterial regulatory activity which contributes to the homeostasis of every animal and to the equilibrium of such groupings as social organisms belong to', and 'genetic copying is the semiotic process *par excellence*, and iconicity plays a pivotal role in it' (Sebeok 1989 [1979]: 120). But being less restrictive in the use of the term *iconicity* does not necessarily mean being less consistent in the use of this term. How so? As pointed out by Sebeok (1989, referring to Peirce in the foreword to the second edition of *The Sign and Its Masters*), the meaning of symbols can grow. I may add that any explication of a concept can be seen as an

attempt to localize this concept within a ('hierarchical') 'network' of associated concepts. If one of these concepts 'grows' in meaning, this has to affect — just in order to remain consistent — the surrounding concepts. For example, I can analyze the interaction between text and picture, or — if I prefer a *broad*er meaning of *text* — analyze the interaction between two different components of the text (Fenk 1993). Since the term *text* is closely related with the term *language*, we may characterize these components as written language on the one hand and — in a broader meaning of *language* — 'picture language' on the other hand. And since the term *language* is closely connected with the term *syntax*, we will soon be confronted with questions about the syntactical modes of picture language. Answering such questions may again presuppose, or lead to, a broader meaning of *syntax*. The very same dynamic process of the 'growing' of the meaning of mutually dependent concepts takes place when the (transmission, realization, and evolution of the) genetic program is characterized in terms of *message*, *code*, *syntax*, *semiosis*, and *iconicity*. Such descriptions may be very useful cognitive and communicative instruments within specified contexts and domains, as was the case when the term 'current' was introduced into electrophysics. This extended the applicability of the symbol 'current' by adding a new and context-specific meaning rather than by a generalization of its 'basic' meaning. My aim here is to reveal what might be the 'basic' meaning of the term *icon(icity)* within a 'basic' theory of signs.

As to the example of the reflection in a mirror, Pirenne says: 'The mirror does not represent reality, it presents to us reality' (Pirenne 1970: 11), while the photo, according to Pirenne, is assumed to be a real representation: It offers the same kind of stimulus, 'but with the all-important difference that the representation would do so when the scene was not there' (1970: 11).<sup>2</sup> Maybe this specification (third specification) was inspired by Hockett's (1958: 579) criterion of 'displacement'. But in Pirenne's example it is only a matter of duration or of storing versus non-storing — the photograph, from this point of view, is no more than an outlasting chemical 'imprint' of the mirror image. But storing will not be an appropriate criterion for *sign*: a spoken word or the affirmative nodding of the head has to be classified as a sign even if not stored on a tape.

Another criterion — the criterion of intentional production for the purpose of communication (fourth specification) — raises more problems than it solves. Is the very same photo an icon, when produced intentionally, and non-iconic, when produced inadvertently? If I place a mirror in front of my son's face in order to persuade him to wash his face now and then, this is a case of intentional use for the purpose

of communication — but should we assume that this intention makes the mirror-image an iconic sign? Or do we have to go back as far as the intentions of those who have invented, constructed, produced, or arranged the 'recording set', the camera, the mirror, or the pond reflecting the castle?

Martinak points out that both the mirror image and the photo are so near to reality that (in German) one can hardly ask what they 'mean' ('bedeuten') and what they are a 'sign' ('Zeichen') of:

Ob nun ein Abklatsch das 'selbstverständliche' Zeichen für das Original ist, scheint keiner weiteren Untersuchung zu bedürfen, das möchte ohne Weiteres einleuchten ... Ich wäre indes versucht, etwas paradox zu sagen, es sei mehr 'selbstverständlich' denn 'Zeichen'. Ich fühle es nämlich als eine recht empfindliche sprachliche Härte, wenn ich es versuche, etwa das Spiegelbild als das 'Zeichen' und das Original als dessen 'Bedeutung' zu fassen. Die Frage 'was bedeutet diese Photographie' hat entweder keinen Sinn oder zielt auf dahinter liegende Gedanken, etwa Anspielungen u. dergl., nicht aber auf das, was wir hier erwarten müßten, den dargestellten Vorwurf. (Martinak 1993 [1901]: 30)

#### *Distinguishing two functional types of representation*

*Symbolizing: Denoting concepts or propositions.* Symbolizing means denoting or encoding concepts and propositions ('propositions' in the sense of cognitive and prelinguistic entities). Those representations that realize this function are called 'symbols'. If a symbol — a word, for instance — is 'non-arbitrary' (or 'motivated'), this cannot mean that it is similar to its direct referent, because thoughts, concepts, and propositions have no appearance. It can only mean some similarity between the symbol and the objects falling under the concept encoded by this symbol.

I do not know any argument questioning the status of the symbol as a representation and as a sign. So we can continue in our attempt to specify a similarity-based type of representation.

*Simulating: Achieving perceptual similarity between representation and represented.* My thesis was, and still is, that similarity as such is neither necessary nor sufficient for representation and sign. And all additional specifications examined in my earlier section, 'Similarity is neither necessary nor sufficient for sign', proved to be too weak. But this was only a negative 'definition' of a similarity-based representation. 'Our positive argument says: When similarity is established by imitation, this is a sufficient condition for representation' (Fenk 1994: 49). And if one wants to equate external representation with sign, the result or product of

simulating, imitating, enacting, or modeling activities can be regarded as an independent and autonomous type of sign.

I have to admit that the introduction of this specification — 'similarity established by simulation or imitation' (fifth specification) — is not absolutely cogent. But it is the strongest of all supplementary conditions we have discussed yet. And it is, as compared to any recordings produced with the help of cameras and tape recorders, nearer to the situation in symbolizing insofar as the simulation is created by intelligent actors — and later on, if a certain simulation has become conventionalized — reactivated by intelligent actors. And therefore the simulation and its product can be clearly separated from indexicality and from 'causal' similarity. An example illustrating this:

A shadow we see on the white wall at any rate evokes an indexical interpretation — the shadow indicates for instance the position of the source of light (a), and probably also the interpretation of 'causal' similarity (b): We interpret the dark area not only as a shadow, but as the shadow of a certain object, for instance as the projection of a hand. If now the hand moves in a way that its silhouette looks like the silhouette of a snapping wolf, then it still works as an index in many respects and is still seen as a projection of a hand, but, in addition, the similarity with a wolf is interpreted as the result of a simulating process: The silhouette represents a wolf. (Fenk 1987)

This representation also meets Hockett's (1958: 579) criterion of displacement: It makes us associate a wolf though there is no wolf. But this is another kind of displacement than in Pirenne's example: A non-present animal is represented despite the fact that the silhouette is not stored.

#### *Two different ways of defining iconicity*

After distinguishing two functional types of representation we have two ways of defining the concept of *iconicity*. If we abandon the term 'sign', the differences and correspondences between these two definitions can be demonstrated quite easily. The two versions are compared in the key to Figure 2.

If we now re-introduce the term 'sign' — which is not really necessary to communicate the essence of the two definitions of *icon* (see Fig. 2) — we can either use it as a synonym for *external representation* or as a synonym for *symbol* (Fig. 3). The first possibility corresponds to Version I, which is commented on in the next section, the second to Version II, which is commented on in the section that follows.



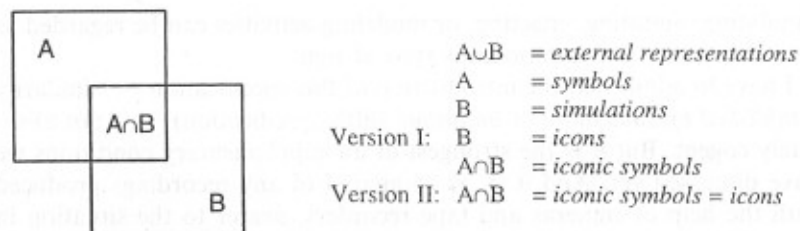


Figure 2. Two ways of defining iconicity (Version I and Version II)

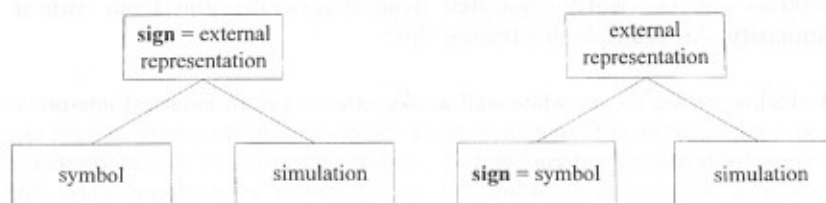


Figure 3. Sign as a synonym of external representation (left side) and as a synonym of symbol (right side) (modified from Fenk 1990: 365)

### Iconicity is established in representations simulating the represented

I declare that symbolizing (A) as well as simulating (B) is a sufficient condition for *sign* and call instances realizing function A 'symbols' and instances realizing function B 'icons'. Iconicity is established in signs where similarity between representation and represented is the result of simulative or imitative activities. Thus I establish three different types of sign (see Fig. 4): 'pure' symbols (function A only), 'pure' icons (function B only), and iconic symbols (both functions:  $A \cap B$ ). This is a practicable

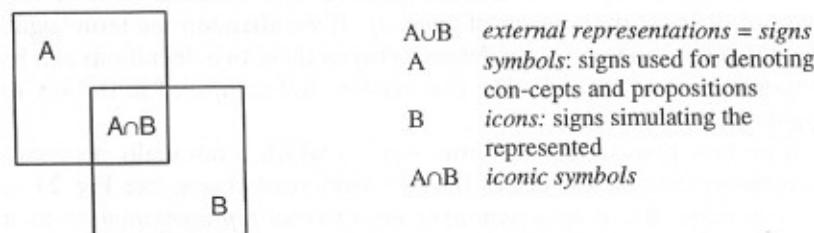


Figure 4. A logical picture illustrating relations between semiotic concepts, with the icons forming an autonomous class of signs

concept of iconicity which is not as far remote from contemporary usage as the even stronger definition given in the next section.

*Iconicity is established only if a sign realizes both the symbolizing and the simulating function*

I declare that only symbolizing (A) is necessary and sufficient for sign, using the following arguments: 'Signs' are those representations we have developed for the purpose of communication; they have to be conventionalized to a certain degree and have to be an element within a conventionalized system in order to represent a certain meaning. Such a representation works as a symbol, whether or not it may — in addition — simulate something. Simulative representations (like drawings), on the other hand, are produced for other purposes than communication as well. In those cases where detailed and faithful pictures are the aim, this runs counter to the need for conventionalization and for standardized patterns. Such representations, if coming into communication, may be the object of communication and may assist communication about the things they represent, but they are not the genuine instrument of communication.

According to this view (Fenk 1987), there is no real sign beside the symbol. And if a symbol, as is the case in an onomatopoeic word, realizes the simulative function as well, then we will call it an 'icon' or an 'iconic symbol'. From this perspective iconicity is no more than a possible attribute of symbols, and nothing but a symbol can be iconic!

### Applications: What is 'iconic' in pictures and in metaphors?

The main difference between our two concepts of *iconicity* becomes clear if we compare Figures 4 and 5: while in the 'weak' version (Fig. 4) the 'icon' covers the whole area of B, it is, in Figure 5, restricted to the overlap of A and B. Despite this difference, the two versions lead to the same consequences in several respects. A strong point of both conceptions is that they achieve clear descriptions of the relation between *symbolicity* and *iconicity* as well as a clear definition of the *iconic symbol*.

The customary approach, defining the icon through mere similarity and the symbol through arbitrariness and convention, enters into difficulties with iconic symbols like onomatopoeic words (e.g., 'cuckoo') and like ○ and △ (for broad-leaved and coniferous trees in a geographical map). In the relevant descriptions signs of this sort are characterized as symbols with iconic components or as icons with symbolic components.

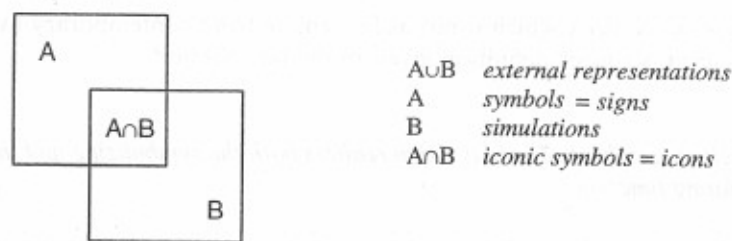


Figure 5. A logical picture illustrating relations between semiotic concepts, with the icons as a special type of symbol

In other authors they are placed somewhere on a 'continuum from the iconic to the symbolic' (Boeckmann 1982: 29), which implies both that 'icon(ic)' and 'symbol(ic)' are contrary terms and that a clear distinction between them would not be possible. Our category of 'iconic symbols' ( $A \cap B$ ) covers those representations which realize the symbolic function as well as the simulative function. These representations have property A as well as property B, such as a Spanish sailor has both properties, being Spanish and being a sailor.<sup>3</sup> This description, I think, is more practicable than to say that this certain Spaniard has a sailor component, or that a certain man is to be placed somewhere on a continuum between a Spaniard and a sailor.

Simulation may have different motives. A fishing boy, for instance, who is simulating characteristic movements of his fishing father, usually does not intend to act as a pantomime or to communicate anything else; he just wants to catch big fish as soon as possible. But within direct communication, simulation often has the function of enhancing comprehension processes; simulation-aided speech of the communicator helps the recipient to reveal, to reconstruct, or to reactivate the meaning (of the message or elements of the message) faster and with lower cognitive costs. Even if used in situations where certain symbols are not, or not yet, available for the recipient, the sign to be illustrated is used as a symbol from the very beginning, but just as a *simulation-aided* symbol, or as a simulation, which is expected to work as a symbol. These simulative properties, after having done their job, may undergo some 'erosion' processes (Haiman 1985). But the symbol remains iconic as long as its simulative properties remain discernible.<sup>4</sup>

An example illustrating some of these aspects: If in a running text a repeatedly occurring noun — let us say: 'camel' — is omitted and replaced by a schematic picture of a two-humped camel, then the reader will grasp the meaning of this sign faster than if an X is substituted for 'camel'. As

soon as the meaning of the sign is more or less precisely revealed, the iconic property of the sign is superfluous. But this iconic property still exists (and might even turn out to be dangerous. The interpretation originally evoked by the icon might prove to be too narrow when the text continues with the sentence: 'As an animal used for riding, the single-humped  $\cap \cap$  is preferred').

Our concept of iconicity and of the relation between iconicity and symbolicity, if really firm and productive, should allow a consistent semiotic description of different kinds of pictures. In outlines, we have already tried this as to photos, as cases of the most naturalistic and realistic pictures, and as to highly schematic pictures like the icons representing conifers and deciduous trees. But how can we characterize diagrams, probably the most widely used type of picture in instructional and scientific texts?

Diagrams of the type used in the present article are sometimes (cf. Alesandrini 1984: 70 ff.) described as 'logical', 'arbitrary', and 'non-representational' pictures. Faced with these so-called 'non-representational pictures', some authors create new sorts or different levels of *iconicity*, obviously in order to sustain the postulate that pictures principally are instances of iconic representation: Boeckmann (1994), for instance, classifies Venn Diagrams as a case of quasi 'second-order iconicity' (Boeckmann 1994: 148). And Schnotz (1994) postulates a 'more abstract form of iconicity that might be called "diagrammatic iconicity"', which is still based on a 'natural isomorphic relation between picture and object' (Schnotz 1994: 108; translation mine). But what is the 'isomorphic object' of our Venn Diagrams?

According to our concept these pictures cannot be classified as 'iconic', because we have reserved this term for cases of perceptual similarity, achieved by simulation, between representation and represented. These pictures represent immaterial conceptual relations; these relations have no appearance and can, therefore, not be imitated or simulated.<sup>5</sup> Such pictures are arbitrary in the sense that they could take on other forms as well (e.g., circles instead of squares), and in that they need symbols (like 'symbol', ' $A \cap B$ ', etc.) in order to obtain their specific meaning. (In Figs. 2, 4, and 5 the graphic configuration remains constant; they receive their different meaning only through different keys.) So we may say: These pictures consist of graphic elements, which are not iconic, but become *symbols* by virtue of their second elements, the linguistic labels ' $A \cap B$ ', 'icon', etc.

In our logical pictures, as we have seen, the very same conceptual relation can be illustrated by different graphic forms, and the very same graphic form can be used for illustrating different conceptual relations.



But in another respect, our figures are not really arbitrary, but seem to be descendents of spatial metaphors (Fenk 1990: 368, and 1992): Figures 1 and 3 refer to the metaphor of conceptual hierarchies and subsumptions ('subsumption metaphor'). The other figures are Venn Diagrams. This type of diagram alludes to the 'inclusion metaphor', to the metaphor of the 'extension' of sets and concepts, of the 'broad' concept 'including' another one, and of 'overlapping' concepts. In other diagrams, illustrating, for instance, the developmental 'cycle' of a butterfly (... adult, egg, larva, pupa, adult ...), the cycle is again a graphic figure capturing a figure of speech, while those elements around the cycle picturing the single stages of metamorphoses (the eggs, the larva, etc.), are 'simulations' (and 'icons' in the sense of my Version I).

The signs  $\circ$  and  $\triangle$  in the geographical map also work as symbols, acquiring their explicit meaning by well-established symbols in the key of the map, but are — in addition — *iconic* symbols: They illustrate, though in a very abstract way, a characteristic difference between the treetops of deciduous and coniferous trees. 'Abstract', here, does not refer to possible levels within a conceptual hierarchy (where 'conifer' is placed below 'tree' and above 'spruce') nor does it mean to be completely apart from reference objects existing in our perceptual world. It means 'highly schematic', or 'with little attempt at detailed and realistic representation'.

Neither similarity in as many respects as possible nor a high degree of correspondence in one of these respects is substantial for *simulation* and *iconicity*: In a cartoon showing two politicians trying to row a little boat in opposite directions, the strokes and spots forming the boat and the politicians are simulations even if the caricaturist characterizes the faces of the politicians very economically, and despite the fact that these politicians have never met each other in a boat. The caricaturist uses simulation — and possibly also some non-iconic symbols (e.g., the initials of their parties tattooed on the politicians) — irrespective of his additional or intrinsic communicative intentions, such as the reference to an actual political conflict, the allusion to a metaphor (saying that we are all sitting in the same boat), the entertainment of the viewers, etc. If a cartoonist attaches the 'simulated' head of a certain politician to the 'simulated' body of a fox, or if he — which will hardly work for all politicians — achieves a portrait representing significant features of both the politician and a fox, these are again cases of simulation where the combinatorial effects allude to a metaphor ('he is a fox'). And the picture of a mermaid or of an unicorn is simulative, whether the parts (the maid and the fish; the horn and the horse) are painted very naturalistically or not, and despite the fact that — as in the case of the politicians in the boat — the

relevant combination of these elements is (probably) not based on sober observation of nature. Considering not only the elements but also the *combinations* — of maid and fish for instance — as (results or cases of) simulation would either mean that the painter 'simulates' already existing pictures of the mermaid or the unicorn, or a use of the term 'simulation' somewhat broader than in this study so far.

There remains the question as to the iconic character of metaphors. In Russell (1959: 5) logical pictures are not mentioned as transformations of metaphors, but as a specific type of metaphor: 'Above all, an attempt has been made ... to translate philosophical ideas into diagrams that convey the same information by way of geometrical metaphor' (quoted from Ueding 1992: 15). Here, and in Rozik's (1994) distinction between 'pictorial metaphor' and 'verbal metaphor', the underlying concept of *metaphor* seems to be rather broad.

According to Peirce (see Fig. 1), metaphors are a subclass of 'hypoicons', i.e., a subclass of signs 'in which likeness is aided by conventional rules' (CP 2.279) (quoted from Schroeder 1989: 14); metaphors are those hypoicons 'which represent the representative character of a representation by representing a parallelism in something else' (CP 2.777) (quoted from Schroeder 1989: 17). Each representation I have defined as 'iconic' is — more or less — 'aided by conventional rules': 'more' in the reproduction of conventionalized iconic symbols, 'less' in the case of drawings and paintings for instance, where the creator's freedom is extremely high but not completely detached from the given historical and cultural background. (The techniques available are only one facet of this cultural context.) But none of these simulative representations are 'metaphors' in its original sense, i.e., in the sense of 'verbal metaphors'. The words constructing the verbal metaphor are conventional symbols, whether the respective metaphorical expression is well established or an ad hoc creation. Are such symbolic expressions *iconic* in our restricted sense?

Keller refers to Haley ('Metaphor is a symbolic statement that represents one thing as an icon ... of something else', Haley 1988: 22) and classifies metaphors as 'meta-icons' (Keller 1995: 183). Should we, then, regard metaphors as a case of second-order iconicity, and our logical pictures as a case of third-order iconicity? In Keller's 'instrumentalistic semiotic approach', which he distinguishes from the 'representationalistic semiotic approach' (of, e.g., Peirce), signs are, first of all, related to the relevant cognitive functions: Symptoms are interpreted by causal inference, symbols by regularity-based inference, and icons by associative inference. ('Associative inference', if not used in the very specific way of Keller, but in the meaning established in cognitive psychology, is also involved in what Keller calls 'causal' and 'regularity-based inference'.)

Associative inference is, of course, also relevant in the interpretation of metaphors and metaphor-based diagrams. But if we stick to the restriction (even in our weaker Version I) that icons are cases of *perceptual* similarity established by simulation, then the metaphor is not iconic: When proceeding from 'iconicity' to 'meta-iconicity' (Givón 1995: 25) or 'second-order iconicity', iconicity in our restricted sense is lost. Classifying Venn Diagrams as a case of quasi 'second-order iconicity', or calling metaphors '(meta-)icons' is, from this point of view, just a case of metaphorical speech. Finding some parallels or *analogies* between, on the one hand, iconicity, and, on the other hand, metaphorical expression, analogical and 'structural representation' (Swoyer 1991), and transparency- and 'naturalness'-principles (e.g., Dressler 1987), cannot mean establishing *identity* between iconicity and all these other principles which have, like iconicity, developed in favor of an economic and efficient communication.

### Recapitulation and conclusions

I have argued that *iconicity* has become a central concept in most of the disciplines dealing with knowledge representation, with a great variety in the — often overextended and inconsistent — use of the term 'icon', and that a 'tractable' concept of *iconicity* would be possible under two preconditions:

- The term 'sign' is restricted to special cases of 'external' representation: mere indexicality, and similarity induced by physical laws are not accepted as a sufficient condition for *sign*. Since we interpret any object (any configuration, any event, etc.) with respect to possible contingencies, *sign* in its literal sense becomes empty if it includes indices.
- One distinguishes two functional types of representation:
  - (A) The function of denoting concepts and propositions. (We can reserve the term *symbolizing* for this sign function.)
  - (B) The simulating function — perceptual similarity between representation and represented is the result of simulating (imitating, picturing, modeling, enacting, etc.) activities.

Now we have two ways of defining *iconicity* as a property of a sign:

- (1) We accept not only function A but also function B as a *sufficient* condition for *sign*, and the whole set of instances realizing function B as *iconic*. The 'overlap' of A and B ( $A \cap B$ ) might then be called 'iconic symbols'.

- (2) We regard function A as a *necessary and sufficient* condition for *sign*. Iconicity is established only in representations realizing both the symbolizing and the simulating function ( $A \cap B$ ). In this more restrictive version, iconicity is no more than a possible attribute of symbols, and nothing but a symbol can be iconic!

Both conventions allow a simple description of 'iconic symbols' such as onomatopoeic words: a symbol (A) is iconic if it realizes function B as well. And both conventions lead to some striking consequences when used for the semiotic description of a Venn Diagram that might be used to illustrate our two versions of iconicity. Such a picture is neither 'non-representational' (it represents a relation between concepts) nor 'arbitrary' (it refers to the spatial metaphor of 'overlapping' concepts) or 'iconic' (it is not similar to what it represents), but symbolic by virtue of the symbolic labels giving the graphic elements (areas of circular or quadratic or any other arbitrary form) their relevant and specific meaning.

Constructing meta-iconicity or second- and third-order iconicity for metaphors and for metaphor-based diagrams turns out to be incompatible with the essence of *iconicity*. While metalanguage is still language, iconicity gets lost in these so-called 'meta-iconic' representations.

### Notes

1. In Peirce (1976 [1908]) the term *sign* — even in its most restrictive (?) definition — encloses indices: 'I now limit it, so as to define a sign as anything which is on the one hand so determined (or specialized) by an object and on the other hand so determines the mind of an interpreter of it that the latter is thereby determined mediately, or indirectly, by that real object that determines the sign' (Peirce 1976 [1908]: 886).
2. In Eco (1986) this is one out of a number of arguments for his thesis, that 'the mirror image does not meet the requirements for a sign' (1986: 228).
3. Such a description is not compatible with the equation 'symbol = non-iconic sign', which Pelc (1986: 8) attributes to Morris (1971: 37–38). But it is compatible with Peirce if *symbol(icity)*, *icon(icity)*, and *index(icality)* are regarded, as in Ransdell (1986), as *dimensions* instead of distinct classes of sign: 'Thus when we identify some sign as being iconic, for example, this only means that the iconicity of that sign happens to be of peculiar importance to us for some reason or other implicit in the situation and purpose of that analysis, but there is no implication to the effect that it is therefore non-symbolic or non-indexical' (1986: 57).
4. Some principles of 'naturalness' or transparency — like the one called 'the iconic display of temporal succession' (Haiman 1985: 4) — seem to be quite resistant against erosion processes: Changing the word order — e.g., according to the principle 'the more frequent before the less frequent' found in freezes (Fenk-Oczlon 1989) — would diminish transparency without diminishing the expenditure of coding. But frequently used word constructions get shorter even in those cases where this economy principle comes into conflict with the 'iconic' principle of semantic markedness (Fenk-Oczlon 1990). In

general, there seems to be 'an inverse correlation between iconicity and economy' (Haiman 1985: 18) which can be explained in terms of information theory (Fenk and Fenk-Oczlon 1993): 'An increasing frequency of a (super)sign goes hand in hand with an increasing "erosion" of this (super)sign: It shortens and becomes less transparent. Negative effects of the erosion are counterbalanced by higher familiarity' (1993: 21).

5. Using Haiman's (1985: 10 ff.) terminology in order to illustrate that his description of diagrams does not fit logical pictures: Our Venn Diagrams cannot 'resemble' their 'object', and this is also true for Cartesian diagrams. Such a diagram showing, for instance, the weight of trouts as a function of their age can hardly be said to 'resemble' the abstract dimension *time* (x-axis) or an elsewhere existing orthogonal relation between time and weight. In that they do not resemble their 'object', they also do not 'suppress' any shapes of their 'object' (as a stick figure caricature actually does).

## References

- Alesandrini, K. L. (1984). Pictures in adult learning. *Instructional Science* 13, 63–77.
- Andersen, Peter B. (1995). The force dynamics of interactive systems: Toward a computer semiotics. *Semiotica* 103 (1/2), 5–45.
- Boeckmann, Klaus (1982). Warum soll man im Unterricht visualisieren? Theoretische Grundlagen der didaktischen Visualisierung. In *Visualisierung in der Mathematik*, Hermann Kautschitsch and Wolfgang Metzler (eds.), vol. 6, *Schriftenreihe Didaktik der Mathematik*, 11–33. Wien: Hölder-Pichler-Tempsky; Stuttgart: B. G. Teubner.
- (1991). Die Medien als Welt der Zeichen. In *Massenmedien verstehen*, Klagenfurter Projektgruppe Medienerziehung (ed.), 34–40. Wien: Österreichischer Bundesverlag.
- (1994). *Unser Weltbild aus Zeichen*. Wien: Braumüller.
- Dambska, Izydora (1973). O konwencji semiotycznych. In *Studia Semiotyczne* 4, Jerzy Pelc (ed.), Warszawa: Ossolineum.
- Dressler, Wolfgang U. (1987). Naturalness in word formation. In *Leitmotive in Natural Morphology*, Wolfgang U. Dressler, Willi Mayerthaler, Oswald Panagl, and Wolfgang U. Wurzel (eds.), 97–126. Amsterdam/Philadelphia: John Benjamins B. V.
- Eco, Umberto (1986). Mirrors. In *Iconicity: Essays on the nature of culture; Festschrift for Thomas A. Sebeok*, Paul Boissac, Michael Herzfeld, and Roland Posner (eds.), 215–237. Tübingen: Stauffenberg-Verlag.
- Fenk, August (1987). Zum Verhältnis von 'Darstellung' und 'Aussage'. Am Beispiel der 'didaktischen Visualisierung'. In *Medien zur Veranschaulichung von Mathematik*, Hermann Kautschitsch and Wolfgang Metzler (eds.), vol. 15, *Schriftenreihe Didaktik der Mathematik*, 9–42. Wien: Hölder-Pichler-Tempsky; Stuttgart: Teubner.
- (1990). Graphische Darstellung und kognitive Repräsentation. In *Technik und humane Daseinsgestaltung*, Nobert Derner, Claus-Dieter Heinze, Fritz Klaus, and Adolf Melezinek (eds.), 365–371. Alsbach: LTV.
- (1992). What do logical pictures stand for? *Journal of Visual Literacy* 12 (2), 45–49.
- (1993). Text-picture transinformation. In *Quantitative Text Analysis*, Luděk Hřebíček and Gabriel Altmann (eds.), vol. 52, *Quantitative Linguistics*, 151–158. Trier: Wissenschaftlicher Verlag Trier.
- (1994). Spatial metaphors and logical pictures. In *Comprehension of Graphics*, Wolfgang Schnotz and Raymond W. Kulhavy (eds.), 43–62. Amsterdam: North-Holland.
- Fenk, August and Fenk-Oczlon, Gertraud (1993). Menzerath's law and the constant flow of linguistic information. In *Contributions to Quantitative Linguistics*, Reinhard Köhler and Burghard B. Rieger (eds.), 11–31. Dordrecht: Kluwer Academic Publishers.
- Fenk-Oczlon, Gertraud (1989). Word frequency and word order in freezes. *Linguistics* 27, 517–556.
- (1990). Ikonismus versus Ökonomieprinzip. Am Beispiel russischer Aspekt- und Kasusbildungen. *Papiere zur Linguistik* 42 (1), 49–69.
- Givón, Talmy (1995). *Functionalism and Grammar*. Amsterdam and Philadelphia: John Benjamins.
- Goel, Vinod (1991). Spezifikation und Klassifikation von Repräsentationssystemen. *Klagenfurter Beiträge zur Technikdiskussion* 46 Klagenfurt: Interuniversitäres Forschungsinstitut für Fernstudien der österreichischen Universitäten.
- Goodman, Nelson (1968). *Languages of Art*. Indianapolis: Bobbs-Merrill.
- Haiman, John (1985). *Natural Syntax: Iconicity and Erosion*. Cambridge: Cambridge University Press.
- Haley, Michael C. (1988). *The Semeiosis of Poetic Metaphor*. Bloomington: Indiana University Press.
- Hockett, Charles F. (1958). *A Course in Modern Linguistics*. New York: Macmillan.
- Jorna, René J. (1990). Wissensrepräsentation in künstlichen Intelligenzen, Zeichentheorie und Kognitionsforschung. *Zeitschrift für Semiotik* 12 (1/2), 9–23.
- Keller, Rudi (1995). *Zeichentheorie*. Tübingen and Basel: Francke.
- Knuf, Joachim (1995). Work and play: Semiotic perspectives on a software demonstration program for the Macintosh. *Semiotica* 103 (1/2), 47–67.
- Macdonald-Ross, Michael (1979). Scientific diagrams and the generation of plausible hypotheses: An essay in the history of ideas. *Instructional Science* 8, 223–234.
- Martinak, Eduard (1993 [1901]). *Psychologische Untersuchungen zur Bedeutungslehre*. Leipzig: J. A. Barth. [Reprinted in *Kodikas/Code, Ars semeiotica* 16 (1/2), 125–226.]
- Morris, Charles (1971). *Writings on the General Theory of Signs*. The Hague: Mouton.
- Oeser, Erhard (1976). *Wissenschaft und Information*. Volume 3, *Struktur und Dynamik erfahrungswissenschaftlicher Systeme*. Wien and München: Oldenbourg.
- Peirce, Charles S. (1906). Prolegomena to an apology for pragmatism. *The Monist* 6 (4), 492–546.
- (1976 [1908]). [Letter to] P. E. B. Jourdain. In *The New Elements of Mathematics*, Carolyn Eisele (ed.), vol. 3/2, 879–888. Berlin: Mouton; Atlantic Highlands, NJ: Humanities Press.
- (1976). *Καινὰ στοιχεῖα*. In *The New Elements of Mathematics*, Carolyn Eisele (ed.), vol. 4, 236–263. Berlin: Mouton; Atlantic Highlands, NJ: Humanities Press.
- (1931–1958). *Collected Papers of Charles Sanders Peirce*, Charles Hartshorne, Paul Weiss, and A. W. Burks (eds.), vols. 1–8. Cambridge, MA: Harvard University Press. [Reference to Peirce's papers will be designated CP.]
- Pelc, Jerzy (1986). Iconicity: Iconic signs or iconic uses of signs? In *Iconicity: Essays on the Nature of Culture; Festschrift for Thomas A. Sebeok*, Paul Boissac, Michael Herzfeld, and Roland Posner (eds.), 7–15. Tübingen: Stauffenberg-Verlag.
- Pirenne, M. H. (1970). *Optics, Painting and Photography*. Cambridge: Cambridge University Press.
- Ponzo, Augusto (1985). Semiotics between Peirce and Bakhtin. *Kodikas/Code, Ars semeiotica* 8 (1/2), 11–28.
- Posner, Roland (1980). Ikonismus in den natürlichen Sprachen. *Zeitschrift für Semiotik* 2, 1–6.
- Ransdell, Joseph (1986). On Peirce's conception of the iconic sign. In *Iconicity: Essays on the Nature of Culture; Festschrift for Thomas A. Sebeok*, Paul Boissac, Michael Herzfeld, and Roland Posner (eds.), 51–74. Tübingen: Stauffenberg-Verlag.
- Rozik, Eli (1994). Pictorial metaphor. *Kodikas/Code, Ars semeiotica* 17 (1/4), 203–218.



- Russell, Bertrand (1959). *Wisdom of the West*. Garden City, NY: Doubleday.
- Schnotz, Wolfgang (1994). Wissenserwerb mit logischen Bildern. In *Wissenserwerb mit Bildern*, Bernd Weidenmann (ed.), 95–147. Bern: Huber.
- Schroeder, Christoph (1989). Sprachlicher Ikonismus: Theoretische Grundlagen und Beispiele aus dem Türkischen. *Papiere zur Linguistik* 41 (2), 3–76.
- Sebeok, Thomas A. (1976). *Contributions to the Doctrine of Signs*. Lisse: Peter de Ridder.
- (1989 [1979]). *The Sign and Its Masters*. Lanham, MD: University Press of America.
- Smythe, William E. (1990). Wie sind Symbole zu interpretieren? Repräsentation bei Frege und Peirce. *Zeitschrift für Semiotik* 12 (1/2), 47–62.
- Swoyer, Chris (1991). Structural representation and surrogate reasoning. *Synthese* 87, 449–508.
- Ueding, Wolfgang M. (1992). Die Verhältnismäßigkeit der Mittel bzw. die Mittel-Mäßigkeit der Verhältnisse. Das Diagramm als Thema und Methode der Philosophie am Beispiel Platons bzw. einiger Beispiele Platons. In *Diagrammatik und Philosophie*, Petra Gehring, Thomas Keutner, Jörg F. Maas, and Wolfgang M. Ueding (eds.), 13–49. Amsterdam: Rodopi.
- Van der Veer, Gerrit C.; Wijk, Robert; and Felt, Michael A. M. (1990). Metaphors and metacommunication in the development of mental models. In *Cognitive Ergonomics*, P. Falzon (ed.), 133–149. London: Academic Press.

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