Can You Visualize Theory? On the Use of Visual Thinking in Theory Pictures, Theorizing Diagrams, and Visual Sketches

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Abstract

Although the visualization of data is on the agenda for sociologists today, thanks to big data, the author raises the question of whether it may not also be possible to visualize theory and, especially, to improve it through visual thinking. The main purpose of this article, more precisely, is to open up a discussion of how visualization and visual thinking can be used as a tool for theorizing in sociology and thereby help produce new and creative theories. Three different types of visualization are discussed: theory pictures, visual sketches, and theorizing diagrams. Theory pictures summarize a theory that has already been developed. Visual sketches are used for early attempts to theorize; they are then typically discarded and replaced by new sketches. Theorizing diagrams draw on ideas from Charles Sanders Peirce and can be described as visual representations that are used to generate new theories. Examples are supplied.

It is more common to use forms of visual representations in the natural sciences than in sociology, both when it comes to working out the analysis and when it is being presented. As a result, what may be called the visual culture of sociology has not been as fully developed as one may have wished (e.g., Edling 2004; Fyfe and Law 1984; Healy and Moody 2014).[1] The drawbacks of this situation have become especially felt with the emergence of big data, for which the need for visual representations is extra strong.

That different techniques for how to visualize data will develop very quickly in social science seems clear from the fact that big data is here to stay. And presumably this is true both for the kind of visual representations that are needed to explore the data more efficiently and for those that are needed to display it. So far, however, nothing has been said about the need

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to visualize *theory* in sociology, although it is common in the natural sciences to both use visual representations and to work out solutions to scientific puzzles with their help.

The main purpose of this article is to open up a discussion of how to use visual thinking when you theorize in sociology, that is, how to use it as a tool for theorizing. The key point is that sociologists may not want to draw solely on language when they theorize, if it is possible to complement or combine this type of thinking with visual thinking. I will try to make this point as convincingly as possible by discussing what is meant by the expression "visualizing theory in sociology" and by commenting on literature that is relevant in this context. As the subtitle of the article indicates, the discussion will be centered on a few different ways of visualizing theory in social science: so-called *theory pictures*, full-scale *theorizing diagrams*, and *visual sketches* that are part of the work process and used to theorize.

THEORY PICTURES

Before 1991, when Michael Lynch published an article on this topic in *Sociological Theory*, there existed next to no discussion of the ways in which sociological theory can be visualized (Lynch 1991a; see also Lynch and Woolgar 1990; Slawski 1989; Toth 1980). Lynch's general message, however, was a negative one. Most visual representations of theory in sociological work, he found, were of poor quality and primitive in nature. They rarely went beyond what was said in the text.

Lynch distinguished among several different types of visual representations in sociology. All of these are well known to most sociologists. You can, for example, link factors through causal or quasi-causal vectors, as in organizational charts and ecological models. Theory is also often represented by fourfold or multifold conceptual squares. Well-known examples of this can be found in the works of Parsons and Habermas. Different versions of path-analytical diagrams are common as well. Finally, according to Lynch, there also exist some schemes, developed primarily by anthropologists, that are used to represent such topics as calendars and kinship networks.

Lynch's term for all of these visual representations was *theory picture*. A theory picture, he wrote, is typically constructed and used to convey an impression of rationality and scientific rigor. The main rhetorical point to convey to the reader is that the analysis is truly scientific. These visual representations, as he phrased it, are a form of "rationalized mathematics" (Lynch 1991a:11). There is also another quality to the existing theory pictures in sociology of which Lynch was very critical. This is that "they do not supply readers with puzzles, evidences, or notation systems from which to work out a sense of what the text is saying independent of its words" (p. 11). Theory pictures simply repeat what is said in the text, and they do not use the full capacity of visual representations.

The bulk of Lynch's (1991a) article consists, to repeat, of a sharp critique of the existing ways of visualizing theory in sociology.[2] At the time he wrote this article, Lynch was involved in a project in science and technology studies on the material representation of facts in the natural sciences, and it is clear that in comparison with these, the representations of sociologists were often of a primitive quality (e.g., Coopmans et al. 2014; Knorr Cetina 2003; Latour 1986; Lynch and Woolgar 1990). Still, Lynch did not rule out the existence of some novel and better forms of visualization in sociology. In the last sentence of his article, he noted that at some time in the future, sociologists may be able to "articulate the beginnings of a theoretical language that has yet to be spoken" (Lynch 1991a:17).

Lynch's term *theory picture*, as I see it, has the good quality of capturing the fact that some theory representations do not go beyond the text in which they can be found. A theory picture tries to capture something that already exists—that is all. This fact, however, does
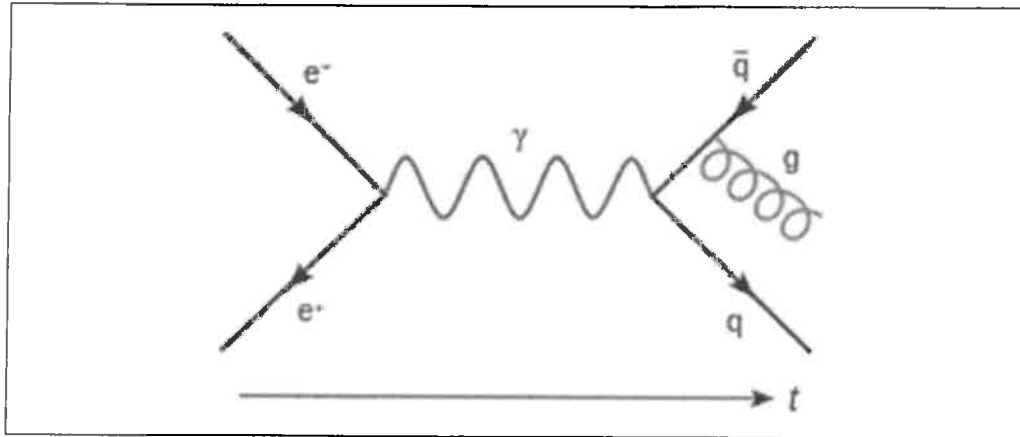
Figure 1. The famous Feynman diagram.
Source: "Feynman Diagram Gluon Radiation" by Joel Holdsworth (https://en.wikipedia.org/wiki/Feynman_diagram).
Note: The Feynman diagram shows how an electron and a positron collide and in doing so produce a photon
(the wavelike line in the middle). The photon then becomes a quark-antiquark pair that radiates a gluon (the
downward-spiraling line).

not to my mind mean that theory pictures are without value. Nor must they necessarily be scientistic, as Lynch argued.

I suggest that theory pictures can often be valuable. This is especially the case when they exhibit the following three qualities: *clarity, simplicity,* and *expressiveness.* A combination of these three qualities can make an illustration very useful as a way of summarizing a theoretical argument, be it in the form of a full-scale theory, a social mechanism, or a concept. Such a picture may also make this type of argument easy to memorize and to teach.

Sociologists can also get some inspiration for constructing high-quality theory pictures from the natural sciences, which have a rich tradition in this regard. One of the best-known theory pictures in physics is the Feynman diagram, which portrays a very difficult part of atomic theory in a way that is generally considered ingenious and that has been widely diffused (Kaiser 2005). All Feynman used in his diagram were a few lines and arrows (see Figure 1).

To illustrate what a good theory picture might look like in sociology, take, for example, Arthur Stinchcombe's (1986) visualization of Robert K. Merton's notion of social structure (Figure 2). Stinchcombe captured Merton's theory of social structure well, depicting it as centered on individual choice while portraying it as social in nature.[3] The motivation of the actors, as well as their character, is the result of interactions between the individual and the social structure. Through a feedback loop, Stinchcombe added dynamics and process to his conceptualization.

There is also the famous diagram that can be found in the work of James Coleman, usually referred to as the Coleman diagram but also as the Coleman boat, the Coleman bathtub, and the Coleman-Boudon diagram (see Coleman 1986, 1990; for its use, see, e.g., Foss 2008; Manzo 2007; Stoltz 2014). This figure represents an attempt to visualize the way a social system operates. According to Coleman, this type of system is best understood in terms of transitions between a macro-level and a micro-level or between a societal level and the level of individuals. The main argument is that macro-level forces or variables do not directly cause other macro-level forces or variables. Instead, forces at the societal level or the macro-level influence individuals at the micro-level, and these individuals, in their turn, influence forces at the societal or macro-level (see Figure 3).
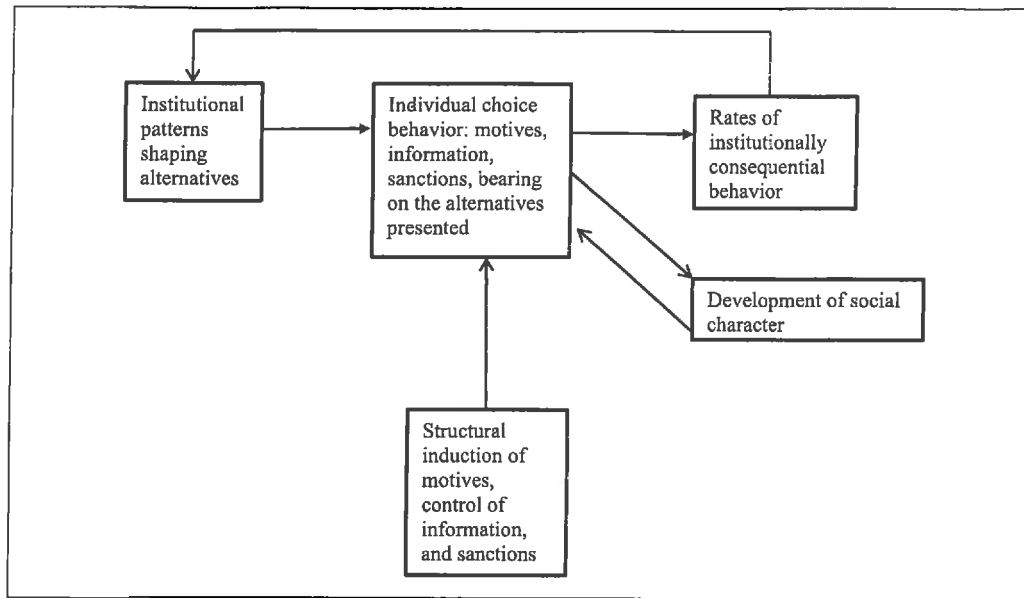
Figure 2. Merton's theory of social structure, according to Arthur Stinchcombe.
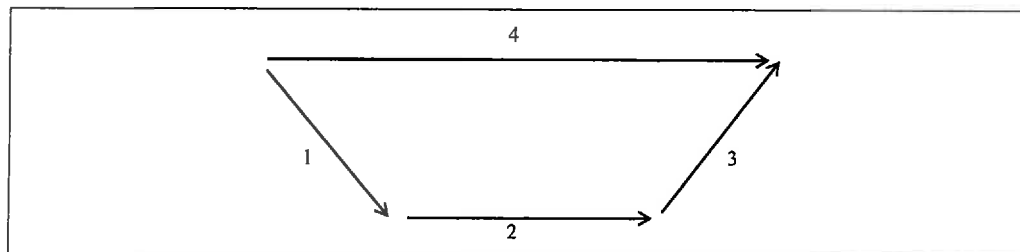Source: Stinchcombe (1986:293).

Figure 3. The Coleman diagram.
Sources: Coleman (1986, 1990).

The visual representations used in networks should also be mentioned in this context. In April 1933, when Jacob Moreno presented the first visual representations of networks at a meeting of the Medical Society of New York, he announced that he had discovered a revolutionary way of visualizing social relations. All that was needed to produce these, he said, were some colored lines and arrows. "With these charts, we will have the opportunity to grasp the myriad of networks of human relations" ("Emotions Mapped by New Geography" 1933).

To a sociologist of today, the idea of using graphic illustrations is nearly identical to the use of networks. Although only a small number of articles in sociology contain visual representations (other than ordinary charts and tables that present data), it is different with network studies.[4] Note also that the discussion of networks makes it necessary to address the question of what differentiates the visualization of data from the visualization of theory. This is a somewhat thorny issue, in my view, and most illustrations that can be found in articles with network analyses fall in the former category; that is, they visualize data. As examples of visualizations of theory, in contrast, one can mention the illustrations that accompany Mark Granovetter's article on strong ties or Ronald Burt's work on structural holes.

One concept that may help clarify the difference between theory and data in the case of networks is that of *colligation* (e.g., Swedberg forthcoming; Whewell 1840). According to the theory of colligation, to connect facts by rearranging them in some way belongs to the realm of methods and the handling of data. To connect facts through *an explicit idea*, in contrast, means that you have introduced some theory. From this perspective, a graph that simply portrays, say, some version of two separate clusters with nonredundant information constitutes data. If the graph is stylized and used to illustrate the idea of structural holes, however, you have a theory that is being visualized.

DIAGRAMS FOR THEORIZING

Lynch (1991a), to recall, mentioned the possibility of "a theoretical language that has yet to be spoken" (p. 17). He was also positive to visual representations that "supply readers with puzzles, evidences, or notation systems from which to work out a sense of what the text is saying independent of its words" (pp. 11, 17). To develop this new language would clearly be a demanding task and probably a collective one as well. I will nonetheless proceed in this direction and present what I shall call *diagrams for theorizing*, which can be described as heuristic diagrams for theorizing in sociology. The person who has come the closest to producing something like this is Charles Sanders Peirce. Before proceeding to Peirce, however, I will first say something about visual thinking as well as diagrams and how these can be used for theorizing purposes.

The term *visual thinking* is often associated with psychologist Rudolf Arnheim's (1969) study *Visual Thinking*, while the term *visuospatial thinking* is the one preferred among cognitive psychologists today (e.g., Shah and Miyake 2005). Arnheim, who had been trained in gestalt psychology in Germany in the 1920s, argued that perception represents a specific form of thinking, drawing on mental images, forms or visual concepts, and the like. That there exists a link between perception and spatial ability has been shown in modern cognitive science and also that perception and language are related. The biological foundations of visual thinking represent an area in neurophysiological research that is still little developed. What exactly happens when you think in terms of mental images is also not known. Because the visual system is interfaced with the human capacity to think with the help of words, however, an interaction between the visual system and the verbal system is likely (e.g., Berwick and Chomsky 2016).[5]

There exist many different types of diagrams, several of which are used in sociology and the social sciences (such as tree diagrams, network diagrams, flowcharts, function graphs, scatterplots, certain kinds of maps, and so on).[6] The ones I focus on here—*theorizing* or *heuristic diagrams*—are of a special kind and differ from theory pictures on several accounts. Although a theory picture allows you to get a quick sense of some existing theory, a theorizing diagram can be characterized as a tool for theorizing. It helps you enter a problem through visual thinking and work it through with its help. A theory picture is also closed by nature, in the sense that it represents a finished theory. A theorizing diagram in contrast is *open*, meaning that it does not have a single solution but can be worked out, with the help of visual thinking, in different ways. They are in this sense not so different from the kinds of drawings that are used in Rorschach tests, and they allow different interpretations. They differ from these, however, in that you must slowly and deliberately work through them. A theorizing diagram should also have an intellectually energizing quality to it. It should operate a bit like an *analogon*; that is, it should be able to trigger your visual and theoretical imagination (Sartre [1940] 2004).

Before proceeding any further, let me back up a little and explain why I use the term *diagram* when I speak of theorizing diagrams, and in what sense. Lynch indicated that he used

the term *picture* to express the fact that the visual representation of the theory does not add anything new to the verbal account. A diagram of the type I have in mind differs from such a picture in that it is deliberately flexible and can be worked out in ways that cannot be decided in advance. When you work with a theory picture, there is only one way to proceed. But when you work with a theorizing diagram, this is not the case.

When you construct a diagram, including a theorizing diagram, you typically use the very same tools as when you produce a theory picture. In both cases, you operate on an abstract level and use basic geometric forms or so-called geometric primitives, such as circles, squares, points, and lines (e.g., Tversky 2011). If the figure is in three dimensions, a few more figures need to be added. Just like a theory picture, a diagram belongs, in other words, to what Simmel called "social geometry" or what we could call "visual ideal types," with Weber.

A diagram is usually executed on paper, which makes it two-dimensional (although modern computer technology makes it possible to operate with three-dimensional diagrams). Although black used to be the only color, this is less the case today. Still, the diagram is usually set off against a white background. Numbers but also single words or letters are typically part of a diagram, just as they are part of a theory picture. This makes it hybrid in nature and allows you to draw on several symbolic systems at the same time.

There exists a fairly huge literature on diagrams, from classical texts by James Clerk Maxwell and Charles Sanders Peirce to a quickly growing modern literature, with contributions by anthropologists, cultural historians, cognitive scientists, logicians, and many others (e.g., Bender and Marrinan 2010; Cheng and Simon 1995; Cromley, Snyder-Hogan, and Luciw-Dubas 2010; Eddy 2014; Glasgow, Narayanan, and Chandrasekaran 1995; Gooding 2010; Kirsh 2010; Larkin and Simon 1987; Maxwell 1877; Nersessian 2008:161–66; Osborn 2005; Peirce 1906; Shin, Lemon, and Mumma 2014). One of the many insights from this literature is that diagrams draw on the human capacity to understand and reason in a multimodal way, that is, not only with the help of words and numbers but also through visual representations of various types. Whether there exists a distinct type of "diagrammatic reasoning" or not, it is clear that people can think effectively in other ways than with the help of formal logic and that they also do so. In the cognitive science literature, references are made to visuospatial thinking; and this capacity is clearly involved when diagrams are used (e.g., Hergarty and Stull 2012; Schulheis and Carlson 2013; Shah and Miyake 2005).

The term *diagram* comes from the Greek *diagramma* ("to mark out by lines"), and it refers, as mentioned earlier, to many different visual representations, such as tables, graphs, and electrical diagrams. Maxwell (1877), for example, defined a diagram as "a figure drawn in such a manner that the geometrical relations between the parts of the figure illustrate relations between other objects." The central feature of a diagram, in other words, is an analogy between the structure of some phenomenon and its geometric expression.

Maxwell's view of the diagram can also help explain why diagrams are attractive to sociologists. Much of what goes on in social life is invisible to the eye. Social relationships and social structures therefore need to be expressed through verbal accounts and visual representations, including geometric forms.

Note that a diagram goes from being a picture to becoming a diagram with which to work only if you leave the verbal account behind and enter into the visual logic of the figure and go from there. One way to do so in an effective way is the following. You start by focusing on the diagram for a few minutes, till you have made the transition into its visual language. Once you are "inside" the diagram, you begin to think in its images and follow their logic; that is, you think in a different way than when you exclusively use words and conventional logic.

To turn an ordinary diagram into a theorizing diagram, you should at this point also try to explore its potential, conducting as it were mental experiments on it, to get a better grip on

the problem you are working with. Because sociological problems are usually empirical, you may want to begin by thinking for a while inside the logic of the diagram, then leave it to look at the facts again, then go back into the diagram, and so on. Language plays a role in all of these operations, but to a varying degree.

Although some people are known to think primarily in terms of images—Einstein is a famous example[7]—it is also possible for a person to decide to make a deliberate transition from a nonvisual way of understanding a problem to one that is primarily visual in nature. As a young man, Benoit Mandelbrot taught himself to translate algebraic problems into geometric forms to solve them ("translating algebra back into geometry, and then thinking in terms of geometric shapes" [Mandelbrot 2012:70]).

Another person who taught himself to think in diagrams as a young man was Charles Sanders Peirce (Kent 1987:3). Because the ideas of Peirce on how to use diagrams come the closest to what is called theorizing diagrams in this article, it may be helpful to describe his ideas on this topic in some detail. In the view of Peirce, diagrams can be extremely helpful to scientists, both when they want to work their way through a problem and when they try to come up with new ideas. Peirce often speaks as if using a diagram constitutes the best way to approach scientific and philosophical problems; in fact, far better than to do so by writing (e.g., De Waal 2013; Stjernfelt 2007). One reason for this may be that Peirce himself thought exclusively with the help of diagrams.[8]

Peirce's main discussion of diagrams can be found in his studies of logic, from the early 1870s onward (e.g., Misak 2010:84). The main result of this work is his so-called system of existential graphs (for an introduction, see, e.g., Kent 1987; Peirce 1906; Roberts 1973; Stjernfelt 2007). Peirce's hope for these graphs was huge, namely, to produce "a moving picture of the action of the mind in thought" (Peirce, quoted in Pietarinen 2006:104).

Peirce (1906) presented his ideas on existential graphs in an article called "Prolegomena to an Apology for Pragmaticism." Existential graphs or logical diagrams, as Peirce also called them, are simple in nature and consist of words in combination with fairly plain geometric figures, constructed with the help of circles, dots, and lines. At the most fundamental level, what they show is how some logical proposition stands in relation to other logical propositions.

According to Peirce, a logical diagram also has an overall "form," which is caused by the way its "parts" or "components" are positioned in relation to one another. Each part, he says, determines some other part, and the result is the kind of skeleton-like image Peirce associated with icons in his semiotics (e.g., Peirce 1932:778). Peirce's view of diagrams was, like that of Maxwell, fundamentally structural in nature.

"A diagram," Peirce (1998) wrote, "is a kind of icon [that is] particularly useful, because it suppresses a quantity of details, and so allows the mind more easily to think of the important features" (p. 13). "Many diagrams," he added, "resemble their objects not at all in looks; it is only in respect to the relations of their parts that their likeness consists" (p. 13).

With the help of diagrams of this type, it is possible to work out the reasoning that goes into, say, a syllogism, and this reasoning is, like all diagrammatic reasoning, primarily *deductive* in nature. Existential graphs allow you to reason step by step till you find a solution. In this sense they are not so different from a labyrinth, in which you also proceed by trying "one path after another," all in the hope of getting to the center (Peirce 1906:502–503).

In contrast to mathematical diagrams, logical diagrams do not present you with the most efficient solution to some problem, according to Peirce. Their focus is instead on how to proceed analytically and in a deductive fashion when you approach a problem. "The mathematician wants to reach the conclusion, and his interest in the process is merely as a means to reach similar conclusions" (Peirce 1906:503). A logician, in contrast, is someone whose "desire is to understand the nature of the process by which it [the conclusion] is reached."

One reason that makes it possible to also explore new ideas with the help of existential diagrams is that each of the parts that makes up the graph does not have a fully determinate meaning. Another is that each part is related to other parts, and the logician can experiment with changing their internal relations in various ways: add a link, remove one, and so on. Deductive reasoning of the diagrammatic type, in other words, has an abductive quality to it.

This abductive quality can also be heightened with the help of experiments:

> One can make exact experiments upon uniform diagrams; and when one does so, one must keep a bright outlook for unintended and unexpected changes thereby brought about in the relations of different significant parts of the diagram to one another. Such operations upon diagrams, whether external or imaginary, take the place of the experiments upon real things that one performs in chemical and physical research. (Peirce 1906:493)

It is clear that Peirce's system of existential graphs is quite special in nature and also that it is not very suitable for the social sciences. It was constructed to deal with logical propositions, and the main type of reasoning was deductive in nature. Any kind of interaction or confrontation with empirical material was not part of Peirce's approach.

But Peirce was also very interested in other types of diagrams beyond logical diagrams, including the kinds of diagrams that are used by scientists in their everyday research. These are of special interest for social science and for the idea of theorizing diagrams in this article. What they show is that diagrams can be extremely useful also when empirical research is involved. For this reason they are of extra interest to sociologists.

As an example of empirical diagrams, as opposed to logical diagrams, Peirce mentioned how Kepler used diagrams in his famous work on Mars. Kepler, Peirce pointed out, went back and forth between his diagrams and what he observed in reality, in an attempt to better understand the movements of Mars. What finally made it possible for Kepler to make his discovery of the elliptical form of the course of the planets, Peirce (1966) suggested, was the way in which he was able to manipulate the mental diagram in his mind:

> His admirable method of thinking consisted in forming in his mind a diagrammatic or outline representation of the entangled state of things before him, omitting all that was accidental, observing suggestive relations between the parts of his diagram, performing diverse experiments upon it, or upon the natural objects, and noting the results. (p. 255)

Just as with logical graphs, experiments can be carried out with the help of an empirical diagram. Although the thinking that goes into the reading of the diagram is still mainly deductive in nature, it represents a novel type of deductive thinking (Hintikka 1983; Peirce 1932:267). It is novel in that it broadens the conventional view of deduction as being a way of drawing of necessary conclusions from some premise. From this perspective, deduction can include observation, experimentation, and abduction.

In his discussion of Kepler, Peirce also touched on the central role imagination plays in the construction of a diagram. It must be a special type of imagination, Peirce (1966) wrote, one that is structural in nature:

> The first quality required for this process, the first elements of high reasoning power, is evidently imagination; and Kepler's fecund imagination strikes every reader. But "imagination" is an ocean-broad term, almost meaningless, so many and so diverse are its species. What kind of an imagination is required to form a mental diagram of a

complicated state of facts? Not that poet-imagination that "bodies forth the forms of things unknowne" [Shakespeare], but a devil's imagination, quick to take Dame Nature's hints. The poet-imagination riots in ornaments and accessories; a Kepler's makes the clothing and the flesh drop off, and the apparition of the naked skeleton of truth to stand revealed before him. (p. 255)

SOCIOLOGICAL DIAGRAMS FOR THEORIZING

Similar to the kind of diagrams Kepler used, sociological diagrams of the theorizing type should ideally be heuristic as well as oriented to empirical problems. This means that besides using the conventional tools when you create a diagram—geometric forms of various shapes, verbal notations, and so on—a sociological diagram of the theorizing type also must somehow help the analyst to capture distinctly sociological phenomena. This means that it should be able to capture such phenomena as social structure, social action, and social forms.[9]

More concretely, what would a theorizing sociological diagram look like? One way to answer this would be to look at the diagrams we can find in the sociological literature and see if any of these have these qualities. Somewhat to my surprise, I have been unable to locate a single diagram in sociology that would broadly fit the description of a theorizing diagram. Although it is true that I have been able to inspect only some of the literature, such as the standard works in sociology and *Sociological Theory*, and a bit more, the result was nonetheless disappointing.

Note, however, that the requirements for a theorizing diagram are strict. Most diagrams simply illustrate what has been said or provide the reader with an easy way to get the gist of an argument. For a diagram to qualify as a theorizing diagram, in contrast, the author would have to indicate in the accompanying text that the figure was either of help in developing a theory or (better) that it has this general quality. The author should also signal that a different type of thinking—visual thinking—was involved and was consciously drawn upon.

One of my early leads was a text by Howard Becker (2007), suggestively called "Thinking with Drawings." Becker is one of the pioneers of visual sociology, so I thought that he might also have looked into the possibility of using visual figures to theorize. Becker's text begins promisingly enough with a discussion of design thinking, which can be described as a contemporary form of thinking in engineering in which visual thinking plays an important role. The basic message in this type of work is that analytical or verbal ways of approaching reality are not enough. You also need to include a visual component, and this changes the whole approach.[10]

But from here Becker moved on to what he called "data pictures," which he contrasted with the "theory pictures" of Michael Lynch (Becker 2007:176). These data pictures turn out to be visual representations that allow the researcher to physically see how some data fit a certain category or concept. Data points are, for example, placed within circles or boxes that represent classes, and this gives the reader a very direct sense for how individual data fit some theoretical category.

In continuing to struggle with the question of what a theorizing diagram in sociology might look like, I eventually settled on the following strategy: I would try to produce one of these diagrams myself. I would also try to see if some theory picture could also work as a theorizing diagram, even though its author had not intended this to be the case.[11]

The theorizing diagram I would design would be one consciously constructed according to these rules: it would consist of a few basic geometric figures, and you should be able to work with it by entering into its visual language and stay there, not just inspecting the

finished product (as in the case of a theory picture). The diagram should also be able to guide you in certain directions without locking you into a single solution.

My second strategy, to repeat, was to explore whether it would be possible to take one of the more interesting theory pictures in the sociological literature and see if it could also work as a theorizing diagram. The author might not have intended his or her figure to be used in this way (as evidenced by the lack of a statement to this effect), but it could nonetheless help you work out some theoretical problem by entering into its visual language and drawing on visual reasoning.

I began by looking at the theory pictures I was familiar with, to see if any of them could also work as theorizing diagrams. Some theory pictures turned out very quickly to be unsuitable for this purpose. Some were much too general to work as theorizing diagrams. These were often centered on very general and nonspecified entities, such as "social factors," "nature," "technology," and the like. Some were descriptive rather than explanatory in nature, with their strength being that the person who looked at them could get a quick summary of some theory. You entered into the visual language of the diagram but did not do much visual thinking.

Some theory pictures were also fairly conventional in the way they had been designed, such as Parsons's AGIL diagram and the kinds of diagrams that can be found in the work of Habermas. A few boxes and arrows were used; that was all. They were typically quite simple, avoiding any attempt to visually express more difficult social phenomena such as emergence (as in Durkheim) or meaning (as in Weber).

Still, a small number of diagrams remained to be explored in more detail. There was, once again, James Coleman's picture of the micro-macro problem. I also found some interesting and unorthodox diagrams in the works of Harrison White, Pierre Bourdieu, and Bruno Latour. Other diagrams of this quality no doubt also exist (e.g., Turner 2010).

In what follows I present and discuss one of these theory pictures to make the point that there may indeed be some theory pictures that can also work as theorizing diagrams, if they are approached with this type of diagram in mind. The one I have chosen to use as an illustration is the micro-macro diagram of James Coleman. Although Coleman to my knowledge never discussed why diagrams are useful to sociologists or discussed how visual thinking may help you theorize, he definitely liked to illustrate his ideas with figures and also to think with the help of analytical drawings in a way that few other major sociologists have done. His work contains many interesting diagrams, and the reader will often find several versions of the same diagram, something that reflects the fact that Coleman liked to play around with diagrams and recast them, according to the task at hand. In the words of Gudmund Hernes, who was one of Coleman's students, "He used visualization as a way to explore and clarify his own thinking" (personal communication, December 17, 2015). Those of us who have seen Coleman lecture also know that he often included drawings and diagrams in his presentations.

The most famous of all of Coleman's diagrams is his micro-macro figure, which has been much discussed and is viewed by many sociologists as an important advance (e.g., Abell 2000:519). Note that although the Coleman diagram is usually presented as one figure, Coleman used two figures when he initially presented his ideas (Coleman 1986:1321–22). The first was a simple straight line, showing what it is like when macro phenomena are theorized as directly influencing other macro phenomena. The example Coleman used to illustrate his thought was Weber's *The Protestant Ethic*. After a brief discussion of why Weber's argument that "the Protestant religious doctrine" influences "the capitalist economic system" was wrong, Coleman presented his own micro-macro diagram, as a correction.

Coleman's own diagram consists of two lines, instead of just one, and these are linked by two other lines. Although it looks closed, his diagram is to some extent open simply by virtue

of focusing on a classical but still vexing problem in sociology, namely, the relationship between micro and macro. Even more important, it has some qualities that make it possible for the viewer to enter into the visual logic of the diagram and work with it, as opposed to just scanning its surface as you do with a theory picture.

Let us first look at the way that Coleman constructed his diagram, to see how he makes the reader transition from the verbal rendition of his problem to its visual form. First there is the problem of emergence, or going from a lower to a higher level, and it is addressed with the help of two parallel lines (and the words *micro* and *macro* inside the diagram). These are lines 2 and 4 in Figure 3. Emergence takes the route of line 3, while line 1 illustrates the opposite route, from macro to micro.

That the social behavior Coleman discussed is not static but part of a process is depicted through visual means in the following way. You get some intuitive sense of this simply by making your way through the three steps of the diagram: (1) from macro to micro, (2) from micro to micro, and (3) from micro to macro. This sense is strengthened through Coleman's innovative move of positioning lines 1 and 3 in the trapezoid in such a way that they visually signal movement to the reader. More precisely, they are angled downward and upward, with both the downward line and the upward line pointing to the right, something that in visual language translates into movement for the viewer or reader, and is crucial to the general structure of the diagram.

Coleman's diagram is also open in the sense that it is unfinished or ambiguous to some degree; and thanks to this, it invites the reader to work on it and complete it, also in a visual form. That Coleman was not 100 percent sure how to draw the diagram himself is clear from the fact that he experimented with it in various ways, such as removing a line, adding a new one, using different types of lines, and so on (e.g., Coleman 1990:10, 634–47, 702). He also pointed out that the transition from micro to macro (line 3) was not well understood in sociology; it constituted in his view "the main intellectual hurdle both for empirical research and for theory" (Coleman 1986:1322).

That the open quality of Coleman's diagram is closely linked to its visual character is also evidenced by the fact that sociologists who have commented on the Coleman diagram have followed Coleman in trying to amend or complete its visual form. Or, to phrase it differently, in exploring its visual-theoretical qualities, commentators have discovered parts that need to be improved and added to, in order to make the diagram a better guide for research.

Peter Hedström and Petri Ylikoski (2010), for example, suggested the addition of special mechanisms along each of lines 1 to 3. Other sociologists have argued that it is the macro-to-micro link (line 1) that needs some work, rather than the micro-to-macro link (line 3) (e.g., Edling and Rydgren 2014). There are also those who have tried to visually recast Coleman's diagram in a more fundamental way, in their attempt to improve it. They have suggested that it needs a whole new level, and more (see, e.g., Abell, Felin, and Foss 2008; Jepperson and Meyer 2011; Vromen 2010).

In my own view, each of the transitions denoted by lines 1 to 3 in the Coleman diagram is open to exploration along different lines. The micro-to- macro transition, for example, can be the result of aggregation, emergence, or confrontation with an already existing social structure—three very different processes. All of these suggestions are inspired by my visual work with Coleman's figure. Similarly, the macro-to-micro transition can take the form of, say, manipulation, coercion, or influence—again, three very different processes that easily spring to mind while you are inside Coleman's figure. Also the micro-to-micro transition can take many different expressions, from a superficial transmission to a reinforcement of existing ideas. A radical change in the whole meaning structure of some phenomenon may also be involved, as exemplified by Weber's argument in *The Protestant Ethic*. It may finally also

be the case that there is, after all, a direct effect at the macro-to-macro level, even if it is not the whole story (line 4). Coleman has suggested this himself, as have others (e.g., Sampson 2013:62–64).

In short, the Coleman diagram invites someone who struggles with an empirical case of micro-macro to come up with different theoretical options and strategies, set off not only by Coleman's verbal argument but also by the visual thinking that his diagram inspires to. In both types of thinking, the central idea of the diagram is kept intact, namely, that you need to go from the societal level at time 1 to the individual level, and then back up to the societal level at time 2, rather than moving directly from the societal level at time 1 to the societal level at time 2. Coleman both leaves the analysis open and directs it.

Judging from the example of the Coleman diagram, it would seem possible to use at least a small number of the existing theory pictures as rough substitutes for deliberately designed theorizing diagrams. This opens up some interesting prospects for theorizing. But there is also, of course, the important issue that now needs to be addressed: what would a deliberately designed theorizing diagram look like, and what can it accomplish?

In what follows I try to answer this question by constructing such a diagram. I do so on the assumption that a theorizing diagram operates primarily through its visual logic and that even if verbal thinking clearly is involved when you work with a diagram of this type, visual thinking is more important. The reader should also keep in mind that the task of designing a truly useful theorizing diagram stands and falls with the talent of its designer.

A theorizing diagram should address a sociological problem of some generality and difficulty. It should not be linked too closely to a single empirical case but be general in nature. It must also not be constructed so that only one solution is possible but be open to some extent. The trick is to capture the problem with enough structure and constraint so that there is some depth and quality to the visual representation, *and*, at the same time, build in some visual directions in which several solutions can intuitively be sought, even if these cannot be stated or known in advance.

In constructing a theorizing diagram, I start out from Weber's theory of social action; one reason for this is that it explicitly includes the element of meaning in the analysis, making it capable of addressing topics that many types of mainstream sociology, including that of Coleman, usually leave to the side or only address implicitly. A second reason is that Weber's use of the ideal type lends itself very easily to visual representation, even if Weber himself never used any of these in his work.

In chapter 1 of *Economy and Society,* Weber ([1922] 1978) provided his classic definition of social action. This type of action consists of three key elements: (1) an *action* (2) that is *invested with a meaning* and (3) that is *oriented to one or several actors and/or to an order* (*Ordnung*). An actor can, for example, interact with another person (say, a waiter in a restaurant), while orienting his or her action to an order (say, how a waiter is supposed to behave in a restaurant). Weber dealt with the element of meaning, both in the action itself and in his concept of order.

How do you represent meaning with the help of geometric figures, of the type that are typically used in a diagram? This is a difficult question to answer because the concept of meaning is hard to conceptualize and therefore presumably also hard to portray visually. In the case of Weber, however, this problem has a relatively straightforward solution. There are two reasons for this: Weber's ideal type and what he called adequacy at the level of meaning.

If you represent action through a straight line (which is typically done in, say, network analyses), you can introduce the element of meaning into the figure simply by adding a parallel line or melding the line for meaning with that of action. The reason for this is that an action and the meaning that is invested into it have to fit closely together, according to
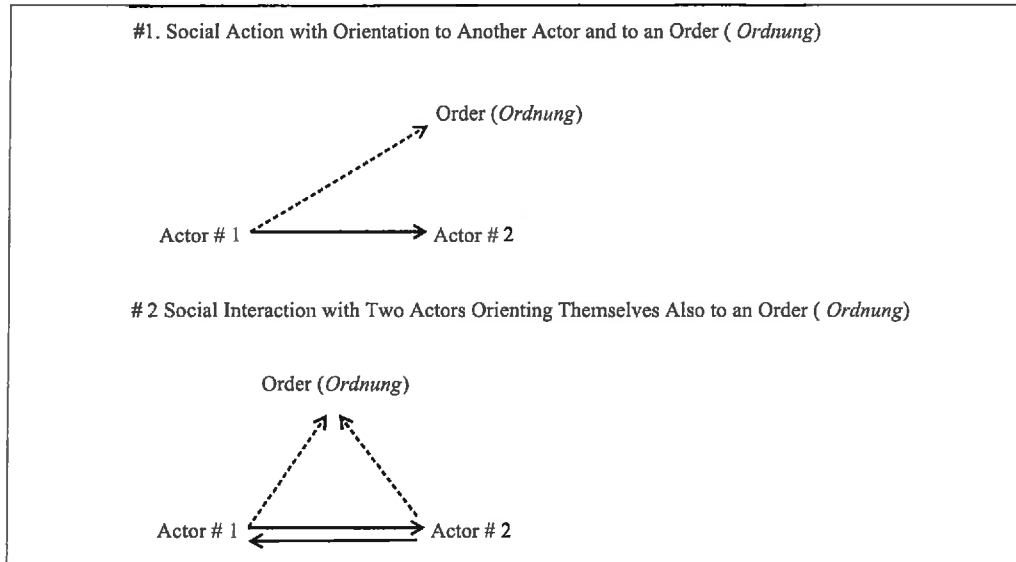
Figure 4. Max Weber on social action and social interaction.
Source: Weber ([1922] 1978:4–28).

Weber; this is what is meant by "adequacy at the level of meaning" (Weber [1922] 1978:11). If, say, you stretch out your hand to greet some person, this should also be followed by the intention or meaning of greeting someone.

In the ideal type you also assume a simplified type of action, namely, that the actor has full knowledge of everything relevant, is fully aware of what is going on, makes no errors, and so forth. Although social action in empirical reality may be better represented by some strange and nonsymmetrical line, in the case of Weber's ideal type, you can and should use a straight line.

Note also that what Weber calls an order (*Ordnung*) means something different from, say, order in the works of Parsons or Hobbes. A Weberian order consists of a scheme for how actors should act when they carry out certain tasks. Again, what Weber has in mind is meaning and action in their ideal typical version. In terms of visuals, an order can therefore be represented as a circle, a dot, or a line, depending on what is most congenial or intuitive for the viewer, makes the overall gestalt of the diagram simple, and so forth.

It is fairly easy, in other words, to visualize Weber's theory of social action with the help of a diagram, and this is also the case that is analyzed here in the form of a theorizing diagram, namely, social interaction between two (typical) actors. In the case presented here, you have two actors, each of whom is directing or orienting an action at the other (Figure 4). Note that the two figures that depict social action and social interaction are open in several respects. We are dealing with ideal types, so deviations from this type of behavior (taking the form of actors' knowledge, errors, level of consciousness, etc.) can easily be drawn as lines that break away from the straight lines. There is also the fact that no ideal typical meaning is fixed in advance; it depends on what particular type of interaction that is being researched.

In continuing to build a theorizing diagram, let me now switch to another theoretical perspective that is useful in this context and take a building block from there. It is often useful to construct a theory or a mechanism with the help of pieces from different theories, because most general theories have some flaws or weaknesses. In this particular case, I take an idea
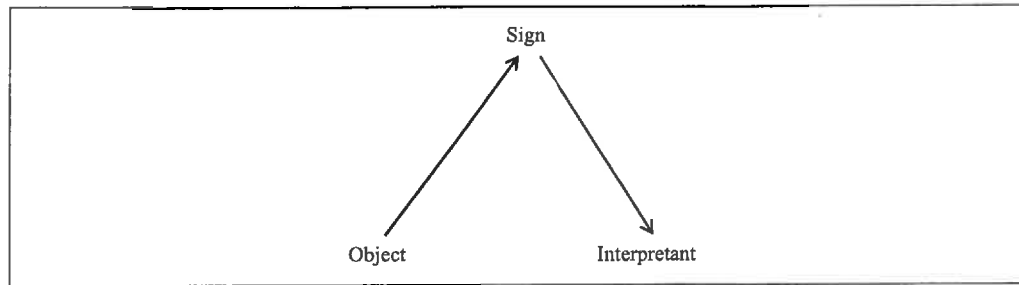
Figure 5. Charles Peirce's theory of signs.
Note: According to the semiotics of Charles Peirce, an object determines its sign, and the sign determines the interpretant. As opposed to Saussure, Peirce discussed not only the sign and what it refers to (signifier, object) in his theory but also the interpretant.

from the work of Peirce, and what I have in mind is something from his semiotics (e.g., Atkin 2013; Peirce 1991).

What is attractive about Peirce's semiotics for a sociologist is first of all that it draws attention to the role of signs in social life. There are three parts to Peirce's theory of signs: objects, signs of these objects, and the impact of these signs (the so-called interpretant). To this can be added that Peircean semiotics also comes with a surprising and interesting argument, which is one of the reasons I am using it here. This part also comes in very handily for the causal part of the theorizing diagram I am designing, and it helps correct for the methodological individualism that can be found in both Coleman and Weber.

What I am referring to is that a sign is determined by its object, which in its turn determines the interpretant. An axe, to take a material object as my example, determines the sign for an axe, which in its turn determines how an axe is perceived (see Figure 5).

That a sign is decided by its object is quite straightforward, while the argument that it also determines the interpretant is counterintuitive for sociologists. Sociologists would typically argue the opposite, namely, that signs take their meaning from a social construction carried out by a group of actors. An axe gets its meaning from the community that uses the axe.

But what makes Peirce's theory of signs so useful and suggestive for sociology is especially that the social world can be construed as consisting of signs and that these signs affect us. I walk down a street in Stockholm, and I suddenly see a swastika on a wall and am filled with revulsion. The arrow of causality in Peirce's theory goes, to repeat, from the object to the interpretant via the sign. In Weber's theory of social action, in contrast, the meaning originates in the mind of the actor and affects the other actor, when accompanied by an action.

The next step I take in constructing my theorizing diagram is to add Peirce's theory of signs to Weber's theory of social action and in this way create a new configuration (see Figure 6). In doing so, Weber's theory of social action is changed, in that the actor is now influenced by social forces. We similarly improve on Peirce's theory, in which the actor/interpretant is not any longer dependent but can now also act autonomously.

It is also possible to build together these two parts from Weber and Peirce in a slightly different way. By proceeding in this way, you can produce a figure that comes closer to looking like Coleman's diagram. The reason for doing this is that this construction allows you to better capture the interaction involved, just like the Coleman diagram allows you so effectively to capture micro-macro phenomena. It brings out much stronger than the earlier figure that two levels, not just one, are involved in an interaction: that of the two individuals and that of the order (*Ordnung*), to which they are orienting their actions and which also influences their actions. The fact that two levels are involved is implicit in Weber's theory, but the
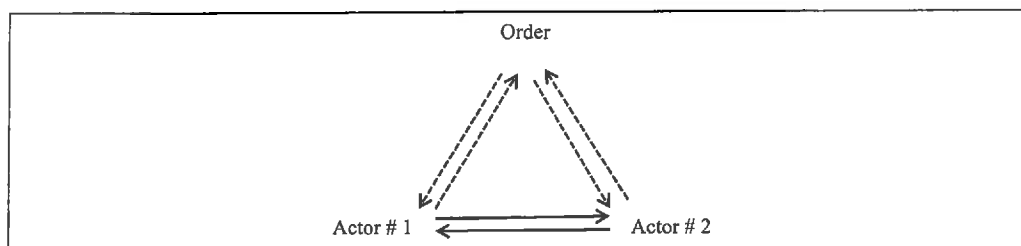
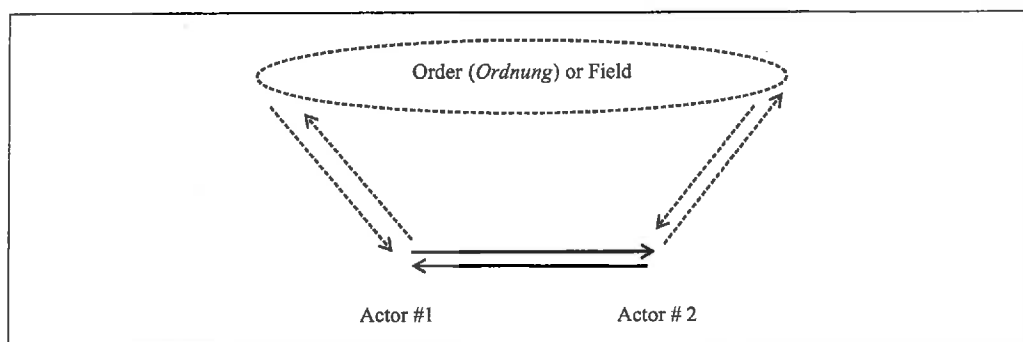**Figure 6.** The models of Weber and Peirce combined.

Figure 7. A theorizing diagram of interaction.

visualization brings it out with clarity, thanks to the Coleman-inspired idea of using two parallel lines to indicate two levels.

By drawing the order (*Ordnung*) as a flattened circle, as I have done, it is also assigned a visual center place in the diagram, something that is appropriate for a meaning-centered sociology such as Weber's interpretive sociology. It also shows that the element of meaning is crucial for the way that the interaction will develop, something that is hard to do with Coleman's diagram. Furthermore, the element of methodological individualism that is part of both Coleman's and Weber's approaches has now become muted and replaced by a more social perspective (see Figure 7).

Is the resulting theorizing diagram of interaction open or closed? At first it may look closed. But as soon as you start to work your way through the diagram, and especially when you start confronting the ideal types with empirical reality, this changes. It now becomes clear that although the diagram indicates some general directions to follow, it is silent on how to work out each part of the diagram. When you start to see how the actors' meaning and actions deviate from the ideal type's requirements of full knowledge, full awareness, no errors, and so on, you can go back to the diagram, draw new lines that represent the deviations, and see where this leaves you. Just as the micro-macro problem is still unsolved in several respects, so also is the idea of a meaning-centered sociology, and this results in more openings as well.

It is also possible to visually link what goes on inside this diagram to the context in which the interaction is embedded. In this way as well the diagram inspires you to theorize. Note that taking the context into account also makes the diagram less artificial and especially diminishes its quality of looking timeless. The field or the Weberian order to which the actors are oriented is in reality linked to other fields or orders. Assume, for example, that we are looking at the interaction of a patient to a nurse in a clinic and that both are oriented to

"how patients and nurses are supposed to interact in this setting." This field or order is in its turn linked to several other orders in the hospital setting (cf. the idea of role sets). The hospital itself is also part of an order or a field of organizations, and so on. And all of this can be visually represented, with some (visual) imagination.

The actors involved in the example of patient-nurse interaction also have their own individual histories. They are embedded in various networks as well, past as well as present. Following the logic of this example, the embeddedness can also be cast in terms of Peirce's theory of signs, coupled with Weber's view of interaction as mutual orientation of two actors. Not only does the interaction between the two individuals become anchored or linked to a larger context in this way, we may also feel impelled to work this out.

In the case of the diagram I have presented here, the complexity is such that there may well be too little constraint and too much openness. Hopefully the example still works, in that it gives a sense of what a theorizing diagram might look like and how to construct one. A theorizing diagram should inspire the researcher through its use of visual means to look for visual solutions in certain directions, given certain assumptions. The A and O of a theorizing diagram is that it invites to visual thinking, that it enables visual reasoning, and that it points to ways in which a solution can be found, primarily by working with visual means.

Is the theorizing diagram I have constructed a successful one? One answer would be that this is the case if it helps researchers analyze cases of interaction and in doing so generates some new theoretical insights. Researchers will be helped in this enterprise not by only bringing in their knowledge of what constitutes social interaction (coming from Weber, Simmel, Goffman, etc.) but also by having their visual thinking activated, inspired, and guided by the diagram.

If the diagram I have constructed does all of this, it works. But note that this is a very tall order. We usually derive theoretical inspiration and knowledge only from the best sociologists, and the same is probably also true when it comes to visual theoreticians. Who will become our visual equivalents to Weber, Simmel, Goffman, and so on, is of course unclear, but note that the bar is set high and well beyond what I have accomplished here.

WORK SKETCHES, OR USING SKETCHES TO THEORIZE

Although I believe that an argument can be made for at least considering the possibility of developing and using theorizing diagrams in sociology, at the moment they may well represent more of a promise than a real possibility. In the concluding remarks to this article, I will return to this question and say something both about the promise that comes with this type of diagrams and some of their drawbacks. Before proceeding to that part of the article, however, something must be said about one more way of using visual thinking for theoretical purposes in sociology. This third type of visual figure is much less ambitious and complex than theorizing diagrams, something that makes it attractive. Adding to its appeal is that it is also already very much in use; its practical value is therefore all the more easy to establish.

What I am referring to is the visual sketch or the small drawing that many of us produce when we try to figure out the theory part of our research. There exist many different types of sketches that are used in sociology, and the one that will be discussed here is what I will call a theorizing sketch. It is characterized by the fact that it is used primarily for theorizing purposes; and it usually takes the form of a quick and tentative drawing of the theoretical part of some problem. A theorizing sketch differs from a theory picture in that it is unfinished; it is also primarily heuristic in nature. As opposed to the theorizing diagram, it lacks a firm structure. It is liquid, amorphous, and temporary by nature. Whereas a theorizing diagram embodies a distinct and consciously worked out theoretical perspective, a sketch can go in

many directions. A sketch lacks the stability of a diagram; it is in front of you in one moment, crossed out and thrown away in the next, only to be replaced by another one.

This amorphous nature of the sketch also represents one of its strengths. According to a standard work on diagrams called *Diagrammatic Reasoning* (Glasgow et al. 1995),

> Sketches have a significant component of "vagueness" to them—but this vagueness plays a functional role in that it helps the designer avoid overcommitment to those aspects of the design to which she is not yet ready to make a precise commitment, but at the same time still take advantage of the visual mode of organizing problem-solving activity and inference-making. (p. xxv)

Theorizing sketches sometimes have a playful quality to them. When you start to draw a line, it is not always clear where it will go. If it will turn into a doodle or an advanced sketch is first decided after a while. You begin by drawing a line, but what next? Many artists have been fascinated by the element of uncertainty in the sketch. Paul Klee ([1925] 1953), for example, started his *Pedagogical Sketchbook* with the following sentence: "An *active* line [is] on a walk, moving freely, without a goal" (p. 16, emphasis added).

Besides being vague and sometimes having an element of playfulness to it, what also characterizes a theorizing sketch is that it will not be published. This is an important feature that it shares with many other kinds of notes and sketches that are produced during the research process. Michael Lynch (1991b) made precisely this point in an article on the use of diagrams in the natural sciences:

> Diagrams are constituents of a work process. They are *used*. Although it may seem especially suitable to study diagrams by examining examples found in historically significant publications, *published* illustrations are not the only, or even the most common, form of pictorial display in scientific research. Lab researchers typically produce numerous sketches, data displays, micrographs, and other "inscriptions" that do not appear in their publications. (p. 211)

Sketches of various kinds are part of the work process, Lynch noted, and they are *used*. But it is possible to go one step further and argue that some of them also *actively help* produce the end result. In this sense they are true tools of production. This is, for example, the view of C. Wright Mills (1959), who wrote as follows in an appendix on craftsmanship in *The Sociological Imagination*:

> Charts, tables, and diagrams of a qualitative sort are not only ways to display work already done; they are very often *genuine tools of production*. . . . Most of them flop, in which case you have still learned something. When they work, they help you to think more clearly and to write more explicitly. They enable you to discover the range and the full relationships of the very terms with which you are thinking and of the facts with which you are dealing. (p. 213, emphasis added)

Mills mentioned several kinds of visual tools when he described how you can get the sociological imagination going (p. 211). The one that comes the closest to a sketch of the theorizing kind is what he called "diagrams of a qualitative sort." Mills also makes the interesting point that most tables and diagrams fail. This is often also true for the theorizing sketch. This type of sketch is often produced, crumbled up, and thrown away. It is then followed by a new sketch that may suffer the same fate till something worthwhile has come into being.

But even if "most of them flop," as Mills (1959) wrote, visual tools such as diagrams, charts, and tables are very helpful in his view. They get your imagination going, and "when they work, they help you to think more clearly and to write more explicitly" (p. 213).

Theorizing sketches have so far been described in a very general way, and it is time to be more specific. First, a sketch that is used for theorizing purposes differs from sketches made for theory pictures. The former are tools of discovery and help you move ahead theoretically, whereas sketches for theory pictures have as their main goal to produce a picture of a theory that already exists. Both, however, come close to Nelson Goodman's (1976) general definition of the sketch as a "working guide" (p. 192).

What both of these types of sketches also have in common is that they are often thrown away or at least not published. As a consequence, they are hard to study and to generalize about. Only a minuscule number of sketches survive, and when this happens to be the case, they can sometimes be found in the archives, among the notes or early versions of some manuscript. Presumably this is also the case for sociology, even if I cannot think of a single famous case in which sociological sketches of this type have survived (Weber, Goffman, Bourdieu, etc.).

But there do exist some cases in sciences other than sociology in which sketches have survived. At the Museum of Natural History in New York City, for example, you can still inspect Charles Darwin's first sketch of the evolutionary tree of life (with the tentative words "I think" written on the drawing).[12] And many of Sigmund Freud's neurological drawings and diagrams have survived (Gamwell and Solms 2006).[13] In the manuscript for *New Introductory Lectures*, from 1933, for example, you can see four early sketches of what eventually became Freud's famous diagram of how the human mind works (Freud 1933:111).

The notes and sketches James Clerk Maxwell left behind go one step further, in that they allow you to follow nearly step by step how he worked out the theory of electromagnetic radiation. Maxwell did so primarily by thinking in terms of analogies, first by using one type of analogy and then another, using the first as a bridge to the second. The way Maxwell used analogies in his sketches has been studied by cognitive historian Nancy Nersessian (2008), who has also tried to study the process of how scientific problems are solved with the help of so-called think-aloud protocols. This way of proceeding—having a person speak aloud as he or she grapples with a problem—was introduced in the early 1980s by Herbert Simon and others (e.g., Ericsson and Simon 1980). What is of interest to us here is that the protocols Nersessian presented contain, among other things, a number of sketches produced as part of the attempt to solve a problem (Nersessian 2008:61–90).

Theorizing sketches make use of the same visual alphabet as theorizing diagrams. To what has already been said on this topic, the following can be added. The figures that are used in a sketch consist of individual geometrical figures as well as dots and lines, coming together in some overall configuration. The figures are usually some version of standard geometrical figures, such as circles, squares, and triangles. The lines can be drawn in different ways: they can intersect, they can have arrows, they can be used to express a feedback loop, and so on. Lines are typically symmetrical, even when they are broken up, turned into dots, and so on. Numbers, letters, and words are also often used in a sketch.

Just like theory pictures and theorizing diagrams, theorizing sketches follow certain visual conventions or visual norms. Some of these are not specific to sociology or social science. You typically read a figure from left to right and from top to bottom. If time is involved, it usually starts from the left and goes to the right, as does a process that is depicted in a sketch. In *Visual Thinking*, Rudolf Arnheim (1969) also discussed how some visual norms have emerged historically. Renaissance artists, for example, famously used a drawing grid to teach themselves a new way to create a sense of spatial perspective, which soon became a visual norm for other artists to follow.

Sociology also has some visual conventions of its own. A sociological triad of the type Simmel first spoke of is typically presented as three dots in fairly close proximity to one another, with two or three of these linked together through straight lines. An arrow that is drawn as a link between two geometrical figures, and that points in one direction, usually indicates causality or some type of influence going in this direction.

But it is also clear that sociology may have to develop new visual conventions and add to its repertoire of visual signs, if it is going to make headway in visualizing theory. One such candidate for a novel visual sign or convention is to my mind Coleman's way of representing the micro-macro problem. The figure he uses to represent this problem is new in sociology and can be used for a number of other problems, namely, two parallel lines that are connected by two angled lines to produce a sense of process and time. A close look at the sociological literature will in all likelihood also result in the discovery of several other interesting figures that are little known today. Still, new conventions and new figures will need to be devised if the idea of visualizing theory is ever going to flower in sociology.

It should also be noted that what makes a theorizing sketch *sociological* is that it is used to capture sociological phenomena at a certain level of abstraction. The individual figures that are used to produce the sketch—circles, rectangles, and so on—are typically also icons in that they display some kind of similarity with the way that sociologists view social phenomena. A strength of the sketch is that it can easily capture multiple and similar structural relationships, because it uses geometrical figures in very simple configurations. Concrete individual phenomena, in contrast, demand much more individualized forms of expression than the basic geometrical forms.

The geometrical elements that have been mentioned so far can be used not only when you make a theorizing sketch but also to produce theory pictures and theorizing diagrams. There does, however, exist one more important feature of the theorizing sketch that cannot be found in the theory picture and the theorizing diagram. It has to do with the fact that many of these sketches do not have any other audience than the people who make them. A theorizing sketch is usually produced for private use and not for public use, which means that it can make use of private representations as well as public representations.

You do not have to go so far as to argue (against Wittgenstein) that a private language can exist to realize that it is very common for people to use figures that have clear meanings only to them personally. Nelson Goodman has similarly argued that a sketch is like a painting in that it is made up of symbols that can easily take on different meanings through very small changes in the way that things are drawn (e.g., Goodman, Perkins, and Gardner 1972:15). A diagram, in contrast, primarily draws on symbols that are basically insensitive to changes in their appearance: a circle is a circle even if it is not perfectly symmetrical, just as some letter in the alphabet is perceived as the same letter even if a different font is used.

All of this makes the theorizing sketch into a very helpful and flexible tool for the researcher. It helps you experiment, and it minimizes the distance between an idea and its representation. It thrives and lives its life in the backstage area of the theorizing process.

That the visual language of the theorizing sketch is both private and public makes the project of putting together an exhaustive list of all the visual signs that can be used when you produce a sketch of this type both illusory and wrongheaded. But this should not be used as an excuse for not trying to produce a list of what the basic signs are and how they can be combined to capture and express theoretical ideas. Such a list would be very helpful, not least to have around when visual thinking is taught to students.

Take, for example, Ernest Gellner's (1970) elegant visualization of the fact that a message from one group of people to another group is often understood in a slightly different way. Gellner used a straight line to represent the message, while the audience is depicted as a circle. When the straight line hits the circle, it changes direction, indicating that it also

changes meaning. This way of showing a change in meaning gives associations to the way that a ray of light is refracted when it hits a prism.

Theorizing sketches can take a number of different forms, from something that comes close to a doodle, to a carefully constructed first version of a social process. But just as sketches come in many forms, they also come in many numbers, and the reason for this is that a sketch is typically unfinished and points ahead to the next one. Sketches allow you to start and then start again and in this process to improve things a bit, and then improve them some more. Because a theorizing sketch will never be published, it is not infected with the kind of anxiety that comes with going public. And because it is private, the sketch can tap into and express ideas that are unique to the individual who has produced it, as well as the particular case he or she is working on.

CONCLUDING REMARKS ON VISUALIZING THEORY: PROMISES AND PROBLEMS

At the outset of this article, it was noted that its primary purpose is to open up a discussion of whether it is possible to improve theory by visualizing it and, if so, how to do it. Can visualization become an effective tool for theorizing in sociology? In these concluding remarks I continue this line of questioning; I also briefly summarize the argument so far.

The visualization of theory can lead to different products, such as theory pictures, theorizing diagrams, and visual sketches. As opposed to Michael Lynch, who opened up this debate, I have argued that theory pictures can be very helpful. They can help convey the essence of a theory in a very quick, efficient, and intuitive manner; they can also summarize a theory in a helpful way as well as present it in a form that makes it easy to memorize.

I have also suggested that visual figures can help make theoretical advances possible and discussed two concrete examples that illustrate this: the Coleman diagram, which was not intended to be a theorizing diagram by its author but which has some potential in this direction, and a consciously designed theorizing diagram of my own, centered on social interaction. Even if the status of so-called theorizing diagrams is still unclear, this is not the case with the sketch. The sketch represents a very common and useful form of visualizing theory that we need to know more about, so we can use it more effectively.

But there also exist some important issues relating to the visualization of theory that have not been discussed so far. On the negative side, there is for example the case that visual representations have a tendency to overreach and even deceive, precisely by being visual. According to a historian of science, "images [that are used in the work of scientists are often] much too powerful, likely to lead to the deceptive excesses of imagination rather than the calm reflections of reason" (Wise 2006:79).

John Maynard Keynes (1951:152, 156–57) made a similar point in his discussion of how to use diagrams in economics. Although these types of diagrams are often elegant and can inspire you in your work, he says, they should also be left behind after a while in the research process. The reason for this is they may be deceptive, unless accompanied by ample text and data. Alfred Marshall, Keynes pointed out, delayed the publication of his major work in economics for many years, because he wanted to add plenty of text to the diagrams.

This brings us to a second problem, which has to do with the role of data in visualizing theory. There exists a tendency in contemporary sociology, among both theoreticians and methodologists, to keep theory and data apart. In this article I have tried to handle this problem by emphasizing that theorizing diagrams in sociology cannot be purely theoretical (as Peirce's logical diagrams are). Sociology is an empirical science as opposed to, say, philosophy and mathematics. There consequently has to be an interaction throughout the research

process between theory and data. You need to go back and forth to the data as you try to calibrate and visualize the theory part.

Another problem with the separation between data and theory, and how it affects the visualization of theory, is the following. Some of the people who work with big data have a tendency to ignore theory altogether, while others make little use of it. Because these people come from many disciplines other than sociology and also from outside academia, it is not likely that much help will come from them in bringing together data and visual theorizing in sociology.

But there also exist some very positive aspects to the attempt to visualize theory in sociology. One of these is that it would allow sociologists to draw on a new tool when they theorize, namely, their capacity for visual thinking. It is well known today that thinking is multimodal in nature, and visuospatial thinking is part of the human equipment. It is a competence that is linked to other competences, such as language and memory, with which it interacts in important ways.

Another advance is linked to the following fact. Wittgenstein famously argued that many philosophical problems have their roots in language, and to some extent this may also be true for sociology. It is easy enough to get lost in sociological terminology and to create phantom problems, as discussions of social structure, embeddedness, and so on, testify. Visual thinking allows you to bypass language to some extent and can for this reason be of help in situations in which ordinary logic and thinking do not work well. "Don't think but look!" as Wittgenstein (1953:66e) once put it.

Another positive aspect of the project with visualizing theory is that most of us already do it—and could do it better with some guidance. Who has not tried to work out a problem with the help of a sketch with arrows, squares, circles and so on? So why not try to improve this capacity through a bit of education and exercise?

Students who take theory classes should in my opinion be trained to use their visual capacity, so they can both theorize better and organize data better. Students usually respond very positively to visual stimulation in the form of pictures and movies, so using more visualization may be one way to improve the teaching of sociology and make it more effective and creative. Students would probably also want to learn more about the ways in which they can use their visual capacity when they do their own research (see, e.g., Toth 1980).

And yet, many tasks remain. We may, for example, want to put together a catalogue of existing visual figures and also further develop the alphabet of visualization. We need to have more knowledge about what happens when people think in terms of pictures rather than words. We also need to develop a pedagogy for how to teach ourselves and others how to use visual means when doing research.

Still, all in all, there exist in my view several reasons why visualization of theory and visual thinking already now deserve to be introduced on a full scale into sociology. First and foremost, this would help sociologists theorize better and also handle data better. To be fully successful, however, it is important to emphasize that this effort must be collective. A first step in this direction would be to have a full and lively discussion about the possibility of visualizing theory in social science, as well as the multiple ways in which this can be done, such as theory pictures, theorizing diagrams, and visual sketches.

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NOTES

1. I do not discuss visual sociology (or visual anthropology) in this article, even if many interesting ideas about the visual culture of social science can be found in this type of work. The main thrust of visual sociology is different from that of this article, namely, to analyze visual representations and also to use photography and film to produce such representations. Still, anyone interested in visualizing theory will clearly find it suggestive to read works such as *Gender Advertisements* by Erving Goffman (1979), "Photography and Sociology" by Howard Becker (1974), and many other studies in visual sociology. For visual sociology more generally, see, for example, John Grady (forthcoming). For visual anthropology, see, for example, Taylor (1994) and Banks and Ruby (2011).

2. With a bit of satire mixed in. In a conversation with Lynch about his article on April 17, 2015, he characterized his article as "a satire."

3. One criterion Lynch used to decide if a theory picture is good or not is whether it depicts a theory well. Jonathan Turner has, for example, summarized many theories visually, but Lynch (1991a:3) found his theory picture of ethnomethodology superficial and wrong. So one reason for labeling Stinchcombe's theory picture as "good" is that Merton himself approved of Stinchcombe's rendition (e.g., Merton 1975). An additional and more important criterion in my mind is how innovative a theory picture is in translating an argument made with the help of ordinary language into one that draws (primarily) on visual signs.

4. According to Joel Podolny (2003), the visualizations of sociological network studies are preferable to the diagrams produced by economists, especially microeconomists. The reason for this is that network analysts are better at tracing what is going on in social life. From the perspective of this article, however, Podolny mixes up visual representations that express data, on one hand, with those that are theory pictures and diagrams for theorizing. The diagram that expresses the demand-supply curve, for example, is a theory, whereas network illustrations usually depict data (including the infamous "hairball" pictures).

5. Can one also theorize better by switching over to the sound system? The answer would seem to be "no" (e.g., Pesic 2014). Music, however, can stimulate creativity. According to Einstein's sister, "musical reveries . . . put him in a peaceful state of mind, which facilitated his reflection" (Pesic 2014:271).

6. For so-called concept maps and mind maps, see, for example, Wheeldon and Åhlberg (2012).

7. The Einstein quotation reads as follows: "The words or the language, as they are written or spoken, do not seem to play any role in my mechanism of thought. The psychical entities which seem to serve as elements in thought are certain signs and more or less clear images which can be 'voluntarily' reproduced or combined. . . . The above mentioned elements are, in my case, of visual and some of muscular type. Conventional words or other signs have to be sought for laboriously only in a secondary stage, when the mentioned associative play is sufficiently established and can be reproduced at will" (quoted in Pietarinen 2011:2–3). Another person who thought in visual terms and who valued "the visualising faculty" very highly was Francis Galton. "Our bookish and wordy education tends to repress this valuable gift of nature," as he put it (Galton 1951:79).

8. "I do not think I ever reflect in words: I employ visual diagrams, firstly because this way of thinking is my natural language of self-communication, and secondly, because I am convinced that it is the best system for the purpose" (Peirce, quoted in Pietarinen 2011:2–3).

9. As an example of a heuristic diagram in economics, one can mention the demand-supply schedule. According to Alfred Marshall, whose name is closely linked to the discovery of the demand-supply curve, diagrams are very useful to the economist. He wrote in *Principles of Economics*, "The use of the latter [i.e., diagrams] requires no special knowledge, and they often express the conditions of economic life more accurately, as well as more easily, than do mathematical symbols. . . . Experience shows that they give a firmer grip of many important principles than can be got without their aid; and that there are many problems of pure theory, which no one who has once learned to use diagrams will willingly handle in any other way" (Marshall [1920] 1986:ix; cf. Keynes 1951:152, 156–57; Larkin and Simon 1987:94).

10. Design thinking, which is becoming increasingly popular these days, has its roots in design and engineering and can be summarized in its early and classical form as the insistence on using one's visual capacity when designing an object (for a designer) or figuring out how to construct it (for an engineer). Modern engineering eliminated the visual education after World War II, which has made many people argue for its reintroduction, including Herbert Simon (1996). Eugene Ferguson (1978, 1992) is generally seen as having made the original plea along these lines. During the past 10 to 15 years, a somewhat

different and expanded version of design thinking has become popular in management science, business schools, and certain strands of popular literature. Here design thinking stands for an alternative to analytical thinking in that it is open and alive to new and practical challenges (e.g., Brown 2009; "The Evolution of Design Thinking" 2015; Lockwood 2009). What sets both of these versions apart from the main argument in this article is the following. In its classical version, the end object is an object that has an important visual dimension (be it the design of, say, a vase or a car). This is not the case for sociological theory, which in its final version is nonvisual. The expanded, contemporary version of design thinking has few connections to scientific thinking. It is very critical of what is seen as analytical and linear forms of thinking, and it argues that thinking must be complemented with action.

11.   This way of proceeding was suggested to me by the editor of *Sociological Theory*, Mustafa Emirbayer.
12.   I thank Gudmund Hernes for telling me about this.
13.   I thank the editor of *Sociological Theory*, Mustafa Emirbayer, for drawing my attention to these.

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