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Discussion

Models and perspectives on stage: remarks on Giere's *Scientific perspectivism*

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ABSTRACT

Ron Giere's recent book *Scientific perspectivism* sets out an account of science that attempts to forge a *via media* between two popular extremes: absolutist, objectivist realism on the one hand, and social constructivism or skeptical anti-realism on the other. The key for Giere is to treat both scientific observation and scientific theories as *perspectives*, which are limited, partial, contingent, context-, agent- and purpose-dependent, and pluralism-friendly, while nonetheless world-oriented and modestly realist. Giere's perspectivism bears significant similarity to earlier ideas of Paul Feyerabend and John Dewey. Comparing these to Giere's work not only uncovers a consilience of ideas, but also can help to fill out Giere's account in places where it is not fully developed, as well as helping us understand the work of these earlier authors and their continuing relevance to contemporary concerns in philosophy of science.

1. Introduction

Ronald Giere's recent and remarkable book, *Scientific perspectivism*, joins a long line of attempts to go *Beyond objectivism and relativism*,[1] *Beyond realism and anti-realism*,[2] *Beyond positivism and relativism*,[3] and so on.[4] Giere wants to find a middle way between an absolutist, objectivist realism and the constructivist or skeptical alternatives. The search for such a *via media* is quite admirable, though perhaps the attempt is not as novel as Giere implies.[5] He forges this path by treating scientific observations and theories as 'perspectives', a visual metaphor that implies a subjectively oriented side that avoids the negative aspects of objectivism, but enough of a world-oriented side that it also avoids the negative features of relativism and constructivism. Giere also takes pains to emphasize perspectivism's pluralistic nature. He even hopes that his view qualifies as a novel species of realism.

I will attempt to show that Giere's perspectivist project bears much in common with the work of two earlier philosophers: from the prior generation of philosophers of science, Paul Feyerabend, particularly his late work just before his death, and from the first half of the century, the experimental theory of inquiry of John Dewey. Further, I will show that their work can help improve and extend perspectivism in helpful ways, especially on the issues of representation, projection, and purpose. In the course of these

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[1] See Bernstein (1983).

[2] See Hildebrand (2003), Goodman (1996), Frede (1987), and Rorty (1986).

[3] See Laudan (1996).

[4] Besides those with obvious titles, we might also count Kitcher (2001), a variety of works by Rorty and Putnam, much of Feyerabend's work after 1987 (and arguably before), Kuhn's post-*Structure* backpedaling, Peirce, James, and Dewey, back at least as far as Hegel, and a whole host of others in contemporary philosophy of science.

[5] Giere cites scientists and philosophers who fall on the objectivist side, and many sociologists and historians who fall on the constructivist side, but unfortunately discusses none of the work by those trying to find a way between the two. From sociology, Bruno Latour has been very critical of constructivism, and his positive view involving 'hybrids' and 'quasi-objects' shares much in common with perspectivism, as far as I can tell (see for example Latour, 1993). The philosophers mentioned in the notes above have similarly attempted to overcome the dilemma. I have heard that Richard Rorty once said in a seminar that 'Every decade or so someone writes a book called something like Beyond Realism and Idealism. Then the critics go at it, and it always turns out that what lies beyond realism and idealism is . . . idealism!' (SqueakyRat, 2007).

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comparisons, I hope also to throw light on part of Feyerabend that has thus far not been much discussed or well understood and to demonstrate the relevance of pragmatist theories of inquiry to contemporary philosophy of science. These goals face the inevitable problem of attempting to reconcile the vocabularies of three philosophers working in different moments, which I will have to overcome by doing my best to stick to a common terminology.[6] Finally, I will investigate some remaining ambiguities or instabilities in the views being discussed, and I will suggest that the culprit is a continuing, but only partial adherence to the visual, spectatorial metaphor of a 'perspective'.

2. Giere's *Scientific perspectivism*[7]

The major claims of Giere's perspectivism, as I see it, are:

1. Human and scientific observation and scientific theories are all perspectival.
2. Perspectives are an asymmetric[8] interaction between human (biological, cognitive, social) factors and the world.
3. Perspectives are partial and of limited accuracy.
4. Perspectives are neither objectively correct nor uniquely verdical.
5. Scientific truth-claims are relative to a perspective and are about the fittingness of perspectives.
6. Representation is a quadratic, not dyadic relation: '*S* uses *X* to represent *W* for purposes *P*'. (Giere, 2006a, p. 60)

(1) and (2) guarantee that the view avoids both objectivism and constructivism. Together with (3) they lead naturally to (4), which keeps objectivism from sneaking in as the uniquely-best perspective. (5) indicates that there is a limited role for truth and realism, and (6) provides an overall model for how the pieces fit together. While I can neither fully explore all of these ideas, nor explain the arguments for them in great detail in the space permitted, I will try now to give a general sense of Giere's exposition and the most important consequences.

Giere begins his discussion with the case of color vision (Ch. 2). We know that the visual system works something like this: in the eye, there are cone cells that are differentially sensitive to wavelengths of light (unlike rod cells, which more or less don't differentiate). The average human has three types of these cells. When these cells detect light, they relay that information to what are called color-opponent cells. These cells combine the inputs from the cone cells in order to be able to detect the varying shades of light. This leads our color experience to have a certain structure. So, for example, you will never see a red that looks greenish, because of the way these colors are opposed.[9] But while normal color vision is trichromatic, there are humans who are red–green colorblind, and thus only have two cone cells, and there are humans and animals with only rod cells who are monochromatic, and there are even reported cases of human women who are tetrachromats, which is the ordinary condition for some species of fish and birds. They would all have differently structured color experience.

Consider the comparison between trichromat humans, with three basic color cells, and monochromats whose vision is only black and white. Giere draws the following lessons from the comparison: (i) neither perspective is objectively correct or uniquely veridical. Both perspectives are produced by the interaction of a visual system with light from the objects. Within the perspective, robust judgments can be made, but this is true both for the trichromatic and the monochromatic perspectives. Different biology, or different evolutionary paths, would have given us different perspectives, but there seems to be no way to say that one is more veridical than the others. Put differently, colors are not inherent properties of colored objects, but are produced by our interaction with them. (ii) Nonetheless, some perspectives are richer in some ways than others. The trichromat is sensitive to a variety of information from the environment that the monochromat is unaware of, and thus the trichromat can distinguish things the monochromat cannot. (iii) The different perspectives are not incompatible. Knowing the science of color vision, it doesn't seem to make sense to say that the two perspectives conflict with each other. The monochromat might naively think that the trichromat's judgment that 'this is red and that is green' contradicts his own judgments, but recognition of the different perceptual mechanisms involved makes it clear that the disagreement isn't genuine.

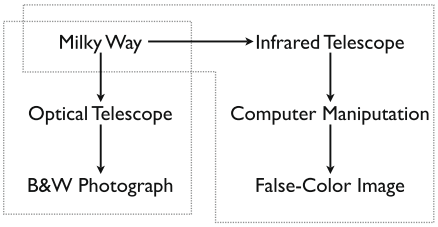

Fig. 1. Observational perspectives on the Milky Way.

These give us the bones of Giere's perspectivism, in the case where he thinks that it is the best explanation of the science (and the explanation that most scientists would themselves use if they had sufficient conceptual clarity).[10] Though I've left out some of the interesting features of Giere's argument along the way (for example his argument for naturalism, and his defense of the causal-structural unity of the world, both on methodological grounds), this example captures the crucial features of the doctrine.

Next, Giere extends the account to scientific observation (Ch. 3). This is fairly straightforward, and can be illustrated with another quick example of Giere's: say we want an image of the Milky Way. We have a couple of options. We can use an optical telescope to produce a standard, black and white photograph, registering the light that reaches us and is within visible wavelengths. Or we can use an infrared telescope, such as the one on the Infrared Space Observatory. The data from this telescope is processed by various computer manipulations, which result in a false-color image, in which visible colors are assigned to elements of the infrared spectrum. These two images, while of the same object, offer very different perspectives on that object, the optical and the infrared (see Fig. 1). Each provides us with different information, may be used for different purposes, and may vary along certain axes of richness of information.

Finally, and most radically, Giere also argues that theories are perspectival, in the following ways: (i) they are partial in that they

[6] I will try to accomplish this by sticking primarily to Giere's terms, and only introducing new terms for concepts that Giere lacks.

[7] Giere has laid out pieces of this view in a variety of works in recent years, to which I have sometimes turned in difficult spots, for further clarification. Principle among these are several discussions in Giere (1999, 2004, 2006b).

[8] The asymmetry is that humans have perspectives on the world, but the world has no perspective on us.

[9] Giere's book contains a number of color plates that illustrate these features quite nicely, as well as the different perspectives in scientific instruments discussed below. The discussion and color illustrations in Churchland (2005) provide even more resources for illustrating the neural workings and phenomenological structure of color vision (Giere, 2006a, p. 123 n. 19, cites Churchland, 2005).

[10] I should point out that it seems to me that Giere's position in this area is not uncontroversial, since there seem to be pretty significant disagreements amongst philosophers of color in how to interpret the findings of the science of color vision.

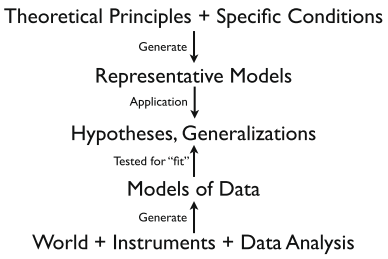

Fig. 2. Giere's models-based account of theories (adapted from Giere, 2006a).

only describe some aspects of nature. So Newton's laws provide a mechanical perspective, while Maxwell's equations provide an electromagnetic perspective. These only represent parts of any actual situation. (ii) Their accuracy or fit with the world is limited. No theoretical perspective is ever perfect, even when we narrow our focus to the aspects of the world it is meant to deal with. (iii) Scientific representations are four-place relations of the form: '*S* uses *X* to represent *W* for purposes *P*' (Giere, 2006a, p. 60). (iv) Scientific representation is to be understood in terms of models rather than systems of statements.

Giere's preferred way to understand theoretical perspectives and how they represent the world is models-based (see Fig. 2). If we hope to avoid the extremes of objectivism and constructivism, we want an alternative explanation of how theoretical principles are related to the world. Giere first notes that, by themselves, theoretical principles are never directly related to the world; they are definitional. If you add to them specific conditions, you can generate (constructively, not deductively) representative models that *do* aim to represent some aspect of the world. On the other hand, the World itself doesn't figure in to the comparison, either. The World, as approached by instruments and basic data analysis taken together generate what Giere (following Suppes) calls 'models of data', which are processed, cleaned up, often idealized versions of the raw data produced by our instruments. Then, via application of the representative models, that are tested for their fit with models of data, hypotheses and generalizations are generated.

Note that all of these arrows represent constructive processes, not logical deductions or mere inductive generalizations. While the processes may become quite entrenched and second-nature, they are not 'automatic' in a deeper sense. We might call these processes 'projections'. When they become second-nature, they often become transparent, unwarrantedly lending credence to more objectivist accounts.

One of the reasons that Giere prefers the models-based account of theories is that it is supposed to avoid certain confusions in the linguistic account:

> The assumption that scientific representation is to be understood as a two-place relationship between statements and the world goes along with the view that scientific theories are sets of statements. A focus on the activity of representing fits more comfortably within a model-based understanding of scientific theories. (Ibid.)

It is hard to see the force of this argument. First, there seems little reason to believe, given what Giere has said, that there are two fundamentally different types of representation, models and statements. Whatever type of relationship representing is, four-place or two-place, it should be so for language as for models. Second, it is not universally agreed that linguistic representation is a two-place relation. C. S. Pierce's semiotics,[11] for one, treats representation as a three-place relation (and his 'interpretant' does the work of Giere's agents and purposes, and more besides). The preference for models over statements must not hang on general features of representation, which they should share, but on more specific claims about the role of models and statements in scientific practice, on which Giere may be on better ground. It would be interesting to know whether linguistic representation plays a role that is not subservient to the construction of models in the way Giere says it is, though. I suspect so, since Giere's story here seems a little *too* neat.

Unlike different observational perspectives, different theories should be, but are not automatically compatible. Just as maps derived from two different systems of projecting the globe can be incompatible when they give different areas for the same continent (Giere, 2006a, pp. 78–80), scientific theories that describe different geometries of space-time are incompatible. There is clearly some breakdown of the analogy to human perspectives, here, but it isn't entirely clear why Giere goes this way. Consider two maps of the world, X_1 and X_2. If one holds the purposes P fixed,[12] then it is clear that there would be some incompatibility between, for example, a Mercator map and a Robinson map, if one's purpose is to understand the relative sizes of Greenland and Africa. But if X_1 and X_2 have their own purposes associated with them, P_1 and P_2 – which they presumably do to some degree, since Mercator's map was created to make navigation easier, while Robinson's was created to give a better overall picture of the sizes and shapes of continents – then their incompatibility might be tied to their inherent purposes, and they only seem incompatible when the context is ignored, like the judgments of trichromats and monochromats, or the optical and infrared pictures of the Milky Way. Likewise, two scientific theories could be compatible if we considered them to be associated with different purposes, and thus different measures of fit or similarity.[13]

Giere promises a quadratic picture of representation, including purposes and agents. Mostly, however, his comments on these features are schematic. The partiality and limited accuracy of perspectives does much of the specific work in Giere's account, rather than agents or purposes *per se*. Giere doesn't say much about how the features of the scientist play a role. He does say that since the perspectival data produced by scientific instruments must be *public*, the subjectivity of the scientist shouldn't play much of a role, and also that we might productively analyze scientific practice using a framework of 'distributed cognition' that would bring in ethnography and cognitive science into science studies (Ch. 5). But none of these things plays a significant role in the detailed discussion of theories and models.

The role of intentions and purposes is not explored systematically or in depth.[14] Here are the different ways in which purposes may play a role, according to Giere: picking out the features of the model which will be compared to the system modeled (ibid., pp. 63–64), determining the measure and strictness of similarity to determine whether the model fits (ibid., pp. 64, 69), choosing which features to attempt to represent (ibid., p. 73), choosing conventions of interpretation of the models (ibid., p. 74), and so on. The only role for purposes that receives much specific discussion, however, is

[11] See Peirce (1998 [1894]) for one of many discussions.

[12] The incompatibility also depends on holding the subjects *S* and the world *W* fixed. Though a radical Kuhnian might insist that scientists working in different worlds could use different models without generating an incompatibility, this possibility is controversial an in any case argued against by Giere. It also seems like one makes a going assumption that subjects of representation are interchangeable. In any case, the point remains that once we regard representation as a four-place relation, it is difficult to regard any two representations as incompatible unless the other three elements remain fixed.

[13] Though it seems to me an open question at this point whether scientific theories might be sufficiently multipurpose or serve similar purposes as to allow incompatibility to remain.

[14] Interestingly, though he makes them seem crucial to account of representing, 'purpose' doesn't even appear in the index of the book.

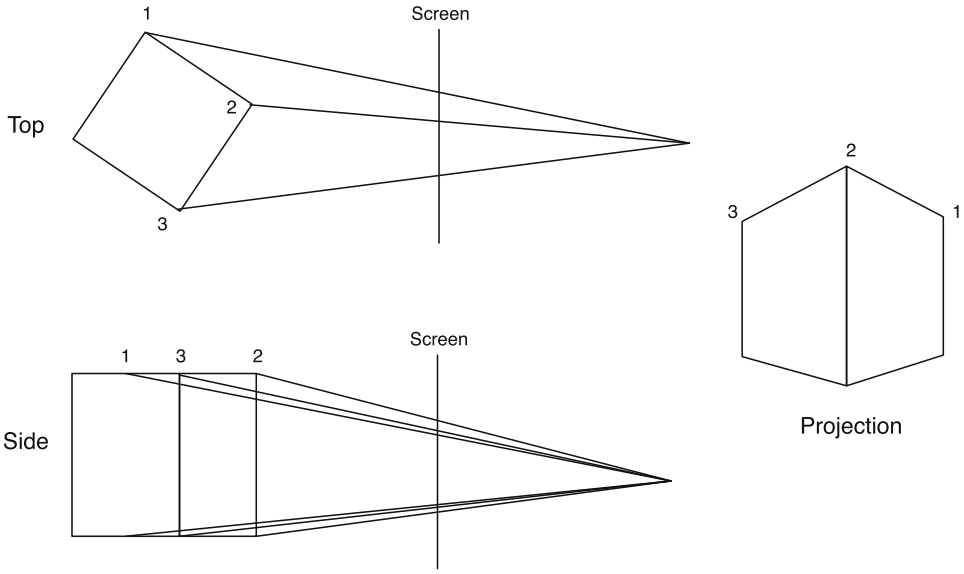

Fig. 3. Rules of projection for single-point perspective (based on Feyerabend, 1999, p. 96, Fig. 6).

'whether the model fits the world as well as desired' (ibid., p. 89). Nothing about the scientists' specific purposes plays a role. For example, if I want this model because I hope to make predictions about the weather or the movement of planets, or because I want to intervene to treat disease or to fix an injured ecosystem, I will have to supplement Giere's account. Of course, Giere's account makes room for such an extension, which is much to his credit.

With these concerns in mind, I want to move now to a discussion of Feyerabend's work on the invention of perspective in Renaissance art, and its relation to scientific representation.[15] Feyerabend takes the place of the agent seriously in a way that Giere doesn't deliver on, but on many points, they are in substantial agreement.

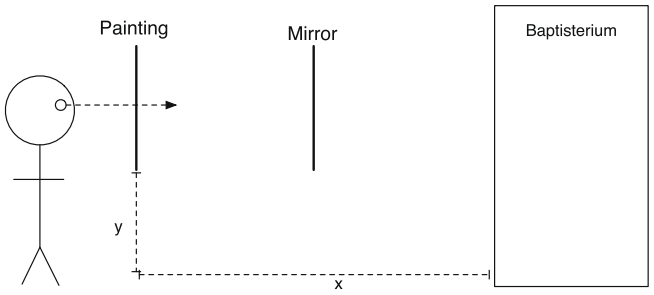

Fig. 4. Brunelleschi's perspective experiment (based on Feyerabend, 1999, p. 95, Fig. 5).

3. Feyerabend on representation and perspective in art and science

Looking at two pictures of the Madonna with child, one from the thirteenth century and another by Raphael in the sixteenth,[16] and without much knowledge of recent art history and criticism, we may be inclined to think of the earlier one as clumsy, unrefined, unrealistic, and a poor representation of its subjects, while the second might strike us as deft, sophisticated, and highly realistic. In Chapter 4 of Feyerabend (1999), he attempts to show us that we ought to regard this reaction as naive, that we can understand both of these paintings as equally realistic, or, alternatively, as equally artificial and conventionalized. In doing so, he points to a sophisticated, perspectivist theory of representation.

Feyerabend takes us to the Renaissance, and the invention (or rediscovery) of perspective in modern painting. The innovators in the use of perspective like Brunelleschi brought techniques from architecture, geometry, and optics to create definite rules for the construction of a painting. Seen in Figure 3 is one representation of such a construction principle. In Figure 4 we have in schematic form an 'experiment' by Brunelleschi discussed at length by Feyerabend. Brunelleschi created a picture of a church in Florence, 'the Baptisterium', as seen from a spot a certain distance away from it. To view the painting one must come up to this spot, hold the painting a certain distance from the ground, and peer through a small, conically shaped hole in the center of it. A mirror, held across from the paining, reflects the image back to you, though the hole, ensuring that you are at exactly the right place for viewing the picture. Remove the mirror and something remarkable happens; there is very little change in what one is seeing! If the positioning is absolutely right, one should be able to move the mirror in and out and see just how well the two match. Feyerabend describes the situation thus:

> Brunelleschi examined his painting by checking it against something else. This 'something else' was not a building . . . it was an aspect of a building . . . the effect (of an object) on an individual, or a group, or a device . . . that approaches, uses, views, analyzes, or 'projects' it according to more or less clearly describable, though not always clearly recognized, procedures . . . His experiment involved two artifacts, not an artifact (the painting) and an art-independent 'reality'. (Ibid., p. 100)

So, we don't have direct comparison of the painting and the building. What we have is a projection of the painting and an aspect of

[15] Giere himself suggests such a comparison (Giere, 2006a, p. 14), though he doesn't follow up on it, and Feyerabend is not among the authors he cites as having made connections between perspective in Renaissance art and scientific representation.

[16] Feyerabend (1999) includes two such examples on pp. 90–91. You can find them at http://www.artandarchitecture.org.uk/fourpaintings/daddi/inner_centre/humanity.html (Figure 1) and http://www.wga.hu/frames-e.html?/html/r/raphael/2firenze/1/22grandu.html (both accessed 6 February 2008).

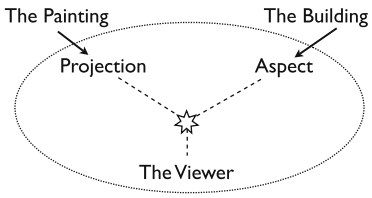

Fig. 5. Brunelleschi's 'Stage'.

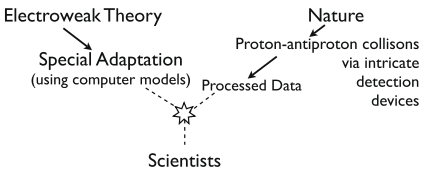

Fig. 6. The CERN stage for the UA1 experiment for the discovery of W and Z particles.

the building, both arrived at thanks to rigorously specified viewing conditions. We might call the projection of the painting a 'representational model', because, without the system of projection, it would not be seen as similar to the building,[17] though, significantly, the painting is not an abstract object, and the methods of projection are physical rather than abstract. Likewise, Brunelleschi produces an *aspect* of the building just as scientific instruments produce one or another aspect of the Milky Way, and these, not the objects themselves, are compared to the model.

Only when things are arranged just so between the painting, building, and viewer, can we make the comparison:

> The best way to describe the situation is by saying that Brunelleschi built an enormous stage,[18] containing a preexisting structure (the Baptisterium), a man-made object (the painting), and special arrangements for viewing or projecting both. The reality he tried to represent was produced by the stage set, the procedure of representation itself was part of the stage action, it did not reach beyond it. (Ibid., pp. 100–101)

So, in Figure 5 we have Brunelleschi's stage, with the stage action called 'representation' happening only within this circle.

Feyerabend applies the same schema to scientific experiments as well (thus implicitly accepting the idea that the problems of scientific representation are just a specific case of representation generally, not an entirely other beast). In the case of the CERN experiments that led to the discovery of the W and Z particles, we have Nature being projected via a large, complicated, and delicate set of instruments to produce proton–antiproton collisions (an artifact), and we have the electroweak theory being adapted by clever mathematical tricks and computer models. The data arrived at is then further processed and idealized, and only then does comparison take place (see Fig. 6).

Figure 7 shows a generalization of Feyerabend's model to scientific representation, given in Giere's own terms. Man-made objects (paintings, theories) are compared with the World only through projections, just as in Giere's own view. Theoretical principles must be transformed into representational models, and the scientist must generate models of data in order to make a comparison. That comparison must also equally account for and *create* an audience, that is, the mostly unspecified agent of Giere's account. In addition to the background features of the agent, their beliefs, habits, practices, biological and cognitive capacities, they take on a role as the audience of the representation. Just as with the generation of representational models and models of data, the adoption of this role is projective and additive.

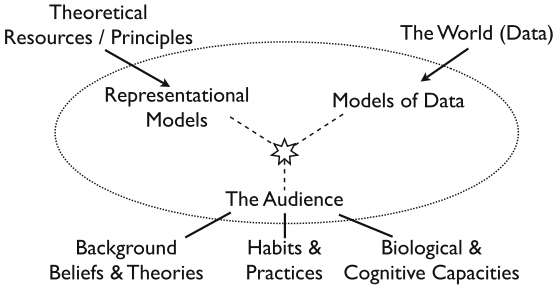

Fig. 7. Feyerabend's dramatic model of scientific representation.

What get compared, what really are part of the act of representation, are two functional artifacts, two things created by their role on the stage: representational models and models of data. Theories are not compared with the world. Additionally, the comparison, the similarity or fit between these two objects, is not an abstract relation, but it is an *act* carried out by agents fulfilling another functional role in the process of representation, the audience. The 'stage' highly constrains theory, facts, and audience; its construction makes comparison possible, and this construction is a projective process. As we've seen, the process of projection can take many forms; sometimes causal–physical action or constraint, sometimes highly abstract processes.

By looking at things in this way, in addition to the further specification of the role of agents in the act of representation, we might make a further distinction between types of purposes that play a role in representation. On the one hand, there are purposes that form part of the background of the audience; call these 'interests'. Much of Giere's own discussion of purpose seems to fall in this category. On the other hand, there is the purpose that guides the comparison in the first place, that prompts the construction of the stage; call this the 'guiding purpose'. It is this purpose that will provide the most fundamental reference to use, insofar as a representational activity has connection to human practices, and it is this sense of purpose that seems highlighted by the scheme '*S* uses *X* to represent *W* for purposes *P*', but which is largely neglected by Giere's own discussion.

For help with these problems, we will now turn to a discussion of the pragmatists, philosophers of practice and purpose *par excellence*.

[17] Indeed, this was a problem for later Renaissance painters, who wanted to produce paintings that could be viewed in a normal way. For example, it was known by Leonardo, Raphael, and others that the 'correct' projection, according to the geometric rules, of a sphere is usually an ellipse. Nevertheless, they are always represented by circles (though Raphael did experiment with ellipses in engraved reproductions, finding them to be unacceptable). See Feyerabend (1999), p. 98 n. 8.

[18] I think 'stage' here is an unfortunate mixing of metaphors, since Feyerabend has so far been working with perspective and painting rather than a dramatic example, and that this has contributed to the difficulty of understanding this chapter. Perhaps the dramatic metaphor came readily to his mind because of his experience as an actor earlier in his life. Perhaps, however, the metaphor of the stage does work that sticking to the perspective and painting metaphors would not do so easily. And a play no less than an artwork provides the audience with a certain perspective.

Fig. 8. Dewey on the temporal development of inquiry.

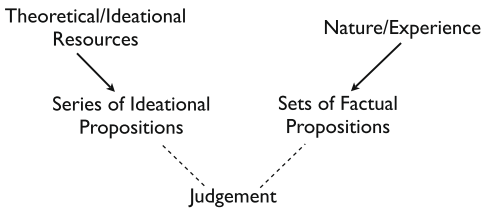

Fig. 9. Dewey on the production of judgment.

4. Peirce and Dewey on purpose and inquiry

The main reason to turn to a discussion of Peirce and Dewey[19] is that, both for Giere and Feyerabend, the question of 'purpose' or 'interest' has arisen, but the role that purposes play in the processes of representation that have been discussed has been fairly under-specified. Clearly, it has to be part of the human contribution in both cases, what I have called 'interest'. But this seems to be insufficient, and I also want to understand the role of purpose in guiding the overall activity, in bringing the 'stage' together in the first place.

Giere says that fit is interest-relative, but the overall purpose is just to represent a certain aspect of the world to a desired degree. So, we may look at how a subway map represents the subway. Our interest in using the map to navigate the city will inform how accurately the otherwise highly idealized map fits the landscape; if all we care about are the relative positions of stations and lines, it may fit with complete accuracy. But here, purpose is only being discussed at a late stage in the game, at the level of hypotheses and generalizations. Yet, obviously, the map was created for a reason, and while Giere clearly acknowledges that there is an overall purpose guiding the activity, he says little about it.

Feyerabend is clear that there are many other purposes besides imitation for works of science or art, though he also focuses on imitation. But imitation or representation by itself doesn't suffice for a purpose. Without an idea of the purpose or interest one has in constructing a representation, it is a vain or silly enterprise, a kind of game. Children may engage in games of imitation, following around a sibling and repeating their every action, mimicking everything they say; scientific representation is more than this. We need to know what distinguishes pointless from significant representations, arbitrary from useful similarities. One could create a model that quite accurately fits a large or perhaps infinite number of facts about the contents of my desk or this table, but this representation has very little significance to anyone, and really no significance to science. As Giere says, any object is similar to any other in countless respects (Giere, 2006a, p. 63). Giere and Feyerabend haven't given us the resources to distinguish significant from insignificant representations, and this is because a relative neglect of the guiding role of purpose.

Let's restrict our discussion from here on out to cases where the activity that representation figures in is inquiry, and ignore other activities, such as immediate use and application, or art, or storytelling, or education, though a more complete account would include them.

According to John Dewey, the purpose of inquiry is to resolve a problematic situation by constructing a judgment that resolves the problem.[20] That is to say, we begin in a certain situation that involves us, our environment, and the projects and practices we are engaged in. Something in that situation becomes disturbed or problematic, and inquiry is the process of trying to return that situation to a settled state. The projects and practices in the situation can vary from the mundane and practical to the recherche and academic, and so inquiry is not restricted to narrowly practical problems.

It will be helpful to mention Peirce, because he first developed the pragmatist theory of inquiry that was brought to higher articulation by Dewey, and he described it in somewhat less technical terminology.

C. S. Peirce's theory of inquiry argues that inquiry begins with genuine doubt, which arises from disruptions of concrete practice, not idle speculation. Peirce's favorite foil for his scientific epistemology is Descartes, who wants to begin all inquiry by doubting everything that can be doubted, and building up only from what is absolutely certain. Peirce thinks this method is fruitless and impossible, as such 'paper doubt' cannot actually get us to challenge our beliefs. Of course, everyone nowadays thinks that Descartes method is fruitless and impossible, but what's important is that Peirce's *explanation* of this failure is that it fails to create the irritation of doubt that can lead to real inquiry and the creation of new beliefs.[21] Competent inquiry proceeds until belief is so settled as to allow practice to continue without further disruption.[22]

As Peirce says:

> The irritation of doubt is the only immediate motive for the struggle to attain belief . . . Some philosophers have imagined that to start an inquiry it was only necessary to utter a question whether orally or by setting it down upon paper . . . But the mere putting of a proposition into the interrogative form does not stimulate the mind to any struggle after belief. There must be a real and living doubt, and without this all discussion is idle. (Peirce, 1992 [1877], pp. 114–115)

Dewey takes up this line of thought in his own writings on Logic and Inquiry:[23]

> The function of reflective thought [that is, inquiry] is . . . to transform a situation in which there is experienced obscurity, doubt, conflict, disturbance of some sort, into a situation that is clear, coherent, settled, harmonious. (*How we think*, LW 8:195)

So, for Dewey, inquiry begins in a problematic, doubtful, conflicted situation, it proceeds to identify and attempt solve the problem at hand, until a judgment is issued that resolves the difficulty and is thus called a 'warranted assertion'. If this progression (see Fig. 8) is successful, and the result is stable, we would say that inquiry has succeeded in its purpose.

Dewey also has a picture of inquiry that bears similarities to the perspectivist accounts given by Giere and Feyerabend. Though Figure 9 leaves out many features of Dewey's theory of inquiry, it highlights those features that are most directly relevant to the present discussion. We begin, on the one hand, with general

[19] Giere (1999) briefly discusses his own relation to pragmatism.

[20] Perhaps it is not entirely right to think of this as a general purpose of inquiry. The purpose of inquiry is going to be set by the particular problems in the situation at hand, and it might be infelicitous to refer to the guiding purpose of all inquiry as problem-solving. If this is right, then it is better to think of problem-solving as a purpose-schema.

[21] Compare Kierkegaard: 'The method which begins by doubting in order to philosophize is just as suited to its purpose as making a soldier lie down in a heap in order to teach him to stand up straight' (Kierkegaard, 1999 [1952], p. 5).

[22] This last glosses over some technical points in Peirce, but at no significant cost to us, here, as we will quickly turn to Dewey's appropriation of Peirce's insight.

[23] The most important sources for this are *Essays in experimental logic*, *How we think* (rev. ed.) (LW 8), and *Logic: The theory of inquiry* (LW 12).

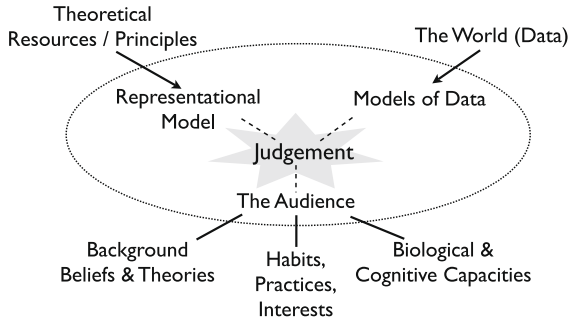

Fig. 10. Complete dramatic-perspectivist model of scientific inquiry.

theoretical, or to use Dewey's favored term, ideational resources, and on the other, with nature or experience. From the ideational resources, we construct or project a series of ideational propositions that lead us from general theoretical principles to applicable claims. Through interacting observationally and experimentally with the world, we construct a set of factual claims meant to help identify the problem and test solutions. The whole process concludes when the ideational and factual resources can be combined or coordinated to issue a judgment.[24]

Like Giere, Dewey believes that theoretical principles or ideational propositions, at the most general level, are definitional, not directly referring or describing any concrete features of the world. Their content, for Dewey, comes from both the interrelationships between theoretical concepts, and their eventual operational power of applicability. From our theoretical resources, we arrange a series of propositions that leads closer to applicability, and thus can be put into operation.[25] Dewey says of facts that they are not given by, but taken from experience, emphasizing the constructive element in this process. So, not the world in itself, but its projection via experimentation and fact-determination plays a role in inquiry. While Dewey did not benefit from the later development of a 'models-based' understanding of theories, his views clearly resonate with it and with perspectivism in many ways.

The goal of inquiry is called 'judgment', and it is understanding this goal that can help us understand the role of purpose in guiding inquiry (see Fig. 10). For Dewey, what guides the selection of facts and the inferences from theoretical resources to the ones that are directly applied is their ability to lead to a judgment that can effectively solve the basic problem; to oversimplify: it answers whatever question needs to be answered for practice to resume. All features of inquiry—problem-statements, hypotheses, theories, facts, methods, and ultimately forms of warranting—are revisable in service of this basic goal. Also, Dewey makes clear that, in inquiry, this process (which Feyerabend would call 'stage-construction') is a highly experimental enterprise (which should be no surprise to anyone familiar with the production of plays). It is understanding the various requirements on judgment that a problem-situation can create that will provide specific lessons about the role of guiding purpose in different contexts.

5. Conclusion

First, I want to emphasize the ways in which these three philosophers converge: All of them provide a picture in which inquiry and representation inherently requires projection, both of facts and theory, and they make clear that the process of projection is a highly constructive, not deductive, process. Some projection is physical rather than abstract as with Brunelleschi's viewing set-up and scientific experiments. The process of projection may become transparent as it becomes routine, thus (falsely) encouraging naive, objectivist realism.

The final picture of perspectivism, as shared among these authors, is the following:

1. That observation and theory are both limited and partial perspectives on the world.
2. That inquiry doesn't disclose a single, coherent description of the world, but a plurality of overlapping perspectives, which are compatible in one sense, which are all perspectives on the same world, but don't add up to an *absolute view* of the world.
3. These perspectives are inherently bound to our purposes, interests, practices, and abilities.
4. Representation is a four-way affair between theory, world, audience, and guiding purposes.

To return to Giere's recent work, I think we have learned that the human contribution cannot be downplayed, but must be understood as making as much of a contribution to the activity of comparison as the things being compared. We need a thorough account of purpose as guiding not just fit, but the selection of theory, fact, and methods of projection. The whole activity of representation is guided by a purpose. And we must understand how different purposes can allow for guiding scientific activities in different ways. One promising direction is to treat the purpose of scientific inquiry, in the most general terms, as problem-solving.

There are many difficulties in understanding perspectivism, some of which I've tried to mitigate here. Perhaps one source of the difficulty is that 'perspective' is a visual metaphor that suggests knowing is ultimately a passive activity, that is, the 'spectator theory of knowledge' that Dewey warned us about again and again.[26] While the perspectivist would be quite right to respond that visual perception is not at all a passive process, the naive association remains there to cause trouble. Perhaps, since Giere speaks of perspectives as a particular type of *interaction* with the world, and since we've seen that his account could benefit from bringing the discussion to the forefront, it would be best to change metaphors. One option is to more fully adopt Feyerabend's artistic–dramatic metaphor, which highlights the active elements, and end up with *scientific dramatism*. Or perhaps it would be better to follow Dewey, and replace the model of visual perception with a model of practical coping in the world, thus giving us *scientific pragmatism*. Whatever one wished to call the view, however, and whatever way one prefers to talk about it, Giere has clearly made a significant contribution to making the view clear and compelling.

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[24] One of the most important differences with Giere that the reader will notice is role of linguistic terms: ideas, facts, propositions, judgments, claims. Actually, though he uses these terms, his views about them differ radically from the tradition, in that all of these stand both for meaningful symbols (not necessarily linguistic) and for *operations* (they have operational meanings).

[25] Dewey has interesting things to say here about logical forms that guide this development, which I don't have space to discuss.

[26] Especially in *The quest for certainty* (LW 4).

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