

Skepticism and Spatial Objects

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Abstract: I defend external world realism. I assume that the principle of inference to the best explanation is justified: roughly, a hypothesis that provides a better explanation of the total evidence is more probable than one that does not. I argue that the existence of a world of spatial objects provides a systematic explanation of the spatial contents of visual experience, and that it provides a better explanation than traditional skeptical hypotheses. This paper thus pursues the explanationist strategy of BonJour (2003) and Vogel (1990, 2005, and 2008). It is an improved, more compelling defense, for at least two reasons. First, the attention to spatial properties, and in particular to what I call perspectival projections, makes the explanatory power of the realist hypothesis much more vivid and concrete. Second, the argument preserves and elucidates much that seems correct in the explanationist arguments others have offered while avoiding significant problems and shortcomings.

Key words: External world skepticism, realism, inference to the best explanation, abduction, Jonathan Vogel, Laurence BonJour.

I defend external world realism. I assume that our experiences have accessible spatial content but leave more or less open the metaphysical nature of these experiences and contents.¹ I also assume that the principle of inference to the best explanation is justified: roughly, a hypothesis that provides a better explanation of the total evidence is more probable than one that does not.² I am interested in arguing against what Vogel (2005) calls a “domestic” or “non-exotic” skeptic, someone who grants such sources of justification but denies that we have

¹ For simplicity, I sometimes characterize these in terms of sense data, though nothing I say here depends essentially on this.

² As many have argued, in order for belief in a hypothesis to be justified, it is not enough that it be more probable than each competing hypothesis. It must, minimally, be more probable than its negation, and so more probable than the disjunction of all competing hypotheses. I agree. However, in this paper I have the more modest goal of showing that the non-skeptical hypothesis is significantly better than the traditional skeptical hypotheses, and improving on the attempts of others to do the same. For the record, I’m inclined to believe that the non-skeptical hypothesis is more probable than its negation, and that this has something to do with the fact that a simpler hypothesis’ probability rises *dramatically* relative to other hypotheses the greater the set of data they explain. But again, I cannot tackle this issue here, and will aim for the more modest goal of showing that the non-skeptical hypothesis is far better than the traditional skeptical hypotheses. Thanks to an anonymous referee for pointing out the need for clarification on this issue.

justification for belief in the external world. I argue that the existence of a world of spatial objects provides a systematic explanation of the spatial features or spatial contents of visual experience, and that it provides a better explanation than traditional skeptical hypotheses.

This paper is thus an attempt to provide a version of the explanationist or abductive argument suggested by Russell (1912), and defended more recently by Bonjour (2003), and Vogel (1990, 2005, and 2008). As I hope to show, it is an improved, more compelling argument, for at least two reasons. First, the attention to spatial properties, and in particular to what I call perspectival projections, makes the explanatory power of the realist hypothesis much more vivid and concrete.³ Second, the argument preserves and elucidates much that seems correct in the explanationist arguments others have offered while avoiding significant problems and shortcomings.

The structure of the paper is as follows. First, I introduce the idea of a perspectival projection and illustrate, in a rough but intuitively compelling way, the explanatory power of the realist hypothesis (sec. 1). I then characterize perspectival projections more carefully, and give further examples of shapes and the kinds of projections they tend to have (sec. 2). I then argue that the realist hypothesis provides a powerful, systematic explanation of the spatial structure of experience (sec. 3), and that it provides a better explanation than traditional skeptical scenarios (sec. 4).

1. An artist's window to the world

For many of us, the mention of perspectival projections brings to mind a technique for drawing an object or scene that involves recreating the two-dimensional image it projects. The technique in question is sometimes referred to as "Alberti's window," described by the artist Leon Battista Alberti in 1436: if you want to capture an observed scene on your canvas, recreate the image that would pass through a window replacing your canvas (see Palmer 1999, 230-1). A physical application of this technique might involve placing a glass plane or window between you and some object, and tracing, directly onto the glass, the lines and marks projected by the object visible to one fixed eye. What results is one of many possible projected images of the object. An artist working from objects as she sees them in her mind can use the technique to determine the projected images of the imagined objects and copy these images on canvas in order to represent a three-dimensional world.

³ I am not claiming that every attempt to provide an explanatory argument against skepticism must appeal to perspectival projections. The appeal to projections provides relatively concrete and compelling illustrations of the explanatory virtues of the realist hypothesis, but perhaps a defense that focuses on different spatial properties or different characterizations of experience can do the same, or strengthen the realist's case.

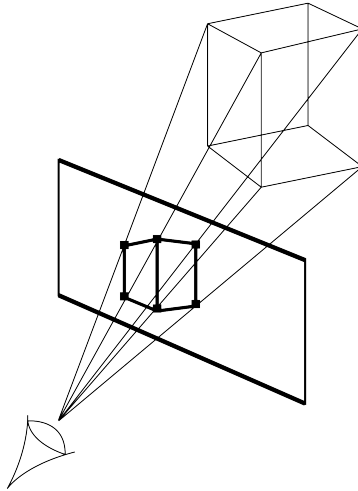


Figure 1. Alberti's window

Of course, our artist normally takes for granted that the world consists, among other things, of medium-sized physical objects that produce projections in an approximately Euclidean space.⁴ But she might, in a philosophical moment (she has just read Descartes's *Meditations*), wonder whether she can justify such an assumption. She wonders whether the spatial content of experience can be explained by the existence of three-dimensional objects with the sorts of spatial properties we ordinarily attribute to them. She realizes that she has no difficulty determining the structure of projections of objects; *given* that objects with such-and-such spatial properties exist and produce projections, the projections have such-and-such features. But how, she asks, could she move in the opposite direction, from the images themselves to the objects that allegedly produce them? The problem is that any single two-dimensional image has many three-dimensional interpretations, that is, three-dimensional objects or scenes that could have projected it. For example, consider (a) and (b) in fig. 2 below. The Y-shaped projections—"Y-vertices"—can be produced (a) by lines that meet at a

⁴ An artist normally relies on other assumptions that go beyond perspectival projective geometry. To give one simple example, she might assume that people tend to be smaller than trees and draw a tree and a man to be the same height because she wants the viewer to perceive the tree to be farther than the man.

point (e.g., forming the corner of a cube as in the figure, or a node of a tree or plant) or (b) by disconnected lines. Similarly, a coin or circular disc, an elliptical disc, and an egg-shaped object could each project an ellipse if viewed from a certain angle. These different objects or scenes can account for the same projection. So, given a single two-dimensional image, the hypothesis that it is the projection of this or that specific kind of three-dimensional object will not be very likely.

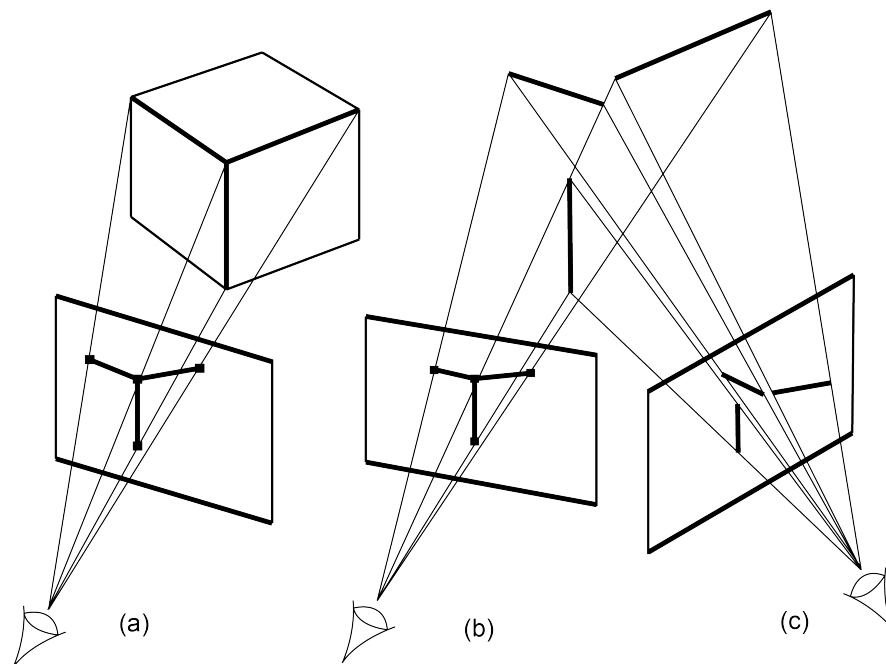


Figure 2. (a) and (b) illustrate the problem of determining the structure of the projecting stimulus from a single image. (c) disconfirms the hypothesis suggested by (b) that the stimulus consists of lines meeting at a point in 3D space.

Our philosophical artist might wonder, however, whether the fact that she has many more images at her disposal improves her epistemic position. While each of the images has many plausible three-dimensional interpretations, as a collection they can be systematically explained by the fact that they are projections of an object with such-and-such a shape, and alternative shapes ruled

out by the fact that projections of these are not produced.⁵ For example, confronted with an image of three lines meeting at a point, she might hypothesize that these lines represent three straight lines in three-dimensional space that are connected or touching at one end (fig. 2 (a)). If that's right, she should expect to still have a visual experience of three lines whose ends meet at a point when she moves slightly to the right or to the left, though the lines' sizes and the angles between them would change slightly. If her expectations are confirmed, this provides further support for the hypothesis. If, however, the lines' ends break away from each other (as in fig. 2 (c)), then the hypothesis is disconfirmed, and the hypothesis that there are disconnected lines before her suggests itself.

This illustrates, in a rough but intuitive way, the power of the realist hypothesis: the spatial properties experienced over time have the structure of projections of objects with such-and-such three-dimensional features in (at least approximately) Euclidean space. But we should proceed more carefully, clarifying the idea of a perspectival projection (sec. 2) and providing further illustrations of its explanatory power (sec. 3). And, of course, we need to defend the claim that the realist hypothesis is a better explanation of our experiences than the skeptical alternatives (sec. 4).

2. Perspectival projections

Imagine a three-dimensional Euclidean space and a simple object in that space. Imagine straight lines that extend from the object's edges, contours, and perhaps other marks on its surface, and converge onto a point some distance away from the object—call it the projection point or observation point. Finally, imagine slicing these lines with a plane (the “image plane” or “Alberti's window”) perpendicular to the line of sight, somewhere in between the point and the object. It won't matter much where we make the slice, so long as we do so more or less consistently; we could just stipulate that all slices are made some constant, short distance from the observation point. Though I will focus on the upright projection of Alberti's window, we could also make the slice on the other side of the observation point, across the projection lines after they have gone through the observation point; the projection would be inverted, as it is in the eye or in a pinhole camera. A perspectival projection is the two-dimensional intersection of the image plane with the straight lines extending from the edges, contours, and other marks of the object to the observation point. A projection function takes as input a set of points in a three-dimensional space corresponding to the projecting object(s) or scene, and a single point corresponding to the point of observation, and yields as output points on the image plane corresponding to the projections.

⁵ More plausibly, some misleading projections are produced but are rare or not terribly misleading; they can be explained away as the distorting effects of the media through which the images are projected, or distorting effects of processes or mechanisms involved in producing the projection.

We can tell a priori what projection is generated by a given spatial structure and observation point in Euclidean space.⁶ Given a three-dimensional, Euclidean space, a specific shape or surface within that space, and a particular point relative to it (the inputs of the projection function), and given that the shape or surface is projected toward this point, it follows, a priori, that such-and-such a projection is generated (the output of the projection function).⁷ A point will always project a point. A straight line will very rarely project a point, but will otherwise project a line (of varying lengths). Two straight lines whose ends meet at an angle will in almost all cases project two lines whose ends meet at an angle, an “L-vertex” or “L-junction”, though the angle and size of the lines in the projection can change; in a small subset of cases (i.e., when both lines share a plane with the line of sight), the two connected lines will project a single line. Two straight detached lines almost always project two straight lines, often project detached lines, often project attached or crossing lines, and very rarely project lines that meet at an end to form an L-vertex. A circle or disc sometimes projects a circle, sometimes a line, but most often an ellipse. Parallel lines will in a few cases project two parallel lines, in a few cases project two points (more precisely, at most one point and a very short line), but in most cases will project lines that converge (towards the “vanishing point”), as in the following figure.

⁶ The claim is not that we know a priori that space is or must be Euclidean; rather, the claim is that *if* a space is Euclidean and thus-and-such shapes are projected toward some point, *then* the projection is thus-and-such.

⁷ Of course, there are bound to be limits to our abilities here as with any other a priori subject matter. Projections of complex shapes can be difficult to determine.

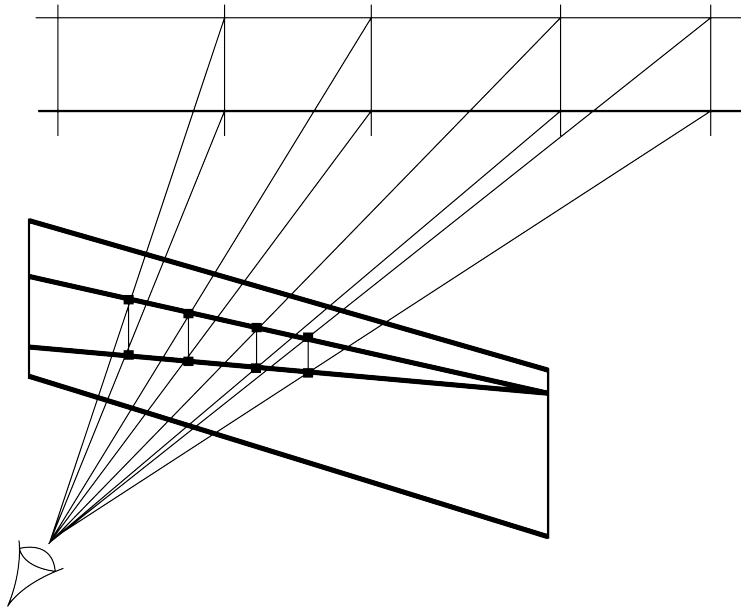


Figure 3. Parallel lines projecting converging lines

We can also compare the shapes and projections of three-dimensional volumes. We know that only certain kinds of spatial structures can have certain kinds of projections, and that some projections are much more likely to be produced by certain structures than by others. We know that corners (of a room or a cube, for example) project Y-vertices, L-vertices, or arrow-vertices depending on orientation (see fig. 4 below; see also Palmer 1999, 237ff.). We know that, by comparison, three detached lines, or lines that do not meet to form a corner, tend not to project Y-vertices, L-vertices, or arrow-vertices; they project such vertices from very few angles, if any (see fig. 2 above). We know that blocks do not project curved lines, but that discs, spheres, cones, and cylinders do, and that spheres project more circles than cylinders, discs, or cones do. I can go on in tedious detail, but you get the point and can grasp and compare complex relations of projection more easily than I can describe or illustrate them.

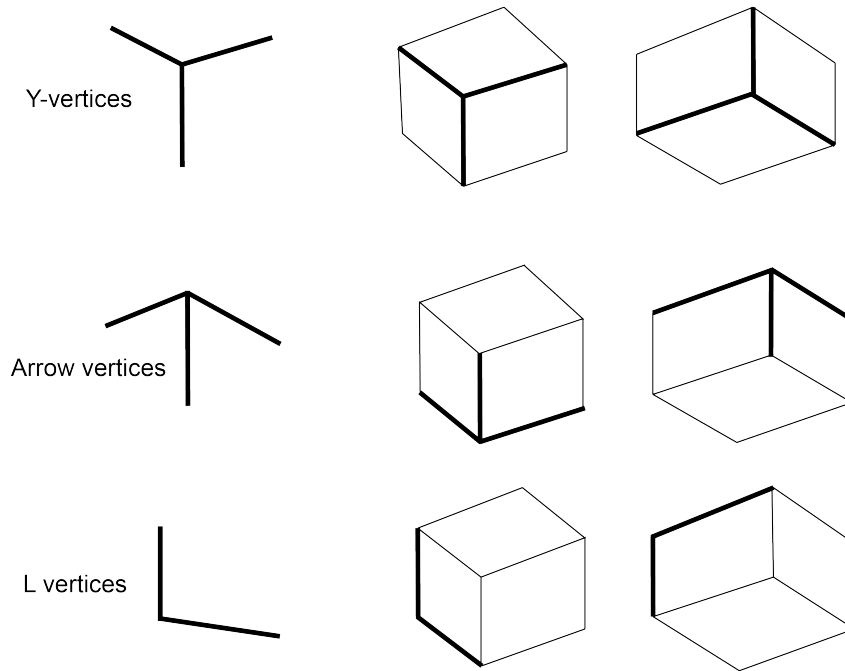


Figure 4. Vertices projected by corners and edges of cubes

We can add assumptions or hypotheses and ask what follows about the nature of the projections. We can limit our consideration to a single space with many more or less determinate structures and a single observer, and allow their positions to change over time. We can limit the size of the angle from which projections are received, allowing only a limited “cone” of projection-lines extending from the surrounding space onto the observation point. We can allow this cone to swing around so that projections can be received from different regions of space. And we can hypothesize that projection lines do not (at least usually) go *through* objects, and hence that objects occluded by other objects from the observation point do not produce projections relative to that point. Given these inputs and constraints we can determine, for any one time, a single projection as output, and over time, a series of projections.

For all but the simplest spatial layout, if the observation point moves or rotates relative to the layout in a more or less continuous fashion (successively occupying points on a straight or curved path), certain changes in projection are likely, whereas “jumping” around to different spots and orientations would yield the same series of projections only for a relatively limited set and ordering of such positions, if at all. In our idealized, geometric space, a single point projects a

point from all distances and there is no change whether the observation point takes a continuous path or jumps around chaotically. A sphere will project the same circles, of the same size, from all points of view that are the same distance away from it, but the circles projected will gradually grow or shrink as the distance between the observation point and the sphere changes (see fig. 5). Projections of cubes will vary in more or less continuous ways, with projections of the sides of cubes getting larger or smaller with change in distance, and varying in size and shape in certain continuous ways with slight changes in angle or orientation (see fig. 6).

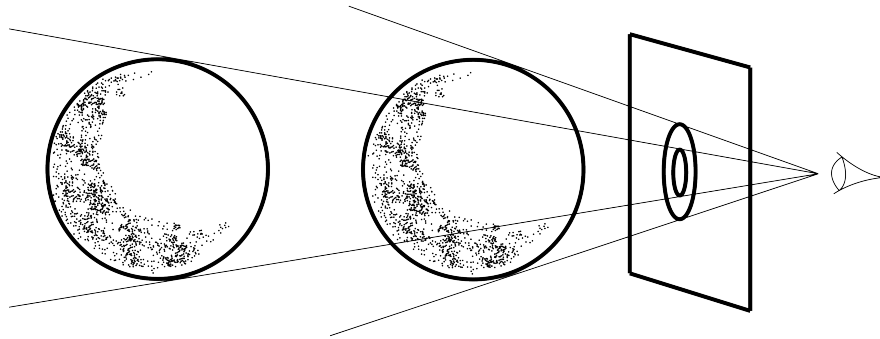


Figure 5. Change of projection size with distance from object

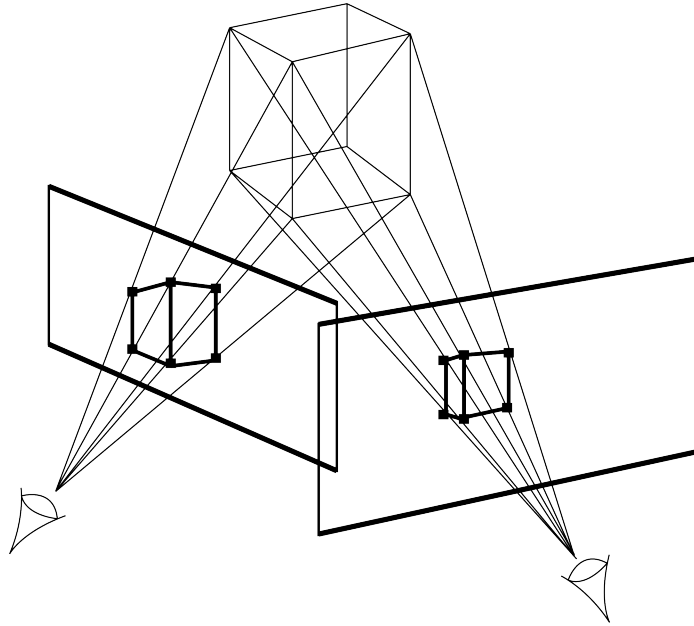


Figure 6. Two projections of a cube. Change in perspective leads to slight foreshortening of some sides, and elongation of others.

Once again, you can grasp complex changes in projection more easily than I or anyone can describe them. The general point is that certain kinds of changes in projection are “more likely” given certain kinds of spatial structures and changes in relative position and orientation. None of this is empirical or inductive; it is a matter of determining, among possible Euclidean projections of such-and-such three-dimensional spatial structures, the proportion of them that have such-and-such projections. If we fix the shape of the object projected but allow the projection point or observation point to vary, we can determine the portion of the surrounding space towards which certain kinds of projections are generated, and we can compare the portions of space towards which different sorts of projections are generated. If an object projects shape A toward observation points that occupy a larger part of the surrounding space than it does shape B, then, other things being equal, the object is more likely to project A than B; and the larger the space of observation points towards which the object projects shape A as compared to B, the more likely that the object will project A

as opposed to B. To give one simple example, the points of view from which a disc will project an ellipse, and in this sense “look elliptical,” take up a larger portion of the space surrounding the disc than the points of view from which a disc will project a circle, or a line, or either. This is why, other things being equal, a disc is less likely to project a circle than an ellipse, less likely to project a line than an ellipse, and also less likely to project either a line or a circle than an ellipse.

3. The Explanatory Power of the Real World Hypothesis

The real world hypothesis (RWH) is, roughly, that there exists a world that contains relatively stable, three-dimensional objects generally capable of changing their positions and orientations over time, a world that at least approximates, in its spatial aspects, what we commonsensically take it to be. There exist in the external world two-dimensional projections of such objects, projections produced roughly in accordance with Euclidean laws of projective geometry, and copied or represented in experience. The latter should be regarded as part of the RWH, but to distinguish it let us call it the “projections hypothesis.”⁸

I sometimes characterize experiences as though they involve sense data, but I want to leave more or less open how the relevant experiential features and our awareness of them should be understood. The debate between sense datum, adverbial, and intentional accounts is an important one, but I intend to ignore that debate here and leave open which of these is correct. What is important for our purposes is that spatial features or spatial contents be part of the accessible, sensory or phenomenal character or content of experience, and that our characterization of that content not be arbitrary, ad hoc, or question-begging against the external-world skeptic.

In talking of two-dimensional projections represented in experience I am *not* assuming that visual experiences lack *depth*. My current visual experience is, phenomenologically speaking, not of a two-dimensional plane but of a topology of surfaces that vary in depth, concavity, and orientation—something like David Marr’s (1982) “2½ D Sketch.” The appeal to perspectival projections is compatible with this. However we understand the nature of our experience of depth, the important point is that the two-dimensional features are pervasively embedded in a richer, more complex perceptual experience, and hence the hypothesis that explains these features explains much of the underlying structure of experience. When I seem to perceive something as being distant, as convex or concave, as

⁸ Accepting the projections hypothesis leads naturally to the question of how the projections and corresponding visual experiences containing representations of them are produced, to a suggestion that the projections are produced by the light emitted from or reflected by the object and entering the subject’s eyes, and to scientific attempts to understand the process of vision. Of course, the experiential content does not “copy” the projections perfectly. The brain processes them and produces consciousness of a visual field, with enhancements, distortions, and imperfections, but with many complex features of the physical projections (the retinal images or structure of cross-sections of light in front of the eyes) still preserved. But the subject need not know exactly how these projections and corresponding experiential features are produced.

cubical, etc., the shapes, marks, color patches, boundaries and lines of my phenomenal space do not disappear. I don't have to experience a tree as a flat image in order to notice that its boundary takes up a large part of my visual field; and I don't have to stop perceiving a boulder as a large, round, stationary object to be aware that it occupies a small and moving part of my visual field. What I notice in such cases is something open to introspection and already there in experience, not something somehow inferred from an experience wholly lacking in such two-dimensional phenomenal features.

Do our experiences contain the properties of projections of commonsense three-dimensional objects? Mine do, and I'll bet yours do as well. That various shapes in my visual field often simultaneously get larger or smaller is explained by changes in distance from objects; that shapes move across my visual field is explained by motion that is perpendicular to the line of sight; other continuous changes can be accounted for by gradual change in orientation or direction of motion.

Consider an example from BonJour (2003, 88-89).⁹ Typically, when I take myself to be looking at a matchbox in normal conditions, viewing it at close range, from different angles, I have a distinctive pattern of experiences. Associated with each side of the box, I experience "a collection of [two-dimensional] sense-data, varying more or less continuously in shape, intuitively as the angle from which the object is perceived is altered" (BonJour 2003, 88). Sense data in such a collection can be regarded as "perspectival distortions" of each other; and "perspectivally distorted versions of two or three such two-dimensional shapes can be experienced as adjoined to each other in ways that can be viewed as perspectivally distorted images" of the matchbox (88-9). BonJour does not explain what a perspectival distortion is or why these shapes can be regarded as perspectival distortions of each other. My discussion elucidates his admittedly already intuitive claims. It makes clear why the experienced shapes corresponding to the sides of the box are perspectival distortions of each other: they are all projections of rectangular surfaces viewed from slightly different angles. It also makes clear why these rectangular shapes are experienced as adjoined: the T-vertices and Y-vertices that adjoin two or three sides (respectively) are projections of the edges and corners where the actual sides of the box meet. The relevant experiences are thus easily explained by the RWH.

This discussion of perspectival projections helps the realist better address a question that BonJour takes to be a "crucial part of the overall issue": "precisely what it is that warrants viewing these qualitatively distinguishable experiences as all appearances of one and the same specific sort of physical object or physical situation" (87). BonJour's brief discussion of perspectival distortions provides something of an answer, though it also raises a parallel question: precisely what is it that warrants viewing these qualitatively distinguishable experiences *as perspectival distortions of one and the same physical object*? By answering this question, the appeal to perspectival projections elucidates BonJour's discussion of

⁹ See also Price 1950, which is the inspiration for BonJour's discussion.

perspectival distortions, and provides a more complete answer to the initial question.

Consider another example, illustrated by figure 7 below—the optic flow that results from observing a row of trees while moving in a directly perpendicular to the line of sight. When I take myself to be looking out the window of a moving bus or train, I experience the “motion” of colored marks and shapes. I might notice that certain shapes, perhaps near the center of my visual field (e.g., what I take to be the image of a barn or tree near the horizon) are relatively stationary and easy to focus on, while others closer to the periphery of my lower visual field (e.g., what I take to be images of bushes, rocks, or trees closer by) are moving by much faster, and that the marks in between move proportionally slower as they approach the center of focus, taking longer to traverse the visual field. I can account for variations in the speed of these shapes by the fact that I am moving in a direction more or less perpendicular to my line of sight in (at least approximately) Euclidean space, and that some of the observed objects are closer to me than others. That some shapes traverse my visual field much faster than others is explained by the fact that distances perpendicular to the line of sight that are farther away have shorter projections than equal distances that are closer. The latter fact can also be expressed by saying that parallel lines extending away from me project lines that converge, and if extended far enough, would project lines that converge onto a point (the “vanishing point”). The hypothesis of motion perpendicular to the line of sight also explains why the shapes that seem to be whizzing by in the lower part of my visual field tend to be larger than, and also tend to occlude, the shapes moving more slowly above them.

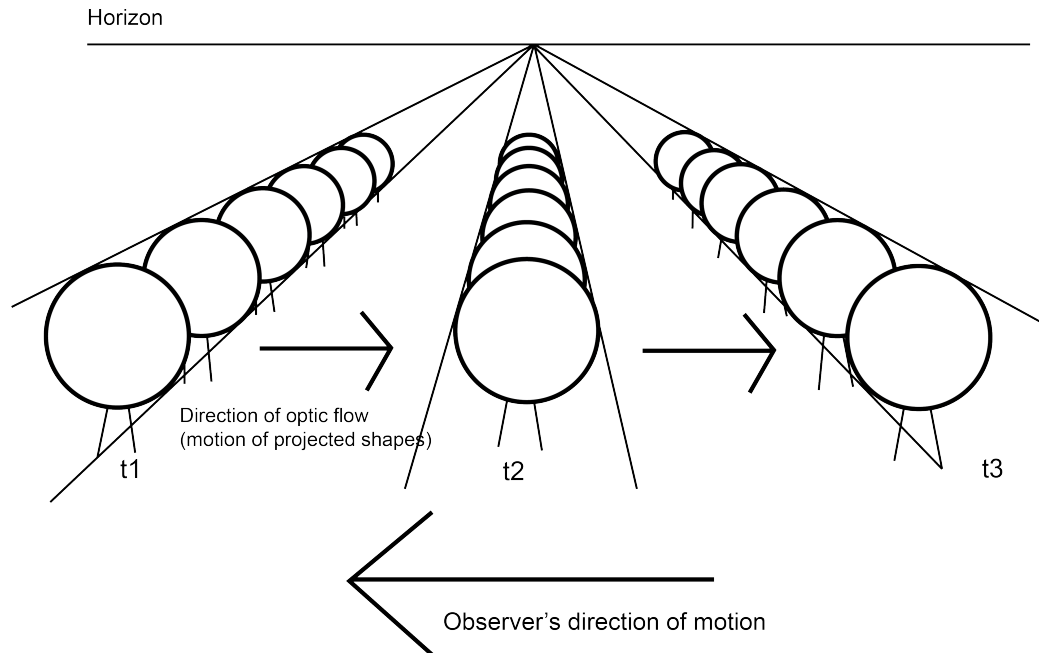


Figure 7. Optic flow resulting from motion perpendicular to the line of sight.

4. Realism vs. Skeptical Hypotheses

We have seen that the RWH has significant explanatory power. In this final section I argue that the RWH is superior to the traditional skeptical hypotheses. I also show how the argument improves on Vogel and Bonjour's attempts to arrive at the same conclusion.

Since we are now comparing hypotheses, I shall be more explicit about criteria for explanatory goodness. I do not intend this to be a rigorous treatment of explanatory goodness, and will not defend this selection of criteria here. I will simply note that these are intuitively plausible and commonly regarded as epistemically relevant, and that other explanationists like Vogel (1990, 2005, 2008) offer very similar criteria, though in different terms. My contention is that the RWH does significantly better than the skeptical hypotheses by this intuitive set of criteria.

Explanatory power: Other things being equal, a hypothesis is better the more it explains.

- *Explanatory breadth:* Other things being equal, the more phenomena are explained the better.
- *Explanatory depth:* Other things being equal, the more contingent explainers are explained, the better.

Simplicity: Other things being equal, simpler explanations are preferable to more complex ones. This applies to both types and tokens:

- Other things being equal, the fewer the *types* or *kinds* of contingent entities, processes, causal or lawful regularities (etc.) posited, the better.
- Other things being equal, the fewer the *token* contingent entities, processes, causal or lawful regularities (etc.) posited, the better.

We can increase the explanatory power of a hypothesis by positing more explainers, and we can keep simplifying a hypothesis by explaining less and less. What we really want is a combination of simplicity and explanatory power; we want to explain more with less. This naturally leads us to look for an explanation of the data that is “unified” in that sense that it involves a relatively small set of interconnected explainers that together account for a great deal of data, as opposed to a hypothesis with *piecemeal* explanations, i.e., one which posits various unconnected explainers, each of which explains only some specific observation or relatively narrow range of data.

4.1 Isomorphic Skeptical Hypotheses and Vogel’s Argument

The skeptic can make things difficult for the realist by relying on the Humean point that since causal relations are contingent, there are few *a priori* restrictions on what sorts of entities stand in any given causal relations. Experiences could be caused by objects or worlds they misrepresent. Every item (object, event, state, etc.) *O* posited by the realist’s hypothesis to explain our experiences could be replaced by another item *O**, with wildly different properties, without changing the structure of the regularities between these items and the subject’s experiences. Following Vogel (1990, 660; 2005, 75), let’s call any such hypothesis an “isomorphic skeptical hypothesis” (ISH). Indefinitely many such hypotheses can be constructed. Insofar as explanatory virtues depend on this structure, the explanatory virtues of the RWH can be retained by an ISH—or so the skeptic might argue.

Consider, for example, a version of the brain-in-a-vat hypothesis that Vogel (1990) calls the computer skeptical hypothesis (CSH). The CSH can retain the structure of the RWH by replacing every real world object or process with a computer file or computing process, and having the latter objects or processes cause the same experiences as the former. Thus, just as wind coming through a window could cause certain tactile sensations and cause a paper sitting on a desk to move, the latter of which could cause me to have certain visual experiences, so too a particular “wind” program or file could cause me to have the same tactile sensations and activate another “paper motion” program, which could cause me to have the same visual experiences (Vogel 1990, 660-1; 2005, 76). Isomorphic hypotheses like the CSH might seem to mimic the causal structure and hence match the explanatory power of the RWH.

Vogel offers an intriguing argument that skeptical alternatives are bound to have complications. His strategy against the skeptic is to argue that *X*’s being

spatial constrains what regularities X enters into: there are *necessary* relations between certain spatial properties in the world posited by the RWH. It cannot be assumed that replacing reference to these properties with others, as an ISH does, and keeping the structure of the relations the same, will preserve these necessities; such a change does not preserve the “modal configuration” of the RWH. And there is no reason to think that the contingent regularities introduced by an ISH will be offset by advantages it has over the RWH. Other things being equal, a hypothesis that invokes fewer contingent explanatory regularities is preferable to a competitor that invokes more. Therefore, the realist hypothesis is preferable to its isomorphic skeptical competitors.

To illustrate this strategy, consider the main necessity that Vogel discusses: two distinct objects cannot occupy the same spatiotemporal location. An ISH works by replacing objects with certain “pseudo-objects” (items other than the perceived commonsense objects, such as elements in the memory of a computer) and replacing properties like location with “pseudo-location” (some property other than location, such as magnetic properties on the computer disc). But it seems that metaphysically distinct entities can share any property other than spatiotemporal location. Therefore, an ISH’s positing of a causal structure in which two items, pseudo-objects, cannot share the same property, a pseudo-location, is an invocation of a contingent regularity, while the corresponding regularity invoked by the RWH is not contingent.

This is an ingenious argument, but not unproblematic. One apparent problem is that the alleged necessity just discussed might not really be a necessity at all. Suppose we take these objects to consist instead of particles or simples arranged in complex ways, with certain forces or other relations between these simples. The fact that some objects exclude others might then be due to the dynamics governing such objects or their microscopic parts, and thus not necessary. Vogel (2005, n. 21) notes some of these complications but seems to think that there are other necessities since spatial objects are such that, “necessarily, they conform to some kind of geometry...” (2005, n. 22). Perhaps one of the best examples is the triangle inequality, which is generally regarded as definitive or axiomatic of traditional Euclidean and non-Euclidean geometry: the length of any one side of a triangle is less than the sum of the lengths of the other two sides (Vogel 2008, 547-8, n. 59, and n. 60).

Still, a problem remains. Corresponding necessities might be preserved by replacing spatial properties with properties of the mirroring thoughts or intentional states of God or the evil demon, a being who has infallible knowledge of necessities that apply to space. If our experiences are the effects of the evil demon’s conceiving an elaborate spatiotemporal world in his mind, he will necessarily conceive of space in accordance with the necessities that apply to it. If it is impossible for two objects to share a spatiotemporal location, then God or the evil demon cannot conceive of them as co-located; if it is impossible for one side of a triangle to be at least as long as the other two sides, then it is impossible for the evil demon to conceive of one side being at least as long as the other two. For every necessity that applies to the sorts of properties posited by the realist

hypothesis, there is a necessity that applies to the corresponding thoughts or intentional states of the evil demon.

Vogel's (2008, n. 60) discussion of ISH's handling of the triangle inequality might suggest a reply to this problem. Let $\text{Dist}(a, b, c)$ be the distance from a to b to c in the real world, and let $\text{Dist}(a, c)$ be the distance from a to c in the real world. Let $\text{Dist}^*(a^*, b^*, c^*)$ and $\text{Dist}^*(a^*, c^*)$ be the corresponding pseudo-distances in the ISH. As Vogel makes clear, the criticism of ISH is not that it fails to explain the data, but that the need to invoke a contingent regularity parallel to the triangle inequality makes the explanation more complicated, and hence inferior. There might be a necessity in the vicinity, Vogel says, but it isn't the right one: "Perhaps...we have the following: necessarily (if ISH gets the data right, then the value assigned to $\text{Dist}^*(a^*, b^*, c^*)$ is greater than the value assigned to $\text{Dist}^*(a^*, c^*)$)." But "we do not have the following: (if ISH gets the data right, then (necessarily, the value assigned to $\text{Dist}^*(a^*, b^*, c^*)$ is greater than the value assigned to $\text{Dist}^*(a^*, c^*)$)." This might suggest the following reply to my objection to Vogel: it may be that necessarily (if God succeeds in simulating RWH-objects, then God's beliefs track truths of geometry); but not: if God succeeds in simulating RWH-objects, then (necessarily, God's beliefs track truths of geometry). But the reply doesn't work, for unlike the ISH, the latter does hold at least for the God hypothesis. Just as objects in RWH necessarily satisfy certain truths of geometry, the thoughts or beliefs of *God or an infallible demon* necessarily track truths of geometry. The positing of such a deceiver is precisely what makes it plausible to say of the God or demon hypothesis, but not of ISH, that there are necessities in it that parallel any necessities in RWH.

In a recent book, Kevin McCain considers a very similar objection to Vogel's modal configuration argument.¹⁰ The demon hypothesis does not have to posit an additional fundamental regularity because the sensations we have may be the result of the demon's implementing a plan that includes a virtual space. This virtual space could be a mathematical representation of an imaginary space that has the same mathematical properties as the space of [RWH]. [McCain 2014, 135]

Mathematical and geometric truths like the triangle inequality hold of necessity not only for physical space but also for this virtual space.¹¹ These necessary truths can therefore play the same explanatory role as the necessities that hold

¹⁰ Thanks to an anonymous referee for bringing this to my attention.

¹¹ It is important for the objection that the demon conceive of or imagine a *spatial arrangement*; it is not enough that the demon have in mind some mathematical representation that just happens to serve as a representation of a spatial arrangement. The demon can have different mathematical representations of course, not all of which are spatial representations; but the God or demon I am considering *necessarily* conceives or imagines the nature of *space* in such a way that it satisfies constraints like the triangle inequality.

for the RWH, and no additional contingent regularities are needed. McCain responds on Vogel's behalf that the demon hypothesis will still need to posit a fundamental regularity that the demon implement a plan that includes such a virtual space and the demon will not change plans after such a deception has begun. Without this regularity there would be no guarantee that the distances between a^* , b^* , and c^* [the represented locations in the demon's imaginary space] are governed by the triangle inequality because it is possible that they are not arranged spatially at all since they are mental states or features of mental state of the demon. [2014, 136]

As will become clear in section 4.3 below, I believe there is something to McCain's response. But it is not adequate as it stands. We are supposing that the demon has in mind a detailed virtual or imaginary space, and if we hold this fixed, then the triangle inequality holds of this space necessarily. McCain doesn't contest this, but points out that the demon's "choice" to "implement a plan" that involves this virtual or imagined space and his "choice to stick with a particular plan once implemented" are both contingent (2014, 136). The RWH needs no corresponding contingency.

However, it seems that the RWH does posit parallel contingencies: the real world has a particular spatial arrangement corresponding to the particular spatial arrangement the demon imagines; this spatial arrangement is stable or unchanging in certain ways corresponding to the stability of the demon's imagination or intentional states. McCain's point, I take it, is that the demon's choice to implement a particular plan (and stick with) is something more than the demon's *imagining* a space and not changing certain aspects of the space that he imagines. But it remains unclear what more is involved. We can suppose that the imagining is something the demon does *by choice*, and this contingency would then correspond to the contingency, on the part of the RWH, that the world involves a certain sort of arrangement. It is not clear what more the positing of this demon's chosen imagination involves that goes beyond the RWH's positing of a spatial arrangement.¹²

4.2 BonJour on "Analog" and "Digital" Explanations

¹² McCain goes on to discuss what he takes to be a further advantage that the RWH has over the demon hypothesis, one that is perhaps already suggested by talk of the demon's "choices" and "plans". The demon hypothesis "makes claims about a demon that is *bent on deception*" (my emphasis) and this "gives rise to a slew of unanswerable questions" (2014, 137): Why does this demon so deceive me? Why deceive me in this particular way, to believe these things? And to what end? It is here that I think McCain comes closest to providing the response to skepticism that I favor, though the skeptic might attempt to avoid these additional questions by making no claim about the demon's intention to deceive while leaving everything else in place: the demon simply imagines a detailed spatial world of the RWH sort, and his ideas of this world produce the corresponding experiences in us directly. I consider and respond to this concern in section 4.3 below.

Following BonJour, let us distinguish between “analog” and “digital” skeptical explanations. “Digital” explanations “explain experience by appeal to the combination of something like a *representation* of the sort of world that figures in the [RWH], together with some agent or mechanism” that produces the sort of experience one would have if the represented world were actual for one (BonJour 2003, 93). Traditional versions posit God, a Cartesian evil demon, or some other such being, and this being’s representation of the sort of world characterized by the RWH. “Analog” explanations, on the other hand, “explain the features of experience more or less directly by appeal to basic features of objects in the hypothesized world” as opposed to representations of such features (ibid.).

BonJour offers two reasons to prefer something like the RWH over skeptical “analog” explanations. First, he claims that there is something “rather arbitrary” about an explanation that posits a world with features “utterly different from those that are reflected in experience”; an arbitrariness “reflected in the fact that there is and apparently could be no basis at all for preferring one such digital mechanism to another” (2003, 95; see also Moser 1989, 104). Unfortunately, this is unsatisfactory as it stands. The skeptic might claim that if there are indefinitely many such alternatives with no apparent basis for preferring, or assigning different probabilities to, some of them over others, so much the worse for the realist. Perhaps such skeptical hypotheses intuitively seem arbitrary, but we need a better, clearer, non-question-begging reason to regard them as arbitrary or inferior.

BonJour’s second reason for preferring the realist explanation to digital explanations has to do with the way in which the digital explanation seems to be more complex than and parasitic on the analog explanation. A digital explanation is successful only if (i) “the corresponding analog explanation could indeed account for the experience in question,” and (ii) “the specific translating mechanism postulated by the digital explanation can indeed successfully do the job of emulation...” (2003, 95). BonJour tentatively suggests that the realist analog explanation is “less vulnerable to problems and so more likely to be true” on the grounds that its explanatory success depends only on the truth of (i), whereas the digital explanation’s success depends on the truth of both (i) and (ii). In a footnote, he says that while it is “tempting” to appeal to the fact that “the probability of a conjunction of two [logically independent] non-necessary claims is lower than that of either claim separately....this would not work if the second claim were a necessary truth, as might be claimed for at least the God hypothesis” (2003, 95 n.24): *necessarily*, God can successfully emulate any physical world’s production of experiences. This explains the tentativeness and vagueness of BonJour’s suggestion. Thus, though BonJour does not discuss Vogel’s modal configuration argument he recognizes a difficulty having to do with modality that is similar to the one I raise for Vogel. He does not, however, offer a solution that clearly avoids the problem. His second (admittedly tentative) reason for rejecting digital explanations is therefore not satisfactory as it stands.

4.3 The Superiority of the Real World Hypothesis

My strategy is to argue that the RWH is able to treat various experiences or experiential features as resulting from certain causal processes or relations of the same kind, and that this gives the RWH an advantage over the traditional skeptical hypotheses.

Compare the CSH to the RWH. Corresponding to each three-dimensional object invoked by the RWH, the CSH posits a file or portion of a computer disc with certain magnetic properties. Corresponding to each projection produced by each object, the CSH posits another file, activated by the first, with different magnetic properties. Let O be an object with shape S and varying locations or positions $L_1 \dots L_n$ relative to the observer, corresponding to which the CSH invokes file $F(O)$ with fixed magnetic properties $E(S)$, and “inputs” $I(L_1) \dots I(L_n)$. The latter “inputs” could be regarded as further magnetic properties of the computer. Let $P_1 \dots P_n$ be projections of O resulting from changes in position $L_1 \dots L_n$, corresponding to which the CSH invokes files $F(P_1) \dots F(P_n)$, which are produced or activated by $F(O)$ given $I(L_1) \dots I(L_n)$.

To explain why $P_1 \dots P_n$ result from O and inputs $L_1 \dots L_n$, the RWH posits straightforward laws or processes of projective geometry; the very same laws or processes govern how all the projections are produced. To explain why $F(P_1) \dots F(P_n)$ result from $F(O)$ and inputs $I(L_1) \dots I(L_n)$, what laws or processes could the CSH posit? One possibility is for the CSH to posit that each of $F(P_1) \dots F(P_n)$ results from $F(O)$ and the inputs $I(L_1) \dots I(L_n)$ respectively. Each $F(P_x)$ would be explained piecemeal by $I(L_x)$ and a causal or lawful relation between $I(L_x)$ and $F(P_x)$. The RWH, on the other hand, allows us to regard each P_x as a projection of a particular, more or less stable three-dimensional shape in motion relative to the observer; the existence of each P_x results from L_x and a relation between L_x and P_x , *but each instance of the latter relation is accounted for in a unified way, as a projection relation*. We are assuming that CSH and RWH are isomorphic in Vogel’s sense (see section 3.1): each particular object, projection, event, etc., has its counterpart in the CSH; the difference is that the RWH can treat the many token processes or relations between these particulars as exemplifications of projection. The skeptic who infers from this isomorphism that the two hypotheses share all explanatory virtues ignores the virtue of being able to regard various phenomena as exemplifications of the same kind or type of process or relation.

A natural reaction is to turn to traditionally popular skeptical hypotheses that are “digital” in BonJour’s sense, e.g., hypotheses that posit God, an evil demon, AI, or some other such being, and this being’s *representation* of the sort of world characterized by the RWH. But these hypotheses introduce more complexity, for they invoke items that escape the one-one mapping of spatial objects to ideas of them in the mind of God (the evil demon, AI, etc.). God *intends to deceive me into thinking that perceptible spatial objects of the sort posited by the RWH exist*. The intention to deceive doesn’t correspond to anything invoked by the RWH to explain our experiences—it is something over and above the deceiver’s representation of items and features of the RWH-world, something over

and above the representation of physical objects and events, bodies, eyes and other organs.

One likely concern is that these skeptical hypotheses are simpler since they posit very few entities—the mind of the deceiver, the mind of the victim, and the mental states, ideas, and experiences of each—whereas the RWH is committed to more (see, e.g., Vogel 1990, 662; Fumerton 2005, 95). But if the RWH invokes spatial objects with movable parts to explain certain patterns of experience, then each of these movable parts will have their corresponding items (ideas or representations) in the skeptical alternative. The initial reaction that such skeptical hypotheses are simpler can be explained as a result of the intuition that, other things being equal, objects tend to be more complex than object parts or internal processes, misapplied to the case where other things are not equal, since the skeptical hypotheses require discrete ideas or representations that correspond to all the discrete objects, parts, and processes that have an explanatory role in the RWH. If the addition of objects in the RWH makes for greater complexity, there is no clear reason why the deceiver’s ideas or mental states which represent these objects do not make for greater complexity as well. Since, in addition to these items, we must posit a persistent intention to deceive, the hypothesis is more complex.¹³

One might attempt to avoid these complications by stipulating that God or the demon’s ideas of certain objects (events, states of affairs, etc.) directly cause in me experiences of projections of such objects (among other things), *without anything like an intention to deceive*. The problem is that this leads to a loss of explanatory power. For consider the fact our visual and various other experiences include particular sorts of contents and not others: our visual experiences systematically represent projections and other, closely related spatial features of a local environment, and not indefinitely other spatial features that exist (according to the RWH) or are represented in the mind of God or the demon (according to the skeptical hypothesis). These include features at the very large and the very small scale, and features that are not parts of the subject’s local environment. The realist can explain why our representations are limited in this way: only features of the world that have an influence on the eyes and other sensory organs of a subject’s body can influence what is experienced. If God or the demon represents the sort of world posited by the RWH, why do my experiences specifically represent these features but not various others represented in his mind? Without something like a persistent intention to deceive or to influence our experiences in some systematic way, there is no explanation.

¹³ Essentially the same point can be made by noting that one can understand the RWH in a way that doesn’t, strictly speaking, invoke distinct macroscopic objects at all, at least not in any reified sense of “object”. The notion of a macroscopic physical object or physical substance can be replaced with the idea of more or less stable spatial arrangement of fields, particles, forces, or what have you. The Berkeleyan God hypothesis and evil demon hypothesis will have to invoke items corresponding to these spatial “objects” and, in addition to these, posit a robust intention to deceive.

Conclusion

Given the above, the burden is on the skeptic to come up with a hypothesis that matches the virtues of the RWH. No doubt, more work needs to be done. While I think it plausible that ordinary subjects possess something approximating this sort of justification, I have not tried to defend this here. I have also made no attempt to take on skepticism regarding inference to the best explanation. Nevertheless, the argument sketched here seems to me to be compelling enough that, at the very least, such a traditional response to the skeptic ought to be taken more seriously than it in fact is.

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