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ORIGINAL RESEARCH

Visual Experience and The Laws of Appearance

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Abstract
Adam Pautz (Pautz, Nanay (ed), Current Controversies in philosophy of perception, Routledge, New York and London, 2017, Pautz, Philosophical Issues 30:257–272, 2020) coined the phrase "the Laws of Appearance" for some underappreciated features of perceptual experience. Pautz suggests that the modal status of the Laws presents a puzzle: it is problematic to regard them as necessary, and also problematic to regard them as contingent. This paper presents possible counterexamples to the laws, suggesting that they are contingent as originally stated (Sect. 1). But the laws are readily modified so as to express constitutive features of normal human visual experience, and thus understood they are metaphysically necessary (Sect. 2). Analogous pictorial laws govern representational painting, and these can be explained by appealing to the representational format of the medium (Sect. 3). This invites the question whether there might be format-based explanations of the Laws of Appearance. If so, can the contingency of the format facts be squared with the necessity of the Laws? The paper answers "Yes" to both questions (Sect. 4).

1 The Puzzle

Laws of appearance, says Pautz, govern what kinds of experiences are possible. Three of his Laws (direct quotation, with ellipses, from his 2020: 258) are:

> *Exclusion Law*. You cannot experientially represent the same surface as pure blue and pure green at the same time.[1]
> *Berkeley's Law*. You cannot experientially represent that something has a color quality without also experientially representing that it takes up space in some way.

[1] Since a single surface can be multi-colored, we might prefer to hear this as saying that one cannot represent the same *area* as both pure blue and pure green at the same time.

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Perspectival Law. An individual cannot experientially represent merely that *there is a cube somewhere in reality*, without any "perspectival information" about its location and apparent shape from "here".[2]

Pautz claims that the laws are puzzling in that they are either necessary or contingent, but both options are problematic. If they are necessary, we would "expect a general explanation", but there does not seem to be such an explanation, so the laws "are all separate, brute modal facts … and that would be very dissatisfying and complicated" (2020: 259). If they are contingent, we need to explain away the "intrinsic plausibility" of the claim that they are necessary.

Although these formulations do not explicitly restrict experience to visual experience, it is plain that this is what Pautz intends (the previous section is headed "What is the representational view of visual experience?"[3]). Indeed, one can regard the Laws as helping to characterize visual experience, showing that non-visual experience is not governed by them. For example, synesthetes can supposedly detect colors by touch. Such perceivers are imaginable even if not actual. Suppose a synesthete tactually experiences a surface as pure blue, and also experiences it as pure green, either visually or by touching the surface with a different hand. One or other appearance must be illusory, but that does not render the combined experiences impossible. On the face of it, this is a counterexample to the necessity of the Exclusion Law: the surface is experientially represented as both pure blue and pure green at the same time. In the context of Pautz's views, we should treat the example as simply reinforcing the point that, necessarily, the tactual synesthetic input is not visual.

Imagine a detection mechanism for colors that gives rise to a distinctive tingling sensation whenever it encounters red (and perhaps other sensations for other colors). The response is the same regardless of how large the red region is, or whether what is detected is a red surface, light or volume. Violating Berkeley's Law, this system represents color without representing space occupancy. In the context of Pautz's views, we could regard the example as explained by the fact that, necessarily, tingling is not a visual experience.

However, the Laws seem to exclude certain forms of possible visual experience. Chameleon eyes can move and focus independently, giving rise to two visual images, even when directed at the same object.[4] This would make it possible for a chameleon (or a possible chameleon-like creature) to form distinct images of the same object, one representing it as pure blue, the other as pure green, violating the Law of Exclusion.

[2] Those who are skeptical that experiential content takes a propositional form (properly described using a full sentential that-clause complement) can regard these laws as slightly modified: visually, you cannot represent color without representing extension, and all perception represents perspectival information (however that may be analyzed).

[3] In both expositions of the puzzle, Pautz begins by posing it as one for representationalists about perception, but concludes by saying it's a puzzle for all theorists of vision (2017: 39, 2000: 270).

[4] See https://en.wikipedia.org/wiki/Chameleon_vision. Birds and horses are further possible candidates for counterexamples to Exclusion, thanks to the bilateral character of their vision.

There are also counterexamples to the Law of Perspective, even as restricted to vision. Suppose one is receiving a virtual reality feed without having any idea where the source camera is located, or in what direction it is pointing. One will experience things as being a certain way somewhere, but not experience anything's location relative to oneself.

2 Restricted Laws of Appearance

To vindicate the laws, we need to restrict them further, claiming only that they hold of normal human visual experience. (An abnormal human might have vision resembling chameleons, or might be assisted by virtual reality feeds.) Making explicit the modal operator, and expressing generality by "a", the Laws will then take this form:

> *Exclusion Law* Necessarily, a normal human visual experience does not represent a surface as pure blue and pure green at the same time.
> *Berkeley's Law* Necessarily, a normal human visual experience does not represent something as having a color quality without also representing it as taking up space.
> *Perspectival Law* Necessarily, a normal human visual experience does not represent merely that *there is a cube somewhere in reality*, without also representing "perspectival information" about its location and apparent shape from "here".[5]

The modal status of these restricted Laws resembles that of constitutive claims relating to other systems of representation, for example this "Law of Dual Representation" for graphs:

Necessarily, a point on a graph represents two values, one on each axis.

This law identifies a feature that makes something a certain kind of graph. Similarly, we can interpret Pautz's position as holding that what makes a normal human experience a visual experience is in part that it obeys the Laws of Appearance. The laws express constitutive features of normal human visuality, and so are necessary. This claim shares the "intrinsic plausibility" Pautz appealed to, and seems immune to counterexamples.

3 Representational Paintings

Analogs of Pautz's Laws of Appearance hold for traditional representational paintings. To formulate the analogs, replace Pautz's "experientially" by "pictorially":

> *Exclusion Law** You cannot pictorially represent the same surface (or area) as pure blue and pure green at the same time.

[5] I have kept as close as possible to Pautz's formulation. The overall form in each case is: $\Box(\forall x(Fx \rightarrow Gx))$.

*Berkeley's Law** You cannot pictorially represent that something has a color quality without also pictorially representing that it takes up space in some way.
*Perspectival Law** You cannot pictorially represent merely that *there is a cube somewhere in reality*, without any "perspectival information" about its location and apparent shape from "here", the place the painter represents the scene from.

These pictorial laws* are constitutive of what it is to be a painting (of the classical representational kind), just as Pautz's Laws of Appearance are constitutive of what it is for a normal human experience to be visual. The laws* can be further explained in terms of the format properties of the representational vehicles of paintings: surface and paint. This suggests we might look for format explanations of the Laws of Appearance.

Representation is relational, holding between a vehicle and a content (as argued by Dretske, 2003: 68). Vehicles, like words, have intrinsic physical properties, and extrinsic contents. Format properties of representational systems are generalizations concerning the vehicle–content relation. The "Dual Representation" property of graphs is a format property. It does not specify any specific graphical content or vehicle. Rather, it provides a generalization relating general facts about vehicles to facts about content. Similarly, the pictorial laws* can be explained in terms of format properties.

Some aspects of pictorial representation have a "reproductive" character: the vehicles of representation, surface and paint, *reproduce* some of the properties and relations represented. Vehicles have the format property of being reproductive if they represent a property in virtue of possessing it themselves. Red paint represents redness in the scene: the vehicle itself possesses the property it represents. This explains the exclusion law*: since no paint is both pure blue and pure green, a painting cannot represent a single area as wholly both pure blue and pure green. Any area in the represented scene corresponds to an area on the painted surface. Since paint on the surface of a painting takes up an area, Berkeley's Law* holds. Since a painting of a scene is from a point of view, a representation of an object is guaranteed to include viewer-centric direction; hence the Perspectival Law*. An area of paint can represent an apparent viewer-centric shape.[6]

Not all pictorial representation is reproductive (in the special sense just specified). Since a painting is essentially two-dimensional, distance cannot be represented reproductively.[7] A representation that *reproduced* relative distance properties would be a 3-D model, not a painting.

Necessarily, a painted surface would not be a conventional representational painting unless it satisfied the pictorial laws*. Likewise, I suggest, it is necessary that an

[6] These observations are oversimplified, ignoring color contrasts and the many ways of representing distance.

[7] We do not have to accept everything Berkeley says about whether distance is represented in vision (it is "a line directed endwise to the eye") to agree that distance and direction are represented in different ways.

experience would not be a visual experience of a normal human unless it satisfied the Laws of Appearance.

4 Format Explanations

A format explanation for a law of appearance would show the law to rest on format features of the underlying vehicles. That a point on a graph must represent two values rests on the geometry of graphs, which fixes format features of their representational elements. Pictorial representation also provides a model for format explanation: features of surface and paint explain generalities about what kinds of pictorial content are possible.

The specific features of format explanations of the pictorial laws do not transfer to vision. As Pautz says, there are no colors in the head, so redness in the world cannot be perceptually represented by redness in the head.[8] More generally, we should not expect to find reproductive format (in the sense here defined for painting) in visual experience. For example, it is extremely unlikely that a visual representation of one object's greater distance from the subject than another's is represented by one representation in the brain being further away from the eyes than another. The possibility I am suggesting is that some more appropriate kind of format explanation might apply to features of perceptual experience. It would count as a format explanation in virtue of its structure, its appeal to general content–relevant properties of representational vehicles, not in virtue of specific similarity to pictorial format explanations.

Suppose that some neural vehicles for vision have neuronal format features F and others have G. Then outline formulations might look like this:

> In normal human visual systems, if a neural state has F, then it does not represent a single area as both pure blue and pure green at the same time. (Exclusion˜)
> In normal human visual systems, if a neural state has G, then it represents a color iff it represents a region. (Berkeley˜)

Exclusion˜ could explain the Law of Exclusion; Berkeley˜ could explain Berkeley's Law. Might such generalizations be known?

Experimentalists have explored a proposal related to Berkeley˜: is it the case that all neural vehicles of visual experience encode both or neither color and size information? Luck and Vogel's empirical work might appear to contribute to this question. They say that "attentional processes are used to combine the features of an object into an integrated percept", the features being "colour, orientation, size and the presence or absence of a gap" (1997: 280–1). The attentional processes are attributed to vision, and are reflected in visual working memory. A state that

[8] The view that perceptual format is iconic, as opposed to discursive, must accordingly re-interpret "iconic" in functional terms that do not require pictures in the head. For a recent discussion of the long-standing iconic versus discursive debate concerning perceptual format, see Quilty-Dunn (2019).

represents color iff it represents size is one whose contents are linked in visual experience, as required by Berkeley's Law.

Although such a result might be regarded as some kind of empirical vindication of Berkeley's Law, it is not a format explanation, as I have defined it, for it mentions specific representational properties. Rather, it is a law in search of a format explanation. One could imagine that there is a purely neural type of brain state that is responsible for the entanglement of the various contents that Luck and Vogel describe. So we might take their results as precursors to format explanations. Later, the intrinsic neural underpinnings of the relevant states would be identified, and then format explanations would be available: the neural underpinnings responsible for the entanglement of contents.

The empirical story is not straightforward. Fougnie and Alvarez (2011) claim that color and orientation can come apart in visual working memory, suggesting that they are independently processed in earlier stages, thus undermining support for Berkeley's Law. Green and Quilty-Dunn (2020: 13) agree with this negative conclusion: "Representations of low-level perceptible features must therefore be able to come apart and be stored separately". Recently, Sone et al. (2019) claim to have resolved this disagreement in favor of Luck and Vogel's position.[9]

Although experimental work is very much in flux, we should be open to the possibility of experimental vindications of Laws of Appearance opening the way to format explanations. If this possibility were realized, what would be the consequences for the modal status of the Laws? The format facts would presumably be contingent, but it seems that contingent facts cannot explain necessary ones. It is tempting to conclude that the Laws, if contingently explained, would not after all be necessary.

An inadequacy in this line of thought can be revealed by a comparison with the Law of Dual Representation for graphs: necessarily a point on a graph represents two values, one on each axis. This is consistent with it being contingent that a certain point is a point on a graph, and so contingent that the point represents two values. Suppose you have been invited to place a point on a graph while blindfolded. Your pen makes a dot within the graph, so the dot has two values. But it could easily have happened that that very dot fell outside the graph. Then it would not have been a dot on a graph, and so would not have had any values. It's a two valued dot, but might not have been; it might not have been a representation at all. This does not undermine the necessity of the Law of Dual representation, for that addresses only points on graphs. The Law has an implicitly conditional structure: necessarily, if something is a point on a graph, it represents two values.

There is a similar contingency in format-based explanation of pictorial laws*. Necessarily, a green blob of paint in a certain picture represents green in the scene portrayed. But the very same blob, individuated as a physical object, for example

[9] One should not infer from the fact that some neural elements have multiple contents that the contents are always processed together. "Place cells" (e.g. Jeffery 2007), and so-called "grandmother cells" (e.g. Gross 2002; Quiroga et al., 2005) respond to a complex of features (at the limit, features jointly specific to a single individual place or object), but the several features are also represented independently in the brain.

in terms of which molecules compose it, did not have to represent anything at all. It might have ended up as simply a blob on the studio floor, representing nothing. Such possibilities do not undermine the necessity of the pictorial laws* already mentioned,[10] nor of this further law*: necessarily, you pictorially represent a certain color by using paint of that color.[11]

A format explanation is, by definition, based on properties that are not explicitly representational, as we have seen for pictures and graphs. A format explanation is one that specifies a relationship between vehicles and content in which the vehicles are not already singled out in contentful terms, but rather in terms of their intrinsic physical properties (like being a dot located on a graph).

Pursuing the analogy with the contingencies just mentioned, it can be the case both that it is contingent whether a neural state token is F, or is G, and also necessary that possessors of these properties meet the condition expressed by the laws. A given token neural state which is in fact representational in a certain way didn't have to be representational in that way, or at all. Yet there can be necessary truths about what neural states with certain properties represent, as schematized in Exclusion˜ and Berkeley˜.

To summarize:

1. The laws of appearance are necessary truths, ones that reveal important features of human visual experience.
2. Possibly, the laws can be grounded in format explanations, which are contingent.
3. The contingency of format explanations is consistent with the necessity of the laws.

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References

Dretske, F. (2003). Experience as representation. *Philosophical Issues, 13*, 67–82.

[10] More exactly, the *truth* of the pictorial laws*, since they are stated with a wide scope necessity operator.

[11] Once again, this oversimplifies the complexity of color contrast effects and specific painterly techniques.

Fougnie, D., & Alvarez, G. A. (2011). Object features fail independently in visual working memory: Evidence for a probabilistic visual-store model. *Journal of Vision, 10*, 1–11.
Green, J., & Quilty-Dunn, J. (2020). What is an object file? *British Journal for Philosophy of Science, 00*, 1–37.
Gross, C. G. (2002). Genealogy of the 'grandmother cell.' *The Neuroscientist, 8*(5), 512–518.
Jeffery, K. J. (2007). Integration of the sensory inputs to place cells: What, where, why, and how? *Hippocampus, 17*, 775–785.
Luck, S. J., & Vogel, E. K. (1997). The capacity of visual working memory for features and conjunctions. *Nature, 390*, 279–281.
Pautz, A. (2017). Experiences are representations: An empirical argument. In B. Nanay (Ed.), *Current Controversies in philosophy of perception* (pp. 23–42). New York and London: Routledge.
Pautz, A. (2020). The puzzle of the laws of appearance. *Philosophical Issues, 30*, 257–272.
Quilty-Dunn, J. (2019). Perceptual pluralism. *Noûs, 54*, 807–838.
Quiroga, R., Reddy, L., Kreiman, G., Koch, C., & Fried, I. (2005). Invariant visual representation by single neurons in the human brain. *Nature, 435*(7045), 1102–1107.
Sone, H., Li, A., & Fukada, K. (2019). Simultaneous recall procedure reveals integrated object representations in VWM. *Journal of Vision, 19*, 202.