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### THE WATERFALL ILLUSION

By TIM CRANE

**I**F you stare for a period of time at a scene which contains movement in one direction, and then turn your attention to an object in a scene which contains no movement, this object will appear to move in the opposite direction to that of the original movement. The effect can be easily achieved by attaching a piece of paper with a spiral drawn on it to the spinning turntable of a record player, and then turning the turntable off while continuing to look at the spiral (see Frisby 1979, pp. 100-101 for a detailed description of how to bring this about). But the illusion of movement can also occur when looking at a waterfall, for instance, and turning one's attention away from the waterfall to a stationary object such as a stone; hence its name — the 'Waterfall Illusion'.

The effect is quite striking, and not difficult to achieve. But the above description is not quite right. For although the stationary object *does* appear to move, it does not appear to move relative to the background of the scene. That is, there is a clear sense in which it also *appears to stay still* (see Blakemore 1973, p. 36). There is a distinct appearance of lack of motion as well as motion. Understandably enough, many find this aspect of the illusion quite extraordinary; John Frisby writes that

although the after-effect gives a very clear illusion of movement, the apparently moving features nevertheless seem to stay still! That is, we are still aware of features remaining in their 'proper' locations even though they are seen as moving. What we see is logically impossible! (Frisby 1979, p. 101)

Presumably what Frisby thinks is logically impossible is that something could be both moving and not moving at the same time; and this claim must be correct. I will argue that this aspect of the Waterfall Illusion poses a problem for a familiar claim about perception: the claim that the content of perceptual experience is composed of *concepts*.

Of course, what one makes of such cases as the Waterfall Illusion partly depends on one's methodology. One could dismiss such cases as uninteresting exceptions, to be dealt with once the truth about normal perceptual functioning has been found. Perhaps this is the right way to treat illusions. But my own sympathies lie with Helmholtz:

The study of what are called illusions of the sense is, however, a very prominent part of the psychology of the senses; for it is just those cases which are not in accordance with reality which are particularly instructive for discovering the laws of those processes by which normal perception originates. (Quoted in Coren and Girgus 1978, p. 9)

On this view of the significance of illusions, the study of illusions could be compared to pathology: one studies the body's abnormal functioning in order to understand normal functioning. Or — closer to home — it could be compared to Russell's idea that one uses logical puzzles (about, e.g., non-referring singular terms) to test the adequacy of a logical theory (see Russell 1957, p. 47). I shall adopt Helmholtz's advice, and see what we can learn about perception from the Waterfall Illusion.

The problem is: what is the content of such a visual experience? Note that the problem concerns the *content* of the experience, not the *attitude*. We are familiar (from discussions of phenomena such as the Muller-Lyer Illusion) with the fact that illusions can occur even when the victim of the illusion knows the truth about what he is seeing. And there is an extensive discussion of whether this fact can be accounted for by a theory which claims that perception is a sort of belief. (Armstrong 1969 argues that it can, Jackson 1977 and Fodor 1984 argue that it cannot.) I cannot enter this debate here, and I do not need to; for *whatever* the fate of the idea that perceptions are beliefs, there is still a problem about characterizing the *content* of an experience like the Waterfall Illusion. In fact, it seems to me to be implausible that the victim of the illusion, knowledgeable or not, would judge the stationary object to be moving — though he might judge that he is drunk (a similar effect can be had by playing the child's game of spinning oneself around and then trying to stay still). But this is not directly relevant to the present point; we are concerned in this paper with contents, not attitudes.

The crucial difference between the Muller-Lyer Illusion and the Waterfall Illusion is this. The Muller-Lyer Illusion presents a conflict between *two* intentional states: the state of believing that

the lines are the same length, and the state of the lines *looking to be* different lengths (I leave open the question as to whether this is a 'suppressed inclination to believe' as the belief theory of perception holds). The Waterfall Illusion, however, presents a contradiction in the *one* content of one attitude. The viewed object seems to be both moving and not moving at the same time. This is the natural way to describe how things seem; unlike the Muller-Lyer illusion, the content of the *experience itself* is contradictory.

Now if the content of this experience is indeed contradictory, then a significant problem arises for those who claim that the contents of experiences are individuated according to certain familiar principles. We may call these principles 'Fregean' because of their origin in Frege's theory of Sense and Reference. Frege introduced a criterion of difference for senses which distinguished senses as the *cognitive value* of expressions; for example, the criterion of difference for the senses of sentences may be expressed as follows:

- (I) for any thinker *A*, and any sentences *S* and *S'*, if *A* understands *S* and *S'* and accepts *S* as true while not accepting *S'*, then *S* and *S'* have different senses.

(I) allows subjects to take different attitudes to sentences with the same truth-conditions; the notion of sense is introduced to explain this possibility. So (I) is meant to individuate the senses of sentences (their *contents*) finely enough to rule out the unnecessary ascription of contradictory beliefs to rational subjects. *De re* considerations aside, we do not want to credit Ralph with the belief that Orcutt is and is not a spy. So (I) is invoked to explain why it is that Ralph does not have contradictory beliefs in this situation, and therefore how identity statements can be informative. The principle is thus meant to provide a test for the cognitive significance of senses; it does not tell us what this is, but it tells us when it is distinct.

Clearly, similar principles apply to the constituents of contents: the senses of singular terms and predicates. If we call the sense of a predicate a *concept* (departing, of course, from Frege's own use of that term) we can introduce a criterion of difference for concepts inspired by (I):

- (II) *F* and *G* are different concepts if it is possible for a subject to rationally judge, of an object *a*, that *a is F* and that *a is not-G*.

Like (I), this principle allows the possibility that a rational subject can apply incompatible concepts to the same object, by taking these concepts to differ in cognitive significance.

One writer who has urged that we individuate contents and their constituents in this way is Christopher Peacocke (see, e.g., Peacocke 1984, p. 365). Now Peacocke has also suggested that we use these principles in individuating the contents of perceptual

experience (see his 1983; but for an important reconsideration not related to the problem discussed in this paper see his 1986, pp. 9–11). In *Sense and Content* he claims that

it is a conceptual truth that no-one can have an experience with a given representational content unless he possesses the concepts from which that content is built up. (1983, p. 19)

If the concepts which build up the representational content of an experience are individuated along the lines of principle (II), then we arrive at a further principle:

- (III) *F* and *G* are different perceptual concepts if it is possible for a subject to have (at the same time) an experience with the content that *a is F* and an experience with the content *a is not-G*.

It follows from this that one cannot have an experience with contradictory representational content. This thought seems to have struck Edward Craig, who writes (in defence of his claim that experience ‘belongs to the category of judgement’) that one cannot see a Necker Cube looking one way, and then imagine it looking *at the same time* the other way (see Craig 1976, p. 13).

But, as we have seen, the Waterfall Illusion is precisely a case where a scene looks as if it is both one way and another (incompatible) way at the same time. Craig’s point is no doubt true of the Necker Cube (and indeed, of most normal perception). But the Waterfall Illusion is a vivid counterexample to a generalization of the point. For what it suggests is that a subject can be ascribed an experience with a contradictory content. But if principle (III) is central to the individuation of perceptual concepts (as it seems to be) then the Waterfall Illusion is, surprisingly, a counterexample to the thesis that concepts are involved in the content of perceptual experience. For the subject can see that the stone (for example) is moving and that it is not moving. But this contravenes (III), since we know that there is only one concept being exercised: ‘moving’.

It seems to me, then, that this illusion presents a problem for those views (such as Peacocke’s (1983) or Craig’s (1976)) which treat the content of perception as conceptual. The argument is not decisive — there are various ways in which one could resist it. One response would be to deny that the two contradictory halves of the content are *really* simultaneous (so that the situation is rather like a very rapid switching between the two ‘aspects’ of the Necker Cube). But this response seems, in the face of the phenomenology, unduly stipulative.

Another response would be to insist that the two halves of the content are not really contradictory, because the concepts involved in each half are distinct. But how plausible is this response? If the concepts in the two halves of the content are not

the same, it is hard to see precisely why the illusion presents this apparent contradiction. Indeed, it is difficult to say exactly what the two distinct concepts *are*; perhaps in the case of looking at a waterfall and then a stone, they might be 'intrinsically moving' (whatever this may mean) and 'not moving relative to other objects'. But in the case of looking at the stationary turntable, the concept 'not moving relative to other objects' cannot be the appropriate one, for the position of the spiral on the turntable relative to other objects is *irrelevant* to the production of the illusion. (The turntable itself could be moving through space, and the illusion would still occur.) The problem for the defender of concepts in perception is to say exactly which concepts are being exercised here, without denying that there is a conflict in how the perceived scene seems to be.

Finally, one might dispense with principles (II) and (III) and try to find some other constraint on the identity of concepts. This would surely be an excessively severe reaction. I suggest that we should leave the Fregean constraints where they belong — with the 'higher' cognitive faculties of judgement, belief and thought, those faculties which are governed by the 'constitutive ideal of rationality' (Davidson 1982, p. 223). Perhaps the fact that perceptual contradictions can occur (however rarely) in the minds of otherwise rational subjects suggests that perceptions are not subject to all of the principles which govern the operations of the higher faculties; perception is, perhaps, a 'sub-rational' process. And this may seem to be supported by Fodor's view that the operations of the perceptual system are 'informationally encapsulated'; that is, the informational content of perceptual states cannot be affected by the contents of states in 'central mind' (Fodor 1984, pp. 64–86). Of course, Fodor's theory of the 'modularity' of visual perception does not on its own explain how there can be perceptual contradictions. But it does suggest an explanation of why perception may not be a wholly rational process, and thus why it is peculiarly vulnerable to phenomena like the Waterfall Illusion.<sup>1</sup>

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## CRANE'S WATERFALL ILLUSION

By D. H. MELLOR

**T**. M. CRANE ('The Waterfall Illusion', ANALYSIS above, pp. 142-7) thinks his eponymous illusion teaches us something about perception. I agree, but not with what it's taught him, namely that perceptual experiences aren't 'composed of concepts' in the sense that beliefs are. Take the concept of motion (*F*) and the belief that something moves. No one who lacks that concept can have that belief, because the belief in some sense contains the concept. What the sense is, and whether concepts are conceptually prior to beliefs, are good questions, but ones I needn't go into. The question here is whether perceptual experiences also contain concepts in this sense, whatever it is. Crane thinks the Waterfall Illusion (WI) experience shows that they don't. I think it shows no such thing.

In the Waterfall Illusion an object *a* apparently looks both to move and not to move. I say we need the concept *F* to have that experience, just as we need it to believe that *a* is *F*. For how, unless it contained that concept, could 'the content of the *experience itself* [be] contradictory', as Crane says it is (p. 144)? What is the contradiction, is not *Fa* &  $\sim Fa$ ? Crane doesn't say. Nor does he say how, without containing the concept *F*, the WI experience can include believing that *a* looks to be both *F* and not-*F*, which it evidently does.

Why then does Crane deny that in the WI experience *a* is conceived both to be and not to be *F*? His denial is based on his criterion (II) of difference for concepts, inspired by his Fregean cri-