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A GRADABLE APPROACH TO DISPOSITIONS

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Previous theories of the relationship between dispositions and conditionals are unable to account for the fact that dispositions come in degrees. We propose a fix for this problem which has the added benefit of avoiding the familiar problems of finks and masks.

It has proven difficult to articulate exactly how dispositions are related to subjunctive conditionals. The natural starting-point is a simple conditional analysis, according to which an object *o* is disposed to give response *r* to stimulus *s* if and only if, were *o* to undergo stimulus *s*, it would give response *r*. A glass is disposed to break when dropped, for example, if and only if it would break if dropped. For the moment, at least, we follow David Lewis in assuming that implicit dispositional ascriptions – 'This glass is fragile' – can ultimately be understood in terms of explicit correlates – 'This glass is disposed to break when dropped'.[1]

This simple analysis is subject to familiar counter-examples involving finks and masks. A disposition is *finkish* if and only if it would disappear in the presence of the relevant stimulus. Example: a fragile glass is protected by a sorcerer who is prepared, should the glass fall, to cast a spell which will momentarily strengthen the physical structure of the glass, so that it will not break. The glass is disposed to break when dropped, but it will not break if dropped.[2] A disposition is *masked*, in contrast, when it would not disappear in the presence of the relevant stimulus, but where the characteristic manifestation would still be absent. Example: a fragile glass is protected by a sorcerer who is prepared, should the glass fall, to cast a spell which momentarily alters the physical structure of the floor so that the glass will not break.[3]

[1] See D. Lewis, 'Finkish Dispositions', *The Philosophical Quarterly*, 47 (1997), pp. 143–58, repr. in his *Papers in Metaphysics and Epistemology* (Cambridge UP, 1999), pp. 133–51, at p. 133.

[2] See C. Martin, 'Dispositions and Conditionals', *The Philosophical Quarterly*, 44 (1994), pp. 1–8.

[3] See E. Prior, *Dispositions* (Aberdeen UP, 1985), pp. 8–19, 45–9; M. Johnston, 'How to Speak of the Colors', *Philosophical Studies*, 68 (1992), pp. 221–63; A. Bird, 'Dispositions and Antidotes', *The Philosophical Quarterly*, 48 (1998), pp. 227–34, at p. 228. As far as we know, Smith's example of Z-rays (actually a reverse mask) is the first example of this type in the literature: see A.D. Smith, 'Dispositional Properties', *Mind*, 86 (1977), pp. 439–45, at p. 440.

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In response to these problems, complex amendments to the simple analysis have been proposed. Lewis, for example ('Finkish Dispositions', p. 149), offers the following 'unlovely mouthful':

> Something *x* is disposed at time *t* to give response *r* to stimulus *s* iff, for some intrinsic property *B* that *x* has at *t* and for some time *t´* after *t*, if *x* were to undergo stimulus *s* at time *t* and retain property *B* until time *t´*, *s* and *x*'s having of *B* would jointly be an *x*-complete cause of *x*'s giving response *r*.

(An *x*-complete cause of *y* includes all the intrinsic properties of *x* which are causally relevant to *y*'s occurrence.) We doubt that tinkering with the conditional analysis along these lines will ultimately avoid the standard objections. But our concern here is not with finks and masks. We wish instead to introduce an objection that threatens all extant versions of the conditional analysis, be they simple or complex. For there is a problem with the very structure of both versions of the conditional analysis: they both offer us a biconditional with a dispositional ascription on the left and a single conditional on the right, telling us how the relevant object would respond to the given stimulus.

The trouble with this structure is that it cannot accommodate *comparative* dispositional ascriptions. This glass may be simply fragile; but it may also be *more fragile* than that one. This vase can be simply disposed to break if dropped; but it may also be *more disposed to break when dropped* than that one. In contrast, *being such as to break if dropped* simply does not admit of degrees – nor does *being such as to break if dropped in C*, however one cares to fill in the circumstances. In short, dispositions come in degrees, but these counterfactual properties do not. A comparative dispositional ascription cannot therefore be understood in terms of a simple conditional statement.

Comparatives ('*x* is taller/fatter/richer than *y*') establish an ordering between two things regarding some common feature that can be enjoyed to a greater or lesser extent. These are 'gradable properties', and the predicates that express them are 'gradable predicates'. So, for example, 'is tall' is gradable; 'is dead' is not. Unsurprisingly, the standard semantic approach to gradable predicates makes reference to the degrees (or intervals) of a scale along which the objects are being compared.[4] This treatment explains how comparatives are semantically related to their non-comparative positive correlates, which are often context-dependent: that is, they express different

[4] See D. Bolinger, *Degree Words* (The Hague: Mouton, 1972); M.J. Cresswell, 'The Semantics of Degree', in B. Partee (ed.), *Montague Grammar* (New York: Academic Press, 1977), pp. 261–92; E. Sapir, 'Grading: a Study in Semantics', *Philosophy of Science*, 11 (1944), pp. 93–116; A. von Stechow, 'Comparing Semantic Theories of Comparison', *Journal of Semantics*, 3 (1984), pp. 1–77. For the use of intervals rather than degrees, see R. Schwarzschild and K. Wilkinson, 'Quantifiers in Comparatives: a Semantics of Degree Based on Intervals', *Natural Language Semantics*, 10 (2002), pp. 1–41.

properties relative to different contexts of utterance. While 'is taller than' compares objects along the scale of height, 'tall' allows context to settle the minimal point along that scale required to satisfy the predicate. This can be done either directly, or by reference to a comparison class, e.g., *x* is taller than most members of a salient comparison class.[5] And degree modifiers like 'very' can be understood as boosting the required degree of height.[6]

Many dispositional predicates behave in exactly this way. Not only do they have straightforward comparative uses, but the corresponding positives are often context-dependent. An ordinary plastic cylinder may truthfully be described as 'fragile' in the aeronautical testing facility, for example, but not in the kitchen. (The context-dependence of 'fragile' is, of course, consistent with the thesis that the predicate always expresses an intrinsic property. A predicate might express different properties in different contexts without there being any context in which the predicate distinguishes between intrinsic duplicates.) Finally, we need to make sense of what it is for something to be *very* fragile, or *particularly* disposed to break if dropped.

The conditional analyses that have been proposed cannot account for these data because they simply do not provide a scale corresponding to the set of degrees to which things can have a given disposition. Suppose *a* is more disposed to break if dropped than *b* is. This is consistent with each object's being such that it would break if dropped. The difference between them cannot be stated in terms of *being such as to break if dropped*, which does not come in degrees. And it makes no difference whether the conditional involved in the analysis has been scrupulously refined so as to avoid finks and masks.

The standard approach to dispositions thus faces a set of interrelated problems, concerning comparative uses, degree modifiers and context-sensitivity. In order to resolve these issues, we require a scale for each disposition, along which objects can be compared, and by reference to which the context-dependence of dispositional predicates can be explained. In particular, we need to know what it is that makes something *more disposed to break when dropped* than another thing. As a first pass, we could try looking to the *probability* that the object would break if dropped, where probability is understood in terms of objective physical chance, rather than subjective degree of belief. We might, for example, say that *x* is more disposed to

[5] For more on invoking comparison classes to understand gradable predicates, see E. Klein, 'A Semantics for Positive and Comparative Adjectives', *Linguistics and Philosophy*, 4 (1980), pp. 1–45; R. Larson, 'Scope and Comparatives', *Linguistics and Philosophy*, 11 (1988), pp. 1–26; P. Ludlow, 'Implicit Comparison Classes', *Linguistics and Philosophy*, 12 (1989), pp. 519–33.

[6] The details are more complicated, but scales do seem to be required. See C. Kennedy and L. McNally, 'From Event Structure to Scale Structure', in T. Matthews and D. Strolovitch (eds), *Proceedings of SALT IX* (Ithaca: CLC Publications, 1999), pp. 163–80.

break if dropped than *y* if and only if P(*x* is broken/*x* is dropped) > P(*y* is broken/*y* is dropped). (Here 'is dropped' can stand in for whatever hedged or precisified stimulus conditions a proponent of the conditional analysis might want to employ.) The different conditional probabilities between 0 and 1 would correspond to the degrees of the disposition to break if dropped. And we could say that something is disposed to break if dropped *simpliciter* if and only if it has this disposition to some contextually determined degree.

There are two serious problems with the probabilistic approach. First, unless the stimulus conditions are highly specific, an object in one set of circumstances will often count as having the disposition to a greater degree than an intrinsic duplicate in another set of circumstances. Duplicate glasses held at different heights, for example, will differ with respect to the conditional probability of breaking if dropped. And it is widely assumed that at least some dispositions, like fragility, are intrinsic.[7] This problem might be avoided if we can think of the context of a dispositional ascription as specifying stimulus conditions so precise that any two intrinsic duplicates dropped in those settings will be equally likely to break. But the probabilistic proposal also faces another problem: it yields the wrong result in a deterministic setting. Degrees of fragility in a determined world do not reflect the probability that an object would break if dropped, or even the probability that it would break in some precise 'litmus test' scenario. In each case the degree of probability will be one or zero.[8] Instead, the degree of fragility has to do with how *many* of the possible stimulus scenarios are such that the chance of the object's breaking is 1. *This* is an axis along which there are many degrees, even if the objective chance of every event is, as a matter of fact, 1 or 0.

The upshot is that we need to take into account the many different possible settings that are relevant to being disposed to break if dropped, e.g., the many different heights from which an object can be dropped. Considering

[7] Even McKitrick, who criticizes the standard assumption that *all* dispositions are intrinsic, is open to the intrinsicness of fragility: see J. McKitrick, 'A Case for Extrinsic Dispositions', *Australasian Journal of Philosophy*, 81 (2003), pp. 155–74, at p. 170. We think the consensus is right when it comes to fragility and many other dispositions.

[8] Here we are assuming that objective chances concern single cases. There may, however, be a notion of the objective conditional probability of a glass's breaking if dropped according to which the following three things are consistent: (i) the laws are deterministic; (ii) as a matter of fact the glass will be dropped once and will break; (iii) the objective conditional probability of the glass's breaking if dropped is less than 1. Such a notion of conditional probability might naturally be spelt out in terms of the frequency of breaking worlds among all nomically possible dropping worlds. We do not wish to rule out this notion of objective probability; indeed, this sort of approach would bear more than a little resemblance to our own proposal. It also shares with our proposal the burden of making sense of proportions in a domain with uncountably many elements – more on this in a moment.

only heights, we might say that *x* is more disposed than *y* to break if dropped if and only if there are *more* heights at which *x* would break if dropped than heights at which *y* would break if dropped. The greater a thing's disposition to break when dropped, the greater the range of heights at which it would break if dropped. Of course, the issue is complicated by the presence of all sorts of variables which matter, *viz* the hardness of the surface which the thing is dropped onto, the density of the medium through which it is dropped, etc.

Since our final account will have to integrate all of these elements, we introduce the term 'stimulus-case' (or '*s*-case') for every precise combination of values for heights, levels of hardness, densities, etc. More generally, with respect to any disposition, an *s*-case is a fully specific scenario that settles everything causally relevant to the manifestation of the disposition. *S*-cases are to be understood not as worlds, but roughly as *centred* worlds, with the relevant object at the centre being subjected to some specific stimulus conditions. A world with two objects being struck thus contains two striking-cases. (One respect in which *s*-cases might differ even from centred worlds is that they need not be construed as so fine-grained that they specify distant facts not causally relevant to the manifestation conditions.)

We are now in a position to offer the following biconditional:

MORE. *x* is more disposed than *y* to give response *r* to stimulus *s* iff there are more *s*-cases in which *x* would give *r* than *s*-cases in which *y* would give *r*.

Four brief remarks about (MORE): (1) We have to ignore difficult questions about how to make sense of talk of 'more' heights or *s*-cases, given that we are quantifying over non-denumerably many elements. For now, we submit that a successful analysis of dispositions in terms of conditionals will inherit whatever difficulties a successful interpretation of 'more' in such a context would lead to. A measure over the space of heights would be required to justify the assumption that, for example, the heights between 1 and 2 metres make up less than half of all the heights between 1 and 100 metres. Whether there will be a 'natural' measure for hardnesses of surface, etc., is beyond the scope of this paper. A picture like the one presented here may be at work in the conceptual framework behind ordinary dispositional ascriptions, even if it turns out that at bottom, physics is unfriendly to such judgements of proportion.

(2) Unless context restricts the *s*-cases that are relevant, the current proposal might have to appeal to an *ordering* of *s*-cases in terms of significance. For if *x* will break in a few more *close* scenarios than *y*, we might want to count it as more disposed to break, even though (for whatever reason) *y* breaks in many more *distant* scenarios than does *x*.

(3) For some dispositions, the degree to which an object *manifests* a characteristic response may be relevant to the degree to which it has the corresponding disposition. For instance, if two things would break in exactly the same circumstances, but one object would become *more broken* than the other, then arguably it should count as more fragile. Although this difference among objects is clearly no substitute for the different proportions of *s*-cases in which the objects would break, a true account of the scale of fragility might have to take these facts into consideration.

(4) If the world is indeterministic, a standard approach to counterfactuals has the result that, with respect to some fully specific stimulus cases, it will not be true to say that *x would* give response *r*, only that *x would probably* give response *r*.[9] In that case, we could rewrite the second half of (MORE) so as to say 'there are more *s*-cases in which *x would probably* give *r* than in which *y would probably* give *r*'. In fact, if the world is indeterministic, the account should reflect the precise objective chances for each *s*-case. Two objects may be such that they would each probably break in a particular *s*-case, but if one has a *much greater* chance of breaking in that case, this revision of (MORE) does not give it due credit. (That is, except in so far as its differences with the second object are reflected in differences as to whether or not they would probably break in other *s*-cases). A suitably revised version of (MORE) would involve an aggregate value for the many objective chances that *x* would break.

While we may want to refine the details of (MORE), it does establish a scale. Roughly, the degree to which an object possesses the property *being disposed to give r if s* corresponds to the proportion of *s*-cases in which the object would give *r*. We can then follow the standard approach to gradable positives by allowing context to settle to what degree something must possess the property in order to count as disposed *simpliciter* to give *r* if *s*. If this is right, the standards for fragility can vary across contexts without any variance in the set of stimulus conditions that are associated with fragility. So for something to satisfy the predicate 'fragile' as uttered by a waiter (as contrasted with 'fragile' as uttered by an aeronautical engineer), it must be such as to break in a much larger proportion of the very same set of *s*-cases. After all, there are contexts where we say, in one breath, '*x* is more fragile than *y*, but still not fragile'.[10] It would be implausible for the comparative to bring into play a set of *s*-cases different from those invoked by the positive.

[9] See J. Hawthorne, 'Chance and Counterfactuals', *Philosophy and Phenomenological Research*, 70 (2005), pp. 396–405.

[10] Hence 'fragile' is not an absolute predicate, and does not give rise to special semantic puzzles associated with these. See P. Unger, *Ignorance* (Oxford: Clarendon Press, 1975), and *Philosophical Relativity* (Minnesota UP, 1984); D. Lewis, 'Scorekeeping in a Language Game', *Journal of Philosophical Logic*, 8 (1979), pp. 339–59.

Alternatively, we would count *x* as fragile if and only if *x* is fragile relative to some contextually specified class of individuals (i.e., if and only if it is more fragile than most members of that class, or more fragile than the average member). Here it is the comparison class that shifts from context to context. Our purpose here is not to adjudicate between semantic accounts of gradable positives that invoke only degrees (or intervals) and those that invoke comparison classes. The crucial point is that on this account, the positive predicate 'is fragile' is understood *in terms of* the comparative 'is more fragile than', so it is only by invoking something like (MORE) that we can make sense of what it is to be fragile relative to a comparison class.

We conclude that an analysis of dispositions along the lines of (MORE) provides a unified account of comparative uses, degree modifiers and context-sensitivity. As an added bonus, the current approach offers a tidy resolution to old problems as well. It should be clear that on the proposed account, whether or not an object *o* happens to be in a masking or finkish scenario will be irrelevant to its counting as fragile in a context. As long as *o* is fragile to the contextually specified degree (that is, a suitable proportion of *s*-cases are such that *o* would break in them), it makes no difference if the object *o* happens to be in a dropping-case in which it will not break. Indeed, the relevant *s*-cases can *include* masking and finkish cases; these need not in any sense be ignored or ruled out as irrelevant by context. This is important, since many 'masking' cases are relevant to the manifestation of the disposition: some objects may have their fragility masked by being held over a feather bed, but if an object would break if dropped over a feather bed, this is certainly relevant to its degree of fragility.[11] We cannot simply allow these masking cases to be ignored in a context. Luckily, the present account allows for an object that is obviously in a relevant masking *s*-case to count as having the disposition none the less.

One final point: it is far from clear that every disposition is associated with a special class of stimulus conditions. For example, what are the stimulus conditions for the disposition of organisms to grow old? Even when we conceptually associate some dispositional predicate with stimulus conditions, these may just be the usual sorts of circumstances in which the disposition gets manifested, as opposed to the *only* circumstances in which giving a response would count as a manifestation of that disposition. Irascibility, for example, we ordinarily associate with becoming angry when provoked. But if people become angry when complimented, or for no

[11] Appeal to context dependence for dispositional terms cannot solve the problems of finks and masks if context dependence operates by ruling out situations which are not salient. On this, see J. Hawthorne and D. Manley, review of Mumford's *Dispositions*, *Noûs*, 39 (2005), pp. 179–95, at pp. 181–3.

reason whatsoever, this is surely relevant to their irascibility. In short, we know what a manifestation of irascibility looks like – anger. But there are no particular stimulus conditions for it, because anger in any situation can count as a manifestation of irascibility. This consideration may lead us to reconsider the idea that even fragility must have associated with it some special class of stimulus conditions. Perhaps it is simply the disposition to break, not the disposition to break if dropped or stressed, or what have you. If an object were to break when illuminated, or under certain temperatures, or for no reason at all, we would count this as relevant to its fragility. At any rate, this certainly seems right for the simple disposition *being disposed to break*.

With dispositions like these, there can be no biconditional of the standard form. If we take the stimulus condition out of the simple biconditional, we cannot construct a counterfactual on the right-hand side. Obviously we cannot say 'An object is disposed to give response *r* if and only if, if it were in any situation at all, it would *r*'. On a standard semantics for counterfactuals, this would require the object actually to *r*. In short, dispositions without stimulus conditions provide yet another argument for the inadequacy of the standard approach. But using (MORE), we can easily allow that sometimes there are no restrictions on what counts as a stimulus case: *x* is more irascible than *y* if and only if there are more situations – situations of any sort – in which *x* would get angry. And *x* is irascible *simpliciter* if and only if a suitable proportion of situations are such that *x* would get angry in them (or if and only if *x* is more irascible than average within a salient comparison class).

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