RESEARCH

The square of disposition

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I propose a classification of dispositions according to two parameters: (i) whether their argument is a causer, and (ii) whether they are (almost) always realized or only sometimes realized. This results in a four way distinction, which I represent as the Square of Disposition. Each cell of this square corresponds to a different type of disposition; I show that each such type is expressed by a distinct linguistic expression. This correspondence between philosophy-based and linguistics-based distinctions shows the potential usefulness of linguistic considerations in philosophical debates.

1 Introduction and overview

Not all dispositions are the same. Many classifications of dispositions have been proposed, based on a variety of dimensions. In this paper I focus on two dimensions:

1. Whether the bearer of the disposition is an agent/causer or not
2. The modal force of the disposition: (quasi) universal or existential.[1]

Using two dimensions naturally creates a four-way distinction: universal dispositions whose bearer is an agent/causer, existential dispositions whose bearer is an agent/causer, universal dispositions whose bearer is not an agent/causer, and existential dispositions whose bearer is not an agent/causer. I will call this classification *The Square of Disposition*.

In this paper, I argue that the Square is expressed linguistically. Specifically, each of the four classes of disposition represented in the Square corresponds to a linguistic construction.

I should clarify that the goal of the paper is different from standard linguistic papers in that it does not contribute a new empirical discovery but rather aims to provide a conceptual groundwork and a novel perspective on previously unrelated work.

2 The nature of dispositions
2.1 Dispositions and modality

My starting point is the rather standard assumption that dispositions are modal. In fact, this view is so common that it is hard to find an explicit statement of it, and in most sources it is simply presupposed. For example, Vetter (2014: 129) writes: "In the contemporary

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[1] This is orthogonal to the question of whether dispositions are best expressed as conditionals or not, since the universal/existential distinction can also hold for conditionals: "If *p*, then always/sometimes *q*." Conceivably, there might be dispositions whose modal force is between existential and universal, but the possibility of such dispositions is rarely discussed by philosophers, and I will not deal with it in this paper.

literature on the subject, it is almost unanimously assumed that the modal nature of dispositions is best captured by some kind of conditional." Note that what is explicitly claimed to be almost unanimously assumed is not the modal nature of dispositions, but a particular analysis of it, in terms of conditionals. The modal nature is presupposed, i.e. it is presumably accepted even by those individuals (such as Vetter herself) who dispute the conditional analysis.

It therefore follows that dispositions can only be expressed linguistically by modal expressions. The full implications of this assumption, however, are not always appreciated. All modal expressions are intensional, of course, but not all intensional expressions are modal. In other words, modality is a stronger notion that intensionality.

Intensionality, it is important to note, does not come in one form only. In particular, a construction may exhibit intensionality with respect to the time index, but not with respect to possible worlds, or vice versa. For example, Landman (1989: 726–727), in his discussion of groups, draws the following distinction (original emphasis):

> The intensionality that I am concerned with here concerns… the fact that committees **at the same moment of time** can have the same members, without being the same committee. Another form of intensionality concerns the well known observation that committees need not have any members at every moment of time of their existence, and that in the course of time, they may change their members, while staying the same committee. I do not think that this kind of intensionality has the same source as the 'atemporal' intensionality that is the topic of this paper.

It is this precisely this 'atemporal' form of intensionality that I have in mind when I talk about modality. Modal expressions are parametric on possible worlds: they are sensitive not only to what happens in the actual world, but to what happens in other worlds.

For example, the expressions *The President of the US* and *Donald Trump* have the same extension. However, they have different intensions, since in different possible worlds the US might have a different president. Modal expressions are sensitive to this distinction: when we substitute one of these expressions for another in a modal statement, the corresponding truth values might differ. For example, while the American Constitution makes (1a) true, (1b) is false; and while (2a) is true, (2b) is false.

(1)   a.   The American President was necessarily born in the US.
      b.   Donald Trump was necessarily born in the US.

(2)   a.   The American President may be a woman.
      b.   Donald Trump may be a woman.

Of course, modality is only a necessary condition for being a disposition, and arguably a weak one at that. Therefore, demonstrating that a construction is modal cannot be used as proof that it expresses a disposition, only that it is a legitimate candidate, and this is all I will claim for the constructions discussed in this paper. And yet, the criterion of modality is not as weak as it might seem, and is, in fact, very useful: it rules out a number of constructions that "feel" dispositional, and that have, in fact, been proposed as expressions of dispositions. For example, generics and habituals are often considered to express dispositions; as I show below, they are not, despite appearances, modal, hence cannot express dispositions.

2.2 A note on habituals

Habituals are often thought to express dispositions. For example, Fara (2005) proposes that *N* is disposed to *M* when *C* iff the habitual sentence "*N M*s when *C*" is true.[2] Indeed, habituals have a dispositional "feel", but in order to be able to express a disposition, they need to be modal. Fara seems to be aware this. While he does not provide a complete semantics of habituals, it is clear that he thinks of them as modal constructions: "a habitual is true just in case every exception to it is a permissible exception, provided we count not just actual exceptions but some merely possible ones as well" (Fara 2005: 67).

But are habituals modal? The answer, unfortunately, is no. To be more precise: although habituals are intensional, they are parametric on time, not worlds. That is to say, they are only sensitive to stable properties (properties that hold throughout time) but not essential properties (properties that hold across worlds).

First, let us see that habituals are parametric on time. Let us consider Sally, whose birthday is December 25th. It is a historical fact that Israeli Prime Minister Menahem Begin and Egyptian President Anwar el-Sadat met on December 25th, 1977. But there were other meetings between Israeli and Egyptian leaders, at other times, before and after that date. Now, if someone were to utter (3a) on 25.12.1977, (3b) would clearly not follow.

(3) a. Sally drinks on her birthday.
     b. Sally drinks when Israeli and Egyptian leaders meet.

However, habituals are not parametric on possible worlds: when a habitual is evaluated, no world other than the actual world is considered, not even, as is often suggested, worlds that preserve essential properties of the actual world. To see this, note that (unless one believes in astrology) Sally's birthday is not an essential property of Sally: she could have been born on any other day, and still be the same person. Since Sally's birthday is not an essential property of Sally, there are possible worlds that preserve essential properties of the actual world, in which Sally's birthday is not on Christmas. But such worlds are *not* considered when a habitual is evaluated: (4b) *does* follow from (4a).

(4) a. Sally drinks on her birthday.
     b. Sally drinks on Christmas.

For another example, consider (5).

(5) Sally smokes.

The truth of (5) depends only on what happens in the actual world. This is the case even if we take the view that Sally's attitude (positive or negative) towards cigarettes is one of her essential properties.

Suppose that Sally is really fond of cigarettes. There are, of course, any number of possible worlds where Sally engages in smoking. There are even many such worlds that preserve essential properties of the actual world. And yet, if, in the actual world, Sally is confined to a smoke-free prison, then (5) is false, regardless of what happens in these other worlds. Conversely, suppose that Sally is really averse to smoking; so there are many worlds, including worlds that preserves essential properties of the actual world where she never touches a cigarette. But suppose that, in the actual world, she is constantly harassed

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[2] See also Boneh & Doron (2010).

by a militant smoker who forces her to smoke at gunpoint, and, consequently, she smokes several cigarettes every day. Sentence (5) would then be true.[3]

Since modality is necessary condition for the expression of dispositions, and habituals fail this condition, they cannot be candidates for the expression of dispositions.

2.3 Active and passive dispositions

As we consider the nature of dispositions, it behooves us to begin at the beginning. And, just like many other philosophical investigations, the study of dispositions begins with Aristotle.[4]

Aristotle has established what is perhaps the most interesting property of dispositions: that they do not have to be realized. To take the classic example, if a piece of glass is fragile, it means that it is disposed to break if struck. But if it isn't struck, it probably won't break; and yet, even if it is never struck and never breaks, it is still fragile.[5]

Since Aristotle allows for unrealized disposition, he is faced with the task of explaining when a disposition *is* realized. His answer is that this happens when the right conditions obtain. Specifically: "When the agent and the patient meet in the way appropriate to the disposition in question, the one must act and the other be acted on" (Metaphysics IX 5).

Aristotle's statement is usually interpreted to imply two types of disposition, *active* and *passive*. And then, dispositions are realized when the bearer of the active disposition and the bearer of the complementary passive disposition meet in an "appropriate" way.

For example, glass has a passive disposition to break if struck, and a hammer has an active disposition to break the glass if it strikes it. If the two meet in an appropriate way— the hammer strikes the glass—the glass breaks.

A universal disposition is usually thought to be subject to a *ceteris paribus* clause. As Kripke (1982: 27) notes, "*ceteris paribus* notions of dispositions, not crude and literal notions, are the ones standardly used in philosophy and in science." For example, Martin (1994) considers the following scenario. We normally would agree that a live wire is disposed to conduct electricity if touched by a conductor. But now suppose we connect the wire to a special device that senses when the wire is touched by a conductor, and then instantaneously makes the wire dead. So, although the wire is, indeed, disposed to conduct electricity when touched by a conductor, in fact it won't.

Lest one might think that Martin's example is a special and bizarre case, consider the much more everyday situation described by Johnston (1992). Suppose a fragile glass cup is protected by packing material. Then it is still fragile, i.e. disposed to break if struck, yet will not break because of the packing.

It is therefore better to discuss quasi-universal, rather than universal dispositions.

2.4 Capabilities and passivilities

Can we have a type of disposition that doesn't have to be realized, even if the conditions for it obtain? Thomas Reid (1788) argues that the answer is yes, and calls such dispositions *powers*.[6]

For Reid, an agent has the power to perform an action only if the agent has the power to *choose* to perform the action. It follows that the agent who has the power to perform

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[3] The judgments might be different for the deceptively similar (i), as discussed in section 7 below.

  (i) Sally is a smoker.

[4] See Jansen (2009) for a thorough discussion of Aristotle's theory.

[5] It is well known that there are exceptions to this property of dispositions—they will be discussed in section 5.

[6] Sometimes a distinction is drawn between active and passive powers, but for Reid all powers are active: "passive power is no power at all… a contradiction in terms" (Reid 1788: 21).

an action also has the power not to perform the action. Hence, a power doesn't *have* to be realized, but rather *can* be realized.

There is another conclusion that follows from Reid's conception: the agent that has a power must be sentient, with a will and an understanding. Reid's argument is as follows. An agent has a power only if she has the power to exert it; an agent has the power to exert only if she has a will; an agent has a will only if she has an understanding; therefore, an agent has a power only if she has a will and an understanding.

However, it could be argued that Reid's powers are both too narrow and too broad.

Powers are too narrow because they must involve a sentient agent. However, is it not clear that all dispositions that don't have to be realized must satisfy this restriction. Indeed, Cartwright (1994) discusses such dispositions, which she calls *capacities*.

For example, aspirin has the capacity to relieve headaches, but this capacity is not always realized. Cartwright (1994: 3) writes:

> "Aspirins relieve headaches." This does not say that aspirins always relieve head-aches, or always do so if the rest of the world is arranged in a particularly felici-tous way, or that they relieve headaches most of the time, or more often than not. Rather it says that… on occasion some of them do.

Since dispositions are modal, it follows from Cartwright's characterization that capacities express possibility rather than necessity: their modal force is existential, not universal.

Clearly, an aspirin is not a sentient agent, so capacities do not require a sentient agent. However, we can note that, nonetheless, the aspirin's role is not passive—we can say that it has the role of a *causer*.[7] We can therefore conclude that capacities are active dispositions.

Powers are also too broad, in the sense that they do not specify the role of the agent. Often, a subtype of power is singled out—the powers that relate an agent to an *action*. Such powers are usually called *abilities* (Maier 2014).

We can combine both the extension of powers to capacities and their restriction to abili-ties, namely identify the subtype of capacity that relates a causer to an action. Let us call such dispositions *capabilities*. Capabilities, then, are active dispositions that relate a causer to an action and have an existential modal force.

Are there also *passive* dispositions with an existential modal force? It would mean that *x* has a disposition to sometimes have a certain property if something acts on *x* in the appropriate way.

Such dispositions do, indeed, seem to exist. For example, to say that someone is irritable means they have the disposition to get angry when provoked, but it doesn't mean they *always* have to get angry if provoked. Let us coin a new term for such dispositions: *passivilities*.

2.5 The Square of Disposition

According to the distinctions drawn above, dispositions vary along two dimensions:

1. Whether their argument is a causer;
2. Whether they are always (universal) realized or only sometimes (existential).

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[7] See Copley (2018) for more on the distinction between agents and causers.

We can represent this classification in a table, which I call *The Square of Disposition*:

	+ **causer**	–**causer**
existential	capability	passivility
universal	active disposition	passive disposition

3 Natural language metaphysics

The distinctions plotted on the Square of Disposition are notoriously elusive to define precisely. It proved very hard to come up with clear, widely accepted criteria for being active, for example.

In this paper I want to suggest an alternative. While metaphysical distinctions such as active/passive are hard to make, in linguistics the corresponding distinctions are often much clearer, with useful tests. If we could map the metaphysical Square of Disposition onto a corresponding *linguistic* Square, we would get much clearer criteria. Of course, linguistic judgments are not always clear and uncontroversial, but often they are; and even when they are not, the judgments can, on many occasions, be corroborated using experimental methods or corpus studies.

This paper is concerned with the construction of such a linguistic Square; I will argue that each of the types of disposition in the Square corresponds to a specific linguistic construction.

But first, a natural question arises. Even if the project of this paper is successful, what is the significance of this fact? How could a linguistic distinction be relevant to a metaphysical one?

This very question is addressed by Bach (1986: 573). He writes: "Metaphysics… deals with questions like:… What kinds of things are there and how are they related?" But then he notes that "anyone who deals with the semantics of natural language is driven to ask questions that mimic those just given:… What kinds of things and relations among them does one need in order to exhibit the structure of meanings that natural languages seem to have?"

Of course, the metaphysical and linguistic questions, although parallel, are not the same. But is an answer to the linguistic question relevant to the metaphysical question? Bach (1986: 593) asks: "Do the fundamental distinctions that are reflected in the overt and covert categories of natural language correspond in any way to the structure of the world?" and he answers in the affirmative, for the following reason: "One of our main resources for coming to understand the world is, after all, language, a sort of tool box for doing whatever it is we want to do."

In other words, while the distinctions drawn by natural language may not reflect the way things really are, they do correspond to some extent (though perhaps not perfectly) to our perception of them. And to that extent, the investigation of linguistic distinctions between different constructions is relevant for the investigation of the dispositions expressed by these constructions. In the rest of this paper we will attempt to discover this mapping between dispositions—as expressed by the Square—and linguistic constructions.

4 Passivilities and *-able*

Let us begin with the newly coined term of passivilities: passive dispositions with an existential modal force.

A natural candidate for the linguistic expression of passivilities is the class of adjectives with the suffix *-able* or *-ible* in English: *irritable, conceivable, washable, accessible*, etc.

Clearly, the argument of these adjectives is not a causer, let alone an agent, hence they are appropriate as expressions of passive, rather than active, dispositions.[8]

What about their modal force? First, we must demonstrate that *-able* adjectives are modal to begin with. Consider the following example. Let us suppose there are many databases on some computer server. Some are *accessible*, but others are protected by a password; some are *searchable*, whereas others lack a search engine. Let us further suppose that, in point of fact, ever since the server had been placed online, every database that was accessed, was also searched, and vice versa. So, in this scenario, the property of being accessed and the property of being searched have the same extension. However, it still doesn't follow that a database is accessible iff it is searchable. There might be a database that is accessible, although it has never, in fact, been accessed; but if it *had* been accessed, the user would have found that it is not searchable. Hence, although the properties of being accessed and being searched have the same extension, the properties of being accessible and being searchable do not. Hence, *-able* adjectives are modal, and are therefore appropriate as expressions of dispositions.

The modal force of *-able* adjectives is usually existential; they can, but do not have to, be realized: if something is accessible, it means that it *can* be accessed; if something is searchable, it means that it *can* be searched; if something is conceivable, it means that it *can* be conceived, etc. Indeed, regarding the corresponding suffixes in German, Kratzer (1981: 40) points out: "In general, the suffixes *-lich* and *-bar* express possibility."

It has long been known, however, that there are exceptions to this generalization. Kratzer herself notes a clear exception—*payable*:

(6)   The rent amounts to twenty guilders, payable on the first of January.

Kratzer notes: "Here, it is not that the twenty guilders *can* be paid, they definitely *have to* be paid on the first of January" (original emphasis). So, in this case it appears that *-able* can mean (deontic) necessity rather than possibility.

Other exceptions to the generalization that *-able* indicates possibility are not hard to find. If something is edible, it does not mean simply that it can be eaten; rather it means that it can be eaten *safely*; and if something is chewable, it does not mean merely that it can be chewed, but indicates that it is tasty (Fortin 2013).

But are these really exceptions? Fortin (2013) argues that the answer is no. He proposes that the basic sense of *-able* is possibility; all the additional senses are cases of conversational implicature.

One piece of evidence for his proposal is cancelability—the strengthened sense can be canceled:

(7)   a.   Benefits are payable at age 55, but may be deferred at the member's discretion.
        b.   A: Is this edible?
               B: Yes. It'll put you in hospital, but you can eat it.
        c.   All vitamins are chewable, it's just that they taste shitty.

Sentenc (7a) means that benefits *may* be paid, not that they have to be paid; in (7b), B affirms only the possibility sense of *edible*; and (7c) clearly canceles the *tasty* sense of *chewable*, though not its existential modal force.

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[8] Of course, while the argument is not an agent/causer, the adjective itself may imply an agent; for example, if something is washable, whoever does the washing is certainly an agent. See Alexiadou (2018) for discussion.

Another argument involves *reinforceability*: implicature, but not entailment, can be reinforced without the sentence being odd. For example, (8a) is fine, whereas (8b) seems redundant and odd:

(8)   a.   Some, but not all of the students came to the lecture.
       b.   ?Some of the students came to the lecture, and/but not all of them stayed away.

Now, note that the strengthened meaning of *-able* is reinforceable wthout oddness:

(9)   a.   The invoice is payable no later than 30 days after receipt.
       b.   It is safely edible.
       c.   These tasty chewable tablets will make you feel better in no time.

Of course, conversational implicature must be *calculable*: it must be shown to follow from Grice's maxims. Fortin analyzes the implicature of *x is payable by date d* as follows. Its literal meaning is simply "*x* can be paid by date *d*." By scalar implicature, we can conclude that "*x* can't be paid by date $d+1$", "*x* can't be paid by date $d+2$", etc. We therefore get the strengthened meaning, namely "*x* must be paid by date *d*."

The literal meaning of *edible* is simply "can be eaten." But Fortin points out that almost anything can be eaten. Hence, saying of something that it can be eaten is really giving very little information. This is a flouting of Quantity; hence, the strengthened meaning is conversationally implicated. A similar explanation is proposed for *chewable*.

An alternative explanation is provided by Maier (2016). He agrees that the basic meaning of *-able* adjectives is existential, and that their meaning is often strengthened, but he argues that strengthening is semantic rather than pragmatic. Specifically, it has to do with the ordering source according to which the expression is evaluated, which restricts the existential quantifier. Thus, for example, to say of something that it is edible means that there exist worlds where it is eaten, but these worlds have to be "normal", in the sense that they are closest to the ideal: "Thus moldy bread, though there may be an accessible world where it is eaten, may not be not edible, for the worlds at which it is eaten depart from an ideal according to which all eatings are good in the sense of being, for example, tasty and nutritious" (Maier 2016: 450).

Both approaches can be formalized, but I choose Maier's approach, where the strengthened meaning is part of the logical form.[9] If *g* is the relevant ordering source, we can say that *x* is edible iff:

(10) $\exists w \forall w'(w' \leq_g w \rightarrow$ **be-eaten**$(x, w'))$[10]

We can conclude, then, that *-able* adjectives are modal, their argument is not a causer, and they have an existential modal force. They are, therefore, the linguistic expressions that express passivilities.

5 Capabilities and dynamic *can*

Recall that capabilities are active dispositions with an existential modal force. I propose that they are expressed by dynamic modals of ability, such as the dynamic *can*:

(11)   John can lift heavy weights.

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[9] Majer's actual formulation is a bit different, but this difference needs not concern us here.
[10] Note that this logical form expresses possibility, i.e. an existential modal force. The universal quantifier is inside the scope of the existential, and serves merely to restrict the existential quantification to normal worlds.

Note first that dynamic *can* is modal. Suppose everybody who climbed the Everest learned Klingon in two months, and everybody who learned Klingon in two months climbed the Everest. So the properties of climbing the Everest and learning Klingon in two months have the same extension. Yet, clearly, they have different intensions: in different worlds, the set of individuals who climbed the Everest is not equal to the set of individuals who learned Klingon in two weeks. Indeed, dynamic *can* is sensitive to this difference in intensions: (12a) need not have the truth value as (12b).

(12)   a.   Sharon can climb the Everest.
           b.   Sharon can learn Klingon in two months.

Having satisfied ourselves that dynamic *can* is a modal, let us consider whether it behaves as a disposition. Recall that we have said that dispositions do not have to be manifested; indeed, dynamic *can* seems to fit the bill:

(13)   Our grad students are so tough, they can even eat cardboard, though thankfully it's never come to that (Copley 2005).

However, let us not be too hasty. Sometimes, dynamic *can* does require the occurrence of actual events, as the oddness of (14) indicates.

(14)   #Terence can be really obnoxious, but he has never been obnoxious.

Is this a counterexample to the proposal that dynamic *can* expresses dispositions?

The answer is no. It has, in fact, been argued that some dispositions do require manifestation of actual instances demonstrating them:

> Fragility does not require manifestation… bravery is unlikely to be a disposition one possesses but never shows; thoughtfulness and intelligence look impossible; gracefulness and humorousness are impossible (Wright 1990–1991: 49)

In fact, dynamic *can* and its synonyms can even have an actual reading, describing a specific manifestation:

(15)   Brown was able to hit three bull's-eyes in a row.

Thalberg (1972: 121) evaluates (15) in the following situation: "Before he hit the three bull's-eyes, he fired 600 rounds, without coming close to the bull's-eye; and his subsequent tries were equally wild… Therefore he does not have this sort of ability at target shooting." He concludes: "'Was able' sometimes means 'had the ability' and sometimes means 'did'."[11]

However, it should be pointed out that *was able to* in (15) doesn't mean merely 'did'; the sentence implies that hitting three bull's-eyes in a row is remarkable, difficult, or otherwise unexpected. From this we can conclude that even actual readings of ability modals have a modal flavor: (15) says that the actual world, where Brown hit three bull's-eyes in a row, deviates from what one would expect.

Indeed, such readings pass the test for modality. Suppose everybody who climbed the Everest wore purple socks and a yellow hat, and everybody who wore purple socks and a yellow hat climbed the Everest. So the properties of wearing purple socks and a yellow

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[11] See Bhatt (1999) and subsequent work for more on the factors affecting such actuality entailments.

hat and having climbed the Everest have the same extension, though of course different intensions. Now, suppose (16a) is true. This does not make (16b) true, since although climbing the Everest is quite a remarkable accomplishment, wearing purple socks and a yellow hat is not.

(16)   a.   Joyce was able to climb the Everest.
        b.   Joyce was able to wear purple socks and a yellow hat.

An important property of dynamic *can* and its synonyms is that they are subject-oriented. Brennan (1993) proposes that dynamic *can* combines with the VP, resulting in a modal property predicated of the subject. For example:

(17)   Mary can swim.

Sentence (17) does not mean merely that it is possible that Mary will swim; rather, it says that the subject (Mary) has the property of being capable of swimming. One way to see this is to assume that Mary doesn't know how to swim. It is still possible that, purely by chance, she will perform the movements appropriate for swimming; yet (17) is nonetheless false. But if Mary does know how to swim, intends to swim, the conditions are suitable for swimming, and there is no hindrance, the truth of (17) implies that Mary will, in fact, swim.

   Let me briefly discuss two pieces of evidence presented by Brennan as part of her argument that these modals are subject-oriented. One is the *in virtue of* test. This expression can only attach to dynamic modals, as in (18a) but not, say, epistemic modals, as indicated by the unacceptability of (18b).

(18)   a.   Joan can sing arias in virtue of her natural ability.
        b.   *In virtue of being a graduate student, Joan may/must be intelligent.

Now, note that *in virtue of* is only fine when it describes properties of the subject, as in (18a), but not the object, as in (19).

(19)   ##In virtue of the rock being lightweight, Mary can lift it.

Note that the problem is not that *in virtue of* cannot describe a property of the object, because, in general, it can:

(20)   They denied him the prize in virtue of his reputation.

Hence, the *in virtue of* test indicates that dynamic *can* is, indeed, subject-oriented.
   The second piece of evidence produced by Brennan involves expletives. Brennan notes that, when a sentence contains an epistemic modal, the subject can be replaced by a semantically empty expletive:

(21)   a.   Some eggs may be in the refrigerator.
        b.   There may be some eggs in the refrigerator.

The same holds for deontic modals:

(22)   a.   Three lifeguards must be on duty.
        b.   There must be three lifeguards on duty.

However, this is impossible in the case of dynamic *can*:

(23)   a.   Only one demon can be in two places at the same time.
       b.   *There can be only one demon in two places at the same time.[12]

It must be admitted, however, that there appear to be counterexamples—sentences where it looks like *can* does not predicate a capability of the subject. For example (24a) predicates of the subject (John) the capability to lift that big stone; but no capability is predicated of the subject in (24b).

(24)   a.   John can lift that big stone.
       b.   That big stone can be lifted by John.

Why, then, is (24b) acceptable?

Tao (2011: 68) proposes: "While [(24a)] expresses John's ability [(24b)] asserts some objective possibility of John's lifting that stone." In other words, *can* is reinterpreted as a circumstantial modal.

The following examples probably makes the point more clearly:

(25)   a.   John can open this safe.
       b.   This safe can be opened by John.

Suppose John knows nothing about cracking safes; he merely tries codes at random. Of course, there is a possibility that he will guess the right code by chance. In this case, (25a) is false but (25b) is true. The explanation is that whereas the former ascribes to John the capability to open this safe, the latter merely expresses a circumstantial possibility that John will open the safe.

However, treating *can* as subject-oriented is not quite accurate; rather, it applies to the external argument. The external argument is usually the subject, but not always. Unaccusatives are a case in point: their subjects are not external arguments. And, indeed, capability *can* is incompatible with unaccusatives:

(26)   Terry can arrive late.

Sentence (26) can only receive a non-capability interpretation, perhaps a deontic reading ("Terry is permitted to arrive late").

It should be noted that the external argument is not merely a formal syntactic notion, but is associated with semantic notions of agentivity and causality (Marantz 1984). Therefore, dynamic *can* is a good candidate for representing capabilities: existential dispositions that require an agent/causer.

If *can* indicates capabilities, it cannot indicate dispositions that do not relate to actions. We would therefore expect it to be bad, in general, with stative verbs. Indeed, *can* appears to be bad with the stative *know,* compared with the non-stative *speak*:

(27)   a.   *Mary can know French.
       b.   Mary can speak French.

It should be noted that Maier (2014) argues that *can* can be used to indicate powers that are not abilities, i.e. that do not have to relate to actions. As an example, he presents (28), and argues that "the power to understand French will be a power, but not an ability."

(28)   Mary can understand French.

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[12] The sentence is, of course, fine if *can* is taken to indicate circumstantial modality rather than capability.

Sentence (28) is, indeed, perfectly acceptable; and *understand* is, indeed, normally a stative verb. However, this sentence does not constitute a counterexample, since *understand* can also be used non-statively—for example, it can be used in the progressive (Comrie 1976: 36):

(29)   I am understanding French more and more.

Sentence (28), then, is not a counterexample, but is just another case where *understand* is used non-statively.[13]

In formalizing dynamic *can*, Brennan makes the ordering source dependent on the properties of an individual, which she takes to be the subject, but we can take it more generally to be the external argument. Formally, putting aside irrelevant details, if $g(\mathbf{m})$ is the ordering source dependent on the properties of Mary (17) would be true iff

(30) $\exists w \forall w'(w' \leq_{g(\mathbf{m})} w \rightarrow \mathbf{swim}(\mathbf{m}, w'))$

6 Passive universal dispositions and middles

First, note that middles are modal. Suppose every book that was read easily was also translated easily, and vice versa. So the properties of being read easily and being translated easilty would have the same extension, though different intensions. Now, suppose a new book has just been published, and has not yet been read (or translated). Then (31a) would not entail (31b).

(31)   a.   This book reads easily.
        b.   This book translates easily.

Now note further that middles have a necessity flavor. Sentence (32) implies that, whenever this bread is cut, it is cut easily, not that it is sometimes cut easily, and sometimes with difficulty.[14]

(32)   This bread cuts easily.

Indeed, it has been suggested (Condoravdi 1989; Ackema & Schoorlemmer 1994; Lekakou 2005) that middles involve a (quasi) universal modal operator. Middles are therefore appropriate for the expression of universal dispositions.

As an aside, it should be noted that, although middles and *-able* adjectives are sometimes treated together (e.g., Gràcia 1992), this approach is dubious, given that the former are universal whereas the latter, as we have seen, are existential. Curiously, even studies that perform thorough comparisons between middles and *-able* adjectives ignore the issue of their respective quantificational forces. Indeed, in her thorough investigation of the issue, Oltra-Massuet (2014: 102) candidly admits: "Whether this modal operator must be understood as existentially quantifying over possible worlds or as universally quantifying over situations in *-ble* remains an open question and need not concern us here."[15]

Lekakou (2005) argues that middles do not ascribe a dispositional property to the external argument of the verb, but rather to the internal one. Furthermore, there are variants

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[13] Another example of a verb that can follow *can* and is ambiguous between stative and non-stative interpretations is *be* (Andrews 1992). I thank an anonymous reviewer for drawing my attention to this verb.

[14] Of course, (32) still allows for exceptional cases, e.g., when the bread is frozen solid.

[15] Incidentally, even she concludes: "*-ble* adjectives cannot possibly have been built on a middle verb as has been proposed in the literature, though they share the same kind of circumstantial modality (Kratzer 1981)—and may share part of their syntactic configuration" (Oltra-Massuet 2014: 12).

of middles where the property is ascribed to an adjunct, or even an expletive pronoun, as exemplified by the following Dutch examples (Ackema & Schoorlemmer 1994; 2006; I am indebted to an anonymous reviewer for drawing my attention to this phenomenon and providing me with these examples):

(33) a. Deze stoel zit makkelijk.
          this   chair sits easily
          'This chair is comfortable to sit in.'

      b. Het zit makkelijk op deze stoel.
          it   sits easily   on this   chair
          'This chair is comfortable to sit in.'

Hence, middles express passive rather than active universal dispositions.

   Just as a demonstration, glossing over important but irrelevant details, and assuming a rather simplistic representation of manner adverbs, we can represent middles as quantification over normal events. For example, we can say that (32) is true in world w iff:

(34) $\forall w'\exists w'(w' \leq_g w \wedge \forall w''(w'' \leq_g w \rightarrow \forall e((\mathbf{cutting}(e,\ w'')\wedge\mathbf{theme}\ (e,\ \mathbf{b},\ w'')) \rightarrow \mathbf{easy}(e,\ w''))))$

Putting this in words, this means that, in normal worlds, all events of cutting this bread are easy.

7 Active universal dispositions and *-er* nominals

-Er nominals are words like *smoker, jogger, liar*, etc. A necessary condition for them to express dispositions is that they be modal, and indeed they are. Specifically, I will show that they quantify over worlds that maintain essential properties of the actual world, i.e. normal worlds.

   To see this, it will be useful to go back to the examples from section 2.2 demonstrating that habituals are *not* modal, to show that *-er* nominals *are*.

   Let us go back to Sally, whose birthday is December 25th. Since Sally's birthday is not an essential property of Sally, there are possible worlds that preserve essential properties of the actual world, in which Sally's birthday is not on Christmas. We can see that these worlds are considered when an *-er* nominal is evaluated, i.e. they can affect truth conditions.

   For suppose Sally drinks on her birthday (and only then). Then (35a) would be true; however (35b) would not follow—Sally may not celebrate Christmas; she may not even be aware that her birthday falls on Christmas.

(35) a. Sally is a birthday drinker.
      b. Sally is a Christmas drinker.

For another example, consider (36a), and contrast it with the habitual (36b).

(36) a. Sally is a smoker.
      b. Sally smokes.

Suppose, as before, that Sally hates cigarettes, but she is constantly harassed by a militant smoker who forces her to smoke at gunpoint. Consequently, she smokes several cigarettes every day. In this situation (36a) is false, although (36b) is true.

   Now suppose Sally is very fond of cigarettes, but she is confined to a prison where no smoking is allowed, and never leaves it. So Sally doesn't actually smoke, and therefore (36b) is false, yet (36a) is true.

To give another example, suppose all animals except dogs suddenly died in the actual world. But they continue to live in other worlds, which can be as normal as you like. Then (37a) and (37b) would have the same truth value, since all the animals are dogs; however, (38a) can still be true without (38b) being true, since one can be certified to be a dog trainer without being certified to be an animal trainer.

(37)   a.   John trains dogs.
        b.   John trains animals.

(38)   a.   John is a dog trainer.
        b.   John is an animal trainer.

Since *-er* nominals are modal, they satisfy the necessary condition for expressing dispositions.

The disposition expressed by *-er* nominals sometimes does and sometimes doesn't have to be manifested. Rappaport-Hovav & Levin (1992) draw a distinction between two types of *-er* nominals: eventive (e.g., *saver of lives*) and non-eventive (e.g., *lifesaver*). In eventive *-er* nominals, the disposition has to be manifested, as exemplified by the unaccepatbility of (39a); in contrast, in non-eventive *-er* nominals the disposition does not have to be manifested, as exemplified by the acceptability of (39b).

(39)   a.   #Cora is a saver of lives, but she has never saved anybody's life.
        b.   Cora is a lifesaver, but she has never saved anybody's life.

Both eventive and non-eventive readings of *-er* nominals are dispositional; but *-er* nominals also have non-dispositional readings:

(40)   a.   John is a murderer.
        b.   I was mesmerized by the singer's voice.
        c.   John is a goner.

Sentence (40a) has a dispositional reading: what John does is murder people. However, it also has a non-dispositional reading, the satisfaction of which requires only the existence in the actual world of one event of a murder committed by John. Sentence (40b) can have a dispositional reading, referring to a person whose profession is to sing, but also a non-dispositional reading, referring to a person who was singing at the event time in the actual world. And since the dispositional reading of (40c) is ruled out pragmatically, it only has a non-dispositional reading: there is in the (immediate) future of the actual world an event of John's being gone.

But note that even these non-dispositional expressions are modal, although not dispositional.[16] Suppose there are exactly three people who murdered someone; and suppose they are about to be executed, and, on their way to the gallows, they are singing, and nobody else is singing. Then, at that moment, the (non-dipositional) properties of being murderers and being singers have the same extension. Yet, although (41a) entails (41b), (42a) does not entail (42b).

(41)   a.   Three people who have murdered someone are about to be executed.
        b.   Three people who are singing are about to be executed.

(42)   a.   Three murderers are about to be executed.
        b.   Three singers are about to be executed.

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[16] Recall that actual readings of dynamic *can*, as exmplified in (15) and (16) above, behave in the same way.

What kind of disposition do *-er* nominals express (under their dispositional readings)? Many researchers (Fabb 1984; Keyser & Roeper 1984; Burzio 1986; Rappaport-Hovav & Levin 1992; van Hout & Roeper 1998; Cohen 2016a) note the External Argument Generalization: *-er* indicates that the argument of the nominal receives the thematic role that the verb assigns to its external argument.

As we have noted above, the subject is often the external argument, but not always, and the relevant case is that of unaccusatives. Indeed, *-er* nominals normally are not formed from unaccusative verbs:

(43)   *arriver, *faller, *descender, *resembler

It must be conceded that sometimes such examples *are* attested, but they do not constitute counterexamples to this generalization. Indeed, Schäfer (2010) notes:

> The literature sometimes provides examples of *-er* nominals derived from alleged unaccusative verbs. But these examples involve verbs that can be reanalyzed as unergatives in the right contexts. Such contexts typically assign [semantic] control to the only argument of the verb.

Hence, we can conclude that *-er* nominals express active dispositions.

-Er nominals have a universal rather than existential flavor, as demonstrated by the following example. By Jewish custom, every baby boy is given a few drops of wine before his circumcision. So, for every Jewish man, in every world (compatible with the custom), there is an event of this man drinking wine. However, this doesn't make him a wine drinker.

One step further is taken by von Fintel & Heim (1999), who identify the universally-flavored quantifier associated with *-er* nominals with the generic quantifier.[17] They note that, under one reading,

> *beautiful dancer* ≈> someone *x* such that generally if *x* dances… *x* does so beautifully.
>
> To develop an approach based on this intuition, we need a way of treating *dancer* as involving a stage-level/episodic predicate (which can be the host of the manner predicate *beautiful*) and a generic quantifier.

When von Fintel and Heim refer to the generic quantifier, they assume universal quantification over normal worlds. Although, as we saw in section 2.2, this characterization of habituals and generics is quite problematic, the identification of the quantificational force of *-er* nominals with a universal quantifier over normal worlds is quite convincing. Hence, we can conclude that *-er* nominals are modal, they require an agent/causer, and have a quasi-universal flavor. Hence, they express active universal dispositions.

In formalizing the meaning of *-er* nominals, I will adopt Brennan's ordering source, which is depndent on properties of the external argument. Assuming the same simplistic view of manner adverbs as before, we can therefore say that (44a) is true iff (44b).

(44)   a.   Robert is a beautiful dancer.
        b. $\forall w \exists w'(w' \leq_g w \wedge \forall w''(w'' \leq_{g(r)} w \rightarrow \forall e((\textbf{dancing}(e, w'') \wedge \textbf{agent}(e, \textbf{r}, w'')) \rightarrow \textbf{beautiful}(e, w''))))$

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[17] See also Larson (1998).

8 Universal dispositions and *will*

Dynamic *can* is usually considered together with other dynamic modals, primarily dispositional *will*. Dispositional *will* does, indeed, seem appropriate for the expression of dispositions, since it usually does not require the occurrence of actual events, as indicated by (45a). However, note that, as can be seen by the unacceptability of (45b), sometimes it does.

(45) a.   Our grad students are so tough, they will even eat cardboard, though
           thankfully it's never come to that (Copley 2005).
      b.   #Frank will start crying if left alone, but he has never cried in his life.

As we have seen, a necessary condition for a linguistic construction to express dispositions is modality. Indeed, dispositional *will* satisfies this requirement. Suppose everyone who ate cardboard wore purple socks and yellow hats, and everybody who wore purple socks and yellow hats ate cardboard. Then the two properties would have the same extension; yet (45a) does not entail (46).

(46)   Our grad students will wear purple socks and yellow hats.

The modal force expressed by dispositional *will* is universal: (47) says that under normal conditions, *whenever* sugar is put into water, it dissolves.

(47)   Sugar will dissolve if put into water.

Example (47) is interesting for another reason. Note that the verb *dissolve* is an unaccusative: its subject is not the external argument. Hence, the argument of dispositional *will* may be the external argument (as in, e.g., (45a)), but does not have to be. Hence, dispositional *will* can express both types of universal disposition: active and passive.

9 The Square of Disposition

We can now fill in the Square of Disposition, for each type of disposition, the linguistic expression that is appropriate for representing it.:

	+ Causer	–causer
Existential	capability: *can*	passivility: *-able*
Universal	active disposition: *-er*	passive disposition: middles
	w i l l	

Before concluding, I have a confession to make. In this paper I first constructed the Square of Disposition, and then tried to fit linguistic expressions into it. However, in the research leading to the paper, I actually worked backwards: I looked at linguistic expressions, and formed the Square so as to fit them in.

What is the significance of this fact? There are many ways to classify dispositions—the Square is only one option. The debate over the correct classification of dispositions will no doubt go on. The debate is, and should remain, a philosophical one, following philosophical considerations.

What I have tried to show is that there is one particular classification that corresponds to what is expressible in natural language. Following Bach's (1986) program of natural language metaphysics, we can go one step further and say that this metaphysical classification is motivated by a linguistic classification. This, of course, doesn't mean that this particular classification is metaphysically correct: the deciding arguments for or against it will still be philosophical, not linguistic, in nature. But, echoing the words of Vetter

(2014: 131): "I am certainly not advocating that philosophy be replaced by linguistics…but I do take these data to provide some motivation for an alternative approach."

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The author has no competing interests to declare.

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