Some speculative remarks on the semantics of money phrases*

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April 11, 2022

In this chapter I offer some speculative remarks on the semantics of what I refer to as *money phrases*, e.g., *five dollars*. Money phrases have some intriguing properties that make their precise semantics tricky to pin down: sometimes they seem to denote degrees (e.g. of expensiveness or value), sometimes concrete objects like cash, and sometimes abstract purchasing power. Determining a basic semantics for money phrases is further complicated by their typical use in constructions pertaining to ownership, which pose their own independent problems. After discussing these three uses for money phrases, I offer a tentative means by which these uses may be semantically unified.

Keywords: money phrases; measurement; degrees; abstract entities; natural language ontology

1 Introduction

In this chapter I provide some rather tentative and preliminary remarks on the semantics of what I call *money phrases*, such as *five dollars*. The basic question I will be seeking to address is a rather simple one: what kinds of objects do money phrases denote? But as we will see, this simple question has a not-so-simple answer. On the one hand, certain uses of money phrases appear to denote degrees of the sort that commonly appear in the literature on gradability and measurement. Meanwhile, other uses give the impression that they refer to physical sums of cash, and still others seem to denote something more abstract: namely, sums of abstract purchasing power. In Section 2 I discuss what differentiates between these three uses of money phrases, and in Section 3 I propose one way in which these three uses might be unified. Section 4 concludes.

* For helpful comments and discussion, many thanks to Rick Nouwen, Giorgos Spathas, and Ildikó Emese Szabó. I look forward to bothering Stephanie Solt about these problems in the future. **Published in Nicole Gotzner & Uli Sauerland (eds.), *Measurements, Numerals and Scales: Essays in Honour of Stephanie Solt*, Palgrave Macmillan, 2022. Please cite that version.**

2 Three uses for money phrases

In this section I will discuss three apparent uses for money phrases: *degree* uses, in which money phrases seem to denote degrees of expensiveness, cost, or value; *concrete entity* uses, in which money phrases seem to semantically range over collections of physical cash; and *abstract entity* uses, in which they seem to range over lumps of abstract purchasing power. In Section 3 I will tentatively propose one way in which these three uses of money phrases might be semantically unified.

2.1 Degree uses

Certain uses of money phrases give the impression that they denote degrees. For instance, as illustrated in (1), money phrases can appear as the differential in differential comparatives, a role that is generally treated as semantically related to degrees:

(1) a. My book is **two kilos heavier** than your book is.
b. My book is **ten dollars more expensive** than your book is.

Let us adopt the commonly assumed view that gradable adjectives denote relations between degrees and individuals (Cresswell 1976; von Stechow 1984; Heim 1985):

(2) a. $[\![\text{heavy}]\!] = \lambda d \lambda x.\ \text{weight}(x) \geq d$
b. $[\![\text{expensive}]\!] = \lambda d \lambda x.\ \text{cost}(x) \geq d$

Let us further assume a semantics for differential comparatives roughly along the lines proposed by von Stechow (1984). Rather than go through the compositional semantics, I will provide a semantics in templatic form as in (3), where *DP1* and *DP2* are referential DPs (type *e*), *Adj* is a gradable adjective (type *det*), and *MP* is a measure phrase like *two kilos* (type *d*).[12]

(3) $[\![\text{DP}_1 \text{ is MP Adj -er than DP}_2 \text{ is}]\!] = \top$ iff
$\exists d[[\![\text{Adj}]\!](d)([\![\text{DP}_1]\!]) \wedge d \geq [\![\text{MP}]\!] + \max(\lambda d'.\ [\![\text{Adj}]\!](d')([\![\text{DP}_2]\!]))]$

The result when applied to (1a) can be seen in (4), where "2 kg." indicates the degree of mass/weight equivalent to two kilograms:

[1] For types α and β, $\alpha\beta$ is the type of functions from α to β. Types are right-associative: $\alpha\beta\gamma$ is what would traditionally be written as $\langle\alpha, \langle\beta, \gamma\rangle\rangle$.

[2] I assume that measure phrases like *two kilos* denote degrees, hence type *d*; an equally plausible alternative is that they are degree quantifiers of type $(dt)t$ (Schwarzschild & Wilkinson 2002, Pasternak & Sauerland to appear). For our purposes this choice is immaterial: either way, measure phrases have denotations that fundamentally trade in degrees.

(4) $[\![$My book is two kilos heavier than your book is$]\!]$
$= \top$ iff $\exists d[[\![\text{heavy}]\!](d)([\![\text{my book}]\!]) \wedge$
$d \geq [\![\text{two kilos}]\!] + \max(\lambda d'.\ [\![\text{heavy}]\!](d')([\![\text{your book}]\!]))]$
$= \top$ iff $\exists d[\text{weight}(\text{my\_book}) \geq d \wedge$
$d \geq 2\text{ kg.} + \max(\lambda d'.\ \text{weight}(\text{your\_book}) \geq d')]$
$= \top$ iff $\text{weight}(\text{my\_book}) \geq 2\text{ kg.} + \text{weight}(\text{your\_book})$

This seems to derive the desired truth conditions: the weight of my book is equal to at least two kilograms plus the weight of your book. If we assume that *ten dollars* denotes a degree of cost or value in the same way that *two kilos* denotes a degree of mass/weight, then (1b) can compose in the same manner, leading to the seemingly plausible interpretation in (5):

(5) $[\![$My book is ten dollars more expensive than your book is$]\!]$
$= \top$ iff $\text{cost}(\text{my\_book}) \geq \$10 + \text{cost}(\text{your\_book})$

Some further potential evidence for a degree-based semantics for money phrases comes from their use in predicative positions. For example, in the same way that *five kilos* is permissible in predicate position with a verb like *weigh*, *five dollars* is permissible in predicate position with a verb like *cost*. Both are also permissible in copular constructions, with roughly the same meaning.

(6) a. My book {**weighs**/**is**} **five kilos**.
b. My book {**costs**/**is**} **five dollars**.

If we assume that *weigh* and *cost* have interpretations that are roughly the same as the adjectives *heavy* and *expensive*, as illustrated in (7), the sentences in (6) with these verbs can compose in a straightforward manner:

(7) a. $[\![\text{weigh}]\!] = \lambda d \lambda x.\ \text{weight}(x) \geq d$
b. $[\![\text{cost}]\!] = \lambda d \lambda x.\ \text{cost}(x) \geq d$

With (6a), *five kilos* first saturates the degree argument of *weigh*, with *my book* saturating the individual argument, leading to a predicted interpretation of true iff my book's weight is at least five kilos. If *five dollars* denotes a degree of cost or value, then (6b) can compose in the same fashion. The copular construction is likely somewhat more complex, but on a degree-based analysis of money phrases whatever works for (6a) should presumably work equally well for (6b).

There is thus evidence suggesting that money phrases have denotations built on degrees of cost, value, or something similar. However, we will next see evidence that money phrases can also denote entities—sometimes physical objects like cash, and sometimes more abstract objects.

2.2 Concrete entity uses

The clearest cases where money phrases seem to denote entities instead of degrees are what I will call *concrete entity* uses, in which the money phrase must denote cash of a certain value. Concrete entity uses come to the fore when a money phrase occupies an argument position that can only be saturated by physical objects, as in (8):

(8) a. Sara handed me ten dollars.
b. Lois threw ten dollars on the ground.
c. Ten dollars fell out of Cassandra's pocket.
d. The tooth fairy left a dollar under my pillow.

But is this really a separate interpretation? Seemingly degree-denoting measure phrases like *two kilos* allow *prima facie* similar readings, as in (9):

(9) (When she bought a barrel of apples,) Sara gave me two kilos.

It thus may be that concrete entity uses of money phrases are simply derived from degree uses in the same manner as in (9). However, there are some problematic differences between (8) and (9). The first is that there is a flexibility in (9) that is not seen in (8). Depending on context, *two kilos* can mean two kilos of various kinds of objects:

(10) (When she bought $\left\{\begin{array}{c}\text{a barrel of apples,}\\ \text{a case of honey,}\\ \text{a sack of rice,}\end{array}\right\}$) Sara gave me two kilos.

This is not the case for, say, *ten dollars*: if Sara handed me ten dollars, she must have given cash; she cannot have given me some apples with a value of ten dollars.

Another difference between entity uses of *two kilos* and concrete entity uses of money phrases is that the former require a salient discourse referent. An out of the blue utterance of *Sara gave me two kilos* is odd, and naturally begs the question: two kilos of what? While there are certain exceptions to this requirement for entity uses of regular measure phrases, these seem to be specific, lexically stored interpretations, such as the beer interpretation of *pint*:

(11) The bartender poured me a foamy pint.

This requirement does not extend to *ten dollars*: an out of the blue utterance of *Sara handed me ten dollars* is completely fine, even if there is no salient wad of cash from which Sara drew the ten dollars.

These two differences between concrete entity uses of money phrases and pure measure phrases can be analyzed roughly as follows. Suppose that entity uses of pure measure phrases like *two kilos* are directly derived from their degree uses and involve covert nominal measurement structures, with a silent pronoun *pro* denoting the (possibly plural) individual from which the two kilos of stuff are taken:

(12) Sara gave me two kilos (OF) *pro*.

The discourse-sensitivity of pronominal interpretation then permits the actual substance of which Sara gave two kilos to vary: depending on context, *pro* can refer to the salient collection of apples, or of honey, or of rice, etc. In addition, since *pro* is a pronoun, its use is deviant without a clear referent. Thus, both of the previously noted properties of entity uses of pure measure phrases are predicted.

As for money phrases, suppose that by some means or another a money phrase like *ten dollars* can simply denote a sum of ten dollars in cash. In this case, we rightly predict entity uses of money phrases to lack both of the distinguishing traits of entity uses of pure measure phrases. Since the former must denote collections of cash, their denotations naturally exclude collections of objects whose value happens to be the right amount. And since there is no pronoun that requires a referent, we do not predict a need for a contextually salient collection of cash.

This just leaves one more issue. We have seen in Section 2.1 that money phrases also appear to have degree uses, much like pure measure phrases. So if entity uses of pure measure phrases derive from their degree uses, and money phrases also have degree uses, can silent nominal measurement structures be built with money nouns instead of pure measure nouns, as in (13)?

(13) Sara handed me a dollar (OF) *pro*.

If a structure like (13) were available over and above a "regular" entity interpretation of money phrases, we would predict there to be additional uses of money phrases that share the same two properties as their pure measure noun counterparts: flexibility in what sort of object is denoted, and a requirement for there to be a contextually salient individual for *pro* to refer to. That is, so long as there is a contextually salient collection of apples, we might predict *ten dollars* to be able to refer to a ten-dollar subcollection of apples, in much the same way that *two kilos* can refer to a two-kilo subcollection of apples. But we have already seen that this is not the case—not only *can* concrete entity uses of money phrases denote cash, but they *must*—meaning a structure like (13) must either be unavailable or lack the interpretive flexibility normally afforded by such covert nominal measurement structures.

To see why this should be the case, note that money phrases are often unavailable in the measure position of nominal measurement structures, as illustrated in (14):

(14) # Sara handed me a dollar of apples.

This can be attributed to an oft-noted property of nominal measurement constructions: roughly speaking, they require that the particular measurement used track part-whole relations, so that a given individual will have a larger measurement than any of its salient proper parts (Krifka 1989; Schwarzschild 2006; Rett 2014; Solt 2015; Wellwood 2015; Champollion 2017; Pasternak 2019). For example, *fourteen grams of* (*the*) *gold* is well-formed

because a lump of gold will have a greater mass/weight than any of its proper parts, while *#fourteen carats of* (*the*) *gold* is ill-formed because a lump of gold will not necessarily have a greater purity than all of its proper parts. Cost, as it turns out, does not meet this mereological requirement. Air, for example, is free, meaning that a two-liter collection of air will have the same zero-dollar cost as all of its proper parts. Buy-one-get-one-free sales similarly violate this requirement, since a two-object collection will have the same cost as both of its one-object parts. We therefore predict that even if (13) is syntactically available as a structure deriving an entity use of money phrases, it cannot afford the same interpretive flexibility as parallel structures with nouns like *kilo*, since this will violate the aforementioned mereological requirement on nominal measurement constructions.

While money phrases like *a dollar* are generally not acceptable in nominal measurement structures, the similar construction *a dollar's worth* is:

(15) Sara gave me a dollar's worth of apples.

Incidentally, *a dollar's worth* also has entity uses, which pattern with those of pure measure phrases and not with money phrases. Consider (16):

(16) (When she bought a barrel of apples,) Sara gave me a dollar's worth.

Note first that in (16), what Sara gives me is not cash, but a collection of apples of a certain value. This is precisely the sort of reading that was previously noted to be absent for *Sara handed me ten dollars*, in contrast to *Sara gave me a kilo*. The same context-sensitivity arises as well:

(17) (When she bought $\left\{\begin{array}{c}\text{a barrel of apples,}\\ \text{a case of honey,}\\ \text{a sack of rice,}\end{array}\right\}$) Sara gave me a dollar's worth.

In addition, an out of the blue utterance of *Sara gave me a dollar's worth* is odd for the same reason as for a parallel utterance of *Sarah gave me a kilo*: one is again led to ask, a dollar's worth of what? All of this suggests that entity uses of *a dollar's worth*, unlike *a dollar*, do involve the presence of covert measurement structures:

(18) She gave me a dollar's worth (OF) *pro*.

2.3 Abstract entity uses

Not all apparent entity uses of money phrases require the presence of physical cash. Consider the examples in (19):

(19) a. Ben transferred ten dollars into my account.
b. The restaurant charged me ten dollars.
c. I only have ten dollars (in my bank account).

d. I earned two dollars for every dollar I spent.

None of these examples requires any possession or transfer of physical cash. In each case, what we are discussing seems to reduce to numbers on a ledger: transferring and charging involve changing the numbers associated with two accounts, and having a certain amount of money involves a certain number being assigned to one's account. But at least at first glance, in the examples in (19) there is still something that I am possessing or transferring or being charged. However, it is not a concrete object, but a highly abstract one: in these examples, a dollar seems to constitute a certain sum of what might be called *abstract purchasing power*. For this reason, I will refer to these uses as *abstract entity uses* of money phrases.

It is worth noting that there is an extra confound that stands in the way of teasing apart any differences between concrete and abstract entity uses of money phrases. Notice that all of the verbs in the examples in (19) have interpretations that involve either a state of ownership (e.g., *have*) or an event of change in ownership (*transfer*, *charge*, *earn*, *spend*). But as noted by Zimmermann (1993) and Kratzer (2015), verbs of (transfer of) possession have a certain amount of opacity in their object positions. Here's an example that Zimmermann (1993, p. 152) attributes to Mats Rooth:

(20) Mats owns 75% of the ball bearings in the basement.

If Mats has a 75% stake in the collection of ball bearings, without being assigned ownership to any specific ball bearings, there is still a reading of (20) that is true.

The opacity of (transfer of) possession verbs could be used to treat supposed abstract entity uses of money phrases as illusory: money phrases simply have degree uses and concrete entity uses, and apparent abstract entity uses are actually concrete entity uses in opaque environments. In other words, when I say *I have ten dollars* on an abstract entity reading, what I am actually saying is that I possess ten dollars in cash—perhaps the cash stores held by my bank, or by the US Treasury, or simply the cumulative global cache of dollars—but since possession is opaque, this does not mean that there is a specific ten dollars in cash that I possess, in the same way that there is not a specific collection of marbles that Mats owns in (20).

However, this reduction of abstract entity readings to a combination of a concrete entity use and an opaque environment makes a faulty prediction about the relation between abstract and concrete readings: namely, it predicts that in order to own some amount of a given currency, that currency must have a physical form of which I have some amount of opaque ownership. In the example above, this meant that while I did not have to be in possession of a specific collection of cash, there had to be enough cash in the world for me to opaquely possess ten dollars. While this happens to be true of the US dollar, it is not true universally, as illustrated by cryptocurrencies like bitcoin. Cryptocurrencies operate through a ledger system that essentially states which account has how much of that currency. Reallocations of a cryptocurrency come exclusively in

the form of a modification to the ledger, and cryptocurrencies lack any form of physical cash. Hence, environments that force a concrete entity reading are infelicitous when the currency at hand is a cryptocurrency:

(21) a. # Sara handed me a bitcoin.
b. # Lois threw a bitcoin on the ground.
c. # A bitcoin fell out of Cassandra's pocket.
d. # The tooth fairy left a bitcoin under my pillow.

But while concrete entity uses of *bitcoin* are unacceptable, it is still possible to possess, transfer, earn, and charge bitcoin, meaning that abstract entity uses of *bitcoin* are still available. This suggests that abstract entity uses of *bitcoin* are not derived from concrete entity uses, and thus that there is indeed a separate abstract entity interpretation of money phrases that is distinct from their concrete entity uses.

3 A preliminary attempt at unification

In this section I will offer a preliminary attempt at a unified semantics of money phrases. This raises the question of which use of money phrases is baked into the lexical semantics of nouns like *dollar*, and which uses are derived through other means. I will not go through arguments in favor of one approach or the other; instead I will simply assume that the lexical interpretations of money nouns are built on their abstract entity uses, with degree and concrete entity uses being derived from those. Whether this is in fact the optimal solution, or whether a more elegant or empirically adequate account is available by starting from concrete or degree uses, is a matter I leave for future work.

Before going through the semantics for *dollar*, it will help to start with a semantics for *money*. Since we are building our semantics on abstract entity uses, $[\![\text{money}]\!]$ will be a predicate true of x iff x is a collection of abstract purchasing power. I will simply notate this as $\text{APP}(x)$.[3]

(22) $[\![\text{money}]\!] = \lambda x.\ \text{APP}(x)$

Thus, if I transfer *a lot of money* to my friend, what I transfer to her is a large sum of abstract purchasing power. This of course leaves open the fuzzy ontological question of what precisely abstract purchasing power is. But this question is not specific to my analysis: any analysis that posits the existence of an abstract entity use must of course

[3] Note that if APP is closed under mereological sum, then the prediction is that *money* should have the syntactic-semantic properties of a mass noun, a fact that is borne out. That said, there is also a somewhat formal use of the plural *monies*, meaning sums of money. It could be that this apparent count use is derived from mass *money*, perhaps through coercion. However, it is worth noting that *#a money*, *#two monies*, etc. are unacceptable, suggesting a somewhat more complicated picture.

posit some sort of abstract entity, and therefore faces questions about what precisely that abstract entity is. I will put aside this important issue, at the same time acknowledging that a more robust formulation of the ontological status of abstract purchasing power will likely prove crucial to any future analysis of money phrases.

With *money* settled, we next move on to *dollar*. Roughly speaking, I take ⟦dollar⟧ to denote a predicate true of x iff x is a dollar-sized lump of abstract purchasing power:

(23) $\llbracket \text{dollar} \rrbracket = \lambda x.\ \text{APP}(x) \wedge \text{size}(x) = \$1$

Notice that the domain of ⟦dollar⟧ presumably contains mereologically overlapping elements, much like ⟦liter of water⟧ (assuming the latter is true of liter-sized collections of water). Adopting the common assumption that the semantics of plurality involves closure under mereological sum, this overlap will persist in the denotation of ⟦dollars⟧ as well. Thus, in defining the semantics for a numeral like *ten* that modifies a predicate P, reference must be made to *minimal, non-overlapping* elements of P (where a minimal element of P is an element of P with no other element of P as a proper part):

(24) ⟦ten⟧ ≈ $\lambda P \lambda x.$ x is the sum of ten minimal, non-overlapping members of P

Thus, ⟦ten dollars⟧ will denote a predicate true of x iff x is a lump of abstract purchasing power that is the sum of ten non-overlapping, dollar-sized lumps of purchasing power.

Let us now see how concrete entity and degree uses of money phrases might be derived from abstract entity uses. We start with concrete entity uses, which can be approached as a form of coercion. The internal argument of the verb *hand*, for example, must be a physical object; since the lexical interpretation of *dollar* does not trade in physical objects, coercion must occur as a last resort. Suppose this occurs through a covert operator CON, which attaches to *ten dollars*:

(25) Sara handed me [CON ten dollars]

Suppose further that CON takes a predicate P true of lumps of abstract purchasing power, and returns a predicate true of physical objects (including pluralities) that in some sense possess a P-collection of purchasing power:[4]

(26) $\llbracket \text{CON} \rrbracket = \lambda P \lambda x.\ \text{concrete}(x) \wedge \exists y[P(y) \wedge \text{possess}(x, y)]$

Thus, ⟦CON ten dollars⟧ will denote a predicate true of x iff x is a physical object (possibly a plurality) imbued with ten dollars of purchasing power, i.e., iff x is ten dollars in cash.

[4] One potentially strange property of the definition in (26) is that it requires that, for example, a ten dollar bill be imbued not just with ten dollars of purchasing power, but with some *specific* ten-dollar lump of purchasing power. It is unclear to me whether this is a good thing or not, but if not then one way of resolving this could be through the aforementioned phenomenon of opaque possession: a ten dollar bill opaquely possesses ten dollars of abstract purchasing power in the same way that Mats opaquely owns 75% of the ball bearings in (20).

One noteworthy benefit of such an analysis is that it correctly predicts that Sara needn't have handed me ten physical objects in order to have handed me ten dollars: we predict truth as long as what Sara handed me was cash worth ten dollars, regardless of whether she handed me ten singles, a sack of dimes, or a ten dollar bill.[5]

As for degree uses, it has previously been noted that non-measure nouns can sometimes fill degree arguments, including the differential in a differential comparative. The following example is from Schwarzschild (2020):

(27) The new engine is a boxcar longer than the old engine.

Here the interpretation seems to be that the new engine's length exceeds that of the old engine by the length of a (contextually salient) boxcar. It is plausible that apparent degree uses of money phrases are reducible to the same phenomenon: if my book is a dollar more expensive than yours is, then my book's expensiveness exceeds your book's expensiveness by the expensiveness of a dollar. The same story, it seems, can be told of predicative degree uses like *cost/be ten dollars*: again, a degree interpretation is coerced through means that are independently motivated for generating degree interpretations from entity interpretations (see Rett 2014 for extensive related discussion).

4 Conclusion

In this chapter I have discussed some intriguing semantic properties of money phrases like *five dollars*: they sometimes seem to denote degrees of expensiveness or value, sometimes predicates of concrete entities (namely, cash), and sometimes predicates of lumps of abstract purchasing power. I have also offered an extremely tentative preliminary analysis seeking to unify these three uses of money phrases: money nouns are lexically defined based on their abstract entity uses, and degree and concrete entity uses are derived through other processes. While many details of this analysis remain to be more fully fleshed out, this seems to be a promising line to pursue.

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[5] Rick Nouwen (p.c.) notes that this does not hold for *quarter*: in order for *Sara handed me three quarters* to be true, she cannot have handed me 75 cents in nickels. This can perhaps be explained by positing that the lexical semantics for *quarter*, unlike *dollar*, is based on its concrete entity interpretation, with other interpretations being derived from that; in this case the fact that *three quarters* means three individual quarters falls out from a standard semantics for plurals and numerals. This analysis in turn suggests the intriguing possibility of a semantic typology for money-related nouns, a matter I leave for future work.

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