Choice Functions in Intensional Contexts: Rehabilitating Bäuerle's Challenge to the Scope Theory of Intensionality

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1. Introduction

The broad theoretical context for this paper is a debate between two approaches to intensionality that differ with respect to the status of world variables in grammar. According to the SCOPE THEORY of intensionality (see Keshet 2011 and references therein), world variables are incorporated into content word denotations and valued by a parameter of interpretation, in such a way that an expression's evaluation world is determined by its structural position. For example, on this theory, the denotation for a common noun like *cat* looks like (1). It is a function from individuals to truth values that returns the value true if and only if the individual it applies to is a cat in the evaluation world w. In a simple sentence like *Garfield is a cat*, the evaluation world is identified with the actual world (or the world indexically associated with the utterance context), whereas in a sentence with a modal expression like *Garfield might be a cat*, the evaluation world of every expression in the scope (c-command domain) of the modal expression is bound and quantified over by the modal.

(1) $[\![\text{cat}]\!]^w = [\lambda x.1 \text{ iff } x \text{ is a cat in } w]$

The scope theory contrasts with what I will call the BINDING THEORY of intensionality (see especially Percus 2000), in which world variables are instantiated by syntactically bound pronouns that saturate arguments introduced by content words. This means that an expression's evaluation world is not necessarily determined by its structural position; instead, it is determined by its binder. When more than one candidate binder is present, multiple interpretations — keyed to binder choice — are in principle possible. For example, on this theory, the denotation for *cat* looks like (2): it expects a world pronoun as its first argument. When embedded into a structure like (3), *cat* combines in the syntax with an indexed world pronoun w_1 that can in principle be bound by any c-commanding world binder; in this example, it is bound by the more remote of the two candidate binders.

(2) $[\![\text{cat}]\!] = [\lambda w.[\lambda x.1 \text{ iff } x \text{ is a cat in } w]]$

(3)
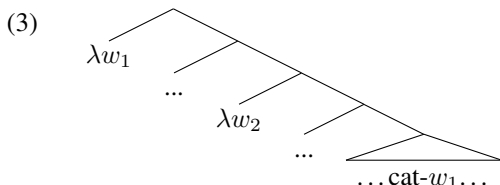
Both approaches face important challenges that involve a number of delicate issues; see Keshet & Schwarz (2014); Percus (to appear) for two recent overviews. Here I have a very narrow focus, namely Bäuerle's (1983) challenge to the scope theory, which Keshet (2010) attempts to defuse by arguing that the challenge can be met using technology independently needed to handle wide scope indefinites. I aim to show that Keshet's solution depends on assumptions regarding the behavior of choice functions in

intensional contexts that create difficulty in accounting for de re readings of indefinites embedded under two or more attitude predicates. The conclusion is that, even if we admit choice function technology, Bäuerle's challenge remains a problem for the scope theory of intensionality. Because this conclusion is relative to Keshet's solution and does not necessarily extend to all other solutions to Bäuerle's challenge that could conceivably be carried out under the scope theory, it does not constitute a decisive argument against the scope theory and in favor of the binding theory. But it does affect the "scoreboard" in the competition between the two approaches, in a way that is favorable to the binding theory.

The organization of the rest of the paper is as follows. Sections 2 and 3 review Bäuerle's challenge and Keshet's proposed solution to it, respectively. Section 4 makes a mild adjustment to Keshet's proposal needed in order to account for finite clause islands. This then sets the context for section 5, where I show that Keshet's proposal faces difficulties that are not easily overcome in accounting for doubly embedded de re indefinites. Section 6 concludes.

2. Bäuerle's challenge

Bäuerle's challenge to the scope theory of intensionality can be illustrated using the sentence in (4), taken from Keshet (2010: 692, ex. 1), and loosely based on a German sentence of Bäuerle's.

(4)   George thinks every Red Sox player is staying in some five-star hotel downtown.

The relevant point is that there is a reading of the sentence in (4) that combines the following three features:

(5)   a.   *every Red Sox player* is read de re; that is, George's belief is about a group of men that happen to make up the Red Sox team, possibly unbeknownst to George.
        b.   George thinks that all the men in question are staying at the *same* five-star hotel downtown.
        c.   *some five-star hotel downtown* is read de dicto; that is, its content is part of George's belief, and there may not even be any five-star hotels downtown.

This is a problem for the scope theory of intensionality, because on such a theory, these three features impose mutually contradictory scope requirements on the LF for (4): (5-a) implies that *every Red Sox player* outscopes *think* (6-a), (5-b) implies that *some five-star hotel downtown* outscopes *every Red Sox player* (6-b), and (5-c) implies that *thinks* outscopes *some five-star hotel downtown* (6-c).

(6)   a.   *every Red Sox player > thinks*
        b.   *some five-star hotel downtown > every Red Sox player*
        c.   *thinks > some five-star hotel downtown*

Taken together, (6-a–c) imply that *every Red Sox player* has both wide *and* narrow scope with respect to *thinks* (and similarly for *some five-star hotel downtown* with respect to *thinks*), a contradiction that would seem to spell trouble for any theory that ties an expressions's de re/de dicto status to its position relative to the relevant intensional operator.

3. Keshet's (2010) solution to Bäuerle's challenge

Keshet (2010) proposes to reconcile Bäuerle's challenge with the scope theory of intensionality by assigning the sentence in (4), on its problematic reading, the LF in (7).

(7) $\exists f$ [every Red Sox player [λ_1 [George [thinks [t_1 is staying in f(5-star hotel downtown)]]]]]

In this LF, *every Red Sox player* has undergone QR to a position above *thinks*, thereby ensuring that it receives a de re interpretation. Moreover, this LF incorporates a choice function analysis of the indefinite *some five-star hotel downtown*: the NP restrictor *five-star hotel downtown* combines with f, a variable over choice functions, which is existentially bound from above the QRed universal quantifier. This captures the second key feature of the reading in question: George thinks that all the men are staying at the *same* five-star hotel downtown. This is guaranteed by virtue of the fact that on this LF, there is

some choice function f that verifies, for every Red Sox player x, the proposition that George thinks x is staying in f(five-star hotel downtown).

But what ensures the third feature of the reading in question, namely that *some five-star hotel downtown* receives a de dicto interpretation? To ensure this, Keshet relies on an innovative idea about how choice functions work in intensional contexts: rather than returning a member of the NP's extension at the actual world (as in Reinhart 1997; Winter 1997), the choice function in (7) returns a member of the NP's extension at the local evaluation world.[1] Thus, even relative to a particular way of fixing the value of f, the value of f(five-star hotel downtown) may vary as we move from one of George's belief worlds to the next, so long as at each belief world, it denotes an individual that counts as a five-star hotel downtown *at that belief world*. This captures its de dicto status. On this approach, indefinites have an analysis that pries apart their intensional status from their quantificational scope: quantificational scope is determined by the locus of the choice function variable's binder, whereas intensional status is determined by the locus of the choice function variable itself.[2] Despite this wedge between intensional status and quantificational scope, the approach nonetheless maintains the scope theory of intensionality, because intensional status is still determined by structural position. But does this assumption about how choice functions behave in intensional contexts hold up against a wider range of considerations? This is the question that I want to address. In order to properly situate the discussion, though, I first need to comment on another feature of Keshet's solution, namely that it involves QR out of a finite clause.

4. Adjustment for finite clause islands

One immediate shortcoming of the analysis in (7) is that it involves QR out of a finite clause. As known since May (1977), QR out of a finite clause is not ordinarily possible: finite clauses are scope islands. This is evidenced by the fact that an object-position quantifier can optionally have wide (inverse) scope with respect to a clause-mate subject (8-a) or with respect to a subject separated by a nonfinite clause boundary (8-b), but not with respect to a subject separated by a finite clause boundary (9).[3]

(8)	a.	[Some student] read [every book].	✓∃ > ∀; ✓∀ > ∃
	b.	[Some student] wants to read [every book].	✓∃ > ∀; ✓∀ > ∃
(9)		[Some student] thinks that Tom read [every book].	✓∃ > ∀; *∀ > ∃

But an easy fix is available: we can adopt Keshet's (2011) 'split intensionality' theory, according to which intensions enter the semantic derivation not via Intensional Functional Application (as in Heim & Kratzer 1998) but instead via a type-shifting operator ∧ that serves as a function from extensions to corresponding intensions. When an intension-selecting expression like *thinks* combines in the syntax with an extension, ∧ intervenes so as to trigger intensionalization and enable the composition to proceed via Functional Application. Crucially, the introduction of ∧ creates a syntactic position that a quantifier can move to where it will receive wide intensional scope but narrow quantificational scope, all while respecting the scope islandhood of finite clauses. On this approach, the LF for the relevant structure is as in (10). Here, *every red Sox player* QRs to a position above ∧, thereby ensuring its de re interpretation, but it has not escaped the finite clause island since it is still embedded under *thinks*.[4]

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[1] Keshet motivates this approach by arguing that *Mary thinks that if two uncles of hers die, she will be rich* has a reading in which *two uncles* has narrow intensional scope but wide quantificational scope (cf. note 2 below). I lack space here to assess this argument, but see Keshet & Schwarz (2014): 33–34 for possibly relevant considerations.

[2] The need for separating intensional status from quantificational scope is well known from Fodor (1970), who argues that it is possible for indefinites to be interpreted in a way that is simultaneously transparent (high intensional scope) but nonspecific (low quantificational scope). But see Keshet (2011) for an analysis of this phenomenon that is carried out in the scope theory of intensionality and that does not even require choice functions, and see also Schwager (2011) for a very different kind of approach motivated by more complicated examples. Because I believe that the issues raised by Fodor's cases are orthogonal to the narrow focus of this paper, I will continue to use the term "de re," but in a more sophisticated treatment this would be decomposed into "transparent" and "specific."

[3] See Grano & Lasnik (2018) for a somewhat more nuanced version of this generalization: QR out of a finite clause is (marginally) possible when the subject of the embedded clause is a bound pronoun.

[4] This approach requires that a quantifier be able to take an expression of type $\langle e, st \rangle$ (rather than $\langle e, t \rangle$) as its first argument; see Keshet 2011: 266–268 for discussion.

(10) $\exists f$ [George [thinks [every Red Sox player [λ_1 [$\wedge$ [t_1 is staying in f(5-star hotel downtown)]]]]]]]

5. Choice functions and de re indefinites

Now let's consider the consequences of the view that a choice function returns a member of the NP's extension at the local evaluation world rather than at the actual world. In particular, will this allow us to derive de re readings of indefinites embedded in scope islands? Consider first the example in (11).

(11)   a.   CONTEXT: Jo and Bill are out shopping. Bill finds a hat that he likes and considers purchasing it. It so happens that the hat is just like mine, but neither Jo nor Bill know this. Jo thinks that that the hat looks great on Bill and hopes he'll buy it.
         b.   SENTENCE: Jo hopes that Bill will buy [a hat just like mine].
         c.   JUDGMENT: *true*
         d.   CONCLUSION: *a hat just like mine* in (11-b) can have a de re interpretation.

Examples like this are not a problem, because, following Keshet's (2011) split intensionality set-up, we can scope the indefinite in (11-b) to a position just above the intensionalizing operator introduced under *hopes*, as in (12). This will ensure that it has a de re interpretation.

(12) $\exists f$ [Jo hopes that [f(hat just like mine)] [λ_1 [$\wedge$ [Bill will buy t_1]]]].

But now consider a variant of (11) with an indefinite embedded under *two* attitude predicates:

(13)   a.   CONTEXT: Mary, Jo, and Bill are out shopping. Bill finds a hat that he likes and considers purchasing it. It so happens that the hat is just like mine, but neither Mary, nor Jo, nor Bill know this. Jo thinks that the hat looks great on Bill and hopes he'll buy it. Jo expresses her hope out loud, and Mary believes Jo.
         b.   SENTENCE: Mary thinks that Jo hopes that Bill will buy [a hat just like mine].
         c.   JUDGMENT: *true*
         d.   CONCLUSION: *a hat just like mine* in (13-b) can have a de re interpretation.

This data point is a problem. Given that QR is finite clause-bound and does not operate successive-cyclically, the highest position to which the indefinite in (13-b) could move would be to a position just above the intensionalizing operator associated with *hopes*:

(14) $\exists f$ [Mary thinks that Jo hopes that [[f(hat just like mine)] [λ_1 [$\wedge$ [Bill will buy t_1]]]]].

But if Keshet is right that the intensional status of an indefinite is determined by the position of the choice function variable itself, then (14) will give rise to a reading whereby *a hat just like mine* is de re with respect to *hope* but, problematically, de dicto with respect to *think*.[5]

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[5]   A similar problem arises if we try to analyze the indefinite in (13-b) as an existential quantifier: the highest position it could scope to would be just above the intensionalizing operator associated with *hopes*. In this connection, it is worth mentioning that this problem for split intensionality arises not just for indefinites but for (other) quantificational expressions as well. For example:

(i)   a.   CONTEXT: There is a group of people in this room. Neither Jo nor Mary know that they're in this room. Mary hopes they're actually outside. She reports her hope to Jo, and Jo believes her.
        b.   SENTENCE: Jo thinks that Mary hopes that everyone in this room is outside.
        c.   JUDGMENT: *true*
        d.   CONCLUSION: *everyone in this room* in (i-b) can have a de re interpretation.

Keshet (2011) aims to capture the putative generalization that nominals embedded under *two* scope islands cannot be interpreted de re. But the data supporting the generalization come from configurations in which the higher island is a finite clause and the lower island is of another sort (*if*-clauses, NP complements, coordinate structures). When a nominal is embedded under two finite clauses, it is not clear that the generalization holds. Ezra Keshet (p.c.) suggests that possibly, *every*-DPs sometimes function not as quantifiers but rather as names that stand in for a particular group of people. See the discussion surrounding (17) below for a reason this may not save the analysis, insofar as the indefinite in (17) could be replaced by a universal and still give rise to an intermediate reading.

There is a possible way out. We could hypothesize that choice functions are flexible, returning members of the NP's extension either at the local evaluation world or at the actual world (see also Geurts 2000, who entertains — but does not ultimately argue in favor of — a similar idea). But this view is challenged by another consideration. As observed by Reinhart (1992, 1997); Romero (1999), the NP restrictor *philosopher* associated with the in-situ *wh*-phrase in the multiple question in (15) has to be interpreted relative to the actual world rather than with respect to the worlds introduced by the modal *would*, as evidenced by the infelicity of the answer in (15-b). And this restriction can be captured on a choice function analysis of the in-situ *wh*-phrase, but *only if choice functions are necessarily relativized to the actual world*.

(15)   a.   Who would be upset if we invited which philosopher?
        b.   #Patricia would be upset if we invited Donald Duck (and Donald Duck was a philosopher).

This conclusion does need to be qualified a bit. Romero (1999) argues that choice functions do not always behave this way. Compare (15) with (16), based on a Spanish example of Romero's.

(16)   a.   Who would be upset if which relative of his that was about to get married didn't call him to tell him?
        b.   Pedro would be upset if his cousin Paco were about to get married and didn't call him to tell him.

But two points should be made here. First, Romero observes that the availability of the de dicto reading correlates in Spanish with subjunctive morphology on the relative clause. This fact, together with the split between (15) and (16), suggests that the availability of de dicto readings for choice functions should be tied to subjunctive morphology rather than being something that is generally available. Second, even in (16), it is not the whole nominal that is interpreted de dicto, but rather only the relative clause. In other words, (16-a) is not asking about hypothetical relatives but rather about actual relatives who are hypothetically getting married. So now it would seem that the only way to salvage the theory would be to hypothesize that choice functions for indefinites somehow work differently from choice functions for *wh*-expressions, which as far as I know is not independently motivated.

There is yet another concern. It would in any case ultimately not be enough to hypothesize that a choice function is interpreted relative either to the local evaluation world or to the actual world: intermediate readings are possible as well. Consider (17).

(17)   a.   CONTEXT: Tom says: "Mary, Jo, and Bill are out shopping. Bill finds a hat that he likes and considers purchasing it. It so happens that the hat is just like mine, but neither Mary, nor Jo, nor Bill know this. Jo thinks that the hat looks great on Bill and hopes he'll buy it. Jo says as much out loud, and Mary believes Jo." But in fact there is no hat just like Tom's — Tom made the whole story up.
        b.   SENTENCE: Tom says that Mary thinks that Jo hopes that Bill will buy [a hat just like his].
        c.   JUDGMENT: *true*
        d.   CONCLUSION: *a hat just like his* in (17-b) can be interpreted de re with respect to *hopes* and *thinks* and de dicto with respect to *says*.

The upshot of (17) for a choice function analysis of indefinites is that we would now have to say that a choice function has the option of being relativized to *any* world introduced by a c-commanding expression — including not only the local evaluation world and the actual world but also worlds introduced between them.[6] But once we say this, we are no longer in the scope theory of intensionality,

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[6] I believe (17) also militates against a suggestion from Orin Percus (p.c.) that one could reconcile (13) with Keshet's theory by assuming that the indefinite combines with a silent indexicalizing operator *dthat* (in the sense of Kaplan 1989) that relativizes the interpretation of an individual-denoting expression to the context. Unless we complicate the theory yet further with context-shifting operators, such an approach will not extend to (17). The problem brought out by (17) also challenges Sudo's (2014) proposal that de re expressions are licensed via contextual equivalence to a de dicto expression. As Sudo (2014: 455) points out, in order for this to be workable for multiple embedding, contextual equivalence needs to be generalized to encompass equivalence relative to an attitude holder.

because now, intensional status is no longer determined by structural position. Instead, it is determined based on available world binders, as in the binding theory of intensionality. The conclusion, then, is that trying to defuse Bäuerle's challenge to the scope theory of intensionality using choice functions ultimately leads us out of the scope theory anyway.

6. Conclusion

In contrast with the scope theory of intensionality, the binding theory of intensionality makes short work of Bäuerle's problematic sentence, and without any need to invoke choice functions. On such an approach, illustrated in (18), the indefinite (analyzed as an existential quantifier) QRs to a position above the universal quantifier, and this is independent of the fact that the indefinite is relativized to George's belief worlds (w_1) whereas the universal is relativized to the actual world (w_0).

(18) λw_0 [George thinks-w_0 λw_1 [some five-star hotel downtown-w_1 [λ_5 every Red Sox player-w_0 is staying-w_1 in t_5]]]

A recurring theme in the literature is that the scope theory of intensionality undergenerates readings while the binding theory overgenerates. I have argued, *contra* Keshet (2010), that even the flexibility that comes with a choice function analysis of indefinites is not enough to save the scope theory from an undergeneration problem, once a wider range of considerations are brought to bear.

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