Indexicals in the semantics of stative verbs and beyond[*]

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1.   Introduction

Since Marantz (1984) and Kratzer (1996), it is widely accepted that external arguments are syntactically and semantically severed from their verbs. Kratzer (1996) proposed that they are introduced by the functional head VOICE, which composes with the verb phrase via the compositional rule EVENT IDENTIFICATION. As Bale (2007) shows using the repetitive presupposition introduced by the presupposition trigger *again* (Dowty 1976, von Stechow 1996, Beck and Johnson 2004), at least two distinct classes of verbs must be distinguished: eventive transitive verbs, which clearly have their external arguments severed, given that they exhibit what he calls *subjectless presuppositions* with *again*, and stative transitive verbs, which disallow such presuppositions, and must therefore therefore be taken to compose with their external arguments via FUNCTION APPLICATION.

In this paper, we propose a different understanding of why stative transitive verbs seem to need to introduce their external arguments directly and thus disallow subjectless presuppositions with *again*. Following Hale and Keyser (1993), we propose that stative transitive verbs contain an *anaphoric index* in their semantic representation, which is bound by the external argument. Furthermore, we suggest the locus of index binding is in functional heads located in the verbal spine, one of which is the VOICE head introducing the external argument (Kratzer 2009). This straightforwardly rules out subjectless presuppositions with stative transitive verbs. We show further that the analysis leads us to expect a parallel with eventive transitive verbs with reflexive themes, a prediction which is borne out. Finally, we extend the analysis to other verb classes argued to also exhibit some sort of binding in that the external argument is represented twice in the semantics, showing that as expected, these disallow subjectless presuppositions, even if the verb is both eventive and transitive. We close with a reflection on how our understanding of the way external arguments are introduced must be sensitive to the lexical semantics of individual verb classes, and neither tied to transitivity, as in Bale (2007), nor a general fact about all external arguments being

introduced VP-externally, as in Kratzer (1996). While we maintain a conservative syntactic analysis in that all external arguments are introduced via verbal functional heads, the individual lexical semantics of the verb conditions the way in which they compose with their argument and, correspondingly, determines whether subjectless presuppositions with *again* are possible.

2. Background: Subjectless Presuppositions

One implication of Kratzer's proposal to sever all external arguments from the verb concerns modification by the presupposition trigger *again*, long observed to be scopally ambiguous (Dowty 1976, von Stechow 1996, Beck and Johnson 2004). Bale (2007) notes that if the external argument is severed and introduced via Kratzer's rule of EVENT IDENTIFICATION, then *again*, by virtue of its semantic type, should be able to attach either before or after the external argument is introduced. In the latter case, a regular repetitive presupposition is produced in which the agent of the presupposed event and that of the asserted event must be identical. In the former case, by contrast, the agent of the presupposed event may differ from that of the asserted event. Bale (2007) shows that this prediction is indeed borne out when the VP headed by an eventive transitive verb, such as *hit*, is modified by *again*.

(1)   CONTEXT: Seymour's dryer broke. He called **a repairwoman who simply hit the dryer until it started working**. The dryer broke down two days later. So...

      a.   **The repairwoman returned and she hit the dryer again.**
      b.   **Seymour hit the dryer again.**

                                                          ((29) in Bale 2007)

On the other hand, if the external argument of stative transitive verbs like *love*, *hate*, and *respect* are also severed from the verb as Kratzer (1996) claims, then we expect subjectless presuppositions to be available with these verbs as well and therefore, we should expect ambiguities on par with eventive transitive verbs. This, however, is not borne out, as Bale (2007) shows.

(2)   CONTEXT: **Seymour's mother loved Frank**, although she was the only one who did. After a while she no longer cared for Frank. Later...

      a.   Seymour's mother rediscovered her feelings and so **Seymour's mother loved Frank again**.
      b. # Seymour grew attached to Frank and so **Seymour loved Frank again.**

                                                            ((47) in Bale 2007)

Based on this asymmetry in the availability of subjectless presuppositions with *again*, Bale concludes that there is a fundamental distinction between eventive and stative transitive verbs. Eventive transitive verbs have external arguments that are introduced outside the verb through functional heads, as Kratzer suggests, while the external arguments of sta-

tive transitive verbs are true arguments of the verbs, and must compose with the verb via FUNCTION APPLICATION.

(3)   a. $\llbracket hit \rrbracket$: $\lambda x.\lambda e.\text{HIT}(e) \wedge \text{THEME}(e) = x$ (no agent argument)

        b. $\llbracket love \rrbracket$: $\lambda y.\lambda x.\lambda e.\text{LOVE}(e) \wedge \text{THEME}(e) = y \wedge \text{EXPERIENCER}(e) = x$

                                       (experiencer introduced directly)

3.   Proposal: Anaphoric Indices

We propose a different understanding of Bale's observations regarding the absence of subjectless presuppositions with stative transitive verbs. Rather than stipulating how their external arguments are introduced, we take a cue from a syntactic analysis by Hale and Keyser (1993) and propose that such verbs contain an *index* that is bound by the external argument. Two pieces of evidence motivate Hale and Keyser's proposal: first, these verbs alternate productively in English with paraphrases containing the overt possessive verb *have*, as well as a ditransitive construction with *give*. In these cases, the experiencer argument can surface as a genitive pronoun, and when it does, it cannot be bound by the structurally closest argument, as is most transparent in the ditransitive *give* construction. For this reason, Hale & Keyser refer to such indices as bound *obviatively*.

(4)   a.   Mary has John's love.

        b.   John$_i$ gives Mary his$_i$ love.

        c.   Mary$_i$ has her$_{*i/j}$ love.

        d.   Mary$_i$ gives her daughter$_j$ her$_{i/*j}$ love.

Second, Hale and Keyser (1993) note that these verbs do not productively form middle constructions. For them, middle constructions arise when the verbal functional head that typically introduces the external argument is lacking such an argument, and therefore does not have the ability to assign accusative case.

(5)   a. *Mary loves easily.

        b. *John hates easily.

        c. *The truth respects easily.

The inability of these verbs to form middle constructions is explained if the indices on these verbs need to be bound obviatively, and middle constructions lack an external argument binder. Intuitively, the lack of an external argument means that the emotion denoted by the verb root cannot be tied to its particular individual experiencer and thus cannot be interpreted.

    We propose a semaniticization of Hale & Keyser's core insight as follows. First, verbs denote relations between individuals and states. The individual argument corresponds to the theme of the emotional state, in effect the entity toward which the emotional state is directed, while the state description is tied to a particular experiencer argument through the use of an index. This index, represented by a natural number and which we represent

more generally with a variable *n* over such numbers, is mapped to an individual through an *assignment function g*; we denote the resulting individual as *g(n)* in the following example with the verb *love*, where the state description is abbreviated as the meta-language relation LOVE-OF between *g(n)* and a state.

(6) $[\![love_n]\!]^g$: λx.λs.LOVE-OF$(g(n))$(s) $\wedge$ THEME(s) = x

Intuitively, the LOVE-OF relation, and any emotive relation so translated, can be understood as a state inalienably possessed by whoever *g(n)* comes to be. Naturally, the inalienable possessor of this state should correspond to the experiencer; after all, emotional states are private experiences, to which only the experiencer has direct access. We turn to how this identification of the experiencer with the inalienable possessor of the state is to enforced presently.
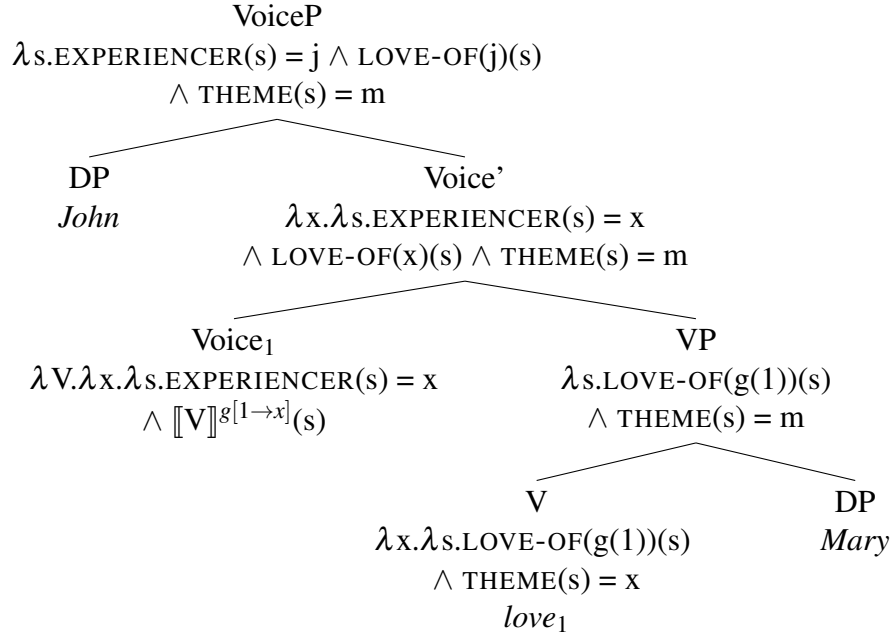
Upon composing with its theme argument, the verb will next compose with its an external argument. Unlike Bale (2007), we follow Kratzer (1996) in assuming that a functional head, which we identify with VOICE, is responsible for introducing this external argument. On top of this standard setup, we add an additional mechanism: following Kratzer (2009), we further treat argument-introducing heads like VOICE as the locus of index binding. Formally, the VOICE head abstracts over the index in its complement; the resulting open individual argument position created by lambda abstraction is then saturated by the argument that the functional head introduces in its specifier. We provide a translation for the VOICE head introducing an experiencer argument below.

(7) $[\![\text{VOICE}]\!]^g$: λV.λx.λs.EXPERIENCER(s) = x $\wedge$ $[\![\text{V}]\!]^{g[n \to x]}$(s)

In words, VOICE serves to introduce the EXPERIENCER argument, while also shifting any matching index in its complement to the individual *x*. This is effected by shifting the assignment function *g* to *g[n → x]*, an assignment just like *g* except that it maps the index *n* to the individual *x*. As *x* is the individual abstracted over by the function denoted by VOICE, this will result in the index being mapped to the EXPERIENCER of the state itself.

A full syntactic and semantic derivation, making use of the denotations of the key lexical entries above, is provided below. Here we use the particular index *1* on *love* and VOICE.

(8)   John loves Mary.

$$\text{VoiceP}$$
$$\lambda s.\text{EXPERIENCER}(s) = j \wedge \text{LOVE-OF}(j)(s)$$
$$\wedge \text{ THEME}(s) = m$$

DP — *John*

Voice'
$$\lambda x.\lambda s.\text{EXPERIENCER}(s) = x$$
$$\wedge \text{ LOVE-OF}(x)(s) \wedge \text{ THEME}(s) = m$$

Voice_1
$$\lambda V.\lambda x.\lambda s.\text{EXPERIENCER}(s) = x$$
$$\wedge \; [\![V]\!]^{g[1 \to x]}(s)$$

VP
$$\lambda s.\text{LOVE-OF}(g(1))(s)$$
$$\wedge \text{ THEME}(s) = m$$

V
$$\lambda x.\lambda s.\text{LOVE-OF}(g(1))(s)$$
$$\wedge \text{ THEME}(s) = x$$
love$_1$

DP — *Mary*

4.   Predictions

With the above analysis in place, the lack of subjectless presuppositions with stative transitive verbs falls out directly as a consequence of the binding of the index induced by VOICE. As with eventive transitive verbs, the VP in (8) is an available attachment site for *again*, producing a repetitive presupposition that Mary was previously loved. Importantly, however, the presupposition produced will contain the index *g(1)*. This index ultimately gets bound by the external experiencer argument introduced by VOICE. In effect, this then requires every prior loving event satisfying the presupposition to contain the same experiencer argument as the asserted event, as previously shown in (2). Adopting Bale's (2007) semantics for *again*, the relevant presupposition produced is shown below.

(9)   a.   Presupposition produced when attaching to VP in (8):
        $\exists s^1 \exists s^2 [s^1 \prec s^2 \prec E \wedge [\text{LOVE-OF}(\mathbf{g(1)})(s^1) \wedge \text{THEME}(s^1) = x] \wedge \neg \, [\text{LOVE-}$
        $\text{OF}(\mathbf{g(1)})(s^2) \wedge \text{THEME}(s^2) = x]]$
        b.   Presupposition after VOICE is introduced in (8):
        $\exists s^1 \exists s^2 [s^1 \prec s^2 \prec E \wedge [\text{LOVE-OF}(\mathbf{j})(s^1) \wedge \text{THEME}(s^2) = m] \wedge \neg [\text{LOVE-OF}(\mathbf{j})(s^2)$
        $\wedge \text{THEME}(s^2) = m]]$

Beyond stative transitive verbs, this general picture of binding accomplished by VOICE makes further predictions for eventive transitive verbs. While eventive transitive verbs typically allow for subjectless presuppositions with *again*, as shown in (1), replacing the theme with a reflexive pronoun rules out subjectless presuppositions.

(10)   CONTEXT: **Seymour** messed up on his exam and was so angry with himself that **he hit himself** repeatedly. Later on, he calmed down and sat down next to his father. After learning that Seymour messed up on his exam and feeling guilty that he did not help Seymour with his schoolwork, Seymour's father got so angry with himself and...
Seymour's father hit himself again.

However, this state of affairs can be understood if we follow Kratzer (2009) and assume that reflexive pronouns start out in the derivation as *minimal pronouns*, represented as indices that get bound by verbal functional heads. This means that we can give eventive transitive verbs with reflexive themes an analysis completely analogous to stative transitive verbs. The VP prior to introduction of VOICE contains an index mapped to an individual serving as the theme argument of the verb.

(11)   ⟦*hit himself$_n$*⟧: λe.HIT(e) $\wedge$ THEME(e) $= g(n)$

Modification of this constituent by *again* presupposes a prior event of hitting with the individual denoted by *g(n)* as theme of the event. Agentive VOICE then maps the index in the VP to the argument it introduces. Subjectless presuppositions are ruled out because any prior event satisfying the presupposition must have a theme identical to its agent, despite the fact that the agent is not included in *again*'s scope. A prior event of a distinct agent hitting themselves does not license the use of *again*, since the reflexive theme bound by the agent will likewise have a distinct interpretation from the asserted event.

(12)   a.   Presupposition produced attaching to VP in (11):
$\exists e^1 \exists e^2 [e^1 \prec e^2 \prec E \wedge [\text{HIT}(e^1) \wedge \text{THEME}(e^1) = \mathbf{g(n)}] \wedge \neg [\text{HIT}(e^2) \wedge \text{THEME}(e^2) = \mathbf{g(n)}]]$

   b.   Presupposition after (11) combines with VOICE to produce (10):
$\exists e^1 \exists e^2 [e^1 \prec e^2 \prec E \wedge [\text{HIT}(e^1) \wedge \text{THEME}(e^1) = \mathbf{s\text{-}f}] \wedge \neg [\text{HIT}(e^2) \wedge \text{THEME}(e^2) = \mathbf{s\text{-}f}]]$

In fact, we may go further and make a related prediction based on the presupposition in (12b). Note that the presupposition produced by *again* taking the VP as its argument, while presupposing an event whose theme happens to be the same as the agent of the event in the assertion, nevertheless does not impose any requirements of the *agent of the presupposed event* i.e., there is no AGENT thematic role in the presupposition. This predicts, then, that so long as the prior event is an event with Seymour's father as theme, a different agent hitting Seymour's father should satisfy the presupposition of *again*. This is indeed borne out, as the context below demonstrates.

(13)   CONTEXT: **Seymour** messed up on his exam and was so angry that **he hit his father** repeatedly. Later on, he managed to calm down and sat down next to his father. After seeing how agitated Seymour got over schoolwork and feeling guilty that he did not help Seymour with his schoolwork, Seymour's father got angry

with himself and...
Seymour's father hit himself again.

Taken together, these observations support the general proposal that binding of indices plays a role in determining the availability of subjectless presuppositions. This can be seen with stative transitive verbs, which on our proposal contain an inherent index bound that comes to be bound by the external argument, and can even be observed in VPs headed by eventive transitive verbs when their complement is a reflexive pronoun.

5. Extensions: Ingestive Verbs

Recall now that Bale (2007) predicts that all eventive transitive verbs should allow subjectless presuppositions with *again* and that their external arguments must be severed from the verb as Kratzer (1996) proposed. It is, however, not difficult to find counterexamples to this prediction. One class of eventive transitive verbs that plainly disallow subjectless presuppositions are verbs of ingestion such as *eat* and *drink*.

(14)   CONTEXT: **John drank the red wine**. He got punched in the gut, causing him to spit the wine back into his cup. Then, Bill came up, grabbed the cup, and...
        # **Bill drank the wine again.**

All else being equal, ingestive verbs appear to constitute an exception to Bale's generalization; indeed, given Bale's reasoning from the unavailability of subjectless presuppositions to type-theoretic distinctions in verb classes, ingestive verbs would need to be treated on par with stative transitive verbs, as a verb class that denotes a function taking its external argument directly, along with its internal argument.

There is, however, reason to think that all else is not equal in the case of verbs of ingestion. Ingestive verbs across languages have been given a decompositional analysis consisting of a causing event and a final result state representing either the state of the theme being digested by the agent (Jerro 2019) or a state of the theme being located inside the agent (Jackendoff 1992). For example, Jackendoff's conceptual semantic structure decomposes the verb *drink* into a caused motion event whereby the theme moves along a path to a location inside an individual's mouth.

(15) $[_{Event}$ CAUSE $([_{Thing}\ ]_i, [_{Event}$ GO $([_{Thing}$ LIQUID$]_j$ $[_{Path}$ TO $([_{Place}$ IN $([_{thing}$ MOUTH OF $([_{Thing}\ ]_i)]\ )]\ )]\ )]\ )]$

Most relevant to our concerns is the fact that the referent of the individual whose mouth the theme ends up in is represented twice in the semantic representation: once as the causer of the event, and one as the inalienable possessor of the location the theme ends up in, as indicated by Jackendoff through co-indexing. Given this basic insight, we can translate this into the approach presented here; the verb *drink* contains an index that serves as the argument of a stative relation, denoted by IN. As with stative transitive verbs, binding of this index is accomplished through an external argument introduced by VOICE, mapping it

to the external argument. The end result is that the external argument is both the causer of the event and the location of the theme at the end of the event.

(16) $[\![drink_n]\!]^g$: λx.λe.DRINK(e) $\wedge$ $\exists$s[CAUSE(e,s) $\wedge$ IN(x, **g(n)**)(s)]

The lack of subjectless presuppositions with ingestive verbs like *drink* is thus given a completely parallel treatment to stative transitive verbs. While the constituent produced after composing with the theme argument is of the right semantic type to serve as *again*'s argument, the constituent contains an index that is bound by the external argument introduced by VOICE, thereby ruling out subjectless presuppositions that would otherwise be available.

6.   Conclusion and Outlook

We proposed in this paper a treatment of the syntax and semantics of stative transitive verbs according to which they contain an anaphoric index in their lexical semantics, which comes to be bound by the external argument introduced by functional heads like VOICE. This makes a desirable prediction: while the external argument is indeed severed syntactically as suggested by Kratzer (1996), subjectless presuppositions are nonetheless not attested (Bale 2007) due to binding of the index within the constituent that *again* takes as its argument. Further support for such a view comes from VPs headed by eventive transitive verbs, which normally allow subjectless presuppositions, disallowing such presuppositions when they contain reflexive pronouns as objects, which we take to also involve binding of an index (Kratzer 2009). Finally, we extended the analysis to the class of ingestive verbs, which by virtue of being eventive and transitive, should in principle allow subjectless presuppositions under Bale's generalization. We showed that this prediction is not borne out, but can be understood if such verbs are given a decompositional analysis whereby their external arguments are doubly represented semantically through an index that gets bound by VOICE, an analysis that completely parallels stative transitive verbs and therefore accounts for the lack of subjectless presuppositions with this class of verbs.

   Bale (2007) took the lack of subjectless presuppositions as a diagnostic for whether external arguments are introduced VP-externally through functional heads like VOICE, distinguishing verb classes based broadly on transitivity and their semantic ontology as eventive or stative verbs. He maintains that the external arguments of eventive transitive verbs are severed syntactically and semantically, while while those of stative transitive verbs are true arguments of their verbs. This approach raises the question of why exactly these classes should differ in how their external arguments are introduced. In contrast, we showed here that, rather than appealing to transitivity and the eventive versus stative distinction, it is a property of the specific lexical semantics of verbs that determine whether or not subjectless presuppositions are observed with *again*. Importantly, we maintain a conservative and uniform syntax for external arguments in that they are always introduced by functional heads like VOICE, with the additional mechanism of binding of indices by verbal functional heads, an analysis motivated elsewhere in the literature (Kratzer 2009). Verbs fall into different classes depending on whether they encode indices that need to be bound;

this classification in turn corresponds directly to whether subjectless presuppositions with *again* are observed.

References

Bale, Alan. 2007. Quantifiers and verb phrases: An exploration of propositional complexity. *Natural Language & Linguistic Theory* 25:447–483.

Beck, Sigrid, and Kyle Johnson. 2004. Double objects again. *Linguistic Inquiry* 35:97–123.

Dowty, David. 1976. Montague Grammar and the lexical decomposition of causative verbs. In *Montague grammar*, ed. by Barbara Partee, 201–245. New York: Academic Press.

Hale, Kenneth, and Samuel Jay Keyser. 1993. On argument structure and the lexical expression of syntactic relations. In *The view from building 20: Essays in linguistics in honor of Sylvain Bromberger*, ed. by Jay Keyser Samuel and Kenneth Hale, 53–109. Cambridge, MA: MIT Press.

Jackendoff, Ray. 1992. *Semantic structures*. Cambridge, MA: MIT Press.

Jerro, Kyle. 2019. Ingestive verbs, causatives, and object symmetry in lubukusu. *Linguistic Inquiry* 50:219–232.

Kratzer, Angelika. 1996. Severing the external argument from its verbs. In *Phrase structure and the lexicon*, ed. by Laurie Ann Zaring and Johan Rooryck, 109–137. Kluwer, Dordrecht.

Kratzer, Angelika. 2009. Making a pronoun: Fake indexicals as windows into the properties of pronouns. *Linguistic Inquiry* 40:187–237.

Marantz, Alec. 1984. *On the nature of grammatical relations*. Cambridge, MA: MIT Press.

von Stechow, A. 1996. The different readings of *wieder* 'again': A structural account. *Journal of Semantics* 13:87–138.

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