On the surface, this talk is about solving an old puzzle about the argument structure of emotion verbs. I actually think that is intrinsically interesting, but I want to take a moment to motivate why this group in particular should be interested.

One of our best sources of information about how people understand and represent events is what they say about events. As we’ll see in a moment, I don’t mean this in the trivial sense that asking people questions is cheaper and faster than doing an MRI experiment, rather
The structure of verbs themselves opens a window onto event structure. [PAUSE] I couldn’t find a good picture of a window into an event or the mind or anything, so we’ll just pretend that there is some kind of event going on in the background here. [CLICK]
The reason is that if you look at the situation with sufficiently fine granularity, there is essentially an unbounded number of events that could happen, but the number of extant verbs is much smaller. So this means that in order to use verbs, we must generalize across events, treating Sally frightening Mary and Bats frightening Jimmy as somehow similar. And, as we shall see, in fact there are generalizations that operate across verbs as well. The fact that we have the generalizations that we have and not some other set of generalizations puts constraints on how we might be representing events. [PAUSE] So it is in that context I would like you to think about the following study and data.
Language involves a mapping between some nonlinguistic idea to be expressed and an utterance. A fundamental question in the study of language is how people establish that correspondence. I’m going to simplify the problem considerably by assuming our speaker here has already retrieved names for components of this thought she wants to express: This is Sally, this is a ball, and the action to be described is one of hitting. The question I’m exploring, then, is the linking problem: how the speaker knows to say...
“Sally hit the ball” and not
“the ball hit Sally”.
That is, how we know it’s always the HITTER that goes in subject position and the HITTEE in object position? One possibility, of course, is that we learn exactly that: a linking rule that maps HITTER to SUBJECT and HITTEE to OBJECT specifically for the verb HIT. Note that this requires that we have some way of generalization across specific instances of hitting in order to designate one event participant the “hitter” and the other, the “hittee”.
And perhaps we learn similar rules for other verbs. Here are some other example sentences with other verbs:
The catcher tagged the runner.
EATER  EATEE
---  ---
The boy eats the tomato.

The boy eats the tomato.
The storm trooper kicked the man.
Notice that these verb-specific rules miss a glaring generalization: In all these cases -- and in many, many more cases, the entity that instigates the action -- the “agent” -- is realized as the sentential subject, and the entity that is affected -- the “patient” -- is realized as the direct object.

This is an extremely pervasive generalization. For some types of events, we see the same linking rule apply for all verbs of that type and across all languages, with at best a small number of disputed exceptions. These linking rules even generalize to novel verbs.
In a nice study, Alec Marantz present participants with novel events such as one in which a horse does something that causes a bear to fall over, and the participant is supposed to use the novel verb “pilk” to describe this event.
Children, like adults, prefer “The horse pilked the bear” rather than “The bear pilked the horse.”
Thus, these linking generalizations are extremely powerful, and any theory of linking rules has to account for this regularity. One option, explored by a number of researchers, is to argue that linking rules are exceptionless and/or innate.
Some of the most famous proposals along those lines are the Universal Alignment Hypothesis by Perlmutter & Postal, and the Uniformity of Theta Assignment Hypothesis by Baker. If some form of these hypotheses were true, it would produce an elegant theory and also have obvious advantages to the language learning.

Of course there are verbs where it’s not completely obvious that there is an agent and a patient. So consider
Elvis left the building.

[READ]. But you can probably get away with adding some additional generalizations, such as goals and sources. A more significant problem is that alongside the broad consistencies I just discussed are also some apparent inconsistencies as well.
Take this scenario. The monkey seems to be experiencing some negative emotion in relation to the lion. This isn’t clearly an action verb, so rather than “agent” and “patient,” let’s say the lion is the STIMULUS of this emotion and the monkey is the EXPERIENCER.

It appears that there are at least two ways of mapping this semantic roles onto syntactic positions: either the STIMULUS maps onto the subject -- “Lion frightens Monkey” -- or onto the direct object -- “Monkey fears Lion”. And in fact there are a number of verbs like *frighten* that take the stimulus as the subject, and a number of verbs like *fear*, which take the experiencer as the subject. Thus any general rule that uses the same semantic roles for both types of verbs is going to get at least one set of verbs wrong.
So the links between syntax and semantics show both broad regularities as well as apparent inconsistencies. Any theory has to explain both. In this talk, I’ll be focusing on “psych verbs” -- the fear and frighten verbs just discussed -- but I should point out that they aren’t the only examples of inconsistent linking rules. So psych verbs here serve as a case study for a broader problem. Theorists have generally taken one of three approaches to the problem of psych verbs.
The first option is to accept irregularity in linking rules. There are broad linking rules such as agent-onto-subject, but for “psych verbs,” there’s no general pattern and the linking rules must be learned verb-by-verb..

The second option maintains regularity in the linking rules by introducing irregularity in the syntax. Probably the most famous of these accounts is Belletti & Rizzi’s, on which fear verbs are normal syntactically-transitive verbs, whereas frighten verbs actually have two internal arguments, which then triggers movement of the stimulus to the subject position.

The third option, called the “finer-grained semantics” approach by Pesetsky, is to maintain regularity in the linking rules by introducing additional complexity into the semantics. In the case of psych verbs, the idea is that there is some underlying difference in the semantics of stimulus-subject frighten verbs and stimulus-object fear verbs. So instead of the verbs involving the same semantic roles “stimulus” and “experiencer”,

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**Hypothesis 1**

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stimulus experiencer stimulus experiencer
↓ ↓
Lion frightens Monkey Monkey fears Lion
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they actually have different sets of semantic roles and thus different linking rules apply, just as different linking rules apply to causative verbs and intransitive motion verbs.
One way to distinguish these possibilities is to look at how they handle generalization. The simplest prediction of the linking rule irregularity hypothesis is that there should be no generalization to novel psych verbs, or at least no systematic generalization, because there aren’t verb-independent linking rules to apply to a novel verb.
For the syntactic irregularity hypothesis, on the assumption that verbs that lack external arguments and require movement are marked or somehow unusual -- which seems reasonable -- people should prefer generalizing the
fear pattern.

In contrast to the other two hypothesis -- and this is the crucial difference we’ll be investigating -- the finer-grained semantics hypothesis clearly predicts that generalizations of psych verb linking rules should
depend systematically on the semantics of the verb. Of course, to test that prediction, we need to know how the semantics of stimulus-subject *frighten* verbs and stimulus-object *fear* verbs differ.
There are three main proposals that have been raised in the literature. One notes that frighten verbs can describe states or events, whereas fear verbs always describe states. Pylkkanen has argued that, even to the extent that both types of verbs can describe states, frighten verbs describe stage-level states whereas fear verbs describe individual-level states. Finally, Pesetsky and others have argued that frighten verbs describe *caused* states or events, whereas fear verbs do not directly encode cause. I’m not going to discuss these in detail because, from our perspective here, it doesn’t matter which, if any are right -- the question at hand is whether there is a semantic difference between the verb classes. For that reason, we used a manipulation that roughly catches all three of these distinctions: temporal duration.
That is, the situation described by a frighten verb is relatively short-lived compared with a situation described by a fear verb. This is easy to see in examples. Consider Mary surprised John -- that probably lasts a few minutes or hours. Now, Mary loved John -- with any luck, that’ll last a lifetime.
Looking back at our predictions, on the finer-grained semantics hypothesis, if we were to ask people to use novel verbs to describe psychological states, they should apply the fear pattern to long-lived situations and the frighten pattern to short-lived situations.
We ran the first experiment in English. The conceit of the experiment was that we were asking participants if they could correctly use Japanese loan-words. Importantly, we chose predicates for which there is no existing English equivalent, so participants couldn’t just use the syntax of an equivalent English verb.

We presented them with 8 long-lived psychological states based on words from Japanese, such as tekitaishin, “the feeling of rivalry”. And the participants had to decide whether it is correct to say “Richard tekitaishins Harvard’s basketball team” or “Harvard’s basketball team tekitaishins Richard” -- that is, is tekitaishin a *fear* verb or a *frighten* verb. The prediction here, again is that it’s a fear verb.

We also presented participants with short-lived states like tokimeki -- the feeling of one’s heart eating because of encountering an attractive person or thing. Here, by hypothesis, participants should prefer the *frighten* use: Seeing the gorgeous necklace tokimeki’s Sally.

And the results
bear this out. For long-lived states, participants preferred the *fear*-type syntax, that is mapping the stimulus onto the object and experiencer onto subject. I should mention that we ran two versions of the experiment: one in present tense and one in past, and as you can see the effect generalizes nicely.
This results are thus consistent with the finer-grained semantics hypothesis and not the other hypotheses...

...at least for English. One interesting thing about psych verbs is that not only do they exhibit these apparently conflicting *frighten* and *fear* patterns in English, these two patterns show up in many different languages. The finer-grained semantics hypothesis could handle these cross-linguistic data one of two ways.
Hypothesis 3
finer-grained semantics

\[
\begin{array}{ccc}
A & B & X & Y \\
\downarrow & \downarrow & \downarrow & \downarrow \\
\text{Lion frightens Monkey} & \text{Monkey fears Lion} \\
\end{array}
\]

Language-specific semantic distinction
or
Universal semantic distinction

One version is that linking rules must be exceptionless within each language, but each language can carve up the semantic space how it wants. Duration matters for English psych verbs, but there’s no need for other languages to use the same distinction as long as they have a distinction.
The other possibility -- the one advocated by Pesetsky -- is that the same semantic distinction should apply to all languages, allowing all linking rules to be innate.
To follow up, then, we looked at Japanese. Japanese is unrelated historically to English and differs structurally in many ways from English, which is important for testing the generality of our semantic effect. Importantly it has a causative affix -(s)aseru which is used to create *frighten* verbs out of *fear* verbs. For instance: Taro-wa koomori-o kowagatta means Taro feared bats. Add -saseru to the verb, though, and you end up with
Experiment 2: Japanese

- Unrelated to English
- Many structural differences
- Causative affix - (s)aseru

(a) Taro-wa koomori-o kowagat-ta.
Taro-TOP bat-ACC fear-PAST
Taro feared bats.

(b) Koomori-wa Taro-o kowagar-ase-ta.
bat-TOP Taro-ACC fear-CAUSE-PAST
Bats frightened Taro.

Koomori-wa Taro-o kowagarASEta, or Bats frightened Taro.
In fact, of monomorphemic psych verbs -- ones without the causative affix -- only about 4 are stimulus-subject *frighten* verbs. This makes for a nice manipulation.
We basically ran the same experiment, but in Japanese and in Japan. Again, the conceit was that we were quizzing people on loan-words, this time from English. Again, we chose states for which there was no existing Japanese verb. The key is that we used *monomorphemic* psych verbs. So if they nonetheless like realizing short-lived states as *frighten* verbs, that would be striking since monomorphemic frighten verbs are nearly nonexistent in Japanese.
And in fact we did find that for short-lived states (shown in red), participants were less likely to choose the stimulus-object *fear* pattern and more likely to choose the stimulus-subject *frighten* pattern, both in the present-tense experiment and the past-tense experiment. This again supports the
the finer-grained semantics hypothesis and is inconsistent with the other hypotheses.
semantics can guide psych verb argument realization
universal syntax-semantics linking rules?

<table>
<thead>
<tr>
<th>Hypothesis 3</th>
<th>Generalization Predictions</th>
<th>Existing Verbs</th>
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</table>
| finer-grained semantics | English ✔ ✔ | Finnish ✔ ✔
|                           | Japanese ✔ ✔ | Mandarin ✔ ✔ |
|                           |               | Russian ✔ ✔ ✔ |

Thus, semantics can guide psych verb argument realization. The data are intriguingly consistent with the proposal that a single semantic distinction underlies linking rules for *fear* and *frighten* verbs in all languages. Of course, data from two languages -- even two historically unrelated languages -- is only a start, though I should point out there is some evidence from other languages as well. As already mentioned, Pylkkanen argued for a similar semantic distinction in existing Finnish psych verbs. We ourselves have additional data suggesting that the long/short distinction applies to existing verbs in Mandarin and Russian as well. So there appears to be enough evidence in favor of the universalist position to make it an intriguing topic of future study.

This discussion has so far focused on the similarities in the English and Japanese data. I’d like to take a look at one difference as well.
Here are the Japanese and English data side-by-side. You’ll notice an interesting baseline effect:
Japanese participants prefer the stimulus-object fear syntax. What can we make of that? The simplest explanation is simply that the Japanese stimuli involved longer-lived states than the English stimuli. However, we did a separate rating study of all our stimuli, and that’s not the case -- if anything, it was the English stimuli that were non-significantly longer-lived. I have those data and can show you how we did the rating study during the Q&A.
As already pointed out, while most mono-morphemic psych verbs in English have the *frighten* syntax, nearly all Japanese psych verbs have *fear* syntax. The *frighten* syntax is largely reserved for psych verbs with overt causative affixes. Participants may be using what they’ve learned from the statistics of their own language to either override the semantic information we gave them or reinterpreting the semantic information to fit their language-dominant pattern. That’s an intriguing possibility because it allows for both innate linking rule biases AND cross-linguistic variation. We tested that possibility by again utilizing the statistics of existing Japanese verbs. Namely
all -aseru affixed verbs are stimulus-subject *frighten* verbs. So if we present participants with novel aseru-affixed verbs,
like this, they should switch from a fear-preference to a frighten-preference, consistent with existing causative verbs in Japanese. And, in fact, they do.

It’s striking that the short/long distinction nonetheless still has an effect. Keep in mind that there are no fear-type -aseru-affixed verbs in Japanese, so they can’t be picking the fear pattern for long-lived states based on analogy to existing -aseru-affixed verbs in Japanese.
So here’s the story. The are broad regularities in the mappings between syntax and semantics, which has led some theorists to propose that linking rules are exceptionless and possibly even innate. I just presented evidence that psych verbs -- which are widely regarded as exceptions to that story may not be so problematic after all: systematic differences in the semantics of psych verbs predict the semantics-to-syntax mapping. Moreover, the same semantic difference is at work in at least several languages. These data support those universalist positions on which linking rules are exceptionless and innate. However, the same data also showed some predictable cross-linguistic variation as well in baseline preferences for particular types of verbs. This interaction of language-general and language-specific factors is intriguing and something we’re currently exploring further. For instance, is this a preference for certain types of linking rules or for verbs with certain kinds of semantics? So take the Japanese participants in Experiment 2 who preferred fear-type syntax for novel monomorphic psych verbs. This could be because they were over-applying the stimulus-object pattern, which is dominant in Japanese -- even to short-lived states, overriding an innate bias to realize short-lived states and frighten verbs. Alternatively, they have a bias to assume monomorphic psych verbs describe long-lived states and interpreted the information we gave them consistent with that bias.
Verbs as a window into event structure

So returning to my metaphor...
thank everyone who contributed to this project, and also you, for listening, and I welcome your questions.