18/02/2021

Psych verbs and their psych side effects

A review of “Hartshorne, J. K., O’Donnell, T. J., Sudo, Y., Uruwashi, M., Lee, M., & Snedeker, J. (2016). Psych verbs, the linking problem, and the acquisition of language. Cognition, 157, 268-288.”

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The systematic mapping hypothesis

- ✓ Event participants; semantic roles and syntactic roles
  - ➢ The dog bit her brother.
  - ➢ Her brother bit the dog.
  - ➢ Word order, case marking, grammatical markers on verb (Dryer & Haspelmath, 2013)
- ✓ Transitive sentences
  - ➢ an agent who causes motion *or* a change of state in another entity is realized as the subject (Baker, 1988; Dowty, 1991; Levin & Rappaport Hovav, 2005).
- ✓ The systematic mapping hypothesis (SMH): broad mappings rules between syntactic and semantic roles across predicates with few, if any, exceptions
- ✓ What is exactly the degree of this systematicity?

Language acquisition and SMH

- ✓ How much is learned and how learning proceeds ?
- ✓ Systematic mapping supports bootstrapping
  - ➢ Syntactic bootstrapping (Fisher et al., 2010; Cassidy et al., 2005)
    - Transitive sentence: subject ↔ actor; object ↔ patient
    - The boy *gorped* the dog. (e.g. petted or fed)
  - ➢ Semantic bootstrapping (Grimshaw, 1981; Pinker, 1984, 1989)
    - Agents of caused motion must be realized as the subject of the sentence.
    - English marks the subject with word order.
- ✓ Two types of theories of language acquisition
  - ➢ **Theories employing abstract linking rules between syntax and semantics: top-down process (e.g. Gleitman, 1990; Grimshaw, 1981; Pinker, 1984, 1989)**
  - ➢ Constructivist theories: bottom-up process (e.g. Goldberg, 1995, 2006; Tomasello, 1992, 2003: verb island hypothesis)

What about exceptions ?

- ✓ "Psych alternation": Agnes's terror of Beatrice
  - ➢ Agnes feared Beatrice.
  - ➢ Beatrice frightened Agnes.
- ✓ "*Dative alternation*": An object moving from Agnes's possession to Beatrice's possession
  - ➢ Agnes threw the ball to Beatrice.
  - ➢ Agnes threw Beatrice the ball.
- ✓ These examples call intro question the systematic mappings from semantics to syntax as well as the utility of learning procedures that seek to exploit such systematicity.
- ✓ Two types of theories of language acquisition
  - ➢ Theories employing abstract linking rules between syntax and semantics: top-down process (e.g. Gleitman, 1990; Grimshaw, 1981; Pinker, 1984, 1989)
  - ➢ **Constructivist theories: bottom-up process (e.g. Goldberg, 1995, 2006; Tomasello, 2003, 1992: verb island hypothesis)**

Constructivist accounts

- ✓ Constructivist accounts (Goldberg, 1995, 2006; Tomasello, 2003 1992: verb island hypothesis)
  - ➢ learning the linking patterns item by item
  - ➢ gradually generalizing
- ✓ Evidence for constructivist accounts
  - ➢ Lexically anchored learning is clearly possible
    - Idioms and other exceptional mappings (Jackendoff, 2002)
    - Adults readily learn lexically-determined mappings in artificial language studies (Wonnacott et al., 2008)
  - ➢ Young children are less likely than older children to generalize novel verbs from one construction to another
    - Syntax-semantic mapping becomes more abstract over time.
  - ➢ Adults and older children quickly learn an arbitrary unattested syntax-semantics mapping and generalize it to new verbs (Casenhiser & Goldberg, 2005; Goldberg et al., 2004)
    - Five-year olds, on the other hand, will only acquire lexically-anchored mappings (Boyd & Goldberg, 2011).

Different semantic construals (?)

- ✓ Dative alternation/Transfer events
  a. Agnes threw/kicked the ball to Darpny. (prepositional dative) → person/organization/location
  b. Agnes threw/kicked Darpny the ball. (double-object dative) → capable of possession → person/organization
- ✓ Two different *semantic structures* or *conceptualizations/construals* of transfer events are expressed and mapped onto two different syntactic forms (Beavers, 2011; Hovav & Levin, 2008).
  - ➢ a. → change of location
  - ➢ b. → change of possession
- ✓ Adults' construction choice in novel transfer verbs depends on this *semantic distinction*. This ability is present by five years of age (Ambridge et al., 2012b; Gropen et al., 1989).
- ✓Similar evidence
  - ➢ Locative alternation → generalization in preschoolers (Ambridge et al., 2012a; Gropen et al., 1991b, 1991a)
  - ➢Causal transitive-intransitive alternations → generalization in 2;6 children (Ambridge et al., 2011; Ambridge et al., 2008)

The SMH reviewed

- ✓ Different semantic structures = Different syntactic structures → allows us to maintain the SMH
- ✓ Nevertheless, we need three kinds of evidence for SMH
  - ➢ Evidence of *systematicity*
  - ➢ Evidence of *generalization*
  - ➢ Evidence from *early emergence*
- ✓ That is exactly the aim of the paper.
- ✓ What if the two sentences express different semantic construals.
  - ➢ Agnes feared Beatrice.
  - ➢ Beatrice frightened Agnes.

Psych verbs

- ✓ Frighten type verbs (FrTV): Agnes frightened/angered/delighted Bartholomew
- ✓ Fear type verbs (FTV): Agnes feared/hated/loved Bartholomew
- ✓ Both classes of verbs describe the same types of emotions.
- ✓ Two preliminary studies were conducted in order to FTV and FrTV
  - ➢ The Valence-Arousal model (Russell, 1980)
  - ➢ Ekman's (1992) basic emotions theory

Ten native English speakers classified 42 fear-type and 216 frighten-type verbs from Levin (1993) into the thirteen basic emotions listed by Ekman (1992), plus the category of "other". Note that we glossed his positive emotion category ("amusement, relief, sensory pleasure, pride in achievement, the thrill of excitement, satisfaction, and contentment"; Ekman, 1992, p. 190) as "enjoyment". Of the 141 verbs that could be classified, the ratio of each emotion type was indistinguishable from the ratio in the language as a whole (approx. 16% fear-type).

Table 1
English psych verbs in each basic emotion category.

Basic Emotion	Fear-type	Frighten-type	P-value
Anger	5	19	0.58
Awe	4	11	0.27
Contempt	1	2	0.07
Disgust	1	0	0.33
Embarrassment	1	4	0.59
Enjoyment	8	20	0.12
Excitement	1	13	0.71
Fear	1	9	1.0
Guilt	0	0	NA
Interest	1	12	0.71
Sadness	0	12	0.24
Shame	0	2	1.0
Surprise	2	7	0.65
Other	1	4	0.59

- ✓ List of verbs (Levin, 1993)
  - ➢ 216 FrTV (p. 189): amuse, convince, depress, devastate, interest
  - ➢ 42 FTV (p. 191): admire, adore, appreciate, enjoy, hate

Possible explanations of the linking patterns

- ✓ There is no clear consensus about what the relevant semantic distinction is or how it explains the linking patterns.
- ✓ Causality
  - ➢ Tenny (1994): the stimulus of FrTV is causal
  - ➢ Dowty (1991): stimulus is always causal
  - ➢ Croft (2012): stimulus of FrTV is causal; experience of FTV is causal
  - ➢ Talmy (1985): semantic illusion that the experience of FTV is causal
  - ➢ Landau (2010): only FrTV may be agentive
  - ➢ Pesetsky (1995)
    - FrTV are causal.
    - FrTV and FTV verbs have different thematic roles.
    - Agnes hated the newspaper article.
    - The newspaper article angered Agnes.

Possible explanations of the linking patterns

- ✓ Aspectual distinctions: FTV → static states; FrTV → events and states
  - ➢ Arad (1998) and Landau (2010)
    - The variation is attributable to systematic differences between different classes of FrTV (e.g. concern → stative).
  - ➢ Grafmiller (2013)
    - The variation is probabilistic and based on world knowledge and the contexts in which the verbs are used.
  - ➢ Pylkanen (1999)
    - All FrTV describe emotional states that can be bound to time and place.
    - No FTV can do so.
    - Agnes concerned Bartholomew yesterday in the kitchen.
    - *Agnes feared Bartholomew yesterday in the kitchen.
- ✓ Other theorists: The linking patterns of the psych verbs is abstract and must be learned (Belletti & Rizzi, 1988; Culicover & Jackendoff, 2005).
- ✓ <u>Previous studies</u>: errors in production and comprehension
  - ➢ L2 learners and patients with agrammatic aphasia → more errors with FrTV (Pinango, 2009; Sato, 2003; Thompson & Lee, 2009)
  - ➢ Children learn FrTV earlier that FTV despite their low frequency (Hartshorne et al., 2015).

Interim summary and beyond

- ✓ FrTV: Bartholomew frightened Agnes.
- ✓ FTV: Agnes feared Bartholomew.
- ✓ Adopted tenets:
  - FrTV express specific instances (episodes) in which the subject *causes* an emotion to the object. → encodes causality
  - FTV express habitual attitudes. → does not encode causality
- ✓ Their account converses with
  - Pesetsky (1995):
    - Non-experiencer roles are different.
    - FrTV encode causality but FTV do not .
  - Dowty (1991) & Tenny (1994): states vs events
  - Pylkannen (1999): bounded vs unbounded states
- ✓ Is there any evidence for this semantic distinction ?
  - Evidence of *systematicity* → Experiments 1-4
  - Evidence of *generalization* → Experiments 5-8
  - Evidence from *early emergence* → Experiment 9

Experiment 1
Episode vs Attitude in English

- ✓ FrTV: emotional episodes, which are anchored in time and place.
- ✓ FTV: habitual attitudes
- ✓ Compare
  - The bats swooped out of the cave and frightened Agnes.
  - *The bats swooped out of the cave and Agnes feared them.
- ✓ List of verbs from Levin (1993)
  - 216 FrTV
  - 42 FTV

Experiment 1 – Method

- ✓ Participants: 48 native speakers of English
  - ➢ Age: 19 - 77 (M = 38, SD = 14)
- ✓ Recruited and tested through the Internet experiment portal: gameswithwords.org
- ✓ Participants were
  - ➢ given sentences such as *Sally frightened Mary*.
  - ➢ asked to rate how long the mental stated was likely to have lasted.
- ✓ Possible answers
  - ➢ Seconds Minutes Hours Days Weeks Months Years
- ✓ Episodes last on average shorter than the habitual attitudes.
  - ➢ Agnes remained frightened for years.
  - ➢ Agnes only feared Bartholomew for a little while, until she got to know him better.
- ✓ Randomization
  - ➢ Order of the verbs for each participant
  - ➢ Names drawn on each trial from a list of 70 female names

Experiment 1 – Results and discussion

- ✓ Participants' answers were converted in a seven point Likert scale for analysis.
- ✓ The **mental state** described in FTV was judged to last *significantly longer* than those described by FrTV ($t(256) = 19.9$, $p < 0.001$).
  - ➢ 18/42 of FTV (42%) → longer durations than any FrTV
  - ➢ 153/216 of FrTV (71%) → shorter durations than any FTV

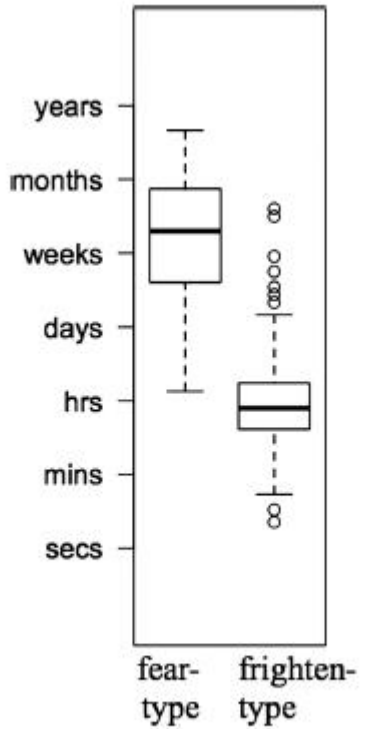


Fig. 2. Results of duration ratings by verb in Exp. 1. Error bars represent 1.5 standard deviations.

Experiment 1 – Results and discussion

- ✓ This experiment contributes also to the debate of whether there are stative FrTV.
- ✓ A stativity test
  - ➢ Progressive
    - John knows the answer.
    - *John is knowing the answer.
    - ?The situation is depressing Mary.
- ✓ Grafmiller (2013): acceptability in the progressive is a pragmatic effect
  - ➢ Temporary situation is odd for relatively durable states.
    - *The house is standing at the end of Longfellow Place.
    - The mobile home is standing at the end of Longfellow Place.
- ✓ In the current study: bore, concern, depress, worry
  - ➢ Average duration longer than the other FrTV (3.7 vs. 2.9 on the 7-point Likert scale) but shorter than the average FTV (5.2)

Experiment 1 – Results and discussion

- ✓ It is not clear from the results of the experiment whether the relationship between syntax and semantics is strong or categorical.
  - ➢ Strong: most of FrTV → episodes *and* most of FTV → habitual attitudes
  - ➢ Categorical: all of the FrTV → episodes *and* all of the FTV → habitual attitudes
- ✓ None of the investigated theories predict or require linking patterns without no exception.
- ✓ Thus, they leave the project of delineating *the semantics of each verb* for future research.

Experiment 2
Causation in English

- ✓ The semantic analysis they adopt (cf. Grimshaw, 1990; Pesetsky, 1995):
  - ➢ FrTV *encode* causation: stimulus causes the mental state to the experiencer
  - ➢ FTV do not *encode* causation (the object is a target of emotion)

- ✓ The participants were
  - ➢ given a sentence: *Agnes frightened Bartholomew*
  - ➢ asked who, if anyone, caused the mental state.

- ✓ Predictions/Reasoning
  - ➢ The subject will be systematically chosen in FrTV.
  - ➢ No strong or consistent preference will be displayed in FTV.

Experiment 2 – Method

- ✓ Participants: 20 native speakers of English
  - ➢ Age: 24 - 41 (M = 30, SD = 5)
- ✓ Recruited through the university study pool and compensated with course credit or a small payment
- ✓ List of verbs from Levin (1993)
  - ➢ 216 FrTV
  - ➢ 42 FTV
- ✓ The sentences were presented on a computer.
  - ➢ The order of the verbs was randomized separately for each participant,
  - ➢ Names drawn on each trial from a list of 70 female names

Experiment 2 - Method

- ✓ The sentences were presented in a court case scenario in a science fiction context.

- ✓ Participants were told that
  - ➢ It is illegal to knowingly or negligently cause emotions in other people.
  - ➢ Sometimes emotions simply happen on their own.
    - If that's the case, then it is nobody's fault and nobody should be convicted.

- ✓ Example: *Mary frightened Sally*
- ✓ Question: Is anyone guilty of causing the emotion ?

Experiment 2 – Results and discussion

- ✓ For statistical comparison, two types of classification based on the majority of the answers were employed.
- ✓ Syntactic classification/labelling
  a) Subject-verbs
  b) Object-verbs
  c) Neither-verbs
  d) Unclassifiable
  - ❖ Results for FrTV and FTV significantly different in a Fischer's Exact test ($p < 0.001$)
- ✓ Semantic classification/labelling
  a) Stimulus
  b) Experiencer
  c) Neither
  - ❖ Results for FrTV and FTV significantly different in a Fischer's Exact test ($p < 0.001$)

Experiment 2 – Results and discussion

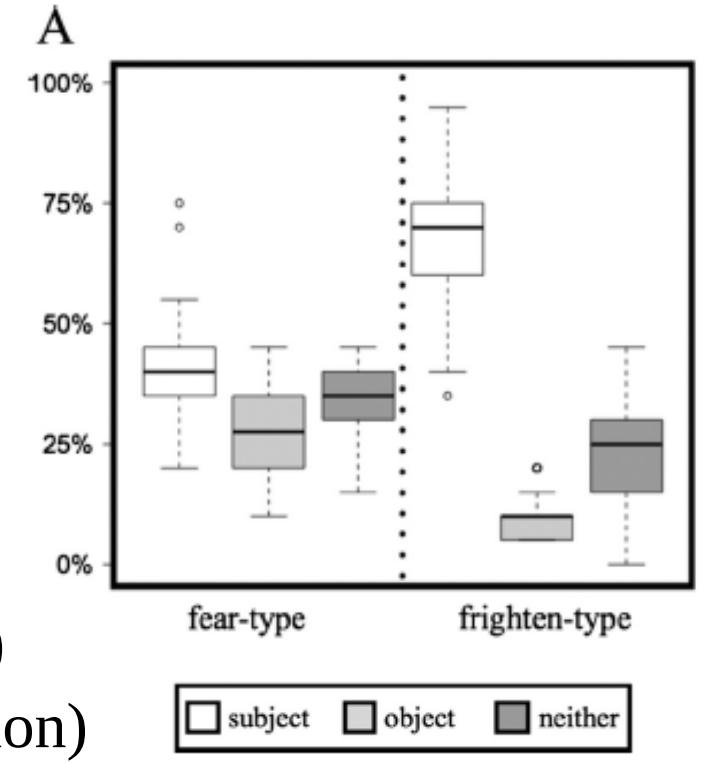
- ✓ Testing the *systematic mapping hypothesis*
  - ➢ Testing whether the semantic distinction holds on average **or** for most/all of the verbs

- ✓ For each item separately, they test whether *the most common response* was significantly more common (in a binominal test) than *the second most common response*.

- ✓ The general pattern was confirmed.

Experiment 2 – Results and discussion

- ✓ 216 FrTV
  - ➢ 118 non-significant preference for the subject (stimulus)
  - ➢ 96 significant preference for the subject (stimulus) ($p<0.05$)
  - ➢ 1 non-significant preference for neither
  - ➢ 1 unclassifiable
- ✓ 42 FTV
  - ➢ 2 significant preference for subject (experiencer)
  - ➢ 18 leaned non-significantly towards the subject (experiencer)
  - ➢ 7 leaned non-significantly towards the object (target of emotion)
  - ➢ 5 leaned non-significantly towards the neither
  - ➢ 10 unclassifiable



Experiment 2 – Results and discussion

- ✓ FrTV: clear intuitions for causality
- ✓ FTV: no clear intuitions for causality
- ✓ Predictions were confirmed
  - The subject was systematically chosen in FrTV
  - *No strong or consistent preference* was displayed in FTV
- ✓ Note: Participants did not necessarily judge that FTV have no cause at all.
  - ➢ They simply appeared unsure as to what exactly the cause was.
- ✓ Alignment with
  - ➢ Grimshaw (1990)
  - ➢ Pesetsky (1995)
- ✓ No alignment with
  - ➢ Talmy's (1985) and Croft's (2012) suggestion: subject is always causal
  - ➢ Dowty's (1991) and Rozwadowska's (1992) suggestion: stimulus is always causal
  - ➢ Landau's suggestion (2010): some but not all of FrTV are causal

Experiment 3
Causation in Mandarin

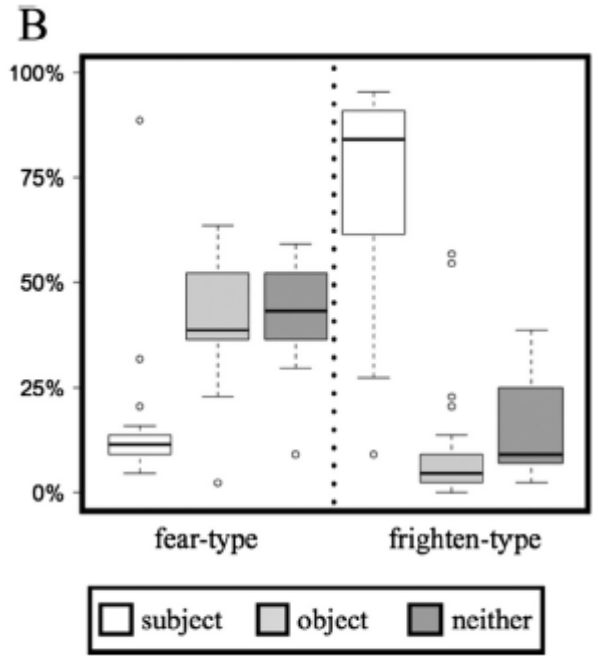
- ✓Aim: to test whether causality is also associated with FrTV but not with FTV

Experiment 3 – Method

- ✓ Participants: 44 native speakers of Mandarin
  - ➢ Age 18-32 (M= 20, SD= 3)
- ✓ Tested in a classroom setting in Taiwan and compensated a souvenir
- ✓ List of verbs compiled by the authors
  - ➢ 25 FrTV
  - ➢ 25 FTV
- ✓ A paper and pencil task
  - ➢ Story-participants/names were randomly drawn from a list of 90 names
  - ➢ Which names went with which verbs was fixed.
  - ➢ Four booklets were created for counter-balancing the order of the verbs and the syntactic role of the story-participants/names.

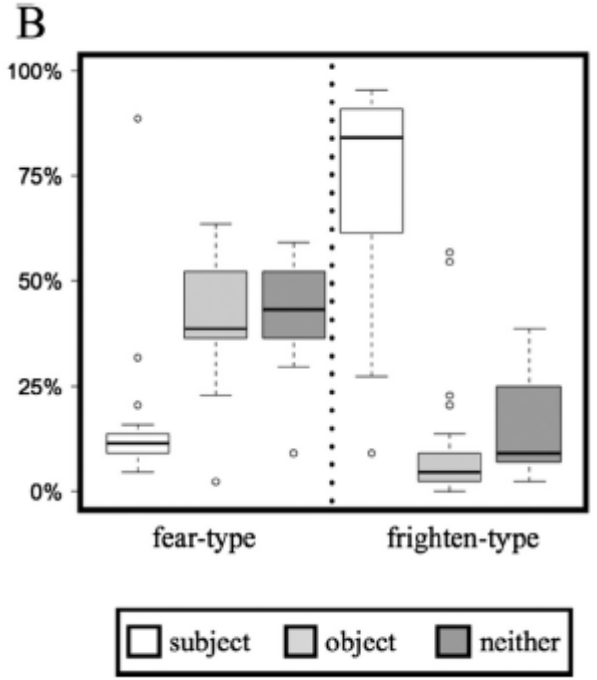
Experiment 3 – Results and discussion

- ✓ Causal responsibility
  - ➢ FrTV: subject (stimulus)
  - ➢ FTV: at least likely to choose neither or any other answer
- ✓ Syntactic labelling
  - ➢ Significant difference in Fisher's Exact Test ($p<0.001$)
- ✓ Semantic labelling
  - ➢ Significant difference in Fisher's Exact Test ($p<0.001$)



Experiment 3 – Results and discussion

- ✓ 25 FrTV
  - ➢ 19 significant preference for the subject
  - ➢ 3 non-significant preference for the subject
  - ➢ 2 non-significant preference for the subject
  - ➢ 1 unclassifiable
- ✓ 25 FTV: no significance was reached → no systematic pattern
  - ➢ 8 leaned non-significantly towards th subject
  - ➢ 14 leaned non-significantly towards th neither
  - ➢ 1 unclassifiable
  - ➢ 2?
- ✓ Sharp distinction about causality
  - ➢ FrTV: subject causally responsible
  - ➢ FTV: rarely license clear conclusions about causality



Experiment 4
Causation in Korean

- ✓ Aim: to test whether causality is also associated with FrTV but not with FTV

Experiment 4 – Method

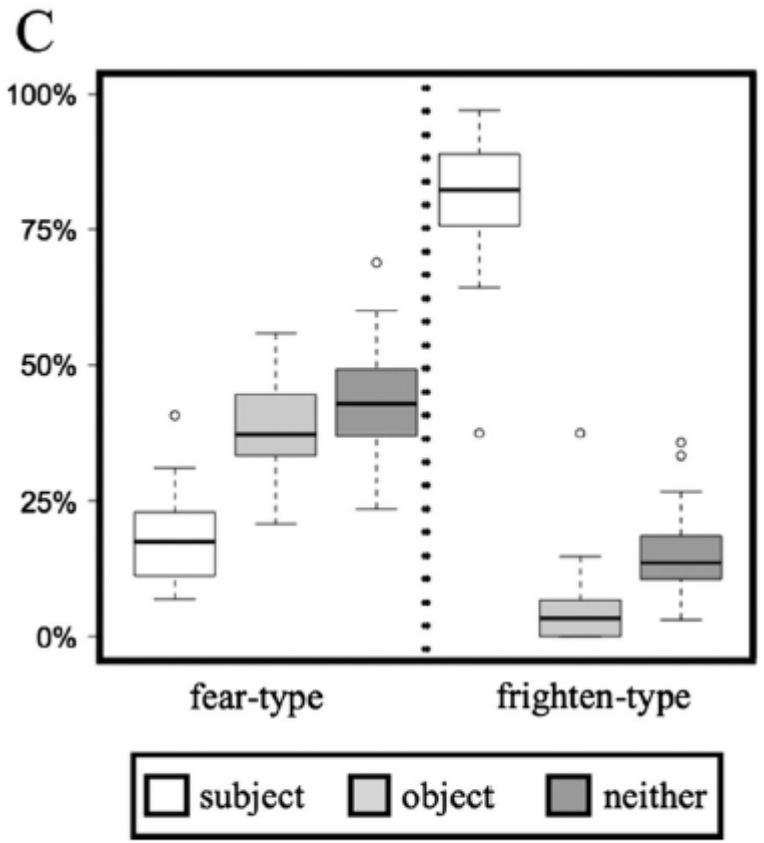
- ✓ Participants: 34 native speakers of Korean recruited and tested online: http://www.gameswithwords.org/Korean/
  - ➢ Age: 24 – 41 (M=30, SD=5)
- ✓ List of verbs compiled by the authors
  - ➢ 40 FrTV
  - ➢ 40 FTV: 20/40 Sub:Nom - Obj:Acc; 20/40 Sub:Nom - Obj:Nom
  - ➢ 10 fillers
- ✓ The sentences were presented on a computer.
  - ➢ The order of the verbs was randomized separately for each participant,
  - ➢ Names drawn on each trial from a list of 100 names

Experiment 4 – Results and discussion

- ✓ Causal responsibility
  - ➢ FrTV: overwhelmingly assigned to the subject (stimulus)
  - ➢ FTV: at least likely to choose neither or any other answer
- ✓ Syntactic labelling
  - ➢ Significant difference in Fisher's Exact Test ($p<0.001$)
- ✓ Semantic labelling
  - ➢ Significant difference in Fisher's Exact Test ($p<0.001$)

Experiment 4 – Results and discussion

- ✓ 40 FrTV
  - ➢ 39 significant preference for the subject
  - ➢ 1 unclassifiable
- ✓ 40 FTV
  - ➢ 23 non-significant bias for ‘neither’
  - ➢ 14 non-significant bias for ‘neither’
  - ➢ 1 subject
  - ➢ 2 unclassifiable
- ✓ Sharp distinction about causality
  - ➢ FrTV: subject causally responsible
  - ➢ FTV: rarely license clear conclusions about causality



Interim summary

- ✓ Experiment 1: Episodes vs Habitual attitudes
  - FrTV: episodes
  - FTV: habitual attitudes
- ✓ Experiments 2-4: Causation cross-linguistically
  - English
    - FrTV: clear intuitions for causal responsibility
    - FTV: no clear intuitions for causal responsibility
  - Mandarin
    - FrTV: clear intuitions for causal responsibility
    - FTV: no clear intuitions for causal responsibility
  - Korean
    - FrTV: clear intuitions for causal responsibility
    - FTV: no clear intuitions for causal responsibility

Overview of experiments 5-8

- ✓ Aim: Do people generalize the aforementioned semantic distinctions?
- ✓ They manipulated whether novel psych verbs described habitual attitudes *or* episodes, predicting that participants would assign FTV syntax to the former and FrTV syntax to the latter.

Experiment 5
Generalization in English (1)

- ✓ "Loan words" from Japanese with no English equivalent
  - ➢ 16 Japanese nouns → English verbs (phonological accommodation)

- ✓ Forced-choice judgment task, based on a semantic description of a psychological state
  - ➢ FrTV syntax, that is exper-*object* syntax
  - ➢ FTV syntax, that is exper-*sub* syntax

- ✓ The semantic descriptions of the verbs were divided
  - ➢ 8 habitual attitudes (e.g. the feeling of rivalry) → <u>paired with enduring, long-lived stimuli for reinforcing the semantic distinction</u> (e.g. Harvard's basketball team)
  - ➢ 8 episodes/specific instances (e.g. uneasiness) → <u>paired with ephemeral stimuli for reinforcing the semantic distinction</u> (e.g. the unexpected exam)

Experiment 5 – Method

- ✓ Participants: 40 *English-speaking* recruited outdoors on Harvard's campus and compensated with a small gift
  - ➢ Experiment 5a (present tense): 20
    - Age: 18-60 (M=25, SD=10)
  - ➢ Experiment 5b (past tense): 20
    - Age: 18-39 (M=23, SD=5)
- ✓ Present tense obscures the distinction between habits and events/episodes
  - ➢ Bartholomew failed the exam (yesterday).
  - ➢ Bartholomew fails the exam (always).
- ✓ Example: douyo = uneasiness
  - ➢ Ken douyos the unexpected exam.
  - ➢ The unexpected exam douyos Ken.
- ✓ Pseudorandomized order
  - ➢ The same condition (episode/attitude) did not occur more that twice in a row

Experiment 5 – Results and discussion

- ✓ More likely to choose the exper-object form for instances/episodes than for attitudes, in both
  - ➢ Exp. 5a (M = 68%, SE = 9% vs. M = 38%, SE = 7, d = 1.4) and
  - ➢ Exp. 5b (M = 67%, SE = 9% vs. M = 41%, SE = 9%, d = 1.0).
- ✓ Logit-transformed results were submitted to by-subjects and by-items ANOVAs.
  - ➢ The main effect of the *semantic manipulation* was *significant*. ($F1(1,38) = 60.8$, $p < 0.001$; $F1(1,38) = 49.3$, $p < 0.001$; $F2(1,14) = 6.1$, $p = 0.03$)
  - ➢ The main effect of tense was not (Fs < 1).
  - ➢ The interaction of tense and semantics was not (Fs < 1).
- ✓ The semantics of psych verbs is employed in order to guide expectations about the linking rules both across present and past tense.

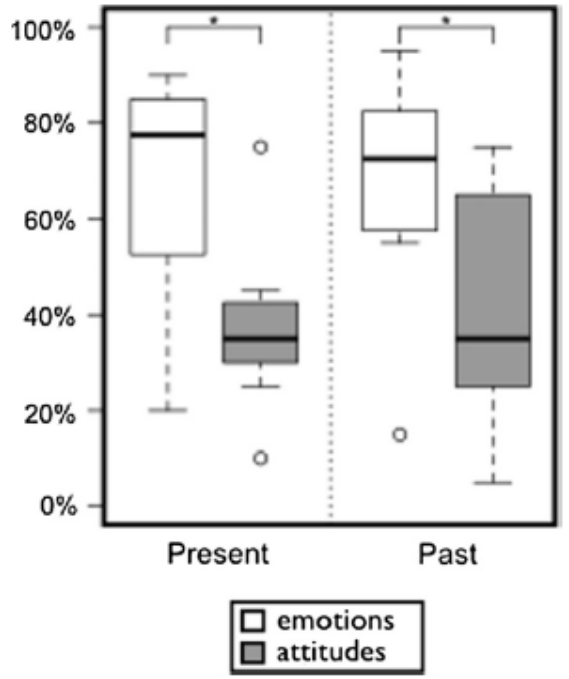


Fig. 4. Percentage of participants choosing frighten-type syntax for each verbfor novel English verbs in present tense (Exp. 5a) and past tense (Exp. 5b). Note that the boxplots show the distribution over items, not subjects. Error bars represent 1.5 standard deviations.

Experiment 7
Generalization in English (2)

- ✓ Does the enduring or ephemeral nature of the inanimate thematic role matter ?
- ✓ It is also possible that participants used linking rules that mapped particular kinds of noun-phrases to subject or object position ignoring the verbs meaning entirely.
- ✓ They only manipulate the definition of the verbs.
  - ➢ They manipulate neither the experiencer or the enduring/ephemeral nature of the inanimate thematic role.

Experiments 7 – Method

- ✓ Participants: 40 English-speaking US residents recruited through the Amazon Mechanical Turk
  - ➢ No age information is provided.
- ✓ 16 definitions of psychological states from Experiment 5 were used.
- ✓ 16 English-speaking participants were recruited to rate how long the psychological state described by the verb would likely last.
  - ➢ 8 emotional episodes
  - ➢ 8 habitual attitudes
  - ➢ With the exception of 2 items the classifications were the same.

Experiments 7 – Method

- ✓ Participants were introduced to Susan who has many emotional relationships with her friends.
  - ➢ For each friend Susan experienced one of the 16 psychological states
- ✓ Participants were
  - ➢ asked to produce a three word sentence that described the psychological state
  - ➢ instructed to use both character's names, e.g.
    - Susan jorutoed Beatrice.
    - Beatrice jorutoed Susan.
- ✓ All verbs were presented in the past tense.
- ✓ No fillers

Experiments 7 – Results and discussion

- ✓ Participants were more likely to link the experiencer with object position for emotional episodes relative to habitual attitudes (M = 52%, SE = 6% vs. M = 24%, SE = 6%; t1(39) = 7.20, $p < 0.001$; t2(14) = 3.25, $p = 0.01$; d = 1.6).
- ✓ Conclusion: The semantics of the novel verbs plays a crucial role in the choice of the linking rule employed.

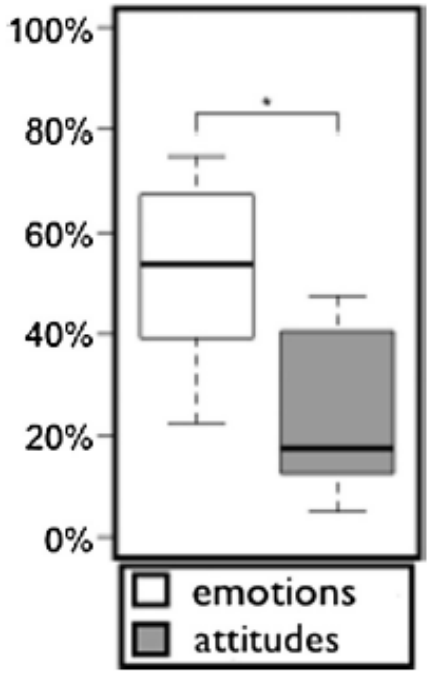


Fig. 6. Percentage of participants choosing the frighten-type form for each verb in Exp. 7 (English). Note that the boxplots show the distribution over items. Error bars represent 1.5 standard deviations.

Experiment 6
Generalization in Japanese

- ✓ The causative morpheme –(s)ase–
  - ➢ The causal affix is added to FTV or other emotion-words, thereby creating FrTV.
- ✓ Example
  a. Taro-wa koomori-o kowagat-ta.
  Taro-TOPIC bat-ACC fear-PAST
  ‘Taro feared bats.’
  b. Koomori-wa Taro-o kowagar-**ase**-ta.
  bat-TOPIC Taro-ACC fear-CAUS-PAST
  ‘Bats frightened Taro.’
- ✓ All –(s)ase– affixed verbs are FrTV
- ✓ Approximately 94% of the unaffixed verbs are FTV.

Experiments 6
Generalization in Japanese

- ✓ "Loan words" from English with no Japanese equivalent
  - 16 English nouns → Japanese verbs via the semi-productive verbalizer –r– (e.g. gugu-r-u: to google) + any necessary phonological accommodation
- ✓ Forced-choice judgment task, based on a description on a psychological state
  - FrTV, experiencer-object syntax
  - FTV, experiencer-subject syntax

Experiments 6 – Method

- ✓ Based on the semantic descriptions, the verbs were divided (see Exper. 5)
  - ➢ 8 habitual attitudes (e.g. greed) → paired with enduring (e.g. money) for reinforcing the semantic distinction
  - ➢ 8 episodes (e.g. *jolt*) → paired with ephemeral stimuli (e.g. the sense of the murder) for reinforcing the semantic distinction
- ✓ Example: joruto (*jolt*): a surprise or shock, esp. of an unpleasant kind and often manifested physically

a. Sono keeji-wa sono koroshi-no genba-o joruto-t-ei-ta
That detective-TOPIC that murder-GEN scene-ACC jolt-V-PROG-PAST
'The detective jolted the scene of the murder.'

b. Sono koroshi-no genba-wa sono keeji-o joruto-t-ei-ta
That murder-GEN scene-TOPIC that detective-ACC jolt-V-PROG-PASS
'The scene of the murder jolted the detective.'

- ✓ 4 fillers/English-derived psych verbs with the light verb –suru:
  - ➢ 2obj-exper verbs
  - ➢ 2 sub-exper verbs

Experiment 6 – Method

- ✓ Participants: 60 *Japanese-speaking adults* recruited in public spaces around Tokyo
  - ➢ Experiment 6a (*without* –(s)ase, past progressive tense): 20 participants
    - Age: 20-38 (M=22, SD=13)
  - ➢ Experiment 6b (*without* –(s)ase, present progressive tense): 20 participants
    - Age: 19-65 (M=31, SD=15)
  - ➢ Experiment 6c (*with* –(s)ase, present progressive tense): 20 participants
    - Age: 19-34 (M=23, SD=6)
- ✓ Causative affixed verbs were not tested in past progressive.

Experiments 6 – Results and discussion

✓ Participants were more likely to select the FrTV form for verbs describing emotional episodes than verbs describing habitual attitudes *independent of* whether

- ➢ the verb was unaffixed and in present tense (M = 29%, SE = 3% vs. 9%, M = 3%, d = 2.3)
- ➢ the verb was unaffixed and in past tense (M = 44%, SE = 6% vs. M = 27%, SE = 4%, d = 1.2)
- ➢ the verb was affixed and in present tense (M = 79%, SE = 3% vs. M = 67%, SE = 3%).

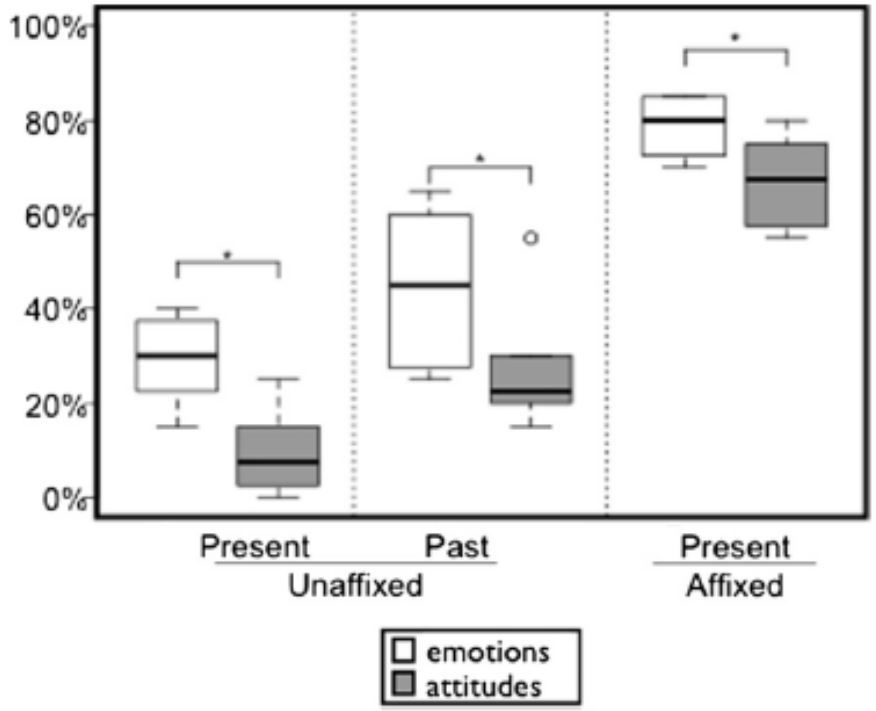


Fig. 5. Percentage of participants choosing frighten-type syntax for each verbfor novel unaffixed Japanese verbs in present tense (Exp. 6a) and past tense (Exp. 6b) and novel affixed verbs presented in present tense (Exp. 6c). Note that the boxplots show the distribution over items, not subjects. Error bars represent 1.5 standard deviations.

- ➢ Significantly more likely to choose FrTV for causally affixed verbs than for unaffixed verbs (6a vs 6c).
  - (t1(38) = 10.3, $p < 0.001$; t2(15) = 20.5, $p < 0.001$; d = 4.5)

Experiments 6 – Results and discussion

- ✓ A 2 (emotional episode vs. habitual attitude) by 3 (Exp. 6a vs. Exp. 6b vs. Exp 6c) ANOVA on logit-transformed results found
  - ➢ the expected significant main effects *of state duration*
    - (F1(1,57) = 36.1, p < 0.001; F2(1,14) = 19.7, p < 0.001)
  - ➢ *and experiment* (more likely to attribute FrTV syntax to –(s)ase– affixed than unaffixed verbs)
    - (F1(2,57) = 38.8, p < 0.001; F2(2,28) = 110.8, p < 0.001).
  - ➢ The *interaction* trended towards significance
    - (F1(2,57) = 2.5, p = 0.09; F2(2,28) = 2.7, p = 0.08).
- ✓Japanese speakers are guided by semantics in determining the linking rule that should apply to novel psych verbs, despite the fact that the linking rule is almost entirely predictable from the morphology of the verb.
- ✓ Conclusion: strong evidence that semantics plays a role in psych verb linking

Experiments 8
Generalization in Russian

- ✓ Grammatical aspect
  - ➢ Perfective:
    - Prefix: *po-*
    - Prefix: *so-*
  - ➢ Imperfective
- ✓ There is little reason to expect a sizeable interaction between lexical/grammatical aspect and psych verb linking.
- ✓ They only manipulate the definition of the verbs.
  - ➢ They manipulate neither the experiencer or the enduring/ephemeral nature of the inanimate thematic role.

Experiments 8 – Method

- ✓ Participants: 259 native Russian speakers recruited and tested through the Internet experiment portal: gameswithwords.org
  - ➢ Age: 15-71 (M=31, SD=9)
  - ✓ Exper. 8a (imperfective): 94 participants
  - ✓ Exper. 8b (*po-* perfective): 73 participants
  - ✓ Exper. 8c (*so-* perfective): 92 participants
- ✓ 10 Russian speakers rated a list of 20 emotional states –based on Japanese verbs
  - ➢ 14(?) emotional states/verbs were drawn
    - 7 longest-lived predicted to be interpreted as *habitual attitudes*
    - 7 shortest-lived predicted to be interpreted as *episodes*
- ✓ 16 verbs were formed via the *-ovat* suffix Japanese sounding word stems
  - ➢ frequently used for foreign loan words
  - ➢ typically results in imperfective aspect

Experiments 8 – Method

- ✓ Participants were randomly assigned to experiments.
- ✓ Verbs were randomly assigned to definitions for each participant.
- ✓ Six filler items
- ✓ Force choice between two possible descriptions of the situation with the novel verb
  - ➢ Participants were given a sentence and they had to choose between the two semantic descriptions

Experiments 8 – Results and discussion

- ✓ Participants were more likely to prefer FrTV syntax for verbs describing emotional episodes than they were for those describing habitual attitudes independent of whether
  - ➢ the verb was imperfective (M = 60.0%, SE = 10.2% vs. M = 42.2%, SE = 10.0%; d = 0.7)
  - ➢ the verb was *po*-affixed perfective (M = 58.7%, SE = 9.8% vs. M = 35.8%, SE = 9.4%; d = 0.9)
  - ➢ the verb was *so*-affixed perfective (M = 63.5%, SE = 10.5% vs. M = 45.3%, SE = 8.8%, d = 0.7).

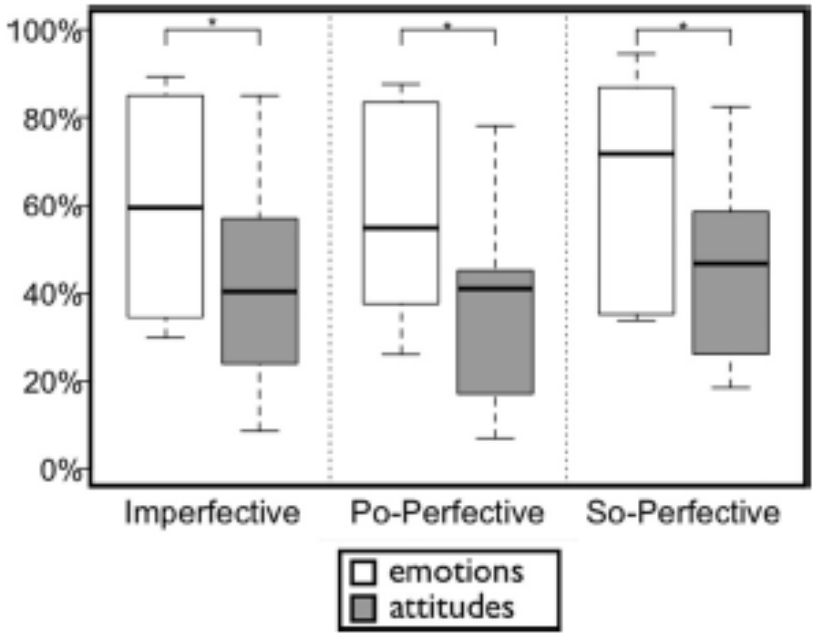


Fig. 7. Percentage of participants choosing frighten-type syntax for each verb for novel imperfective verbs (Exp. 8a), *po*- affixed perfective verbs (Exp. 8b), and *so*-affixed perfective verbs (Exp. 8c) in Russian. Note that the boxplots show the distribution over items, not subjects. Error bars represent 1.5 standard deviations.

Experiments 8 – Results and discussion

- ✓ Response proportions were logit-transformed and submitted to 2 (semantics: attitude vs episode) x 3 (experiment: 8a, 8b & 8c) ANOVAs.
- ✓ The critical main effect of semantics was significant by subjects though not by items ($F1(1,256) = 118.1$, $p < 0.001$; $F2(1,12) = 2.5$, $p = 0.14$).
- ✓ There was a significant main effect of verb type ($F1(2,24) = 9.4$, $p < 0.001$; $F2(2,256) = 3.8$, $p = 0.02$), → slightly more choices of FrTV for *so*-affixed perfectives.
  - ➢ This effect was unexpected and is unlikely to be due to any association between the *so*-prefix and frighten-type verbs.
- ✓ Potential explanation: the semantics associated with *so*- → more compatible with the semantics of FrTV; a possibility left for future investigation
- ✓ The interaction between *morphology* and the *semantic manipulation* was **not** significant ($F1(2,24) = 1.2$, $p = 0.32$; $F2(2,256) = 1.6$, $p = 0.20$).

Interim summary – Generalizations

- ✓ English, Japanese and Russian participants were
  - ➢ more likely to use FrTV syntax, that is object-experiencer syntax, if the *novel verbs* described emotional episodes
  - ➢ more likely to use FTV syntax, that is subject-experiencer syntax, if the *novel verbs* described habitual attitudes
- ✓ These linking patterns *are part of the linguistic knowledge of adult speakers* in all three languages and are actively recruited when learning new verbs.
- ✓ This is particularly remarkable in the case of Japanese where there is a morphological cue that predicts linking patterns with near certainty *and thus might be expected to block the learning of any semantic correlation.*
- ✓ Do these systematic mapping between syntax and semantic structure appear in young children ?

Experiments 9
Generalization is English children

- ✓ Does the semantic distinction discussed have an impact on language acquisition through syntactic and semantic bootstrapping ?
- ✓ Do children employ the generalization (episode ↔ FrTV syntax *VERSUS* habitual attitude ↔ FTV syntax) in order to acquire novel psych verbs?
- ✓ Relative late acquisition of psych verbs
  - ➢ Toddlers use verbs like *like* and *love* but primarily in restricted contexts (e.g. I love you, I like that) (see Hartshorne et al., 2015)
- ✓ Successful role interpretation: who did what to whom in novel sentences
  - ➢ FTV: not until five years old
    - Lion loved Monkey
    - Monkey loved Lion (Hartshorne et al., 2015)
  - ➢ FrTV: little earlier than FTV

Experiments 9 – Method

- ✓ Two groups of children were tested
  - ➢ Participants: 31
    - Age: 4;0-5;10 (M=5;5)
  - ➢ Participants: 31
    - Age: 5;11-7;10 (M=7;2)
- ✓ Brought into the lab or recruited from daycares in the Boston, Massachusetts area
- ✓ In each group
  - ➢ 16 children were randomly assigned to emotional episode
  - ➢ 15 children were randomly assigned to habitual attitude

Experiments 9 – Method

- ✓ Novel psych verbs: gorfin, wixter
- ✓ Several mechanisms were used to ensure that children interpreted the verbs to the intended semantic class
  - ➢ the definitions were based on actual low-frequency psych verbs (envy, pity, encourage, disgust) → nonexistent in child-directed speech
  - ➢ the definitions described emotions with which children are likely to have considerable experience
  - ➢ the definitional descriptions emphasized either *habitual attitudes* or *specific instances of emotion* caused by ephemeral stimuli

Experiments 9 – Method

- ✓ Example of a habitual attitude description

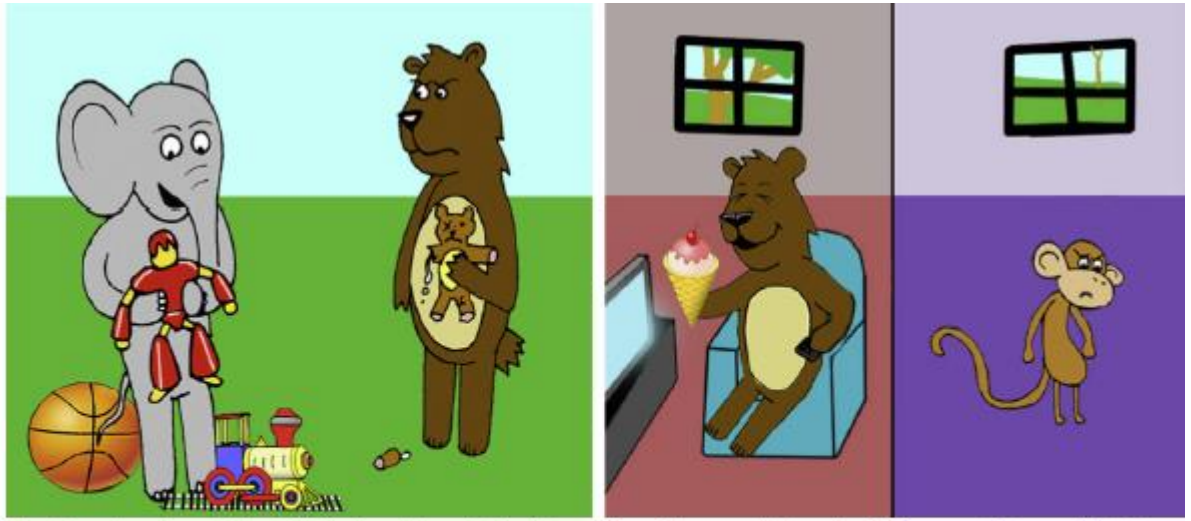
  Some people **wixter** each other. Do you know what wixter is? Wixter is when you want something that somebody else has. Or maybe you think somebody else is so cool you wish you were just like them. That means you feel **wixter**. Do you feel wixter for anybody? [Discussion] What is your favorite thing to do? [Discussion] What if you knew a kid who got to do [favorite thing] all the time? You'd probably feel wixter, wouldn't you?

- ✓ Example of an episode description

  Some people **gorfin** each other. Do you know what gorfin is? You feel gorfin when you see something really, really gross. Or if you had to hold something really slimy, you might feel **gorfin**. Can you think of any times you felt gorfin? [Discussion] What's the grossest thing you can think of? [Discussion] If you saw that, you might feel gorfin.

Experiments 9 – Method

- ✓ Two stories were read.
- ✓ The character under discussion (e.g. bear) functioned both as an experiencer and as a stimulus
- ✓ Who did the bear wixter ?
- ✓ Two possible answers
  - ➢ Elephant → FTV
  - ➢ Monkey → FrTV
- ✓ Counter-balanced order of the two verbs across children
- ✓ Warm-up trials: pull, throw, jump



See Elephant and Bear? Elephant has lots of new toys, but Bear's toys were all old and broken. Elephant got new toys all the time, but Bear never got any new toys. Bear always thought Elephant was so lucky.

See Bear and Monkey? Bear got to watch TV whenever he wanted, but Monkey never got to watch TV. Bear got to eat as much ice cream as he wanted, but Monkey never got any ice cream. Monkey always thought Bear was so lucky.

Fig. 8. An example of a critical trial involving a habitual attitude.

Experiments 9 – Results and discussion

- ✓ All children were more likely to interpret the novel verb as a FrTV, if its definition emphasized emotional episodes rather than habitual attitudes
  - ➢ 4–5 year-olds: 65.6%, SE = 8.8% vs. 33.3%, SE = 9.3%, d = 0.6
  - ➢ 6–7 year-olds: 68.8%, SE = 7.7% vs. 26.7%, SE = 9.6%, d = 0.8

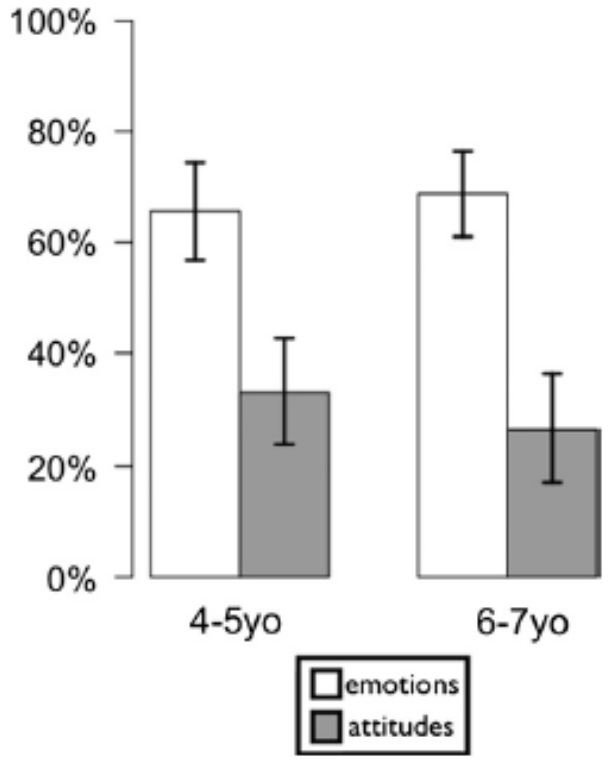


Fig. 9. Percentage of participants choosing frighten-type syntax for each verbfor novel verbs describing emotional episodes and habitual attitudes in Exp. 9. Error bars show standard errors of the mean.

Experiments 9 – Results and discussion

- ✓ Given the two trials, the data were analyzed with a logit mixed effects linear regression with maximal random effects structure
  - ➢ a main effect of semantics (Wald's $z = 2.3$, $p = 0.02$)
  - ➢ no effect of age group (Wald's $z < 1$)
  - ➢ no interaction of semantics and age group (Wald's $z < 1$).
- ✓ Conclusion: children who are just beginning to acquire psych verbs also use semantics to guide expectations about the syntax of new psych verbs.

General discussion

- ✓ Experiments 1-4: FTV and FrTV have systematically distinct semantics.
- ✓ Experiments 5-8: The distinction is used productively by adults.
- ✓ Experiment 9: The ability emerges by 4-5 years old → it may play a role in acquisition
- ✓ Recapitulation of the theoretical tenets
  - ➢ FrTV: episode in which an entity is caused to feel an emotion and it is mapped onto object status
  - ➢ FTV: habitual attitude of an entity, which is mapped onto subject status
- ✓ The results are incompatible with
  - ➢ Belletti & Rizzi (1988), Culicover & Jackendoff (2005), Pinker (1984): there is no systematicity → individually learning
  - ➢ Croft (2012), Talmy (1985): subject is always causal
  - ➢ Dowty (1991), Rozwadowska (1992): stimulus is always causal

General discussion

- ✓ The results are compatible with
  - Pesetsky (1995)
  - Pylkkanen (1999)
  - Ekman (1992)
- ✓ The analysis generalizes across languages (English, Mandarin, Korean, Japanese, Russian).
- ✓ The semantic distinction is not a historical accident.
- ✓ The semantic distinction is a property of language *or* a property of our construal of affective states.
- ✓ Semantic distinction – systematicity – language acquisition
  - The systematic mapping hypothesis
  - Syntactic bootstrapping
  - Semantic bootstrapping

Causal morphemes and linking rules

- ✓ Japanese speakers: more likely to choose the frighten-type pattern for causally-affixed verbs and the fear-type pattern for unaffixed verbs.
- ✓ Montrul (2001): Japanese native speakers → difficulty learning FrTV in languages with no affixes.
- ✓ Two types of explanation
  - ➢ Direct relationship between morphology and linking patterns
    - Causally-affixed psych verbs are more likely to take the frighten-type pattern. → This expectation would be independent of the expectation that emotional episodes will take the frighten-type pattern.
  - ➢ Alternatively, the effect of morphology could be mediated by semantics
    - Causally-affixed psych verbs usually describe *caused emotional episodes*
    - Unaffixed verbs usually describe habitual attitudes T
    - The linking rules apply as normal.
  - ✓ On this account, we would have to assume that the Japanese participants interpreted the verbs differently than we had intended, giving them distinct semantic interpretations depending on the morphology of the verb.

Previous psycholinguistic research

- ✓ Fact: FrTV more difficult than FTV for *adults*.
  - ➢ Adult L2 learners of English are slower to acquire FrTV than FTV (e.g. Sato, 2003).
  - ➢ Individuals with agrammatic aphasia: difficulty producing and comprehending active sentences with FrTV
  - ➢ Tempting interpretation
    - ➢ FTV: standard linking pattern → the subject is the experiencer
    - ➢ FrTV: exception to the standard linking pattern
- ✓ The aforementioned interpretation is *incompatible* with the results of the current study.

Previous psycholinguistic research

- ✓ Explanations facilitating the interpretation of FTV and hindering the one of FrTV
- ✓ The animacy hypothesis: exploitation of animacy-based heuristics
  - ➢ There is a strong tendency for subjects to be animate and for objects to be inanimate.
  - ➢ Weckerly & Kutas (1999): N400 as an index of online interpretation → readers expect animate subjects and integrate them more easily than inanimate ones
  - ➢ MacDonald et al. (1993): tendency to misremember sentences that violate this ordering and judge them to be less acceptable
  - ➢ Prediction: animacy bias will favor FrTV in passives, while hindering FTV
  - ➢ Confirmed: agrammatic aphasics produce and understand passives with FrTV more accurately than passives with FTV (Pinango, 2000; Thompson & Lee, 2009).
- ✓ FrTV: variability regarding the possible syntactic frames they can feature
  - ➢ FTV are rarely used in passives (Ferreira, 1994; Thompson & Lee, 2009).
  - ➢ FrTV similar frequency in both active-passive sentences

Previous developmental research

- ✓ Which verb-type is more difficult?
- ✓ Inconsistent findings
  - ➢ Lord (1979): children from 3 to 8: FrTV were produced with fear-type syntax
  - ➢ Bowerman (1990):
    - Both error types were found.
    - More errors with FTV.
    - None of these linking errors in children under 6 years old → until this age children learn the linking rules in a piecemeal fashion
- ✓ Bowerman's conclusion is incompatible with experiment 9.
  - ➢ 4-5 children extended the linking patterns based on the semantics of the psychological state

Previous developmental research

- ✓ Hartshorne et al (2015)
  - ➢ Children's comprehension of FTV is developed significantly later that the one of FrTV.
  - ➢ Despite the fact that FTV have a higher token-frequency than the FrTV in child-directed speech.
- ✓ Possible explanation
  - ➢ Children learn a verb if they figure out what it means.
  - ➢ This means that they need to understand the relevant in the world event(uality) to which the verb refers.
  - ➢ FrTV have clearer perceptual correlates in the immediate context than FTV given that FrTV describe specific episodes, while FTV describe habitual attitudes
  - ➢ Compare
    - Bartholomew fears Agnes.
    - Agnes frightened Bartholomew.
  - ➢ It is probably hard for the child to understand the eventuality to which the speaker refers to when she uses a FTV.

Two conceptualizations of emotions

- ✓ FrTV: episodes
- ✓ FTV: habitual attitudes
- ✓ No reports of languages in which the causal psych verbs appear with experiencer subjects, while habitual attitudes have experiencer objects
- ✓ Questions that are raised
  - ➢ Why is the mapping from semantics to syntax so similar across languages?
  - ➢ Why do these particular semantic distinctions get encoded rather than other possible distinctions?
  - ➢ Why do languages lack simple constructions that express both the cause of the emotion and the target of that emotion?
- ✓ The linking patterns for different verb classes are simply instantiations of a single broader principle that constrains the mapping from meaning to form.

Semantic structures and clean *mapping rules*

- ✓ Our quiver: semantic representation, syntactic representation and the linking rules
- ✓ Early linking theories
  - ➢ verbal semantic representation: thematic roles, set of entailments
  - ➢ semantically defined verbs classes: externally caused change of state, manner of motion fear verbs, frighten verbs
- ✓ Late linking theories (see e.g. Jackendoff, 1990, 2002; Pinker, 1989)
  - ➢ verbal semantic representation: a verbal root and primitives

Semantic structures and clean *mapping rules*

- ✓ Primitives predicates: CAUSE, BECOME
- ✓ The primitive predicates
  - ➢ are present in many different verb classes
  - ➢ can be used in combination to form complex semantic structures
- ✓ Advantage
  - ➢ Replacing a large set of mapping rules (e.g. specific thematic roles) with a few broad principles based on the geometry of the semantic tree (Levin & Rappaport Hovav, 2005)

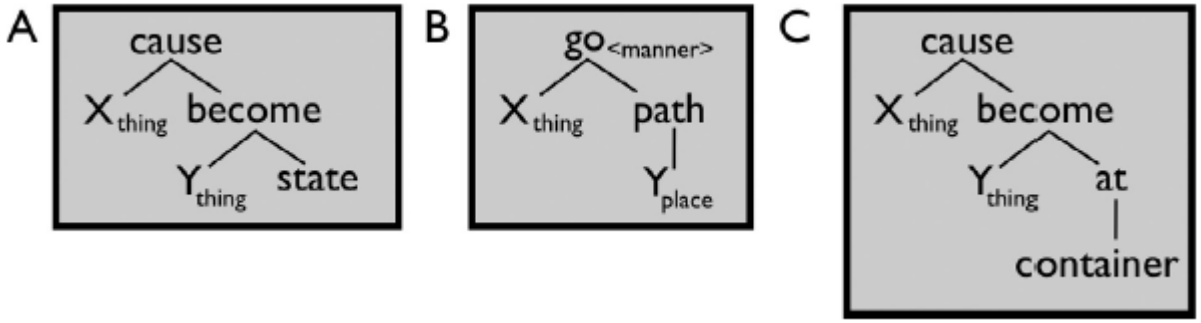
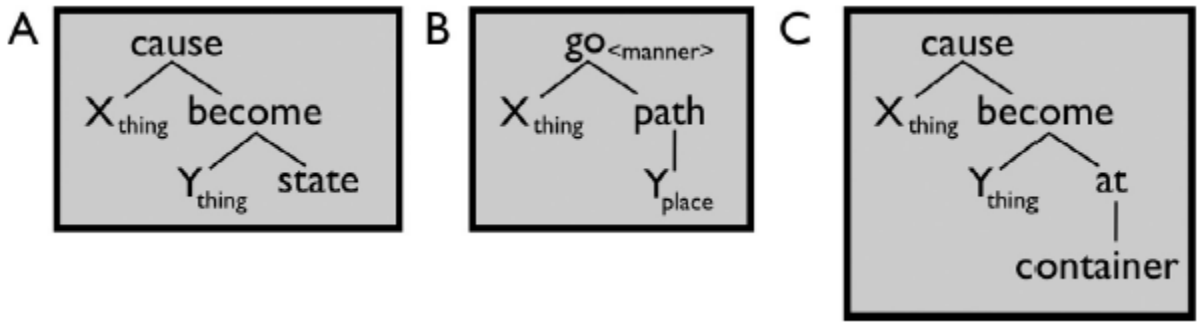


Fig. 10. Examples of the semantic structures for some common kinds of verbs. (A) represents events such as Agnes breaking a vase or Bartholomew searing the tuna. (B) represents events such as Agnes walking to the store or Bartholomew swimming the English Channel. (C) represents events such as Agnes pocketing the change or Bartholomew shelving a book. These examples are based on Levin and Rappaport Hovav (2009) but have been simplified for expository purposes. The variables mark the position of arguments in the semantic structure while the italics mark the material that is encoded in the verbal root.

Semantic structures and clean *mapping rules*

- ✓ Structural prominence is preserved in the linking from semantics to syntax.
- ✓ Prominence preservation is robust both within and across languages
  - ➢ Learners have a strong preference for clean and simple mappings between meaning and form (Bouchard, 1995; Jackendoff, 1992; Levin & Rappaport Hovav, 2005; Wechsler, 1995)



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Semantic structures and clean *mapping rules*

- ✓ Possible representations for FrTV and FTV

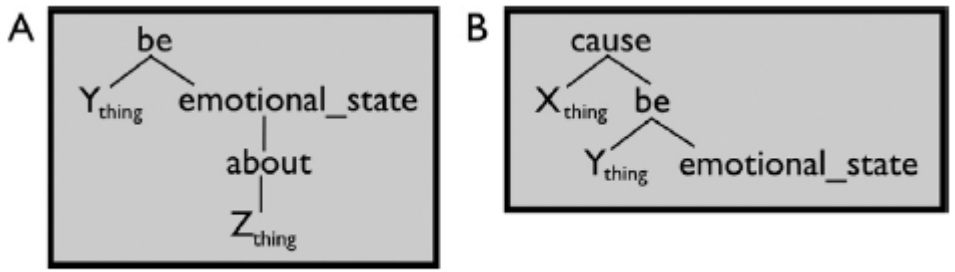

Fig. 11. Possible semantic cores for habitual attitudes (A) and caused emotional episodes (B).

Semantic structures and clean *mapping rules*

- ✓ Structural prominence and language acquisition
  - ➢ unambiguous construal of an event: semantics + prominence → syntax
  - ➢ ambiguous construal of an event: syntax + prominence → semantics

- ✓ The distance between a nativist infant and an empiricist infant is mitigated.

Where do these semantic structures come from?

- ✓ First approach: an innate feature of the language faculty
  - ➢ Classic nativist theories: semantic categories, syntactic categories, linking rules (Baker, 1988; Pinker, 1984)
  - ➢ Contemporary theories: part of the syntactic derivation (see Hale & Keyser, 1993; Harley, 2011; Pesetsky, 1995)
- ✓ Predicate decompositions are linguistic structures: one combinatorial engine generating linguistic structure
- ✓ Challenges of this account
  - ➢ To determine the *evolutionary pressures* that gave rise to these structures.
  - ➢ To determine the *biological mechanisms* that allow development to be constrained to this degree

Where do these semantic structures come from?

- ✓ Second approach: semantic structures are conceptual representations of events
  - ➢ Independent of the language faculty, evolved prior to language
  - ➢ allow us to represent *central features of event*s and to *reason about them*
- ✓ Children's acquisition of basic clausal syntax: mapping of uttered sentences onto pre-existing representations of events (Jackendoff, 2002; Pinker, 2007)
- ✓ Commonalities across languages derive from these event representations.
- ✓ Notions: cause, change of state → explicit parts of our non-linguistic event representations
  - ➢ Notions: temperature, color (maybe implicitly encoded in the root)

Where do these semantic structures come from?

- ✓ This kind of proposals ground acquisition in the child's pre-linguistic conceptual categories
  - ➢ Long history in cognitive science (e.g. Bowerman, 1973; Clark, 1984; Pinker 1989)
- ✓ Two clear advantages
  - ➢ It radical increases the time over which evolution could be at work.
  - ➢ Children's nonlinguistic experiences with events provide critical data for acquiring these representations.
- ✓ Challenge
  - ➢ To demonstrate that there is a unitary concept of cause or goal in infants
  - ➢ To demonstrate that conceptual features (color, temperature), irrelevant to the linking rules are not part of the infant's conceptual representations of events.
- ✓ Fact: Infants represent *causes*, *path* and *goals*, while distinguishing between *entities that can act as agents* and *those that cannot*.

Where do these semantic structures come from?

- ✓ Third approach: semantic features guiding linking rules are selected from a much large set of conceptual primitives by the *communicative pressures shaping languages over historical time*
- ✓ Notions: cause, possession, change of state encoded in linking rules
  → more stable and communicative systems
- ✓ Children's language acquisition
  - ➢ mapping utterances to larger set of conceptual features/primitives
  - ➢ discover the ones that matter based on the patterns of the input
- ✓ Challenges
  - ➢ To describe the relevant communicative pressures
  - ➢ To explain the apparent cross-linguistic stability
  - ➢ To describe the way which children choose the correct set of conceptual distinctions
- ✓ No systematic account (but see Chater & Christiansen, 2010; Gibson et al., 2013; Piantadosi et al., 2011)

Where do these semantic structures come from?

- ✓ Homesign systems as a form of testing historical evolution
  - ➢ Word order regularities which are described using the semantic labels that are used to characterize linking rules in spoken language (e.g., agents, experiencers and recipients) (Coppola & Newport, 2005; Goldin-Meadow & Mylander, 1990).

Why do languages encode these two construals of emotion?

- ✓ Why aren't languages able to encode both the cause and the target of emotion?
- ✓ *The newspaper frightened John about the housing bubble
- ✓ Possible reasons
  - ➢ Language specific evolution
  - ➢ Cognitive constraints
  - ➢ Historical change

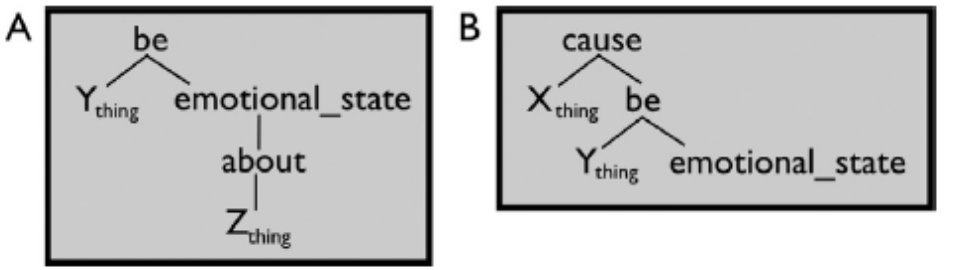

Fig. 11. Possible semantic cores for habitual attitudes (A) and caused emotional episodes (B).

- ✓ It is often possible to infer the target from the cause.
  - ➢ John frightens Mary. → Mary fears John
  - ➢ No need for distinguishing between them

Why do languages encode these two construals of emotion?

- ✓ Another possibility
  - ➢ The conceptual/semantic structures themselves
- ✓ FTV: mental possession
  - ➢ Experiencer: owner of the emotion
- ✓ FrTV: caused states

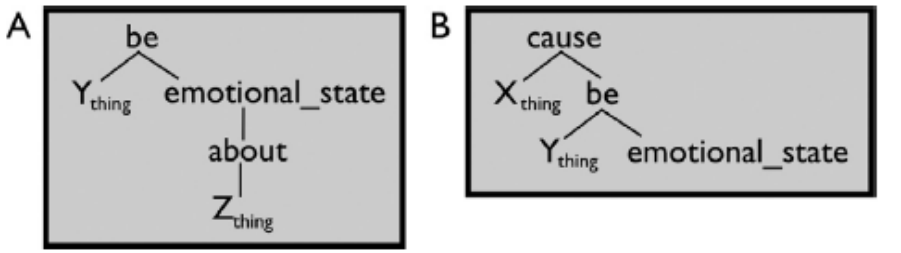

Fig. 11. Possible semantic cores for habitual attitudes (A) and caused emotional episodes (B).

Thank you for your patience and your attention!