Strong Exhaustivity, Alternative Questions and Monotonicity:
Some thoughts on Cremers & Chemla (2016)

Maribel Romero

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1. Introduction

■ EMPIRICAL GENERALIZATION **A**: distributional restrictions of question types

Not all question-embedding verbs equally embed WhQs, AltQs and PolQs. While *wonder*-type verbs and *know*-type verbs do not discriminate, *surprise*-type verbs (e.g. *be happy about, annoy, disappoint*) are known to disallow AltQs and PolQs (Grimshaw 1979, Lahiri 1991, d'Avis 2002, Guerzoni 2003, a.o.).

(1) a. John wonders / knows / was surprised at who visited Mary. WhQ
b. John wonders / knows / * was surprised at whether Paul_{L*H-} or Bill_{H*L-} visited Mary. AltQ
c. John wonders / knows / * was surprised at whether Paul visited Mary. PolQ

■ EMPIRICAL GENERALIZATION **B**: exhaustivity readings of WhQs

When combining with a WhQ, not all question-embedding verbs allow for the same readings in terms of degrees of exhaustivity (Sharvit 2002, Guerzoni & Sharvit 2007, a.o)

- *Wonder*-type and *know*-type predicates easily allows for a strongly exhaustive reading, under which the argument in (2) is valid:

(2) John knows who (out of the set C) walks. VALID
John knows who (out of the set C) don't walk.

- According to a long strand of literature, *surprise*-verbs do not allow for a strongly exhaustive reading, thus making the argument (3) invalid (Berman 1991, Sharvit 2002, Guerzoni & Sharvit 2007, among many others; but see Klinedinst & Rothschild 2011). Instead, *surprise*-preds embedding a question are understood only as having a weaker reading, typically identified with Heim's (1994) weakly exhaustive reading, which makes (5a) false and (5b) true in scenario (4):[1]

(3) It surprised John who (out of the salient set C) called. INVALID
It surprised John who (out of the salient set C) didn't call.

(4) Scenario: For everybody that actually called –e.g. a, b and c–, John expected them to call. But John also expected someone else to call –e.g. d– who in fact didn't call.

(5) a. It surprised John who called. ⇨ NOT TRUE in (4)
b. It surprised John who didn't call. ⇨ TRUE in (4)

[1] See discussion in George (2013) (advocating for mention-some reading) and reply by Spector & Égré (2015) (advocating for weakly exhaustive reading). See also fn. 4 on this handout.

■ CORRELATION between the two generalizations **A and B**:
The inability to embed AltQs and PolQs has been claimed to correlate with the impossibility to interpret a WhQ strongly exhaustively (Guerzoni 2007:§2, a.o.):

(6) All and only the verbs that disallow *whether*-complements (i.e., AltQ and PolQs) generally disallow the so-called strongly exhaustive reading of WhQs.

■ Some approaches in the literature:

(7)

* *Surprise* + AltQ/PolQ	Correlation	* *Surprise*+strong exh WhQ
Abels 2004 Roelofsen, Herbstritt & Aloni 2016	Guerzoni 2007 Guerzoni & Sharvit 2007, 2014 Nicolae 2013a,b Romero 2015	Uegaki 2015

■ DISAGREEMENT ON EMPIRICAL GENERALIZATION **C**: monotonicity of *surprise*-verbs?

- ↑-monotonic (e.g. *be happy about*) and ↓-monotonic (e.g. *surprise*) (Kadmon & Landman 1993, von Fintel 1999, Villalta 2008, Romero 2015):
  However, monotonicity is masked –no upward/downward entailment relations among clauses– because of an additional "perspective" argument.
  ➪ Masking of monotonicity and additional "perspective" argument as key ingredient for Correlation above (Romero 2015).

- By and large ↓-monotonic
  ➪ ↓-monotonicity as key ingredient for Correlation above (Nicolae 2013).

- Non-monotonic: (Uegaki 2015)
  ➪ Non-monotonicity as key for * *Surprise*+strong exh WhQ (Uegaki 2015).

■ Recently, Cremers and Chemla (2016) have presented experimental evidence bearing on the empirical generalization B and on the disagreement C:
DATA ①: Existence of strongly exhaustive readings of WhQs under *surprise*.
DATA ②: Existence of upward/downward entailment relations with *be happy / surprise*.

■ (Modest) GOAL of this talk: To venture some thoughts on how to reconcile the intuitions/analyses in the literature with the new experimental data.
Though we will focus on Romero's (2015) approach for concreteness, the comments might be applicable to alternative approaches as well.

■ Road map:
§ Romero's (2015) analysis of the correlation A-B.
§ Cremers & Chemla's (2016) data ①
§ Cremers & Chemla's (2016) data ②
§ Conclusions

2. Romero's (2015) analysis of the correlation A-B.

2.1 *Surprise*-Vs plus a declarative complement: focus-sensitivity

■ We start with the Stalnaker-Heim-style lexical entry for surprise in (8) (Heim 1992):

(8) $[\![p \textit{ surprises } x]\!] = \lambda w_0.\ \forall w \in \cap Dox_x(w_0)\ [\ Sim_w(\neg p) >_{Exp\_x(w0)} Sim_w(p)\ ]$ (Stalnaker-Heim-style)

■ Villalta (2008), building on Dretske (1975), shows that factive-emotive verbs like *surprise* are focus-sensitive: given scenario (9), the same sentence is judged true –(10)– or not true –(11)– depending on the focus intonation, marked in capitals. This is unexpected under (8), which asks us to compare only p and ¬p.

(9) Scenario: Lisa expected syntax to be taught by John, since he is the best syntactician around. Also, she expected syntax to be taught on Mondays, since that is the rule.

(10) It surprised Lisa [that John taught syntax on TUESdays] ~ C ⇨ TRUE in (9)

(11) It surprised Lisa [that JOHN taught syntax on Tuesdays] ~ C. ⇨ NOT TRUE in (9)

■ To derive focus sensitivity, Villalta adds to the lexical entry (8) an extra argument: the free variable C, related to the embedded CP_{decl} complement via the squiggle operator, as in (12). Given (13), C which must pick as value a subset of the focus semantic value of the CP-complement, $[\![CP_{decl}]\!]^f$. This produces the at-issue content in (14).

(12) [[CP]~C $surprise_C$ NP]

(13) $[\![\alpha{\sim}C]\!]^o$ is defined only if $C \subseteq [\![\alpha]\!]^f$. If defined, $[\![\alpha{\sim}C]\!]^o = [\![\alpha]\!]^o$. (Rooth 1992)

(14) $[\![p \textit{ surprises}_C\ x]\!]$ =
$\lambda w_0.\ \forall w \in \cap Dox_x(w_0){:}\ \forall q \in C\ [q \neq p \rightarrow [Sim_w(q) >_{Exp\_x(w0)} Sim_w(p)]]$

■ Furthermore, Villalta conceives these verbs as degree constructions with C as the comparison class. Romero's (2015) rendition of this idea is given in (15a), which (roughly) states that p reaches a degree d of unexpectedness for x that surpasses the threshold θ of the comparison class C (cf. *tall*). Crucially, as in other degree constructions like (16)-(17), the comparison class C must include the ordinary semantic value (Heim 1999, Schwarz 2010). This is captured in the presupposition (15b), which will be crucial.

(15) $[\![p \textit{ surprises}_C\ x]\!]$
a. Assertion: $\lambda w_0.\ \forall w \in \cap Dox_x(w_0){:}\ \exists d[Unexpected_{x,w0}(Sim_w(p),d) \wedge d > \theta(\{\lambda d'.\ Unexpected_{x,w0}(Sim_w(q),d'){:}q \in C\})]$
b. Presupposition: $\lambda w_0.\ p \in C$

(16) Among the candidates, JOHN is the tallest. ⇨ # if John is not one of the candidates.
(17) Mia, a little girl / #teenager, watches violent movies for a 3-year old.

2.2. The proposal in a nutshell

- Point of departure: Given a context with a younger finalist Al and an older finalist Bill, both (18a) and (18b) are predicted to have the same presupposition —namely, that at most one and at least one of {al, bill} won— and denotation (Dayal 1996, Biezma & Rawlins 2012). Nevertheless, combining *surprise* with this semantic output produces a grammatical sentence in the case of (18a) but leads to ungrammaticality in (18b).

(18) a. It surprised Amy [which one of the two finalists won the competition].
b. * It surprised Amy [whether the younger finalist or the older finalist won the competition].

- Idea: The decisive factor does not lie on the output semantic value per se, but on the way this semantic value was built: Something in the internal composition of WhQ but not in that of AltQs makes them compatible with *surprise*-Vs.

- Two ingredients:
  - *Surprise*-Vs are focus-sensitive and need to retrieve the value for the additional C from some $[\![X]\!]^f$ in the embedded clause.
  - WhQs are built using focus alternatives arising from wh-phrases (Beck 2006) and thus provide the right $[\![X]\!]^f$, whereas AltQs are built via ordinary alternatives (Alonso-Ovalle 2006, Simons 2005, Biezma & Rawlins 2012) and thus do not provide the appropriate $[\![X]\!]^f$ at any point in the tree.

2.3. Deriving Generalization B: * *Surprise*-V + strongly exhaustive WhQ

- Ingredient 1: Focus-sensitive *surprise* in (15)

(19) Which one$_{\{r(alph),t(obi)\}}$ / Who$_{\{r(alph),t(obi)\}}$ called surprised John.

(20) LF: [[Ans **[$_{CP}$ *Q* [$_{IP}$ who$_{\{r,t\}}$ called]~C]**] surprised$_C$ John.

(21) a. $[\![\alpha{\sim}C]\!]^o$ is defined only if $C \subseteq [\![\alpha]\!]^f$; if defined, $[\![\alpha{\sim}C]\!]^o = [\![\alpha]\!]^o$ (=(13))
b. $[\![\alpha{\sim}C]\!]^f$ is defined only if $C \subseteq [\![\alpha]\!]^f$; if defined, $[\![\alpha{\sim}C]\!]^f = [\![\alpha]\!]^f$

- Ingredient 2: Wh-phrases are inherently focus-marked.
  Wh-phrases introduce a set of alternatives as their $[\![.]\!]^f$ (Beck 2006)

(22) a. $[\![\textit{who}]\!]^o$ = #
b. $[\![\textit{who called}]\!]^o$ = #
c. $[\![\ [\textit{who called}]{\sim}C]\!]^o$ = #
d. $[\![Q \text{ IP}{\sim}C]\!]^o$ = $\lambda w_0.\lambda p.\ p \in [\![\text{IP}{\sim}C]\!]^f \wedge p(w_0)=1$
$=_{e.g.}$ $\lambda w_0.\{\text{t called}\}$

(23) a. $[\![\textit{who}]\!]^f$ = $\{x_e\text{: x is human}\} = \{r, t\}$
b. $[\![\textit{who called}]\!]^f$ = {r called, t called}
c. $[\![\ [\textit{who called}]{\sim}C]\!]^f$ = $[\![\textit{who called}]\!]^f$ if $C \subseteq [\![\textit{who called}]\!]^f$; otherwise #.
d. $[\![Q \text{ IP}{\sim}C]\!]^f$ = $\{[\![Q \text{ IP}{\sim}C]\!]^o\}$

- Answer operators (Heim 1994):

(24) $\text{Ans}_{WK}(Q,w))$ = $\cap\ [\![Q]\!]_K(w)$
(25) $\text{Ans}_{STR}(Q,w))$ = $\lambda w'\ [\ \text{Ans}_{WK}(Q,w) = \text{Ans}_{WK}(Q,w')\ ]$

■ Inserting strongly exhaustive Ans_{STR} leads to the violation of presupposition (15b):

(26) * [[**Ans_{STR} [$_{CP}$ *Q* [$_{IP}$ who called]~C]**] $surprised_C$ John]

(27) a. $C \subseteq \{t\ called,\ r\ called\}$
b. $[\![Ans_{STR}\ [...]]\!] =_{e.g.}$ "t and nobody else called"

■ Inserting weakly exhaustive Ans_{WK} does not violate presupposition (15b):

(28) [[**Ans_{WK} [$_{CP}$ *Q* [$_{IP}$ who called]~C]**] $surprised_C$ John]

(29) a. $C \subseteq \{t\ called,\ r\ called\}$
b. $[\![Ans_{WK}\ [...]]\!] =_{e.g.}$ "t called"

(30) $[\![(28)]\!] = \lambda w_0.\ \forall w \in \cap Dox_j(w_0){:}\ \exists d[Unexpected_{j,w0}(Sim_w(\lambda w'.call(tobi,w')),d) \wedge d > \theta(\{\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.call(tobi,w')),d'), \lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.call(ralph,w')),d')\})\ ]$

2.4. Deriving (part of) Generalization A: * *Surprise*-V + AltQ

■ Ingredient 1: Focus-sensitive *surprise* in (15)

(31) * Whether Ralph or Tobi called surprised John.

(32) * [Ans **[$_{CP}$ *Q* [[$_{IP}$ (whether) Ralph or Tobi called]~C]]** $surprised_C$ John]

■ Ingredient 2: In AltQs, the set of alternatives arises from the $[\![.]\!]^o$ of disjunction (Alonso-Ovalle 2006, Simons 2005, Biezma & Rawlins 2012), not from focus. [The disjuncts carry accent, but this may be analyzed as e.g. contrastive foci (Han & Romero 2004).]

(33) a. $[\![Ralph\ or\ Tobi]\!]^o$ = $\{r, t\}$
b. $[\![IP]\!]^o$ = $\{r\ called,\ t\ called\}$
c. $[\![IP{\sim}C]\!]^o$ = $[\![IP]\!]^o$ if $C \subseteq [\![IP]\!]^f$; otherwise #.
d. $[\![Q\ IP{\sim}C]\!]^o$ = $\lambda w_0.\lambda p.\ p \in [\![IP{\sim}C]\!]^o \wedge p(w_0)=1$
$=_{e.g.}$ $\lambda w_0.\{t\ called\}$

(34) a. $[\![Ralph\ or\ Tobi]\!]^f$ = $\{\ \{r, t\}\ \}$
b. $[\![IP]\!]^f$ = $\{\ \{r\ called,\ t\ called\}\ \}$
c. $[\![IP{\sim}C]\!]^f$ = $[\![IP]\!]^f$ if $C \subseteq [\![IP]\!]^f$; otherwise #.
d. $[\![Q\ IP{\sim}C]\!]^f$ = $\{[\![Q\ IP{\sim}C]\!]^o\}$

■ Inserting strongly exhaustive ans_{STR} leads to the violation of presupposition (15b):

(35) * [[**Ans_{STR} [$_{CP}$ *Q* [$_{IP}$ Ralph or Tobi called]~C]**] $surprised_C$ John]

(36) a. $C \subseteq \{\ \{r\ called,\ t\ called\}\ \}$
b. $[\![Ans_{STR}\ [...]]\!] =$ "t and nobody else called"

■ Inserting weakly exhaustive ans_{WK} equally leads to the violation of presupposition (15b):

(37) * [[**Ans_{WK} [$_{CP}$ *Q* [$_{IP}$ Ralph or Tobi called]~C]**] $surprised_C$ John]

(38) a. $C \subseteq \{\ \{r\ called,\ t\ called\}\ \}$
b. $[\![Ans_{WK}\ [...]]\!] =$ "t called"

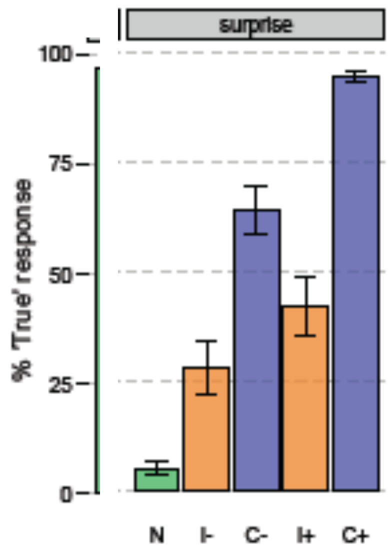
3. Cremens & Chemla's (2016) data ①: strongly exhaustive WhQs under *surprise*

■ Results from Cremers & Chemla's (2016):

(39)

Reading	N	$I^{\ominus}$	$C^{\ominus}$	$I^{\oplus}$	$C^{\oplus}$
SE	0	0	1	0	1
neSE	0	1	1	1	1
WE	0	0	0	0	1
neWE	0	0	0	1	1

(40)



■ Possibility 1: Literal vs. deductive readings (see Theiler 2014)

- Theiler's (2014) idea: *Surprise*-Vs (among others) afford two readings:
  (i) a **literal** reading describing the subject's state of mind / attentive state (awareness of some particular facts that cause her happiness/surprise), and
  (ii) a **deductive** reading, where the fact that is said to cause the subject's happiness/surprise need not even be part of her attentive state.[2]

(41) Scenario:
Bob, Alice and others applied for a waiting job at a café. Alice's friend Mary already works there and hopes that Alice will be hired. Mary is not informed so well about who else applied for the waiting job. In particular, she does not spend much thought on Bob's application. However, she does not hold any grudge against Bob, either: if he does not get the job, this fact in itself will not make Mary happy. Alice calls Mary and tells her that she got the job. Mary is happy about this news.

(42) Mary is happy about who got the job. ⇨ TRUE in (41)

(43) Mary is happy about who did not get the job. ⇨ TRUE in (41) **???**

(44) "There are expressions which seem to disambiguate embedding verbs in favour of the deductive reading. Examples of such phrases are *in a sense* or *in effect*. They appear to relax the definition of what constitutes being happy for instance. That is, inserting *in a sense*, it is justified to talk of Mary being happy about a proposition p even if characteristic features of Mary being happy about p—such as p being part of Mary's attentive state—are absent." (Theiler 2014:43)

(45) **In a sense** / **In effect**, Mary is happy about who did not get the job. ⇨ TRUE in (41)

[2] Theiler (2014) defines a literal and a deductive lexical entry for *be happy*, as a case of genuine ambiguity, and uses an exhaustive operator Exh for the deductive reading, yielding in the end what is known in the literature as the strongly exhaustive reading. We will depart from this implementation.

- Importing Theiler's (2014) insight into our proposal:
  - (i) The **literal** reading arises from (46) and (47), parallel to our derivation of *surprise* + weakly exhaustive WhQ in §2.3 above.
  - (ii) The **deductive** interpretation is a case of loose talk: the lexical entry for the verb is still (46) but context mediates in providing a second proposition/fact r and a second comparison class C': (48).

(46) ⟦*x is happy*$_C$ *(that) p*⟧
a. Assertion: $\lambda w_0.\ \forall w \in \cap Dox_x(w_0)$: $\exists d[Desirable_{x,w0}(Sim_w(p),d) \wedge d > \theta(\{\lambda d'.\ Desirable_{x,w0}(Sim_w(q),d'):q \in C\})]$
b. Presupposition: $\lambda w_0.\ p \in C$

(47) Literal reading of (42):
a. LF: [Mary is happy$_C$ about [Ans$_{WK}$ [$_{CP}$ *Q* [$_{IP}$ who got the job]~C]]]
b. $\lambda w_0.\ \forall w \in \cap Dox_m(w_0)$: $\exists d[Desirable_{m,w0}(Sim_w(\lambda w'.got\text{-}job(alice,w')),d) \wedge$
$d > \theta(\{\lambda d'.\ Desirable_{m,w0}(Sim_w(\lambda w'.got\text{-}job(alice,w')),d'),$
$\lambda d'.\ Desirable_{m,w0}(Sim_w(\lambda w'.got\text{-}job(bob,w')),d'),$
$\lambda d'.\ Desirable_{m,w0}(Sim_w(\lambda w'.got\text{-}job(sue,w')),d'), \ldots\})]$

(48) Deductive interpretation of (45) (roughly):
$\lambda w_0.\ \exists r_{<s,t>}\ \exists C'$ [$r \in C' \wedge$ **Ans$_{WK}$(⟦*who did not get job*⟧)(w_0) contextually entails r** $\wedge$
$\forall w \in \cap Dox_m(w_0)$: $\exists d[Desirable_{m,w0}(Sim_w(r),d) \wedge$
$d > \theta(\{\lambda d'.\ Desirable_{m,w0}(Sim_w(r'),d'): r' \in C'\})]$

■ Possibility 2:

- Klinedinst & Rothschild's (2011) data:

(49) Four students run a race: Bob, Ted, Alice and Sue. Emily expects Bob, Ted and Alice to run it in under six minutes. Only Bob runs it in under six minutes. Emily is surprised who ran the race in under six minutes (since she expected more people to).

- Besides ranging over individuals (x_e), *what/which*-phrases may range over generalized quantifiers ($X_{<et,t>}$), as in (50) (Romero 1998). At least in some cases (and perhaps not as default), a wh-phrase may range over a set of generalized quantifiers of mixed monotonicity, e.g. $\{\lambda P.P(jones), \lambda P.P(murray), \lambda P.\neg P(smith),\ldots\}$, as in (51A-i):

(50) Context: John has some de dicto desires about who to become friends with.
Q: What/which students in his new class does John want to become friends with?
A: He wants to become friends with [every student that has good grades]$_{de\text{-}dicto}$.

(51) Q: Who did John claim was involved in the theft?
A: Jones and Murray but not Smith.
i. 'J. claimed that Jones and Murray were involved in theft and that Smith wasn't.'
ii. 'J. claimed that Jones and Murray were involved and did not claim that Smith was.'

(x) $\lambda w_0.\ \forall w \in \cap Dox_{emily}(w_0)$:
$\exists d[Unexp_{e,w0}(Sim_w(\boldsymbol{\lambda w'.run(bob,w') \ \&\ \neg\ run(ted,w') \ \&\ \neg\ run(alice,w') \ \&\ \neg\ run(sue,w')}),d) \wedge$
$d > \theta(\{\lambda d'.Unexp_{e,w0}(Sim_w(\lambda w'.run(b,w') \ \&\ \neg run(t,w') \ \&\ \neg run(a,w') \ \&\ \neg run(s,w')),d'),$
$\lambda d'.Unexp_{e,w0}(Sim_w(\lambda w'.run(b,w') \ \&\ run(t,w') \ \&\ run(a,w') \ \&\ run(s,w')),d'),$
$\lambda d'.Unexp_{e,w0}(Sim_w(\lambda w'.run(b,w') \ \&\ run(t,w') \ \&\ run(a,w') \ \&\ \neg run(s,w')),d'),$
$\lambda d'.Unexp_{e,w0}(Sim_w(\lambda w'.run(b,w') \ \&\ run(t,w') \ \&\ \neg run(a,w') \ \&\ \neg run(s,w')),d'), \ldots\})$]

4. Cremens & Chemla's (2016) data ②: monotonicity entailment relations

■ Lack of monotonicity entailments (Kadmon & Landman 1993, von Fintel 1999):

(52) a. Mary bought a Honda.
b. Mary bought a car.

a $\Rightarrow$ b

(53) a. John is happy/glad that Mary bought a Honda.
b. John is happy/glad that Mary bought a car.

a $\not\Rightarrow$ b

(54) a. John is surprised/regrets that Mary bought a Honda.
b. John is surprised/regrets that Mary bought a car.

a $\not\Leftarrow$ b

■ Cremens & Chemla's materials and the tendencies they found:

(55) Predicates used in experiment 2 in Cremens & Chemla (2016):

PRED_{-}	PRED_{+}	$\text{PRED}_{\wedge}$
burn flowers	burn roses	burned roses and tulips
buy clothes	buy shirts	bought shirts and trousers
color trees	color pines	colored pines and oaks
compliment humans	compliment children	complimented children and teenagers
destroy musical instruments	destroy violins	destroyed violins and guitars
drink sodas	drink coke	drank coke and lemonade
drive cars	drive Toyotas	drove Toyotas and Fords
eat at restaurants	eat at Mexican restaurants	ate at Mexican and Chinese restaurants
eat meat	eat pork	ate pork and beef
kiss animals	kiss dogs	kissed dogs and cats
play with toys	play with toy cars	played with toy cars and toy soldiers
read books	read sci-fi novels	read sci-fi novels and love novels
read magazines	read news magazines	read news magazines and sports magazines
see birds	see doves	saw doves and crows
taste cookies	taste chocolate cookies	tasted chocolate cookies and caramel cookies
throw balls	throw tennis balls	threw tennis balls and soccer balls
use coins	use quarters	used quarters and dimes
use the internet	send emails	sent emails and visited websites
visit museums	visit French museums	visited French museums and Italian museums
watch sports matches	watch baseball matches	watch baseball matches and football matches

(56) a. The yellow aliens read sci-fi novels.
b. The yellow aliens read books.

a $\Rightarrow$ b

(57) a. John is happy that the yellow aliens read sci-fi novels.
b. John is happy that the yellow aliens read books.

a $\Rightarrow$ b

(58) a. John is surprised that the yellow aliens read sci-fi novels.
b. John is surprised that the yellow aliens read books.

a $\Leftarrow$ b

■ What is the difference between (53)/(54) and (57)/(58)???

- Analysis of the original data (53)/(54) à la Villalta (2008) as implemented in Romero (2015):
  Two different comparison classes are readily used as the value of C in (59) and (60). Thus, the entailment (60)⇒(59) does not go through.

(59) a. LF: [John is surprised$_C$ [$_{CP}$ that Mary bought **[a Honda]$_F$**~C]]
b. λw_0. $\forall w \in \cap Dox_j(w_0)$: $\exists d[Unexpected_{j,w0}(Sim_w((\lambda w'.buy(m,honda,w')),d) \wedge$
$d > \theta(\{\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.buy(m,\mathbf{honda},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.buy(m,\mathbf{toyota},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.buy(m,\mathbf{skoda},w')),d'),\ldots\})]$

(60) a. LF: [John is surprised$_C$ [$_{CP}$ that Mary bought **[a car]$_F$**~C]]
b. λw_0. $\forall w \in \cap Dox_j(w_0)$: $\exists d[Unexpected_{j,w0}(Sim_w((\lambda w'.buy(m,car,w')),d) \wedge$
$d > \theta(\{\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.buy(m,\mathbf{car},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.buy(m,\mathbf{bike},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.buy(m,\mathbf{van},w')),d'), \ldots\})]$

- What may have happened with the experimental items like (57)/(58):

  - All test sentences were about aliens who spent last week on earth and the activities they engaged in. A sentence of shape *John was surprised that the aliens did X* may have been understood as comparing activity X with all the other activities regardless of what activity X was, i.e. against the same comparison class. This would give us (61)-(62), under which the entailment relation (62)⇒(61) holds.

(61) a. LF: [John is surprised$_C$ that [$_{IP}$ the aliens **[read sci-fi novels]$_F$**~C]]
b. λw_0. $\forall w \in \cap Dox_j(w_0)$: $\exists d[Unexpected_{j,w0}(Sim_w((\lambda w'.read(a,sci\text{-}fi,w')),d) \wedge$
$d > \theta(\{\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.\mathbf{read}(a,\mathbf{sci\text{-}fi},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.\mathbf{read}(a,\mathbf{books},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.\mathbf{buy}(a,\mathbf{clothes},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.\mathbf{burn}(a,\mathbf{flowers},w')),d'), \ldots\}$

(62) a. LF: [John is surprised$_C$ that [$_{IP}$ the aliens **[read books]$_F$**~C]]
b. λw_0. $\forall w \in \cap Dox_j(w_0)$: $\exists d[Unexpected_{j,w0}(Sim_w((\lambda w'.read(m,books,w')),d) \wedge$
$d > \theta(\{\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.\mathbf{read}(a,\mathbf{sci\text{-}fi},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.\mathbf{read}(a,\mathbf{books},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.\mathbf{buy}(a,\mathbf{clothes},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.\mathbf{burn}(a,\mathbf{flowers},w')),d'), \ldots\}$

  - Alternatively, focus falls on the polatiry in each sentence of the pair. This gives us the two comparison classes in (63)-(64). But note that, for any given $w \in \cap Dox_j(w_0)$, $Sim_w(\lambda w'.buy(m,honda,w'))$ can only be as far or further away from w than $Sim_w(\lambda w'.buy(m,car,w'))$, as depicted in (65)-(66). Hence $Sim_w(\lambda w'.buy(m,honda,w'))$ can only be as surprising or more surprising than $Sim_w(\lambda w'.buy(m,car,w'))$. This validates the entailment relation (64)⇒(63).

(63) a. LF: [John is surprised$_C$ [$_{CP}$ that Mary **[+Pol]$_F$** bought a Honda]~C]]
b. $\lambda w_0. \forall w \in \cap Dox_j(w_0)$: $\exists d[Unexpected_{j,w0}(Sim_w((\lambda w'.buy(m,honda,w')),d) \wedge$
$d > \theta(\{\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.buy(m,\mathbf{honda},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.\neg buy(m,\mathbf{honda},w')),d')\})]$

(64) a. LF: [John is surprised$_C$ [$_{CP}$ that Mary **[+Pol]$_F$** bought a car]~C]]
b. $\lambda w_0. \forall w \in \cap Dox_j(w_0)$: $\exists d[Unexpected_{j,w0}(Sim_w((\lambda w'.buy(m,car,w')),d) \wedge$
$d > \theta(\{\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.buy(m,\mathbf{car},w')),d'),$
$\lambda d'.Unexpected_{j,w0}(Sim_w(\lambda w'.\neg buy(m,\mathbf{car},w')),d')\})]$

(65) |--|||||||||||||----------------------
w Sim$_w$(λw'.buy(m,**honda**,w'))
Sim$_w$(λw'.¬buy(m,**honda**,w'))

(66) |--|--------------------------
w Sim$_w$(λw'.buy(m,**car**,w'))
Sim$_w$(λw'.¬buy(m,**car**,w'))

5. Conclusions

- Contra many reported intuitions and analyses in the literature, recent experimental data from Cremers & Chemla (2016) show that *surprise*-Vs with a WhQ allow for truth conditions typically derived from the strongly exhaustive reading of the WhQs. This threatens a number of analyses of the correlation between available readings for WhQs and the distributional restrictions of AltQs.

- Two possible ways out have been sketched:
  - The interpretation detected is not a genuine strongly exhaustive reading but a case of loose talk (= Theiler's deductive reading)
  - The reading detected does correspond to the truth conditions of the strongly exhaustive of the WhQs, but these truth conditions are obtained not via Ans_{STR}, but via Ans_{WK} with the wh-phrase ranging over generalized quantifiers.

- Contra the difficulty and disagreement on monotonicity inferences in the literature, Cremers & Chemla's results show that *be happy* gives rise to ↑-entailments and *surprise* (to a minor extent) to ↓-entailments.

- Several possible placements of focus have been explored to derived the novel data from the proposed focus-sensitive lexical entries for *surprise*-Vs.

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