



Leibniz-Zentrum
Allgemeine Sprachwissenschaft



Accounting for Free Choice

Revisiting the challenge for the implicature approach

Lyn Tieu, Cory Bill, and Jacopo Romoli

ELM2, University of Pennsylvania, May 2022

The question: Is **Free choice** an implicature?

- Experimental project [addressing](#) this question

- Experimental project [addressing](#) this question
- Revisiting and extending a previous study

Overview

What is free choice?¹

(1) Angie is allowed to buy the car or the boat.

¹von Wright 1968, Kamp 1974

What is free choice?¹

- (1) Angie is **allowed** to buy the car **or** the boat.
~→ *Angie can choose between the two*

¹von Wright 1968, Kamp 1974

Disappearing under negation

(2) Angie is **not allowed** to buy the car **or** the boat.

Disappearing under negation

- (2) Angie is **not allowed** to buy the car **or** the boat.
≠ It's not true that Angie can choose between the two

Disappearing under negation

- (2) Angie is **not allowed** to buy the car **or** the boat.
 \neq *It's not true that Angie can choose between the two*
 \rightsquigarrow *Angie cannot buy either one*

Two main approaches

1. Implicature based

Two main approaches

1. Implicature based
2. Non-implicature based

The previous study

- Testing a clear **divergent prediction** of the two approaches

The previous study

- Testing a clear **divergent prediction** of the two approaches
- A **challenge** for the implicature approach

The current project

- Revisiting the issue and addressing a potential confound

The current project

- Revisiting the issue and addressing a potential confound
- Refining and extending the challenge

The rest of today

1. Background and the two approaches

The rest of today

1. Background and the two approaches
2. The divergent prediction

The rest of today

1. Background and the two approaches
2. The divergent prediction
3. The previous experiment and potential confound

The rest of today

1. Background and the two approaches
2. The divergent prediction
3. The previous experiment and potential confound
4. The current experiments

The rest of today

1. Background and the two approaches
2. The divergent prediction
3. The previous experiment and potential confound
4. The current experiments
5. Discussion and conclusion

Background

Background

Free choice and double prohibition

- (3) Angie is **allowed** to buy the car **or** the boat.
↪ Angie can choose between the two

- (4) Angie is **not allowed** to buy the car **or** the boat.
 \neq *It's not true that Angie can choose between the two*
 \rightsquigarrow *Angie cannot buy either one*

More schematically

$$(5) \quad \diamond(A \vee B)$$

$$(5) \quad \diamond(A \vee B) \rightsquigarrow \diamond A \wedge \diamond B$$

FREE CHOICE

More schematically

$$(5) \quad \diamond(A \vee B) \rightsquigarrow \diamond A \wedge \diamond B$$

FREE CHOICE

$$(6) \quad \neg \diamond(A \vee B) \rightsquigarrow \neg \diamond A \wedge \neg \diamond B$$

More schematically

$$(5) \quad \diamond(A \vee B) \rightsquigarrow \diamond A \wedge \diamond B$$

FREE CHOICE

$$(6) \quad \neg\diamond(A \vee B) \rightsquigarrow \neg\diamond A \wedge \neg\diamond B$$

DOUBLE PROHIBITION

The empirical puzzle

- How **free choice** arises in positive contexts

The empirical puzzle

- How **free choice** arises in positive contexts
- How **double prohibition** arises in negative contexts

Two main approaches

1. Implicature based
2. Non-implicature based

Background

The implicature approach

The implicature approach²

- Free choice is an implicature

²Fox 2007, Klinedinst 2006, Chierchia 2013, Chemla 2010, Franke 2013, Santorio & Romoli 2018, Bar-Lev & Fox 2017 a.o

The implicature approach²

- Free choice is an **implicature**
- Double prohibition is just part of the **literal meaning**

²Fox 2007, Klinedinst 2006, Chierchia 2013, Chemla 2010, Franke 2013, Santorio & Romoli 2018, Bar-Lev & Fox 2017 a.o

The implicature approach: the gist

$$(7) \quad \diamond(A \vee B) = \diamond A \vee \diamond B$$

LITERAL MEANING

The implicature approach: the gist

$$(7) \quad \diamond(A \vee B) = \diamond A \vee \diamond B$$

LITERAL MEANING

$$(8) \quad \neg\diamond(A \vee B) = \neg\diamond A \wedge \neg\diamond B$$

DOUBLE PROHIB

The implicature approach: the gist

$$(7) \quad \diamond(A \vee B) = \diamond A \vee \diamond B$$

LITERAL MEANING

$$(8) \quad \neg\diamond(A \vee B) = \neg\diamond A \wedge \neg\diamond B$$

DOUBLE PROHIB

$$(9) \quad \text{EXH}[\diamond(A \vee B)] = \diamond A \wedge \diamond B$$

FREE CHOICE

The implicature approach: the gist

- (7) $\diamond(A \vee B) = \diamond A \vee \diamond B$ LITERAL MEANING
- (8) $\neg\diamond(A \vee B) = \neg\diamond A \wedge \neg\diamond B$ DOUBLE PROHIB
- (9) $\text{EXH}[\diamond(A \vee B)] = \diamond A \wedge \diamond B$ FREE CHOICE
- (10) $*\neg\text{EXH}\diamond(A \vee B) = \neg\diamond A \vee \neg\diamond B$ NEGATED FREE CHOICE

- **Free choice** arises as an implicature
- **Double prohibition** is just part of the literal meaning

Background

The non-implicature approach

The homogeneity approach: the gist³

- Free choice is just part of the [literal meaning](#)

³Goldstein 2018, Rothschild and Yablo 2018

The homogeneity approach: the gist³

- Free choice is just part of the [literal meaning](#)
- Double prohibition arises via [homogeneity](#)

³Goldstein 2018, Rothschild and Yablo 2018

$$(11) \quad \diamond(A \vee B) = \diamond A \wedge \diamond B$$

FREE CHOICE

The homogeneity approach: the gist

$$(11) \quad \diamond(A \vee B) = \diamond A \wedge \diamond B$$

FREE CHOICE

$$(12) \quad \diamond A \leftrightarrow \diamond B$$

HOMOGENEITY

The homogeneity approach: the gist

$$(11) \quad \diamond(A \vee B) = \diamond A \wedge \diamond B \qquad \text{FREE CHOICE}$$

$$(12) \quad \diamond A \leftrightarrow \diamond B \qquad \text{HOMOGENEITY}$$

$$(13) \quad \neg \diamond(A \vee B) = \neg(\diamond A \wedge \diamond B) \qquad \text{NEGATED FREE CHOICE}$$

The homogeneity approach: the gist

(14) $\diamond(A \vee B) = \diamond A \wedge \diamond B$ FREE CHOICE

(15) $\diamond A \leftrightarrow \diamond B$ HOMOGENEITY

(16) $\neg\diamond(A \vee B) = \neg(\diamond A \wedge \diamond B)$ NEGATED FREE CHOICE

The homogeneity approach: the gist

(14) $\diamond(A \vee B) = \diamond A \wedge \diamond B$ FREE CHOICE

(15) $\diamond A \leftrightarrow \diamond B$ HOMOGENEITY

(16) $\neg\diamond(A \vee B) = \neg(\diamond A \wedge \diamond B)$ NEGATED FREE CHOICE

(17) $\neg\diamond A \wedge \neg\diamond B$ DOUBLE PROHIB

- **Free choice** is just part of the literal meaning
- **Double prohibition** arises via the homogeneity presupposition

Predictions

The two approaches

- **Successfully** capture basic pattern and more complex data

A simple divergent prediction⁴

Distinguish between the two given a **simple** divergent prediction

⁴Križ 2015, 2017; Tieu, Bill, Romoli & Crain 2020

Free choice vs. double prohibition

- (18) Angie is allowed to buy the car or the boat
 \rightsquigarrow *Angie can choose between the two* FREE CHOICE
- (19) Angie is not allowed to buy the car or the boat
 \rightsquigarrow *Angie cannot buy either one* DOUBLE PROHIB

The implicature approach

(20) Angie is allowed to buy the car or the boat

~→ *Angie can choose between the two*

IMPLICATURE

The implicature approach

- (20) Angie is allowed to buy the car or the boat
 \rightsquigarrow *Angie can choose between the two* IMPLICATURE
- (21) Angie is not allowed to buy the car or the boat
 \rightsquigarrow *Angie cannot buy either one* LITERAL MEANING

The homogeneity approach

(22) Angie is allowed to buy the car or the boat

↪ *Angie can choose between the two*

LITERAL MEANING

The homogeneity approach

- (22) Angie is allowed to buy the car or the boat
 \rightsquigarrow *Angie can choose between the two* LITERAL MEANING
- (23) Angie is not allowed to buy the car or the boat
 \rightsquigarrow *Angie cannot buy either one* (VIA) PRESUPPOSITION

The homogeneity approach

- (24) Angie is allowed to buy the car or the boat
 \rightsquigarrow *Angie can buy one iff she can buy the other* PRES
- (25) Angie is not allowed to buy the car or the boat
 \rightsquigarrow *Angie can buy one iff she can buy the other* PRES

Difference in status

Context: Angie is only allowed to buy the boat

Difference in status

Context: Angie is only allowed to buy the boat

(26) Angie is allowed to buy the car or the boat
 \rightsquigarrow *Angie can choose between the two*

FALSE IMP

Difference in status

Context: Angie is only allowed to buy the boat

(27) Angie is not allowed to buy the car or the boat
 \rightsquigarrow *Angie cannot buy either one*

FALSE

No difference in status

Context: Angie is only allowed to buy the boat

(28) Angie is allowed to buy the car or the boat
 \rightsquigarrow *Angie can buy one iff she can buy the other*

PS FAIL

No difference in status

Context: Angie is only allowed to buy the boat

(29) Angie is not allowed to buy the car or the boat
 \rightsquigarrow *Angie can buy one iff she can buy the other*

PS FAIL

	IMPLICATURE	HOMOGENEITY
POS	IMPLICATURE VIOLATION	PRESUPPOSITION FAILURE
NEG	FALSITY	PRESUPPOSITION FAILURE

	IMPLICATURE	HOMOGENEITY
POS	IMPLICATURE VIOLATION	PRESUPPOSITION FAILURE
NEG	FALSITY	PRESUPPOSITION FAILURE

- Testing these predictions

- Testing these **predictions**
- A simple way to **distinguish** between the two approaches

Previous study

- Tieu, Bill & Romoli (2019) tested the divergent predictions of the two approaches to free choice
- Compared FC disjunction to plain disjunction as an implicature baseline

(30) Angie **is allowed** / **not allowed** to buy the car or the boat.

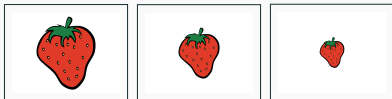
(31) Angie **bought** / **didn't buy** the car or the boat.

- (32) Angie bought the car or the boat.
~> *Angie didn't buy both the car and the boat* IMP
- (33) Angie didn't buy the car or the boat.
~> *Angie didn't buy either* LIT MEAN

- Guessing game: characters are shopping at the store
- FC: Mom has set some rules about what each kid is allowed or not allowed to buy
- Puppet makes a guess about:
 - What the character is allowed/not allowed to buy (FC)
 - What the character will/will not buy (OR)

Procedure

- Read a puppet's guess before seeing a picture of the outcome
- Ternary judgment task: evaluate the puppet's guess against the outcome,⁵ by choosing the appropriate reward given the puppet's statement



⁵Already used in previous work on implicatures, presuppositions, and homogeneity, see Katsos and Bishop 2011, Abrusan and Szendroi 2013, Križ & Chemla 2016, Tieu, Križ & Chemla 2019

Sample target – FC, positive

It's Angie's turn to go to the store.
Raffie, can you guess what the rule for Angie is?



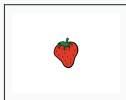
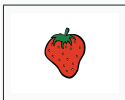
“Angie is allowed to buy the car or the boat.”

Sample target – FC, positive

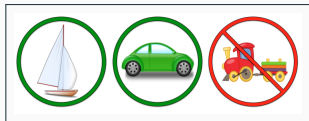
“Angie is allowed to buy the car or the boat.”



Which strawberry should we give Raffie?



Predictions - Disjunction



(34) Angie will buy the car or the boat

IMP FALSE



(35) Angie will not buy the car or the boat

FALSE



Predictions - FC (Implicature approach)



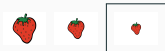
(36) Angie is allowed to buy the car or the boat

IMP FALSE



(37) Angie is not allowed to buy the car or the boat

FALSE



Predictions - FC (Homogeneity approach)



(38) Angie is allowed to buy the car or the boat



(39) Angie isn't allowed to buy the car or the boat

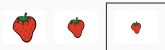


Predictions - FC (Homogeneity approach)



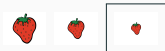
(40) Angie is allowed to buy the car or the boat

PS FAIL



(41) Angie isn't allowed to buy the car or the boat

PS FAIL

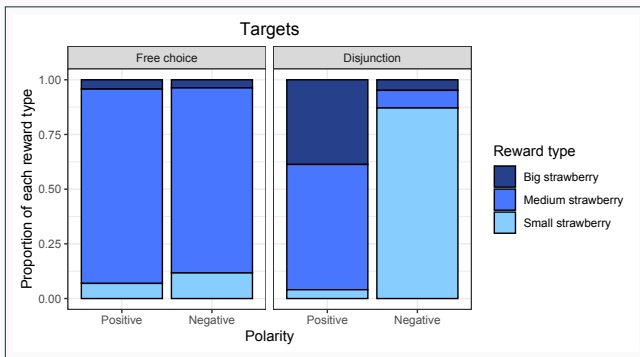


- An interaction between *inference type* (FC vs. OR) and *polarity* (positive vs. negative) would be challenging for the implicature approach but in line with the homogeneity approach

	OR	FC IMP	FC HOM
POS	IMP FALSE	IMP FALSE	PS FAIL
NEG	FALSE	FALSE	PS FAIL

Main findings

- **Symmetric** responses for positive and negative FC
- **Difference** between positive and negative OR — distinction between IMP FALSE and plainly FALSE
- **Interaction** between inference type and polarity — challenging for implicature approach, in line with homogeneity approach



A potential confound

- Intermediate responses to FC in line with homogeneity account
- But could also be due to a charitable response strategy: the puppet mentioned two things, and turned out to be right about one of them (cf. true and false controls, where the puppet is right about both objects or wrong about both objects)
- Participants might be tempted to offer the puppet a medium strawberry for being 'partially right'

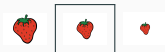
FC targets – Partially right?



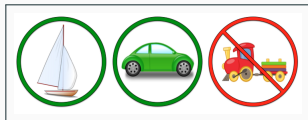
(42) Angie is allowed to buy the car or the boat.



(43) Angie is not allowed to buy the car or the boat.



Strategy would not extend to OR targets



- (44) Angie bought the car or the boat
- (45) Angie didn't buy the car or the boat

The present study

The present study

**Experiment 1: Free choice vs
conjunction**

Exp.1: Testing the charity strategy

- Symmetric intermediate responses to FC in line with homogeneity account, but could also arise from a charity strategy
- Compare to a control where the same charity strategy is plausible, but there is no undefinedness at play — plain conjunctions
- FC condition was the same as in previous experiment

Sample Conjunction target, positive

It's Angie's turn to go to the store.
Raffie, can you guess what will happen?



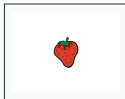
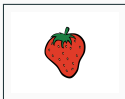
“Angie will buy the car and the boat.”

Sample Conjunction target, positive

“Angie will buy the car and the boat.”



Which strawberry should we give Raffie?



Exp.1: Predictions — No Charitability strategy

- An effect of coordination type (FC disjunction vs. conjunction)
- Replicate intermediate judgments for positive and negative FC
- Minimal rewards for positive conjunction targets, which are false
- Minimal/maximal rewards for negative conjunction targets⁶

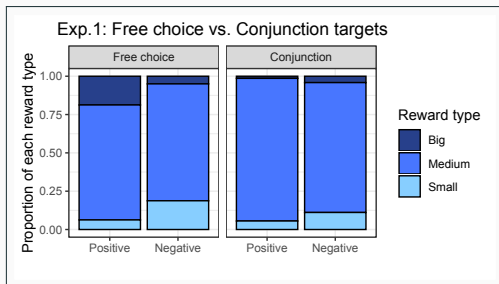
⁶True if $\text{neg} > \text{conjunction}$ and false if $\text{conjunction} < \text{neg}$

Exp.1: Predictions — Charitability strategy

- No effect of coordination type (FC disjunction vs. conjunction)
- Replicate intermediate rewards for positive and negative FC
- Intermediate rewards for positive and negative conjunction targets

Exp.1: Key findings

- No effect of condition⁷
- Replicated symmetric responses to FC — but same behaviour in response to conjunction targets
- Consistent with charity strategy



⁷38 participants (20 FREE CHOICE, 18 CONJUNCTION)

- Exp.1 supports presence of a potential confound
- FC findings could be attributed not to presupposition failure, but rather to a charitable response strategy
- Coordinate structure in particular might encourage participants to reward the puppet for being 'partially right'

Next step: free choice indefinites

- Both approaches can be and have been extended to free choice indefinites⁸

(46) Angie can buy any of the items on the table

- Can extend our experimental design to the FC indefinite, probing for (a)symmetry across the polarities

⁸e.g. Chierchia 2004, 2013; Aloni 2007

The present study

Experiment 2: Free choice 'any'

Exp.2: Free choice 'any' — implicature or homogeneity?

- Instead of comparing FC disjunction to an implicature baseline, compare FC 'any' to an implicature baseline
- Would ideally compare to 'some', but would not be able to include negative polarity due to PPI status
- Compared to indirect scalar implicature of 'not every'

Same predictions as before

- An interaction between **inference type** (FC 'any' vs. ISI 'not every') and **status** (IMP FALSE vs. FALSE) would be challenging for the implicature approach but in line with the homogeneity approach

ISI 'not every'	FC 'ANY' IMP	FC 'ANY' HOM
IMP FALSE	IMP FALSE	PS FAIL
FALSE	FALSE	PS FAIL

Sample 'any' target, implicature-false

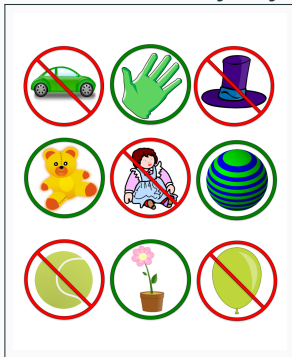
Angie is going to the store.
Raffie, what's the rule for Angie?



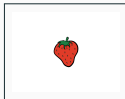
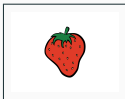
“Angie is allowed to buy any item.”

Sample 'any' target, implicature-false

"Angie is allowed to buy any item."



Which strawberry should we give Raffie?



Sample 'not every' target, implicature-false

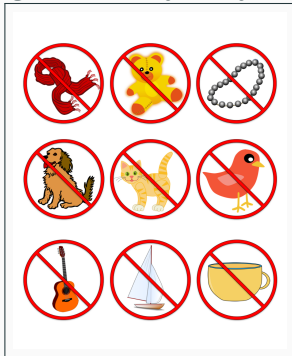
Angie went to the store.
Raffie, what happened at the store?



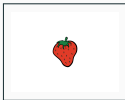
“Angie didn’t buy every item.”

Sample 'not every' target, implicature-false

"Angie didn't buy every item."

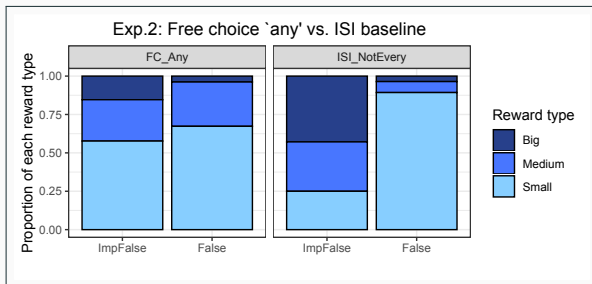


Which strawberry should we give Raffie?



Exp.2: Main finding

- Significant interaction between inference type (FC vs. ISI) and status (IMP FALSE vs. FALSE)
- Consistent with earlier experiment, new data challenging for implicature account but in line with homogeneity account



General discussion

Summary

- Set out to experimentally address debate between implicature and non-implicature approaches to free choice
- Previous findings challenged implicature approach — but associated with confound
- Exp.1 included plain conjunctions and confirmed potential confound
- Exp.2 compared FC indefinite with (indirect) implicature baseline

- Exp.2, as in earlier experiment, revealed asymmetry between free choice and implicature baseline — parallel responses to positive and negative FC, unlike indirect scalar implicature baseline
- As before, challenge for implicature approach to free choice
- As before, in line with homogeneity approach

- Methodological point about what we can conclude from intermediate choices
- With appropriate comparison points, remains a powerful perspective to address current debate
- Can extend to various other inferences, e.g., plural definites, bare plurals, neg-raising, conditionals, ...

Acknowledgments

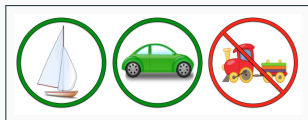
- Thank you to Moysh Bar-Lev, Milica Denic, Simon Goldstein, Mora Maldonado, Paul Marty, Agata Renans, and Paolo Santorio for helpful discussion and feedback.
- Support for this research was provided by Western Sydney University through the University's Research Theme Champion support funding.

Appendix

Appendix

True and false controls in TBR (2019)

True control – Completely right



(47) Angie is allowed to buy the car or the boat.



False control – Completely wrong



(48) Angie is allowed to buy the car or the boat.



Appendix

Exp.1 Methods

Exp.1: Methods

- Participants
 - 38 participants (20 FREE CHOICE, 18 CONJUNCTION), recruited through AMT⁹
- Materials
 - 8 targets (4 positive, 4 negative)
 - 8 controls (4 clearly true/false positive, 4 clearly true/false negative)
 - 6 fillers (exhaustivity implicature)

⁹after excluding 44 participants for failing to score at least 75% accuracy on unambiguous controls

Appendix

Exp.2 Methods

Exp.2: Methods

- Participants
 - 27 participants (13 ANY, 14 EVERY), recruited through AMT¹⁰
- FC materials
 - 8 targets (4 IMP FALSE, 4 FALSE)
 - 8 controls (4 clearly true/false positive, 4 clearly true/false negative)
 - 6 fillers (some-not-all implicature)
- ISI materials
 - 4 targets (2 IMP FALSE, 2 FALSE)
 - 12 controls (8 clearly true/false positive, 4 clearly true/false negative)
 - 6 fillers (some-not-all implicature)

¹⁰after excluding 9 participants for failing to score at least 75% accuracy on unambiguous controls

Appendix

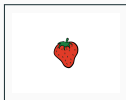
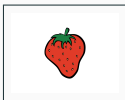
Previous study: Example trials

Sample FC target, positive

“Angie is allowed to buy the car or the boat.”



Which strawberry should we give Raffie?

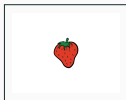


Sample FC target, negative

“Angie is not allowed to buy the car or the boat.”

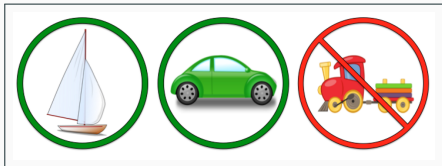


Which strawberry should we give Raffie?

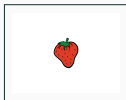
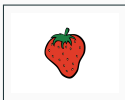


Sample OR target, positive

“Angie will buy the car or the boat.”

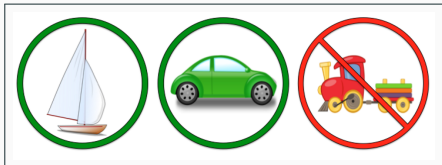


Which strawberry should we give Raffie?

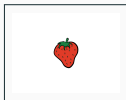
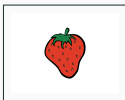


Sample OR target, negative

“Angie will not buy the car or the boat.”



Which strawberry should we give Raffie?



Appendix

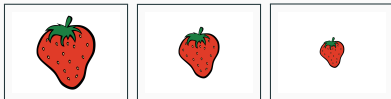
Exp.1: Example trials

Sample Conjunction target, positive

“Angie will buy the car and the boat.”



Which strawberry should we give Raffie?

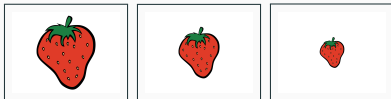


Sample Conjunction target, negative

“Angie will not buy the car and the boat.”

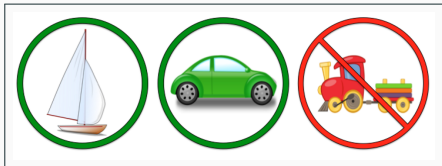


Which strawberry should we give Raffie?

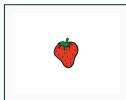
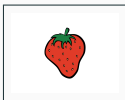


Sample FC true control, positive

“Angie is allowed to buy the car or the boat.”



Which strawberry should we give Raffie?

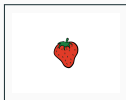
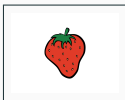


Sample FC false control, positive

“Angie is allowed to buy the car or the train.”



Which strawberry should we give Raffie?

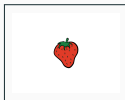


Sample FC true control, negative

“Angie is not allowed to buy the car or the train.”

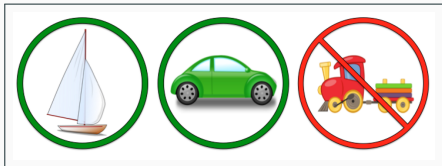


Which strawberry should we give Raffie?

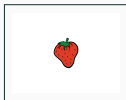
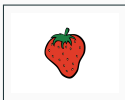


Sample FC false control, negative

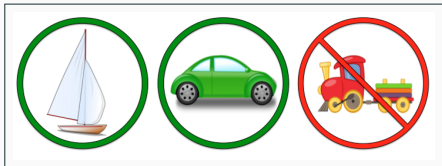
“Angie is not allowed to buy the car or the boat.”



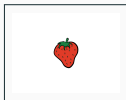
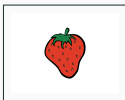
Which strawberry should we give Raffie?



“Angie is allowed to buy the boat.”



Which strawberry should we give Raffie?



Appendix

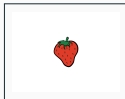
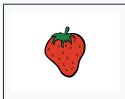
Exp.2: Example trials

Sample 'any' target, implicature-false

"Angie is allowed to buy any item."



Which strawberry should we give Raffie?

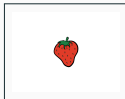
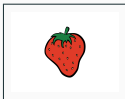


Sample 'any' target, plainly false

“Angie is not allowed to buy any item.”

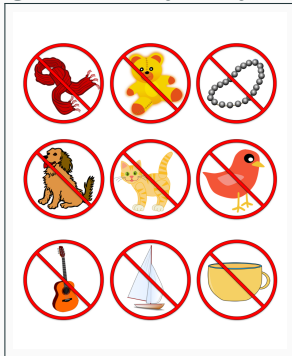


Which strawberry should we give Raffie?

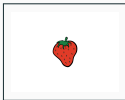
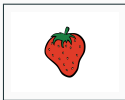


Sample 'not every' target, implicature-false

"Angie didn't buy every item."

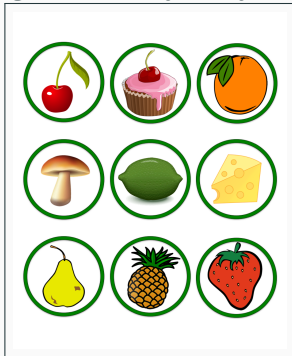


Which strawberry should we give Raffie?



Sample 'not every' target, plainly false

"Angie didn't buy every item."



Which strawberry should we give Raffie?

