UNIVERSAL FREE CHOICE?*

BOB VAN TIEL
Radboud University Nijmegen

1 Introduction

If someone tells me that I can have coffee or tea, I infer that I can have coffee and that I can have tea. These so-called *free choice inferences* (FCIs) appear to compromise the widely held view that 'or' is the natural language equivalent of logical disjunction. After all, a disjunction does not entail its disjuncts. FCIs are not confined to deontic contexts, but occur whenever 'or' is embedded under an existential operator. In (1), for instance, 'or' is embedded under an epistemic modal operator:

(1)   John might be in Amsterdam or Berlin.
     ⤳ John might be in Amsterdam.
     ⤳ John might be in Berlin.

The FCI problem has provoked a wide range of possible solutions. Some of these locate the source of FCIs in the semantics of the existential operator (e.g., Merin 1992, Barker 2010) or the lexical item 'or' (e.g., Zimmermann 2000, Geurts 2005). Others adopt a different approach, explaining FCIs as a variety of scalar implicature (e.g., Fox 2007, Geurts 2010). A scalar implicature (SI) is an upper-bounded construal of a sentence containing a scalar term, as in (2):

(2)   John ate some of the apples.
     ⤳ John did not eat all of the apples.

The reasoning process that underlies the derivation of FCIs can be summarized as follows. A speaker who says (3) could have been more informative by saying (3a) or (3b). These sentences come with an exhaustivity inference that I cannot have tea (in the case of 3a) or coffee (in the case of 3b). Why didn't the speaker use these sentences? Presumably, because she does not believe them to be true. That is, she does not believe that I can have coffee but not tea, and she does not believe that I can have tea but not coffee. Given that the speaker believes her utterance to be true, it follows that she believes that I can have coffee and that I can have tea.

(3) You can have coffee or tea.

    a. You can have coffee.

    b. You can have tea.

Several observations speak in favor of an SI approach. Like SIs, FCIs are absent in downward-entailing contexts. That is to say, (4) does not merely convey that you cannot choose between having coffee or tea; it implies that you cannot have either. In upward-entailing contexts, FCIs can be cancelled by professing ignorance about the truth of the FCIs, as in (5). This again mirrors the behavior of SIs.

(4) You cannot have coffee or tea.

(5) You can take coffee or tea, but I do not know which.

It has also been argued that there are pretheoretical reasons to prefer an SI approach. As a matter of principle, it is better to explain inferences by means of independently motivated pragmatic principles than by positing semantic ambiguities. Grice (1989) calls this principle 'Modified Occam's Razor'.

If the SI approach is correct, FCIs provide an important test case to decide between different theories of SIs. The traditional view is that SIs are conversational implicatures (e.g., Horn 1972, Geurts 2009). Someone who hears (2) may reason as follows. The speaker could have made a stronger statement by saying that John ate all of the apples. Why didn't she do so? Presumably, she does not believe that John ate all of the apples. Assuming that the speaker knows whether John ate all of the apples, it follows that she believes that John did not eat all of the apples.

Alternatively, it has been argued that sentences with a scalar term are ambiguous between a reading with and without the SI. Initially, this ambiguity was taken to reside in the lexical meaning of scalar terms (e.g., Levinson 2000). More recently, it has been proposed that the ambiguity is caused by the optional presence of a covert syntactic operator, whose meaning is essentially that of 'only' (e.g., Chierchia 2006, Fox 2007). If this exhaustivity operator is appended to (2), 'some' is interpreted as 'only some' and thus comes to exclude all. I refer to both elaborations of the ambiguity thesis as *conventionalism*.

The pragmatic and conventionalist accounts make different predictions in case a scalar term is embedded e.g., under a universal quantifier like in (6). According to the pragmatic account, (6) conveys at most that not all the squares are connected to all of the circles. The conventionalist account predicts the stronger inference that no square is connected to all of the circles. This reading is arrived at by attaching the exhaustivity operator to the embedded sentence, before appending the universal quantifier.

(6) All the squares are connected to some of the circles.

While sentences like (6) have been investigated at length, there is still no consensus about what exactly they convey (Geurts and Pouscoulous 2009a, Chemla and Spector 2011, van Tiel submitted).

Both pragmatic and conventionalist accounts of SIs have the means to account for singular FCIs. But only the conventionalist account predicts FCIs to occur in embedded positions. In support of the latter account, Chemla (2009) found that participants consider the universal FCIs in (7) as robust as their singular counterparts:

(7) Every guest can have coffee or tea.
     ⤳ Every guest can have coffee.
     ⤳ Every guest can have tea.

If FCIs are SIs and if FCIs occur in embedded positions, the pragmatic account of SIs appears to be in deep trouble. However, Geurts and Pouscoulous (2009b) have argued that universal FCIs can be incorporated in a pragmatic framework after all. Their account is based on the intuition that universal FCIs are confined to permission-giving sentences. They cite the examples below in order to show that the inferences appear to be less robust in other contexts.

(8) Every student can write a haiku or play the Moonlight Sonata.
     ?⤳ Every student can write a haiku.
     ?⤳ Every student can play the Moonlight Sonata.

(9) Every day, some of the guests ordered scrambled eggs or an omelet.
     ?⤳ Some of the guests ordered an omelet.
     ?⤳ Some of the guests ordered scrambled eggs.

If these intuitions are correct, the problem for the pragmatic account might not be as daunting as it seemed. Of course, it remains to give an explanation as to why universal FCIs are licensed in permission-giving contexts. According to Geurts and Pouscoulous, someone who says (7) actually performs a distributive speech act. The speaker gives permission not to the group as a whole, but to every individual member of the group. The problem of universal free choice thus boils down to the problem of singular free choice. Since several pragmatic solutions to the latter problem have been proposed (e.g., Geurts 2010, Franke 2011), a pragmatic account of SIs can be salvaged after all.

Geurts and Pouscoulous thus provide an intuitively plausible explanation to salvage the pragmatic account. But is their explanation correct? There are at least three reasons to challenge their proposal:

∗ Geurts and Pouscoulous' account hinges on their intuitions about complex sentences. Since intuitions about such sentences are likely to be heavily theory-laden, naive participants should be probed for their judgements.

∗ Only a small number of example sentences are provided to show that universal FCIs appear to be restricted to permission-giving contexts. These examples might be idiosyncratic in some way. It is unclear if Geurts and Pouscoulous' intuitions are vindicated across a wider variety of examples.

∗ One reason for the fragility of universal FCIs in sentences that cannot be used to grant permission could be that the corresponding singular FCIs are less robust as well. If so, the fragility of universal FCIs might be ascribed to this difference instead of an effect of embedding.

To address these concerns, I conducted an inference task in the vein of Chemla (2009).

2 Free choice under embedding

According to Geurts and Pouscoulous, the universal FCIs attested by Chemla are caused by the particular speech act performed by means of the sentences in question. Only FCIs in sentences that

Please indicate how strongly the conclusion follows from the sentence below

Every week, some of the children had the flu or the measles.

CONCLUSION: Every week, some of the children had the flu.

WEAK   STRONG

Figure 1: Experimental item used to test the robustness of universal FCIs.

can be used to give permission survive embedding under a universal quantifier. That is, the effect of embedding a free choice sentence under a universal quantifier on the robustness of FCIs should be significantly bigger for sentences that cannot be used to give permission than for sentences that can. I tested this hypothesis in an inference task.

Two versions of this task were created. In the Baseline version, participants encountered only unembedded free choice sentences. In the Embedded version, the same sentences were embedded under a universal quantifier. The inclusion of a Baseline version was necessary to factor in a possible explanation for Geurts and Pouscoulous' intuitions. The reason that universal FCIs are intuitively less robust in sentences that cannot be used to grant permission might be that FCIs in general are less robust in such contexts. Therefore I investigated the *effect* of embedding rather than just the robustness of embedded FCIs.

2.1   Participants

In total 54 Dutch participants filled in the questionnaire. 30 of these filled in the Embedded version and 24 the Baseline version. Participants were not paid for their participation. No participants were excluded from the analysis. The questionnaire took between 10 and 15 minutes to complete.

2.2   Material and design

Each page of the questionnaire showed a sentence followed by a conclusion (cf. Figure 1). Participants were instructed to indicate how strongly the conclusion followed from the sentence. To this end, they could set a line anywhere on a bar. The further to the right the line was set, the more strongly the conclusion was felt to follow. The dependent variable was the proportion of bar to the left of the line. The set-up of the experiment was essentially the same as the inference task used by Chemla (2009).

The questionnaire consisted of 35 items in seven conditions. In the four target conditions, 'or' was embedded under a deontic, epistemic or dynamic modal operator, or under an existential quantifier.[1] Three filler conditions were added to the mix. The first filler condition consisted of

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[1]Dutch 'mogen' was used to express deontic modality. Both epistemic and dynamic modality were expressed by 'kunnen'. In the epistemic case, every sentence began with 'According to [name]' so that it was clear what modality was intended. The existential quantifier used in the Existential condition was 'enkele' ("some"). The universal quantifier was varied between 'alle' ("all") and 'iedere' ("every").
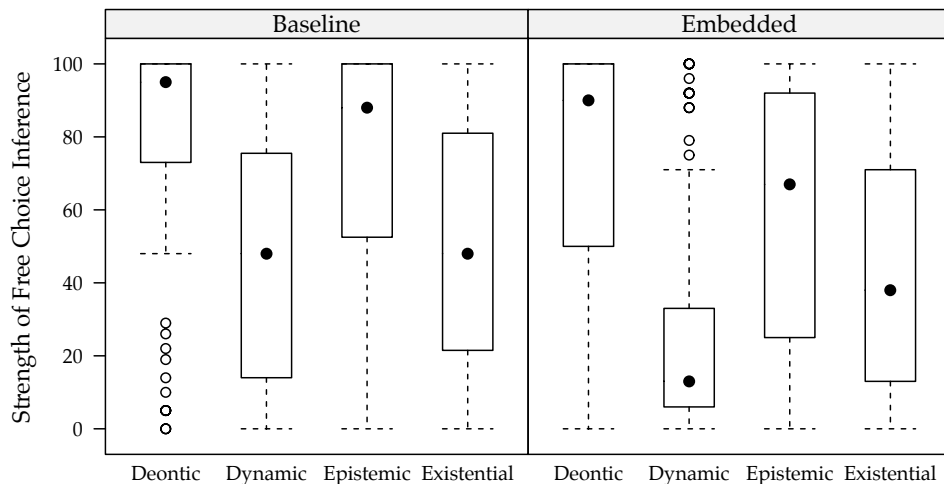
Figure 2: Strength of the FCI when 'or' is embedded under a deontic, dynamic or epistemic modal, or under an existential quantifier.

sentences with 'and' instead of 'or'. The second filler condition consisted of sentences with 'or' embedded in the antecedent of a conditional. An example of the first two filler conditions is given in (10):

(10) a. Every guest took a sausage and a slice of bacon from the barbecue.
  b. If everyone votes for or against the motion, a second vote will not be necessary.

The final filler condition mirrored the target conditions but involved a conclusion that was not supported by the sentence. In every condition but the last, the conclusion was the same as the target sentence except that the disjunction or conjunction was replaced by one of the disjuncts or conjuncts. Every condition consisted of five items. The order of the items and the disjunct or conjunct that was presented in the conclusion was randomized across multiple lists. The full instructions, as well as a list with target sentences, are given in the Appendix.

Note that the conclusion that was offered to participants differs from the one Chemla included in his inference task. Rather than one of the disjuncts, Chemla asked participants whether it follows from e.g., (7) that every guest can choose between the two disjuncts. I avoided this choice of conclusion because it does not readily extend to other free choice licensing environments. However, the results for the deontic context did not differ from those found by Chemla, so this difference appears to be immaterial.

2.3 Results

The lefthand panel of Figure 2 shows the results of the Baseline version. The median strength of singular FCIs is the highest in the Deontic condition ($M = 95\%$). FCIs are slightly less strong in the Epistemic condition ($M = 88\%$), followed by both the Existential and Dynamic condition (both M's = 48%). Paired Welch's t-tests show that all of the means are significantly different (all p's < .05) except for the means of the Deontic and Epistemic condition ($t(197) = 1.41$, $p = .16$) and the Dynamic and Existential condition ($t(197) < 1$).

The results of the Embedded version, as depicted in the righthand panel of Figure 2, show a similar pattern. The median strength is the highest in the Deontic condition ($M = 90\%$). FCIs are less strong in the Epistemic condition ($M = 67\%$), followed by the Existential condition ($M = 38\%$). The median strength of universal FCIs is the lowest in the Dynamic condition ($M = 13\%$). Paired Welch's t-tests show that all of the means are significantly different (all *p*'s $< .05$).

To test the effect of embedding on the robustness of FCIs, I conducted a three-way analysis of variance with Version (Baseline or Embedded) and Condition (Deontic, Dynamic, Epistemic or Existential) as fixed factors and Item as a random factor nested under Condition. There were main effects of Version ($F(1, 16) = 29.94$, $p < .001$, partial $\eta^2 = .652$), Condition ($F(3, 16) = 20.25$, $p < .001$, partial $\eta^2 = .791$) and Item ($F(16, 16) = 3.03$, $p < .05$, partial $\eta^2 = .752$). The interactions between Version and Condition ($F(3, 16) = 1.98$, $p < .157$) and Version and Item ($F(16, 933) = 1.41$, $p < .128$) did not reach significance. The absence of a significant interaction between Version and Item proves that the effect of Version did not depend on the particular items involved.

For a more detailed picture, I compared the effects of Version and Item on the respective conditions by means of two-way analyses of variance. The effect of Item was significant in every condition ($p < .05$). There was a significant effect of Version in the Epistemic, Dynamic and Existential condition ($p < .05$). In the Deontic condition, the effect of Version was marginally significant ($F(1, 234) = 2.89$, $p < .09$, partial $\eta^2 = .012$). The interaction between Version and Item was significant only in the Epistemic condition ($F(4, 234) = 3.25$, $p < .05$, partial $\eta^2 = .053$). On closer inspection, this interaction is almost entirely due to (11):

(11) According to the professor, this / every research question can be answered by means of a survey or an experiment.

The singular FCI licensed by (11) was highly robust ($M = 91\%$), in stark contrast to its universal counterpart ($M = 30\%$). Given the minimal size of the effect, I do not think that this interaction has any theoretical consequences.

3   Discussion

While vindicating some of Geurts and Pouscoulous' intuitions, the results on the whole disprove their explanation for universal FCIs. Universal FCIs are indeed less robust in sentences that cannot be used to grant permission. In fact, only the Deontic condition did not show a significant main effect of Version. That is, the mean robustness of singular and universal FCIs did not differ significantly in the Deontic condition, as opposed to the other target conditions. But a glance at Figure 2 suffices to see that universal FCIs are not absent in at least the Epistemic and Existential conditions. Only in the Dynamic condition might it be argued that FCIs actually disappear under embedding. What is worse, the interaction between Condition and Version does not reach significance. So the effect of Version is the same for all target conditions.

Further evidence against Geurts and Pouscoulous' explanation comes from the particular items used in the Deontic condition. The main verb in the target sentences was either in the present or past tense:

(12)   a. Every visitor can take a cocktail or some lemonade.
       b. Every student was allowed to take an apple or a pear.

While the former sentences can be used to give permission, the latter can only be used to report permission. The effect of embedding on the robustness of FCIs licensed by permission-giving sentences ($M = 95\%$ in the Baseline version against $M = 90\%$ in the Embedded version) was not significantly bigger than the effect of embedding on permission reports ($M = 93\%$ against $M = 90\%$). This provides strong evidence that universal FCIs cannot be explained as distributive speech acts.

A remarkable observation is that the robustness of FCIs largely depends on the kind of operator involved. FCIs are highly robust when 'or' is embedded under a deontic or epistemic modal operator. The inferences are much less robust under a dynamic modal operator or an existential quantifier. This variance is not expected on any account of FCIs and stands in need of clarification. One explanation might be that sentences involving deontic or epistemic modalities require a greater deal of speaker competence than sentences involving dynamic modality or existential quantification. Properties and abilities can usually be observed, permission and knowledge cannot. Partial knowledge about permission and knowledge is thus less likely than partial knowledge about properties and abilities. Since a reading without FCIs expresses partial knowledge, this might have caused more participants to derive FCIs for sentences involving deontic or epistemic modality.

The results pose a serious problem for the pragmatic account of SIs, which predicts universal FCIs to be restricted to permission-giving contexts. However, Franke (2011) tentatively suggests that universal FCIs in other contexts might be accounted for within a pragmatic framework as well. If its FCIs are not licensed, a sentence like (13) is associated with a situation in which some of the guests can take coffee while others can take tea.

(13)   Every guest can take coffee or tea.

According to Franke, if this situation is sufficiently improbable, an interpretation without FCIs might be excluded on a priori grounds. This leads the hearer to adopt the correct interpretation that licenses the FCIs.

Against this proposal, it must be noted that ordinary SIs seem to be notoriously insensitive to probability considerations. Geurts (2010) gives the example in (14). Even though it is presumably highly unlikely that some but not all of the marbles sank to the bottom, this is exactly what (14) conveys. If Franke is right, universal FCIs are thus sensitive to world knowledge considerations in a way that ordinary SIs are not. Franke's account stands in need of explaining this asymmetry. Under what circumstances can plausibility considerations affect the interpretation of scalar terms?

(14)   Cleo threw all the marbles in the swimming pool. Some of them sank to the bottom.

In any case, before concluding that there are embedded SIs and that the pragmatic account is on the wrong track, a more pressing matter is to find out whether FCIs are really SIs. The arguments that have been adduced to prove this point are anything but conclusive. As noted in section 1, FCIs mirror SIs in their propensity to disappear in downward-entailing environments. Admittedly, this behavior poses a problem for theories that locate the source of FCIs in the semantics of 'or' (Zimmermann 2000, Geurts 2005), but other theories are capable of accounting for it (e.g., Barker 2010).

In fact, several observations speak against the idea that FCIs are SIs. In section 1, I noted that FCIs are cancellable by professing ignorance about the truth of the FCIs. This mirrors the behavior of SIs. But SIs can also be cancelled by explicitly rejecting the stronger alternative, like in (15). This conversational move is inadmissible for FCIs, as (16) evidences:

(15)   John ate some of the apples but he did not eat all of them.

(16)   *You can have coffee or tea but you cannot have coffee.

Another worry is that FCIs are licensed even if the disjunction outscopes the modal operator. SI accounts fail to derive FCIs in these environments and have to make ancillary assumptions. For example, Geurts (2010:107) concedes that 'or' has "a non-Boolean flavor" in such contexts.

(17)   You can have coffee or you can have tea.

Recent experimental findings suggest a more direct method to test if a particular inference is an SI. Bott and Noveck (2004) found that the computation of an SI slows down reaction times. Participants who judged underinformative sentences like (18) false – and who thus interpreted 'some' as 'some but not all' – were on average slower than participants who judged the sentence true. In the same vein, De Neys and Schaeken (2007) found that participants who are under cognitive load are less prone to compute SIs. Cognitive load was manipulated by means of dot patterns participants had to remember.

(18)   Some dogs are mammals.

So if FCIs are SIs, similar findings are expected for the derivation of FCIs. Until these have been found, it is impossible to say conclusively whether universal FCIs jeopardize a pragmatic account of SIs or whether SI interpretations of FCIs are consistently off the mark.

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Appendix

Instructions

Dear participant,

First of all, thank you for your participation in this survey. The survey consists of questions like the following:

Please indicate how strongly the conclusion follows from the sentence below

Karel has studied eight hours a day for the past three weeks.

CONCLUSION: Karel will pass his exam.

WEAK   STRONG

The question is the same for all items. The sentence and the conclusion differ per item. Your task is to indicate how strongly the conclusion follows from the sentence. To this end, you can put a line on the bar. The further to the right the line is put, the stronger the conclusion follows from the sentence.

Fill in the items one by one and do not leaf forward or backward. There is no time limit, but do not think too long before giving an answer. Just follow your first intuition.

Target sentences

Deontic

(1)   a. Jan was allowed to take an apple or a banana.

       b. Every student was allowed to take an apple or a banana.

(2)   a. Gerard was allowed to take a bottle of water or lemonade.

       b. Every sportsman was allowed to take a bottle of water or lemonade.

(3)   a. Richard may take a card or roll the dice again.

       b. Every player may take a card or roll the dice again.

(4)   a. Ria may take a cocktail or a glass of lemonade.

       b. Every visitor may take a cocktail or a glass of lemonade.

(5)   a. Johan may take a ham or cheese sandwich.

       b. Every visitor may take a ham or cheese sandwich.

Dynamic

(1)   a. Thomas can speak French or Italian.

       b. Every employee can speak French or Italian.

(2)   a. Hans can play the guitar or the drums.

       b. Every band member can play the guitar or the drums.

(3)   a. Karel can read Greek or Latin.

       b. Every student can read Greek or Latin.

(4)   a. Karin can write a haiku or a limerick.

       b. Every pupil can write a haiku or a limerick.

(5)   a. Marcel can navigate a tank or an airplane.

       b. Every soldier can navigate a tank or an airplane.

Epistemic

(1)   a. According to the doctor, Piet might have the flu or the measles.

       b. According to the doctor, every pupil might have the flu or the measles.

(2)   a. According to the gardener, the seed might be a plant or a tree next year.

       b. According to the gardener, every seed might be a plant or a tree next year.

(3)   a. According to the secret service, the warehouse might be a drugs laboratory or a weed plantation.

     b. According to the secret service, every warehouse might be a drugs laboratory or a weed plantation.

(4)   a. According to the professor, this research question might be answered by means of a survey or an experiment.

     b. According to the professor, every research question might be answered by means of a survey or an experiment.

(5)   a. According to the commander, the city might be a target for bomb squadrons or war ships.

     b. According to the commander, every city might be a target for bomb squadrons or war ships.

Existential

(1)   a. Some people took a dog or a cat out of the animal home today.

     b. Every day, some people take a dog or a cat out of the animal home.

(2)   a. Some children had the flu or the measles.

     b. Every week, some children have the flu or the measles.

(3)   a. Some guests ordered an omelette or a sandwich this morning.

     b. Every morning, some guests order an omelette or a sandwich.

(4)   a. The computer had some problems with the software or the hardware.

     b. Every computer had some problems with the software or the hardware.

(5)   a. Some players received a yellow or red card during the match.

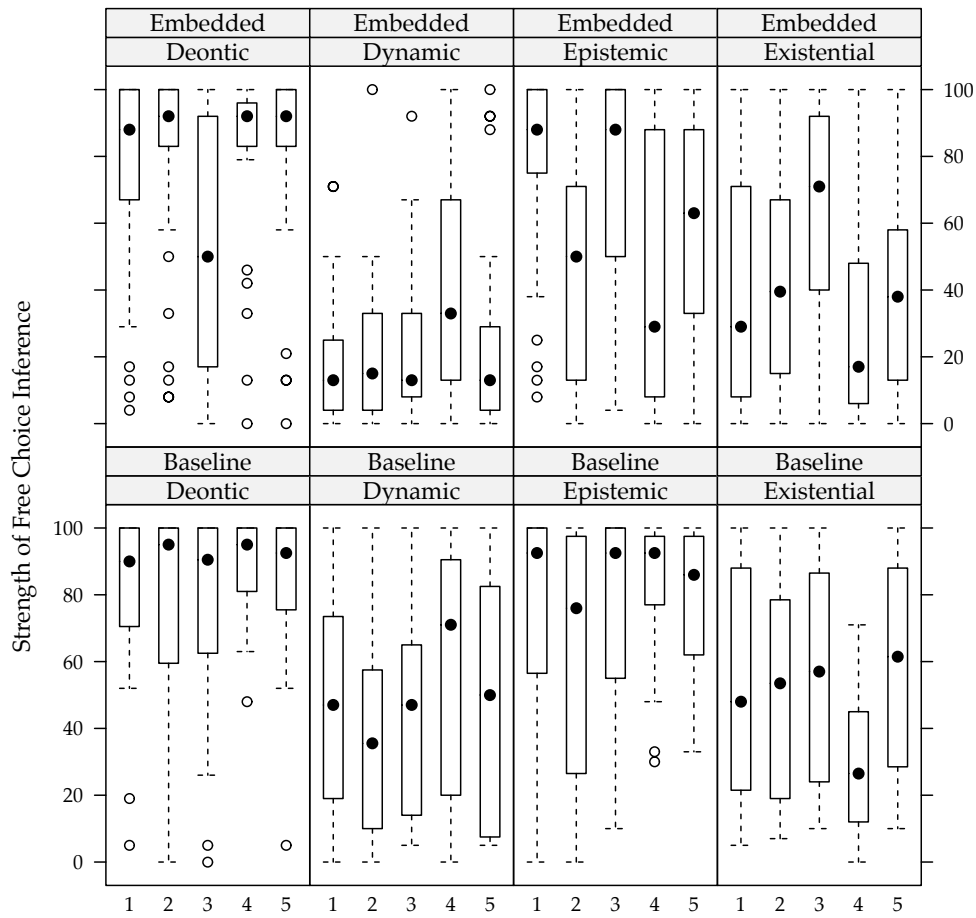   b. Every match, some players received a yellow or red card.

Figure 3: Strength of the FCI when 'or' is embedded under a deontic, dynamic or epistemic modal, or under an existential quantifier, further subdivided by item.