Evidence from Balinese: Subject-Versus Object-Control Varies According to the Identity of the Verb, but not Necessarily the Probability of the Event Described

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Abstract

The objective of the present study was to investigate whether interpretation (Subject-vs-Object control) of an understudied type of control sentence (Sarahi wants someonej [PROi/j] to entertain) depends at least in part on which scenario is most probable. In Study 1, 44 Balinese speakers each rated the relative acceptability of the Subject- and Object-control readings of 272 Balinese sentences of this type. In Study 2, 20 Balinese speakers rated the likelihood of scenarios corresponding to the Subject- and Object-control readings of the sentences from Study 1. Counter to our predictions, however, these ratings did not significantly predict the relative acceptability of the Subject- and Object-control readings from Study 1, apparently because of other, uncontrolled differences between the verbs. We conclude that the question of whether the interpretation of control sentences depends on the relative probability of the scenarios remains unanswered; similar studies in other languages would help resolve this issue.

Keywords: linguistic control; subject-control; object-control; Levinson's pragmatic account

1. Introduction

The phenomenon of syntactic control (or as it was originally known Equi-NP Deletion) has played a major role in linguistic theorizing since the 1960s (e.g., Rosenbaum 1967; Postal 1970). However, like many linguistic phenomena, it has so far chiefly been studied in relation to English. The purpose of the

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present study is to investigate an understudied type of control construction in an understudied language: Balinese. Indeed, to our knowledge, there exist no previous psycholinguistic studies of control phenomena in Balinese at all. Furthermore, the particular proposal studied – that interpretation depends crucially on the relatively likelihood of the original scenarios – has not, to our knowledge, been previously tested experimentally in *any* language; even though it was proposed (for English) over 35 years ago and has been influential in the literature. The present study therefore fills not one but two gaps in the literature.

The phenomenon of control can be illustrated by considering the sentences in 1-2:

(1) Sarah asked Oliver to leave.
(2) Sarah promised Oliver to leave.

The two have identical structures. Yet in (1), Oliver is under the obligation to leave (so-called *object control*); in (2) Sarah (*subject control*). But how do we know this?

The traditional answer (e.g., Rosenbaum, 1967; Chomsky, 1981; Bresnan, 1982; Manzini, 1983; Larson, 1991; Hornstein, 1999; Landau, 2000; Wurmbrand, 2001) is that interpretation is governed primarily by the syntactic structure of the sentence. Essentially, sentences with this structure always yield an object control reading (as in the unambiguous *I told you to leave*), unless the main-clause verb is *promise* (or a near synonym; e.g., *guarantee*), which is treated as a marked exception. The precise syntactic details vary from theory to theory, but the central assumption (McDaniel et al., 1990, p. 298) is that "the closest c-commanding noun phrase (NP) of the next higher clause (if there is such an NP)" controls PRO; a phonologically null element that serves as the subject of the subordinate clause. For example:

(3) Sarah asked Oliver$_i$ [PRO$_i$] to leave.

It is important to state at the outset that our goal in this paper in not to provide evidence *against* such an account, but merely to explore and test the plausibility of a functional explanation of these patterns. Traditional formalist approaches do not, of course, deny the possibility of additional functionalist factors (indeed, as noted above, they already treat *promise* verbs as lexically-learned exceptions); an issue to which we return in the Discussion.

Functionalist approaches to control phenomena have a long history (e.g., Jackendoff, 1969, 1972, 1974; Růžička, 1983; Nishigauchi, 1984; Williams, 1985; Dowty, 1985; Farkas, 1988; Chierchia & Turner, 1988; Sag & Pollard, 1991; Pollard & Sag, 1994; Van Valin & LaPolla, 1997; Culicover & Jackendoff, 2005). Under this approach, interpretation of control sentences is governed primarily by the semantics of the main-clause verb. Essentially, by using a commissive verb such as *promise* (or *guarantee* etc.), the speaker is committing herself to undertake the action in the subordinate clause "by the definition of commissives as a speech act" (Comrie, 1985, p. 57). Jackendoff and Cullicover (2003:529) extend this class to verbs and adjectives that take prepositional-phrase complements:

(4) Sarah [vowed to/pledged to/agreed with/is obligated to] Oliver to leave

Conversely, for a sentence with *ask* (or *persuade, tell* etc.) "to make any sense as a directive, it is essential that the addressee be also the entity with the ability to bring about the action" (ibid). Van Valin and LaPolla (1997, p. 544) call these "jussive" verbs, and note that causative verbs (e.g., *make, force, cause*) have similar properties.

One piece of evidence that would seem to support the functionalist approach (Jackendoff & Culicover, 2003) comes from other types of verbs (5) and nominals (compare 6 and 7), including those that span sentence and speaker boundaries (compare 8 and 9), and that thus would seem to require some functional explanation above and beyond a purely syntactic one:

(5) Sarah learned from Oliver to take care of herself (c.f., *himself)
(6) (I told you about) the order to Oliver from Sarah to take care of himself (c.f., *herself)
(7) (I told you about) the promise to Oliver from Sarah to take care of herself (c.f., *himself)

(8) A: Sarah gave Oliver an order
    B: What was it?
    A: To take care of himself (c.f., *herself)

(9) A: Sarah made Oliver a promise
    B: What was it?
    A: To take care of herself (c.f. *himself).

In the present study, we investigate whether a functionalist approach can extend to another control phenomenon; "cases where the interpretation varies

not according to the [main clause] verb but according to the most probable scenario" (Levinson, 1987, p. 417):

(10) Sarah$_i$ wants someone$_j$ [PRO$_j$] to clean.

(11) Sarah$_i$ wants someone$_j$ [PRO$_{i/j}$] to entertain.

(12) Sarah$_i$ wants someone$_j$ [PRO$_i$] to blame.

It is common to hire a cleaner; rare to seek out somebody in order to clean them (10). It is common to look for a scapegoat; rare to seek out somebody who goes around casting blame in general (12). Many people seek a friend or partner who they can entertain; many also seek a friend or partner who can entertain them (11). Thus, under a functionalist account, the interpretation of 10-12 is determined by the relative probability of the scenarios, rather than (or at least, in addition to) by syntactic structure or the semantics of the main-clause verb. In the present study, we test Levison's (1987) claim systematically in a understudied language: Balinese.

Before turning to the details of the present study, it is important to situate it in the wider debate between formalist and functionalist approaches to language more generally. Here we adopt the definitions of Newmeyer (2010, p. 302), while agreeing with him that most formalists are happy to accept some degree of functionalism and vice versa:

> I consider the autonomy of syntax to be the distinguishing hallmark of formal linguistics: **Autonomy of syntax**: The rules (principles, constraints, etc.) that determine the combinatorial possibilities of the formal elements of a language make no reference to constructs from meaning, discourse, or language use.

> I consider the following to be the distinguishing hallmark of functional linguistics: **External explanation**: Grammatical structure is shaped in large part by the functions that language serves, the most important of which is that of conveying meaning in the act of communication.

Thus, while the aim of the present study is to test a functionalist proposal, it is important to stress that few, if any, of the formalist accounts of control discussed above far rule out any role for semantics/pragmatics; and few, if any, of the functionalist accounts rule out any role for syntactic structure (see, e.g., Jackendoff & Culicover, 2003, pp. 520–521, on 'One purely syntactic dimension'; Levinson's, 1987, character of grammar as "frozen pragmatics").

"Somebody to love": Functionalist accounts of control.

What predictions do functionalist accounts make regarding sentences of the type shown in 10-12? (Although the present study is conducted in Balinese, for the time being – purely for ease of exposition – we will stick to English, which is equivalent in the relevant respects; i.e., for basic Active voice Subject Verb Object sentences). On our reading, functionalist accounts predict that the relative probability of the Subject versus Object control readings of sentences such as 10-12 is determined (at least in part) by the identity of the verb in the subordinate clause. More specifically it is influenced by the relative likelihood of possible events that this verb could describe (e.g., seeking a person who one can clean vs seeking a cleaner). In the present work, we test this prediction by (Study 1) obtaining the relative probability of Subject versus Object control readings of the relevant sentence types and (Study 2) investigating whether these judgments are predicted by ratings (from different participant) of the relative likelihood of the two events. We manipulate these factors by varying the verb in the subordinate clause, as shown in (13):

(13) Sarah [wants / wishes for / desires / needs] a husband to **love / kiss / hug / frighten / annoy / entertain / impress / follow / teach / help / clean / wash / cook / tidy / organize / shock / remember.**

The verbs were chosen to give a good spread between verbs for which the Subject control reading (e.g., 12) and the Object control reading (e.g., 10) are more probable. Four different verbs are used in the main clause (*wants / wishes for / desires / needs*) simply to increase the number of items, and hence statistical power, reliability and generalizability.

Before proceeding, we must determine exactly what syntactic structure is exemplified by the NP object (*a husband to clean/entertain/blame*) in these sentence types. On the Subject-control reading where *Sarah* is doing the entertaining (14), *a husband to entertain* is straightforwardly analyzed as an object relative complex (e.g., Geisler, 1998).

(14) Sarah$_i$ wants [NP a husband [VP [PRO$_i$] to entertain]].

On the Object-control reading where *a husband* is doing the entertaining (15), *a husband to entertain* can be analyzed similarly as a subject relative complex:

(15) Sarah wants [NP a husband$_i$ [VP [PRO$_i$] to entertain (people in general)]].

In principle, an utterance of this type could also be analyzed as an Exceptional-Case-Marking (ECM) construction, with *a husband* as the overt NP subject of the infinitival (analogous to *Sarah wants him to leave*). However, this analysis is rather unlikely with the NP *a husband/a wife* (always the NP used the present study), as it implies a scenario in which Sarah is looking for a man who is *already* someone's husband to do some entertaining. In contrast, the subject relative complex reading implies a more likely scenario in which Sarah is looking for a husband, and wants one who is good at entertaining (see also Bresnan, 1982, and Homeidi, 2004 for analyses of ECM as control).

If we set aside the ECM analysis for cases such as 15, all share the following syntactic structure:

(16) Sarah [wants / wishes for / desires / needs] a husband$_i$ [PRO$_i$] to **love / kiss / hug / frighten / annoy / entertain / impress / follow / teach / help / shock / remember** / **clean / wash / cook / tidy / organize**.

Thus, all else being equal, on the "closest c-commanding NP" heuristic, *a husband* should control PRO, meaning that the Object control reading (14) should be preferred over the Subject control reading (13). Of course, all else is never equal, and the prediction under investigation is that the lexical identity of the verb plays a role in interpretation. While we characterise this as a "functionalist" prediction, it is important to again emphasize that "formalist" accounts also assume that additional communicative/discourse factors play a role in interpretation.

2. Balinese

Balinese is an Austronesian language with around 3 million native speakers, mostly located on the Indonesian island of Bali. Balinese is a particularly interesting language in which to study control phenomena, since – as detailed below – it has a voicing alternation that allows us to examine effects of linear order separate from syntactic structure.

For canonical Agent-Patient Subject-Verb-Object sentences the Balinese control facts are essentially identical to those set out above for English. Indeed, the translation is morpheme for morpheme (note the nasal prefix (*ng-*) on the verb *edotang*, which marks Agentive Voice; the only cue. Since Balinese does not exhibit case marking).

(17) Luh ng-edotang   kurenan   ane   hibur-a
     Luh act-wants   husband   to   entertain-end.clit
     Luh wants a husband to entertain

But, like many Austronesian languages, Balinese also has the Objective Voice/Basic verb construction (indicated morphologically by a null prefix on the verb) (Artawa, 2013; Artawa et al., 2001).

(18) Kurenan ane hibur-a   edotang-a   (teken) Luh
      Husband to love-end.clit   wants-end.clit   (by)   Luh
      Luh wants a husband to entertain

The Objective voice is standardly analysed not as a passive or object-fronting construction, but simply as a Subject Verb Object construction in which "canonical" (at least for English etc.) semantics-syntax mappings are reversed: i.e., Subject=Patient and Object=Agent rather than Subject=Agent and Object=Patient (Arka & Simpson, 1998; Arka, 2003). Nevertheless, for the constructions investigated in the present study, for any Agentive-Objective voice pair, the closest c-commanding NP is the same (here, *kurenan*, 'husband'):

(19) Luh   ng-edotang [NP kurenan$_i$ [VP [PRO$_i$] ane hibur-a]]
      Luh   act-wants   husband   to entertain-end.clit
      Luh wants [NP a husband$_i$ [VP [PRO$_i$] to entertain (people in general)].

(20) [NP kurenan$_i$ [VP [PRO$_i$] ane hibur-a]]   edotang-a   (teken) Luh
      Husband   to entertain-end.clit wants-end.clit (by) Luh
      Luh wants [NP a husband$_i$ [VP [PRO$_i$] to entertain (people in general)].

Balinese is therefore a particularly interesting language to study with regard to control phenomena, because, unlike languages that lack this voice contrast, it allows us to rule out an effect of linear word order. That is, examples such as (19) and (20) differ with regard to order of mention, but are identical with regard to the closest c-commanding NP.

The present paper reports two studies. In the first, we investigate simply whether Balinese shows verb-by-verb differences in terms of which verbs favour Subject versus Object control (as appears to be the case for English; Levinson, 1987). Having established that it does, we then – in Study 2 – go on to investigate the cause of these verb-by-verb differences. Is it the case that, as proposed by Levinson (1987), the likelihood of Subject versus Object control depends on the relative likelihood of the scenarios described by the Subject-versus Object-control readings?

3. Study 1

The aim of Study 1 was to investigate simply whether the relative likelihood of subject- versus object control readings of Balinese sentences varies according to (a) the identity of the subordinate-clause verb (as under Levinson's, 1987, functionalist account) and (b), whether this pattern holds across Agentive versus Objective voice (which would rule out explanations based on order of mention).

3.1 Participants

Participants were 44 native speakers of Balinese, all adult (18+) students at Udayana University. Our original target sample size was 60, but it proved difficult to recruit native speakers in sufficient numbers. Language status was not measured formally, although all would have been native speakers of Indonesian, and have had at least some familiarity with English. Ethical clearance was given by Udayana University (reference 2279/UN14.2.2.VII.14/LT/2021), and participants gave informed written consent.

3.2 Design and Materials

The subordinate-clause verbs (*N*=17) shown in (21-24) were chosen to give a good spread between verbs for which the Subject control reading is more probable (*love, kiss, hug, frighten, annoy, shock, follow, remember*) and the Object control reading is more probable (*entertain, impress, clean, wash, cook, tidy, organize, teach, help*). Unfortunately, the relative probability of the Subject versus Object control readings had to be determined purely on the basis of our native-speaker intuitions, as no suitable corpus of Balinese exists. However, whether or not our intuitions were correct regarding individual verbs, the results of the study demonstrate that we indeed succeeded in selecting verbs that heavily prefer either Subject- or Object-control readings. Each was combined with each of four main-clause verbs (*wants, wishes for, desires, needs*), in Agentive and Objective Voice, and with both *Luh* (a female name) + *husband* and *Wayan* (a male name) + *wife*. That is, each participant rated the following 272 sentences (17 subordinate clause verbs x 4 main clause verbs x 2 Voices x 2 Agent/Patient pairings). The full set of Balinese stimuli can be found in Appendix A.

(21) (Agentive voice) Luh [wants / wishes for / desires / needs] a husband to **[love / kiss / hug / frighten / annoy / shock / follow / remember] [entertain / impress / clean / wash / cook / tidy / organize / teach / help].**

(22) (Objective voice) A husband to **[love / kiss / hug / frighten / annoy / shock / follow / remember] [entertain / impress / clean / wash / cook / tidy / organize / teach / help].**

(23) (Agentive voice) Wayan [wants / wishes for / desires / needs] a wife to **[love / kiss / hug / frighten / annoy / shock / follow / remember]** **[entertain / impress / clean / wash / cook / tidy / organize / teach / help].**

(24) (Objective voice) A wife to **[love / kiss / hug / frighten / annoy / shock / follow / remember]** **[entertain / impress / clean / wash / cook / tidy / organize / teach / help].**

Recall that the reason for including both Active and Objective voice sentences was to rule out any effect of order of mention (which cannot be done straightforwardly in languages such as English). The reason for varying the NPs (*Luh…husband* for half of the sentences; *Wayan…wife* for the other) was to check that any effects observed do not depend on gender stereotypes regarding the relative likelihood of a male versus female performing (or wanting an opposite-sex spouse to perform) particular events.

3.3 Procedure

For each sentence, participants were asked to rate, on a 7-point Likert scale, the relative acceptability of the Subject versus Object control reading, as per the following example:

Wayan wants a wife to love.
In the sentence above, who is doing the loving?
Definitely Wayan 1 2 3 4 5 6 7 Definitely a wife

Wayan ngedotang kurenan ane tresnaina
Di lengkarane disamping, nyen ane seken nresnain?
Pastika, Wayan 1 2 3 4 5 6 7 pastika, kurenan

Sentences were presented in fully-randomized order on an Excel spreadsheet, which each participant completed by entering their numeric rating in a column next to the Likert scale.

3.4 Preregistration

It is important to stress that, due to time constraints, no statistical analysis plan was preregistered. Although the general predictions of the study, and the general data analysis plan, were conceived before data collection began, the details of the analyses themselves were decided upon only after having seen the raw data. Thus, all analyses and findings should be treated as exploratory rather than confirmatory.

3.5 Results

Figure 1 shows (as black bars) the mean ratings on the 7-point scale for the verbs that we designated (on the basis of our native-speaker intuitions) as Subject-control preferring (*love, kiss, hug, frighten, annoy, shock, follow, remember*) and Object-control preferring (*entertain, impress, clean, wash, cook, tidy, organize, teach, help*). The smudged dots show individual ratings, the coloured intervals the distributions, and the white boxes 95% confidence intervals. For the Y axis ("Rating") values less than 4 indicate Subject control (e.g., Luh$_i$ wants [NP a husband [VP [PRO$_i$] to entertain]]), while values great than 4 indicate Object control (e.g., Luh wants [NP a husband$_i$ [VP [PRO$_i$] to entertain (people in general)]]]). Inspection of Figure 1 suggests that participants indeed preferred the Subject-control reading of our "Subject-control preferring" verbs (*love, kiss, hug, frighten, annoy, shock, follow, remember*) and the Object-control reading of our "Object-control preferring" verbs.

However, maximal mixed-effects models (Barr et al., 2013) built using the R JuliaCall package (Li, 2019) to interface with the JuliaStats Mixed Models package (Bates et al., 2022) yielded no significant effect of Verb Type (SUBJ-/OBJ-Preferring), as shown in Table 1. Neither did we observe an effect of Sentence Type (Active/Objective Voice) or an interaction.

Table 1. Mixed effects model of rating data: Rating ~ Stype*Verb_Type + (1+Stype*Verb_Type|participant_id) + (1+Stype*Verb_Type|main_verb) + (1+Stype|subordinate_verb) + (1+sentence_type*diff|GenderSUB))

No		Coef.	Std. Erro	z	Pr(>|z|)
1	(Intercept)	4.92379	0.489266	10.06	<1e-23
2	Stype: O	0.015962	0.0753977	0.21	0.8323
3	Verb_Type: SUBJ-Preferring	-1.16731	0.692554	-1.69	0.0919
4	Stype: O & Verb_Type: SUBJ-Preferring	0.0960752	0.101115	0.95	0.3420

The reason for the nonsignificant effect of Verb Type (Subject/Object-control preferring) becomes clear when we plot participants' Ratings of Subject/Object-control preference for individual verbs (Figure 2).
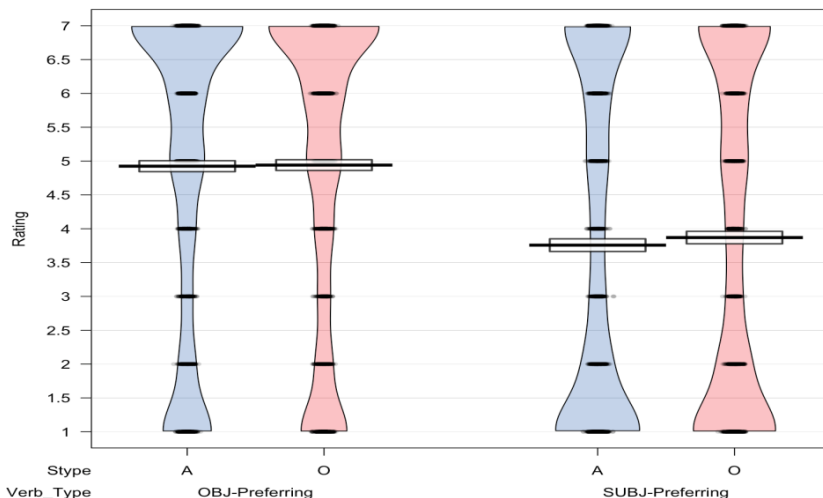
Figure 1. Ratings of Subject control (Y axis <4) vs Object control (Y axis > 4) for "Subject-control preferring" and "Object-control preferring" verbs.

These ratings suggest that our classifications of verbs as Subject-control preferring (*love, kiss, hug, frighten, annoy, shock, follow, remember*) and Object-control preferring (*entertain, impress, clean, wash, cook, tidy, organize, teach, help*) were, broadly-speaking, verified by participants' acceptability ratings; though with a high (and unexpected) degree of variability.
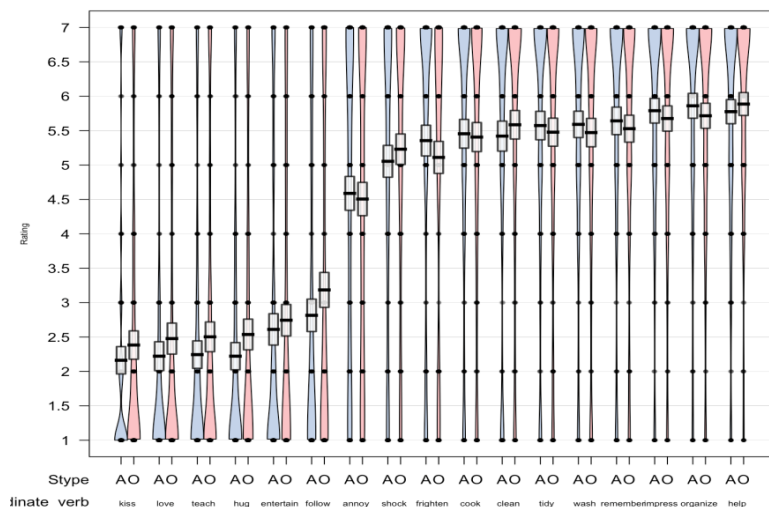

Figure 2. Ratings of Subject control (Y axis <4) vs Object control (Y axis > 4) for individual verbs.

These ratings demonstrate that participants strongly prefer Subject-control readings for *kiss, love, teach, hug, entertain* and *follow* and Object-control readings for *help, organize, impress, remember, wash, tidy, clean, cook, frighten* and *shock*.

Participants do indeed give very different Subject- versus Object- control ratings depending on the verb; it is just that our particular breakdown of Subject- versus Object-control-preferring verbs was not accurate. In fact, participants strongly prefer Subject-control readings for 6 verbs (25) and Object-control readings for 10 verbs (26).

(25) Luh$_i$ wants [NP a husband [VP [PRO$_i$] to kiss, love, teach, hug, entertain, follow]])

(26) (e.g., Luh wants [NP a husband$_i$ [VP [PRO$_i$] to help, organize, impress, remember, wash, tidy, clean, cook, frighten, shock (people in general)]])

Interestingly, they are ambivalent between Subject- and Object control readings for only a single verb, *annoy*. That is, although Subject- versus Object-control clearly differs according to semantic/pragmatic factors – remember that syntactic structure is identical across all verbs – it does not seem to do so in a gradient manner. Although participants seem to show a general reluctance to use the full range of the scale, verbs appear to show an almost categorical split between those that yield Subject- and Object-control readings.

Having established that, for these constructions, the identity of the verb plays a crucial role in establishing Subject- versus Object- control, our attention now turns to the question of exactly how the verb exerts its effects. Is it the case that, as proposed by Levinson (1987, p. 417), "the interpretation varies… according to the most probable scenario"?. In Study 2 we address this question by asking a new group of participants to rate the probabilities of the scenarios that correspond to the Subject- and Object-control readings of the sentences from Study 1.

4. Study 2

The aim of Study 2 was to obtain ratings of the relative likelihood of the scenarios described by the Subject- and Object-control readings of the sentences from Study 1, and to investigate whether – as predicted by the account of Levinson (1987) – these likelihood ratings would predict the relative acceptability of the Subject- versus Object-control readings obtained in Study 1.

4.1 Participants

Participants were 20 native speakers of Balinese from the same population as Study 1 (though none had taken part in this study). A smaller sample size than Study 1 was used, as our intention for the likelihood ratings was not to test for generalizability across participants (e.g., by using a mixed-effects model) but simply to create a by-sentence predictor variable (averaging across participants) with regard to the data already obtained in Study 1.

4.2 Materials and Procedure

For each of the 136 Agent-Objective sentence pairs in Study 1 (17 subordinate clause verbs x 4 main clause verbs x 2 NP combinations [Luh… Wayan vs Wayan…Luh]), we asked two likelihood questions, corresponding to the Subject-control and Object-control readings. For example, corresponding to the Study 1 Agentive-Objective pair *Wayan wants a wife to love* (*Wayan ng-edotang kurenan ane tresnain-a / Kurenan ane kal tresnain-a edotang-a (teken) Wayan*), we asked:

(27) How likely is it that a man wants a wife in order for HIM to love HER?
Amongken gedene keneh anak muani ngedotang kurenan ane tresnaina:
ten majanten pisan 1 2 3 4 5 6 7 majanten pisan

(28) How likely is it that a man wants a wife in order for HER to love OTHER PEOPLE ?
Amongken gedene keneh anak muani ngedotang kurenan nresnain anak lenan:
ten majanten pisan 1 2 3 4 5 6 7 majanten pisan

Likewise, corresponding to the Study 1 Agentive-Objective pair *Luh wants a husband to love*, Study 2 participants were asked *How likely is it that woman wants a husband in order for HER to love HIM?* and How likely is it that a woman wants a husband in order for HIM to love OTHER PEOPLE? We term these ratings "Subject likelihood" and "Object likelihood" respectively. It is important to acknowledge straight away, that it is *extremely* unlikely for man to want a wife in order for her to love other people; and that some of the other scenarios (e.g., a man wanting a wife in order to cook her or to clean her) are even more unlikely. But this is an intentional feature of the stimuli, not a flaw. Levinson's (1987) whole point is that the subject-control reading of sentences such as *Sarah wants someone [PRO] to clean* is difficult to obtain *precisely because* the subject-control reading is extremely implausible.

These questionnaire items were presented in fully-randomized order on an Excel spreadsheet, which each participant completed by entering their numeric

rating in a column next to the Likert scale. Recall that Study 2 participants were asked only the "likelihood" questions exemplified in 27-28; that is, they were not shown the sentences from Study 1.

4.3 Creating the likelihood predictor

For each of the 136 Subject-likelihood and the 136 Object-likelihood ratings obtained, we created a composite Subject-likelihood and a composite Object-likelihood predictor by averaging across all 20 participants. For each pair (e.g., 27-28) we then created a difference score by subtracting the composite Subject-likelihood score from the composite Object-likelihood score. Thus this "difference score" reflects the extent to which it is more likely (for example) for a man to want a wife in order for HER to love OTHER PEOPLE than for a man to want a wife in order for HIM to love HER. For this particular example, the difference score is negative (-4.50), reflecting the fact that participants judge it considerably less likely for a man to want a wife in order for HER to love OTHER PEOPLE (M=1.95/7) than for a man to want a wife in order for HIM to love HER (M=6.45/7).

4.4 Results

Figure 3 plots the relationship between the likelihood ratings obtained in Study 2 (difference score predictor, X-axis) and the Subject-vs-Object control ratings obtained in Study 1 (Y-axis), broken down by (a) main-clause verb (*desires, needs, wants, wishes for*) Study 1 sentence type (Active/Objective) and Study 1+Study 2 NP pairing, identified by the gender of the main-clause subject (e.g.., Male = *Wayan wants a wife to love*; Female = *Luh wants a husband to love*). Inspection of Figure 3 suggests that, consistent with the prediction derived from Levinson (1987) we are indeed seeing a positive relationship between the relative likelihood of the Subject-vs-Object control versions of the events (Study 2) and the relative acceptability of the Subject- versus Object-control readings of the corresponding sentences (Study 1). Figure 4 shows the same data broken down by individual participants (collapsing across main-clause verb), and suggests that this relationship seems to hold for the vast majority of Study 1 participants individually.

To test this possibility statistically, we again ran a fully-maximal (Barr et al., 2013) Julia mixed-effects model, this time using the following syntax:

Rating ~ sentence_type*diff + (1+sentence_type*diff|participant_id) + (1+sentence_type*diff|main_verb) + (1+sentence_type|subordinate_verb) + (1+sentence_type*diff|GenderSUB)

That is the model tests whether the Subject-vs-Object control ratings obtained in Study 1 are predicted by Study 1 sentence type (Active/Object), Study 2 difference score and the interaction; and, if so, whether this holds across (a) Study 1 participants (N=44), (b) main-clause verb (*desires, needs, wants, wishes for*), (c) subordinate clause verb (N=17), and the gender of the main-clause subject (i.e., *Wayan…Luh* vs *Luh…Wayan*). This model (see Table 2) yielded no statistically significant fixed effects or interactions.
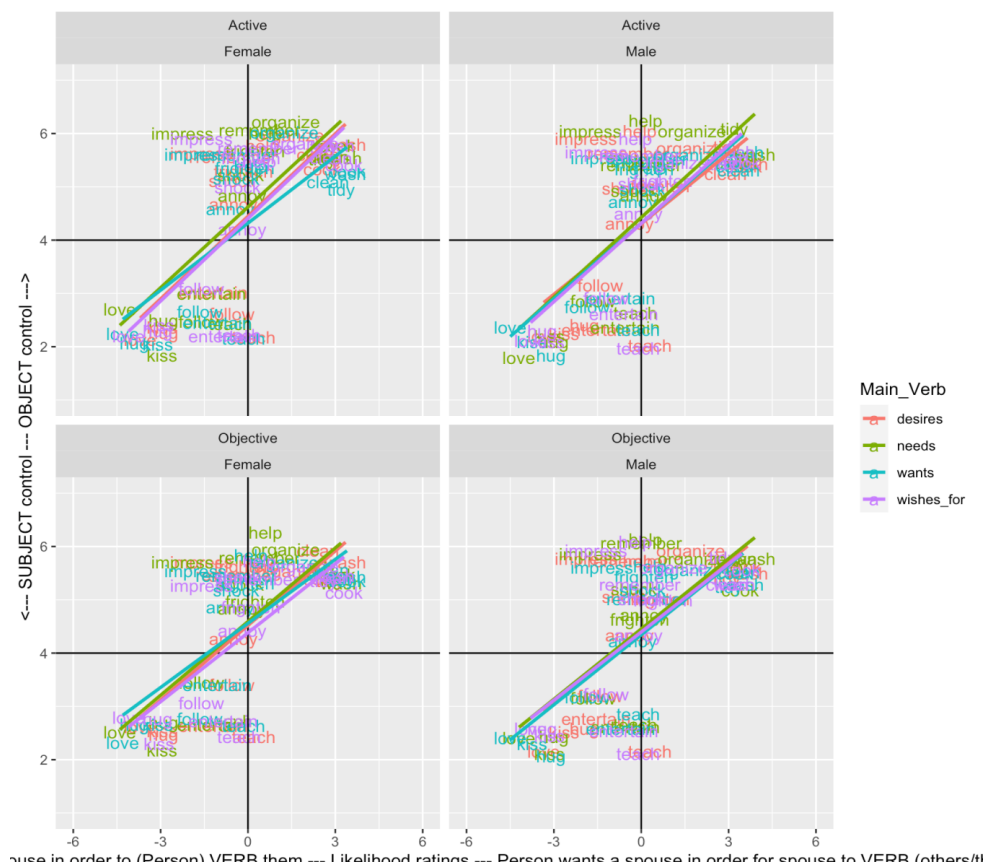

Figure 3. Relationship between the likelihood ratings obtained in Study 2 (difference score predictor, X-axis) and the Subject-vs-Object control ratings obtained in Study 1 (Y-axis). These plots suggest a positive relationship between the relative likelihood of the Subject-vs-Object control versions of the events (Study 2) and the relative acceptability of the Subject- versus Object-control readings of the corresponding sentences (Study 1). However, this relationship was not borne out by the statistical analyses (see main text).

Table 2. No significant relationship between the likelihood ratings obtained in Study 2 (difference score predictor, "diff") and the Subject-vs-Object control ratings obtained in Study 1 (dependent variable).

No		Coef.	Std. Error	z	Pr(>|z|)
1	(Intercept)	4.37455	0.384774	11.37	<1e-29
2	sentence_type: Objective	0.0612925	0.0563257	1.09	0.2765
3	diff	-0.0033008	0.069376	-0.05	0.9621
4	sentence_type: Objective & diff	0.0011655	0.0173077	0.07	0.9463

This result is surprising, given that such a relationship would seem to be apparent in Figures 3 and 4. Furthermore, the fact that participants seem to be showing broadly similar performance (see Figure 4) suggests that the failure to find the predicted effect is not due to wide variability between participants. It seems, then, that the failure to find the predicted relationship must be due to uncontrolled differences between verbs; i.e., differences that are not related to the relative plausibility of the subject- versus object-control actions. To verify this possibility, we confirmed that removing both random effects for (subordinate-clause) verb yielded a worse fit to the data. For completeness, this model is shown in Table 3, although it would be a mistake to try to interpret the significant effects given that it lacks the demonstrably crucial random-effects for (subordinate-clause) verb. Its purpose is simply to demonstrate that, indeed, verbs vary hugely in the extent to their preference for subject- versus object-control in ways that are NOT satisfactorily accounted for by our "plaubsibility" measure.
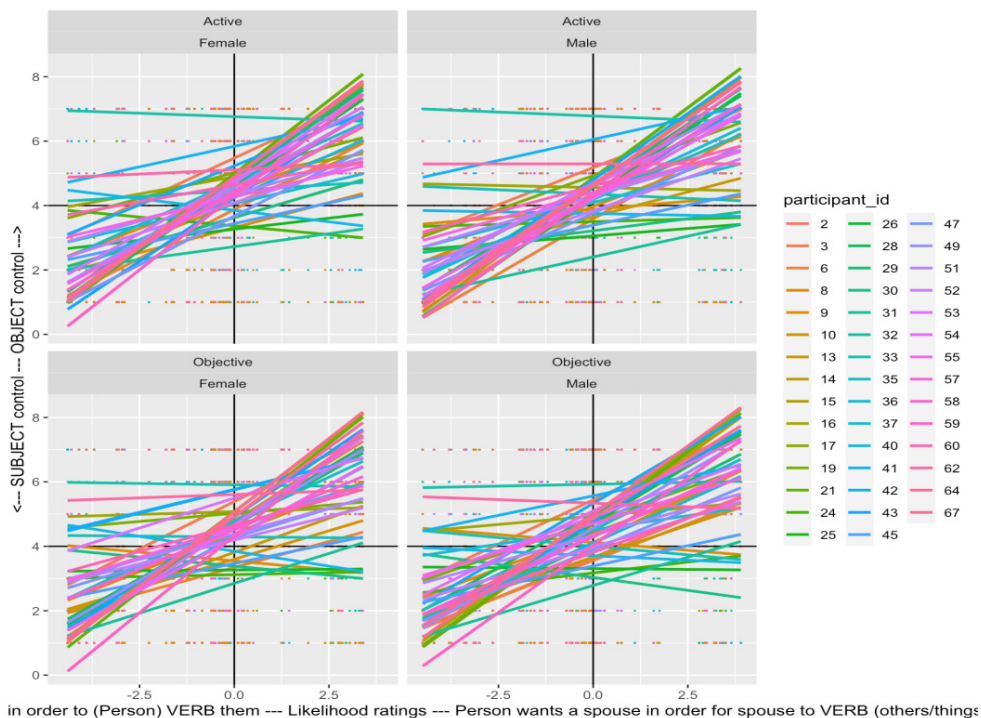
Figure 4. Relationship between the likelihood ratings obtained in Study 2 (difference score predictor, X-axis) and the Subject-vs-Object control ratings obtained in Study 1 (Y-axis), broken down by individual participants. Again, these plots suggest, for almost all participants, a positive relationship between the relative likelihood of the Subject-vs-Object control versions of the events (Study 2) and the relative acceptability of the Subject- versus Object-control readings of the corresponding sentences (Study 1). However, this relationship was not borne out by the statistical analyses (see main text).

Table 3. A model with no random effects for subordinate-clause verb yields a significantly worse fit to the data.

No		Coef.	Std. Error	z	Pr(>|z|)
1	(Intercept)	4.39487	0.123645	35.54	<1e-99
2	sentence_type: Objective	0.0594071	0.0445861	1.33	0.1827
3	diff	0.481102	0.045054	10.68	<1e-25
4	sentence_type: Objective & diff	-0.0444399	0.0176881	-2.51	0.0120

In summary, then, the findings of Study 2 demonstrate that Levinson (1987) is correct to point out that the relative acceptability of the Subject-vs-Object control readings of these types of sentences varies according to the verb. Indeed, as we saw in Study 1, it does so quite dramatically. But, on the basis of Study 2, we do not have any evidence to support Levinson's conjecture that

these verb-by-verb differences in the relative acceptability are determined primarily "according to the most probable scenario".

5. Discussion

The interpretation of "control" sentences (e.g., *Sarah asked/promised Oliver to leave*) has long played a key role in linguistic theorizing. The goal of the present study was to investigate whether interpretation (Subject-vs-Object control) of a different type of control sentence (*Sarah$_i$ wants someone$_j$ [PRO$_{i/j}$] to entertain*) "varies…according to the most probable scenario" (Levinson, 1987: 417). In Study 1, 44 Balinese speakers each rated the relative acceptability of the Subject- and Object-control readings of 272 Balinese sentences of this type (split equally between the Active and Objective Voice).

We observed a clear split between verbs that prefer the Subject reading (*Luh$_i$ wants [NP a husband [VP [PRO$_i$] to kiss, love, teach, hug, entertain, follow]]*) and those that prefer an Object reading (e.g., *Luh wants [NP a husband$_i$ [VP [PRO$_i$] to help, organize, impress, remember, wash, tidy, clean, cook, frighten, shock]]]*). In Study 2, 20 Balinese speakers rated the likelihood of scenarios corresponding to the Subject- and Object-control readings of the sentences from Study. Counter to the prediction derived from Levinson (1987), these ratings did not significantly predict the relative acceptability of the Subject- and Object-control readings from Study 1, apparently because of other, uncontrolled differences between the verbs.

Taken together, the findings of Studies 1 and 2 present something of a puzzle. On the one hand, exactly as we would expect on the basis of Levinson's (1987) proposal, the verbs included in the present study do seem to divide neatly into those that prefer Subject control and those that prefer Object control. And what is more, in many cases, they seem to split – just as Levison (1987) proposes – according to the most probable scenario: *Luh$_i$ wants [NP a husband [VP [PRO$_i$] to kiss/love/hug,* (not for him to kiss/love/hug others!); *Luh wants [NP a husband$_i$ [VP [PRO$_i$] to clean/cook* (not for her to clean him!). Yet on the other hand, these Subject-vs-Object control ratings do not seem to be well predicted by the likelihood ratings obtained in Study 2.

Why not? One possibility of course is that Levinson's (1987) proposal is incorrect altogether, and that the likelihood of the corresponding scenario is the wrong question to ask. Another (not mutually exclusive) possibility is that we failed to explain one or both experimental tasks sufficiently well to the present Balinese participants, who – at least on our intuition – are far less accustomed to taking part in these types of psycholinguistic studies than are Western students. Indeed, some of the raw ratings from Study 1 (the overplotted black dots in Figure 2) are quite surprising. Although the means pattern largely (if not

entirely) as would be expected, there are always some individual judgments that buck the trend. For example, while *cook,* as expected, strongly preferred the Object reading (e.g., *Luh wants [NP a husband$_i$ [VP [PRO$_i$] to cook]*, with a mean of 5.5/7 (where 7=" Definitely Object"), some individual participants gave scores of 1 (see black dots), meaning "Definitely Subject" (i.e., (*Luh$_i$ wants [NP a husband [VP [PRO$_i$] to cook [him]*)! Indeed, inspection of Figure 2 reveals that for *every* verb – both Subject-reading and Object-reading preferring on the basis of average ratings – at least some participants gave ratings at the extreme opposite end of the scale to the typical ratings.

Future research could address this by conducting a similar study in a language whose speakers are more accustomed to taking part in these types of psycholinguistic studies (English, would be one – but of course far from the only – possibility). It would also be advantageous to choose a language with suitable corpora (which Balinese lacks) that would allow for investigation of the relative verb-by-verb frequency of Subject versus Object readings in the wild. Of course, it is important to reiterate from the Introduction that even if such a study *were* to find supportive evidence for a functionalist account, this does not in and of itself constitute evidence against traditional formalist approaches. Indeed, a common finding is that structural effects are most evident at the earliest processing stages, and may be overridden during later stages of processing (for evidence see, e.g., Frazier, Clifton & Randall, 1983; Betancort, Carreiras & Acuña-Fariña, 2006; Kwon & Sturt, 2016).

6. Conclusion

In the meantime, while the present study has uncovered relatively compelling evidence that, for these sentence types, Subject-vs-Object control is determined to a large extent by the identity of the verb, it has not been able to tell us why. It remains to be seen whether it is because, as proposed by Levinson (1987), verbs differ as to the relative likelihood of the relevant events, or due to some other reason, such as lexicalized behaviour. Future studies conducted in other languages should aim to address these outstanding questions, thus bringing us closer to a complete understanding of the functional factors that – likely alongside formal factors – explain control phenomena.

Data availability statement: Data, code and materials can be downloaded from https://osf.io/u23ah/?view_only=a5a946dadd3540c3945a51a441da3fcf (anonymized for peer review).

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