Gender in conditionals*

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Abstract The 3sg pronouns "he" and "she" impose descriptive gender conditions (being male/female) on their referents. These conditions are standardly analyzed as presuppositions (Cooper 1983, Heim & Kratzer 1998). Cooper argues that, when 3sg pronouns occur free, they have *indexical* presuppositions: the gender condition must be satisfied by the pronoun's referent in the actual world. In this paper, we consider the behaviour of free 3sg pronouns in conditionals and focus on cases in which the pronouns' gender presuppositions no longer seem to be indexical and project locally instead. We compare these cases to previously reported shifty readings of indexicals in so-called "epistemic conditionals" (Santorio 2012) and propose a unified account of locally projected gender presuppositions and shifty indexicals based on the idea that indicative conditionals are Kaplanian monsters.

Keywords: conditionals, pronouns, gender presuppositions, context, indexicals, monsters

1 Indexical gender presuppositions

Free third person singular (3sg) pronouns have been reported to have *indexical gender presuppositions*. More precisely, Cooper (1983) claims that

IGP. free (non-anaphoric) 3sg pronouns presuppose that their descriptive gender-specific content (human male/female) is satisfied by their referents in the actual world.

For example, one cannot utter (1) felicitously to say of an individual who is known to be a woman that there is a possibility that she is male and American:

(1) ??It could be that *he* is American (pointing at Scarlett).

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Analogously, one cannot utter (2) felicitously in a context in which the conversational participants know that Scarlett is a woman and Jones mistakenly believes that she is a man:

(2) ??Jones believes that *he* (pointing at Scarlett) is a university professor.

Pronouns anaphoric to proper names also display indexical presuppositions. For example, (3) is infelicitous, where "he$_j$" is anaphoric to the proper name "Scarlett$_j$" (a woman's name):

(3) ??John$_i$ didn't realize that Scarlett$_j$ was a woman. He$_i$ thought that he$_j$ liked him$_i$. (Sharvit 2008)

Yanovich (2010) and Sudo (2012) (among others) remark that counterfactuals like (4) and (5), uttered in a context in which the conversational participants know that Sasha is a girl, also support the view that pronouns anaphoric to proper names have indexical presuppositions:

(4) If Sasha$_i$ were a boy, I would buy her$_i$ a doll.

(5) ??If Sasha$_i$ were a boy, I would buy him$_i$ a doll.

Yet, the pronouns display no indexical presuppositions in indicative conditionals (6)-(7) (from Yanovich 2010), uttered in a context in which Sasha's gender is not known (the Russian name "Sasha" can be the name of either a boy or a girl):[1]

(6) If Sasha$_i$ is a boy, I'll buy him$_i$ a doll.

(7) If Sasha$_i$ is a girl, I'll buy her$_i$ a toy car.

An intuitive characterization of (6)-(7) is that the gender presuppositions of the pronouns are met in the possible worlds described by the antecedents of the conditionals.

One might suggest that the contrast between (4)-(5), on the one hand, and (6)-(7), on the other, depends on the latter being *indicative* conditionals: somehow, the gender presupposition of 3sg pronouns can be locally satisfied in indicative conditionals, but not in counterfactual conditionals. However, as Magdalena Kaufmann pointed out to us (p.c.), one problem with this suggestion is that indicative conditionals (8)-(9) seem to require that the gender presuppositions of the pronouns be met in the actual world and not in the possible world(s) described by their antecedents:

1 The contrast between indicative and counterfactual conditionals with respect to the projection behaviour of the gender presupposition of pronouns was also observed by Geurts (1999: p. 68-9).

(8) If John$_i$ undergoes an operation to become a woman, we'll buy him$_i$ a toy car.

(9) ??If John$_i$ undergoes an operation to become a woman, we'll buy her$_i$ a toy car.[2]

These data show that the behaviour of free 3sg pronouns in conditionals is puzzling. On the one hand, indicative conditionals (6)-(7) allow the presupposition of pronouns to be locally satisfied in a world other than the actual world. On the other hand, (4)-(5) indicate that local satisfaction is not an available option for counterfactual conditionals. Moreover, as (8)-(9) show, local satisfaction seems also to be unavailable for some indicative conditionals.

Our paper is organized as follows. Section 2 sets the stage: we present a version of the indexical presupposition analysis of 3sg pronouns (for short, IPA) and we show that this analysis, combined with a standard intensional semantics for conditionals, fails to account for the contrast between (4)-(5) and (6)-(7). In section 3 we discuss a way to deal with this problem by combining IPA with a trivalent version of the extensional analysis of indicative conditionals proposed by Jackson (1979, 1981, 1987) and Lewis (1986). We reject this extensional way out for two reasons: (i) it suggests that there are different explanations for the failure of the same inference patterns in indicative and subjunctive conditionals; (ii) it fails to account for the behaviour of first person and temporal indexicals described by Santorio (2012) (which we discuss in section 6). Section 4 raises a problem for IPA which is independent of conditionals and concerns the behaviour of 3sg pronouns bound in the scope of modal operators. In section 5 we articulate our proposal. First, we introduce the presuppositional analysis of 3sg pronouns by Del Prete & Zucchi (2017) in order to capture generalization IGP without running into the problem raised in section 4. Then, we present an analysis of indicative conditionals as Kaplanian monstrous operators, building on a suggestion by Weatherson (2001) and Nolan (2003). Our monstrous analysis is similar in spirit to Santorio's (2012), but differs from Santorio's since it treats indicative conditionals *uniformly* as monsters. We show how our analysis accounts for Yanovich's conditionals (6)-(7) and for the observed difference in projection behaviour between these conditionals and Kaufmann's (8)-(9). In section 6 we show how our proposal applies to cases of "indexical shift" involving first person pronouns and temporal indexicals. Section 7 presents some concluding remarks.

2 Caveat: The intuition that (8) and (9) contrast in the way indicated by the question marks implicitly relies on the assumption that the appropriateness of English gendered pronouns depends on biological sex. In this paper, we propose an account of the intuition that (8) and (9) contrast as indicated, without however subscribing to the view that that is how gendered pronouns should be used.

2 Setting the stage

2.1 The indexical presupposition analysis of 3sg pronouns

We subscribe to the following common views:

- 3sg pronouns are variables,
- their gender-specific descriptive content is a presupposition, analyzed as a definedness condition.

Following Kaplan (1989), let's assume that a context c contains a world coordinate c_w and a time coordinate c_t, and that denotation is relative to a context, an assignment function g (which maps individual variables to individuals from the domain of interpretation) and a circumstance of evaluation consisting of a world-time pair. One way to capture generalization IGP is to assume the semantic rules i-ii below, which constitute what we call "the indexical presupposition analysis" (IPA, for short):

- *The indexical presupposition analysis* (IPA)

i. $[\![\text{he}_i]\!]_{c,g,<w,t>} = g(x_i)$, if $g(x_i)$ is male at $<c_w, c_t>$; undefined otherwise.

ii. $[\![\text{she}_i]\!]_{c,g,<w,t>} = g(x_i)$, if $g(x_i)$ is female at $<c_w, c_t>$; undefined otherwise.

Assuming that the verb "think" requires that the denotation of the complement clause be defined with respect to the worlds compatible with the beliefs of the subject (as shown in (10) below), IPA correctly predicts that (3) (repeated below) is infelicitous, since the definedness condition of the pronoun "he$_j$" is not met (assignment g in (10) assigns Scarlett to the variable "x_j" and John to the variable "x_i"):

(3) ??John$_i$ didn't realize that Scarlett$_j$ was a woman. He$_i$ thought that he$_j$ liked him$_i$.

(10) $[\![\text{He}_i \text{ thought that he}_j \text{ liked him}_i]\!]_{c,g,<w,t>}$ is defined only if $\forall w'$ compatible with what John thinks in w at a time t' in the past of t, $[\![\text{he}_j \text{ likes him}_i]\!]_{c,g,<w',t'>}$ is defined.

Indeed, according to rule i of IPA, the gender presupposition of the pronoun "he$_j$" in the scope of "think" must be met relative to the world and the time of the context, not relative to the circumstance of evaluation $<w', t'>$. Since assignment g assigns Scarlett to the variable "x_j", it follows that:

(11) $\forall w'$ compatible with what John thinks in w at a time t' in the past of t, $[\![\text{he}_j \text{ likes him}_i]\!]_{c,g,<w',t'>}$ is defined only if Scarlett is male in c_w at c_t.

Since in the world of the context at the time of the context Scarlett is a woman, this analysis predicts that (3) is not acceptable. (By a similar reasoning, it also follows that (1)-(2) are unacceptable).

2.2 Enter a standard intensional semantics for conditionals

Paired with the standard intensional semantics for conditionals given below, IPA predicts the contrast of acceptability between (4) and (5) (repeated below), uttered in a context in which the conversational participants know that Sasha is a girl:

- *Stalnakerian Semantics*

i. $[\![if\ \varphi, \psi]\!]_{c,g,<w,t>}$ is defined only if $[\![\psi]\!]_{c,g,<w',t>}$ is defined, where w' is the world closest to w such that $[\![\varphi]\!]_{c,g,<w',t>} = 1$.

ii. If $[\![if\ \varphi, \psi]\!]_{c,g,<w,t>}$ is defined, then $[\![if\ \varphi, \psi]\!]_{c,g,<w,t>} = 1$ iff $[\![\psi]\!]_{c,g,<w',t>} = 1$, where w' is the world closest to w such that $[\![\varphi]\!]_{c,g,<w',t>} = 1$.

(4) If Sasha$_1$ were a boy, I would buy her$_1$ a doll.

(5) ??If Sasha$_1$ were a boy, I would buy him$_1$ a doll.

Indeed, the gender presupposition of the pronoun in the consequent of the conditional must be met relative to the world and the time of the context. Since in this world at this time Sasha is female, the analysis predicts that (5) is not acceptable.

However, the combination of IPA and Stalnakerian Semantics incorrectly predicts that one of (6)-(7) (repeated below) ends up undefined and should thus be infelicitous:

(6) If Sasha$_i$ is a boy, I'll buy him$_i$ a doll.

(7) If Sasha$_i$ is a girl, I'll buy her$_i$ a toy car.

Indeed, suppose that Sasha is a girl in the world and at the time of the context c: by Stalnakerian Semantics, (6) is predicted to be true in c, relative to assignment g, just in case $[\![\text{I'll buy him}_i \text{ a doll}]\!]_{c,g,<w',c_t>} = 1$, where w' is the world closest to c_w such that $[\![\text{Sasha}_i \text{ is a boy}]\!]_{c,g,<w',c_t>} = 1$. Since $g(x_i)$ (= Sasha) is female at $<c_w, c_t>$, by rule i of IPA $[\![\text{him}_i]\!]_{c,g,<w',c_t>}$ is undefined and $[\![\text{I'll buy him}_i \text{ a doll}]\!]_{c,g,<w',c_t>}$ will thus also end up undefined. Suppose now that Sasha is a boy in the world and at the time of the context: by a parallel reasoning, Stalnakerian Semantics, paired with rule ii of IPA, predicts that (7) ends up undefined.

3 An extensional way out

3.1 Material conditionals, trivalence, robustness

In this section, we discuss a way of dealing with (4)-(9) based on an extensional semantics for indicative conditionals. Jackson (1987) points out that, while counterfactual (12) makes perfect sense, the corresponding indicative (13) is incoherent:

(12) If Oswald had not shot Kennedy, things would be different today from the way they actually are.

(13) ??If Oswald did not shoot Kennedy, things are different today from the way they actually are.

The same contrast also holds between counterfactuals and indicatives whose antecedent and consequent describe future events. The following examples, from Weatherson (2001), illustrate the point:

(14) If Warren Beatty were to become the next president, things would be different from the way they actually will be.

(15) ??If Warren Beatty becomes the next president, things will be different from the way they actually will be.

The moral drawn by Jackson is that indicatives, unlike counterfactuals, are not intensional, that is, they do not introduce a distinction between the closest world in which the antecedent is true and the actual world.[3] This is why the indicatives in (13) and (15) are incoherent: it cannot be that the way things are (will be) in the actual world differs from the way things are (will be) in the actual world.[4]

3 As Jackson (1987: p. 75) puts it, "indicative conditionals do not take us from the actual world at all." We come back to this objection to an intensional account of indicatives in section 5.2.

4 More precisely, according to Jackson, these conditionals are anomalous because the probability that they are true would not be high, if it came to be known that their antecedent is true. We come back to this in footnote 5.

Jackson thinks that, from the point of view of their truth-conditions, indicative conditionals are equivalent to material conditionals, namely he proposes the following analysis for indicatives:

- *Material conditional analysis of indicatives* (MCA)
  An indicative conditional ⌜If φ, then ψ⌝ is truth-conditionally equivalent to the disjunction ⌜Either not-φ or ψ⌝.

The question that we address next is whether MCA fares better than Stalnakerian Semantics in accounting for the way the gender presuppositions of pronouns project in (6)-(7).

By rules i-ii of IPA, sentences containing 3sg pronouns may be true, false or undefined. We can preserve the spirit of MCA in a three-valued semantics by assuming that the truth-conditions of disjunction ⌜Either φ or ψ⌝ are given by the following rule:

- *Strong Kleene*
  ⌜Either φ or ψ⌝ is true (relative to $c, g, < w, t >$) if one of its disjuncts φ, ψ is true (relative to $c, g, < w, t >$), no matter whether the other disjunct is true, false or undefined (relative to $c, g, < w, t >$).

MCA predicts that (6)-(7) are equivalent to (16)-(17), respectively:

(16) Either Sasha$_i$ is not a boy or I'll buy him$_i$ a doll.

(17) Either Sasha$_i$ is not a girl or I'll buy her$_i$ a toy car.

It is easy to show that, by Strong Kleene, these disjunctions can both be true (hence, defined). Indeed, suppose that Sasha is a boy and I'll buy him a doll. Then (16) is predicted to be true because its right disjunct is true, and (17) is also predicted to be true because its left disjunct is true. Supposing that Sasha is a girl and I'll buy her a toy car, the truth of (16)-(17) is explained in a parallel way.

What happens if we apply MCA + Strong Kleene to indicative conditionals (8)-(9) (repeated below)?

(8) If John$_i$ undergoes an operation to become a woman, we'll buy him$_i$ a toy car.

(9) ??If John$_i$ undergoes an operation to become a woman, we'll buy her$_i$ a toy car.

Let's focus on (9). MCA predicts that (9) is equivalent to (18):

(18) Either John$_i$ will not undergo an operation to become a woman or we'll buy her$_i$ a toy car.

Supposing that John will not undergo the operation, the first disjunct of (18) is true, therefore (by Strong Kleene) (18) is also true and conditional (9) – equivalent to (18) on MCA – is thus predicted to be true, hence defined. In other terms, if the antecedent of (9) is false, MCA + Strong Kleene incorrectly predicts that (9) is defined. Therefore, if the antecedent of (9) is known to be false, the prediction is that (9) should be assertable, contrary to our intuition.

The prediction that an indicative conditional should be true if its antecedent is false is a familiar problem for MCA, and it carries over to MCA + Strong Kleene. This analysis can be rescued if, following Jackson, we require that, to be assertable, an indicative conditional must be *robust relative to its antecedent*:

- *Assertability condition on indicatives* (Robustness)

  An indicative ⌜If φ, then ψ⌝ is *robust* relative to φ iff the (subjective) probability of the truth of ⌜If φ, then ψ⌝ is high, and it would stay high also if it came to be known that φ is true.

This condition, paired with MCA + Strong Kleene, predicts that knowledge that the antecedent is false is no longer sufficient to assert the conditional. For example, (19) below is not assertable, since the subjective probability of the truth of (19) would not stay high if it came to be known that its antecedent is true (since there is no relation between New York being in Australia and Rome being in France):

(19) If New York is in Australia, Rome is in France.

Let's now go back to problematic conditional (9). Suppose we think it likely that John will not undergo the operation. Then, the subjective probability of (9) is high (since the first disjunct in (18) is likely to be true). However, if we were to learn that John will undergo the operation, the subjective probability of the truth of (9) would not stay high, because we would know that the first disjunct in (18) is false and the second disjunct is undefined, hence not true (since the presupposition of "her$_i$" that John is female in the world and at the time of utterance is not met). Thus, once Robustness is assumed, MCA + Strong Kleene correctly predicts (9) to be unassertable. Notice, on the other hand, that no such prediction of unassertability is made for (6)-(7). Indeed, suppose that (a) I think it likely that Sasha is a girl, but (b) in case I am wrong, I'll certainly give Sasha a doll. Given (a), the subjective probability of (6) is high (since the first disjunct in (16) is likely to be true). Moreover, if I were to learn that Sasha is a boy, the subjective probability of the truth of (6) would still be high, since I would be confident that I am in a context in which the presupposition

of "him$_i$" that Sasha is male is met and the second disjunct in (16) is likely to be true. By a parallel reasoning, we may show that (7) could satisfy Robustness.

To sum up, given the indexical presupposition analysis of 3sg pronouns (IPA), pairing a Jacksonian trivalent extensional analysis of indicatives (MCA + Strong Kleene + Robustness) with a standard intensional semantics for counterfactuals (Stalnakerian Semantics) would allow us to capture the projection behaviour of the pronouns' gender presuppositions in (4)-(9). So, why don't we stop here?[5]

3.2 Why we don't stop here

How indicative conditionals should be analyzed is controversial. As we have just seen, Jackson argues that indicatives are material conditionals and subjunctives should be given a possible worlds semantics (see also Lewis 1976, 1986 for the same view). Other authors (Stalnaker 1968, 1975, Kratzer 1986, 2012, for example) argue that both indicatives and subjunctives should be given a possible worlds semantics. A problem for the Jackson-Lewis account is that it fails to provide a *uniform* reason for the fact that both indicatives and subjunctives fail to license inference patterns like hypothetical syllogism, contraposition, and strengthening of the antecedent; indeed, Lewis and Jackson predict that the inference patterns in question are invalid for subjunctives but valid and pragmatically unacceptable for indicatives.[6] This is one reason why, although matters are not one-sided, we would not be satisfied with an account of the gender facts that combined Jackson's extensional semantics for indicatives with a Stalnakerian intensional semantics for subjunctives. Besides such metatheoretical considerations, there are independent reasons to assume that indicatives *do* "take us from the actual world" after all. These reasons have to do with the shifty behaviour of first person and temporal indexicals in indicative conditionals, first described and analyzed in Santorio (2012). We'll discuss them in section 6.

On these grounds, we are going to pursue an account based on an intensional analysis of indicatives. According to it, indicatives contrast with subjunctives in that the former are Kaplanian monsters, unlike the latter. We will argue that not only can this account capture the data discussed so far, but it also delivers a uniform reason for the failure of the same inference patterns in indicative and subjunctive conditionals,

5 Notice that the proposal sketched in this section also explains why (13) is anomalous:

(13) ??If Oswald did not shoot Kennedy, things are different today from the way they actually are.

Indeed, since it cannot be the case that things are different from the way they are, the second disjunct in the equivalent disjunction (i) is necessarily false, thus the subjective probability of the truth of (13) would not stay high if it came to be known that the antecedent of (13) is true.

(i) Either Oswald shot Kennedy or things are different today from the way they actually are.

6 For example, Jackson (1987: pp. 78-85) claims that, although these inference patterns are valid for indicatives, they may nevertheless lead from assertable premises to conclusions that are not assertable.

and it predicts the way first person and temporal indexicals behave in indicative conditionals. Before turning to our account, however, we first point out a problem that the indexical presupposition analysis of pronouns runs into independently of conditionals.

4 A problem for the indexical presupposition analysis of 3sg pronouns

In section 2.2, we considered a problem that arises when combining IPA with a standard intensional analysis of indicatives. But IPA also runs into problems of its own, independently of conditionals. Del Prete & Zucchi (2017: p. 15) consider the following example:

(20) [While watching the 1980 Summer Olympics on TV, Jones regretfully observes that, if the United States had taken part in the Olympics, they would have certainly won some gold medals in boxing. Then, he utters the following sentence:]
It could have been that *every US gold medalist*$_i$ had defeated a Russian who challenged *him*$_i$.

IPA predicts the definedness conditions in (21) below for (20) (where "it could have been that" is translated as "$\Diamond$", "US gold medalist" as "G", and "defeats a Russian who challenges him$_i$" as "$D(him_i)$"):[7]

(21) $[\![\Diamond \textit{ every } x_i\ G(x_i)\ D(\text{him}_i)]\!]_{c,g,<c_w,c_t>}$ is defined
only if, for all w that are accessible from c_w, $[\![\textit{every } x_i\ G(x_i) D(\text{him}_i)]\!]_{c,g,<w,c_t>}$ is defined
only if, for all w that are accessible from c_w, $[\![D(\text{him}_i)]\!]_{c,g',<w,c_t>}$ is defined for every g' such that $g'[x_i]g$ and $[\![G(x_i)]\!]_{c,g',<w,c_t>} = 1$
only if, for all w that are accessible from c_w, every individual which is a US gold medalist at w, c_t is male at $<c_w, c_t>$.

This predicts that, for (20) to be true non vacuously, there must be some male individuals in the actual world such that there is some world in which they are US gold medalists at the 1980 Summer Olympics and they defeat the Russians who

7 The definedness conditions in (21) are derived by assuming the following plausible definedness conditions for modal formulae with a (non-epistemic) possibility operator and for universally quantified formulae:

(i) $[\![\Diamond\varphi]\!]_{c,g,<w,t>}$ is defined only if $[\![\varphi]\!]_{c,g,<w',t>}$ is defined for all w' that is accessible from w.

(ii) $[\![\textit{every } \nu\ \Phi\ \Psi]\!]_{c,g,<w,t>}$ is defined only if $[\![\Psi]\!]_{c,g',<w,t>}$ is defined for every g' such that $g'[\nu]g$ and $[\![\Phi]\!]_{c,g',<w,t>} = 1$.

challenge them. However, there is no reason to assume that the truth-conditions of (20) are constrained in this way. In fact, there are cases which clearly show that the truth of quantified sentences of this type (where a quantifier in the scope of a circumstantial modal binds a pronoun) does not depend on the existence of a world in which the set of individuals satisfying the quantifier restrictor in that world is composed of individuals meeting the descriptive content of the pronoun in the world of the context. Suppose Amazonia is a society in which reproduction is genetically controlled in such a way that only females are generated. In the annual coed games with the Laconians, Amazonian athletes normally excel, but they are disfavored in boxing, in which they are regularly defeated by their male opponents. While watching the games, Hippolyta muses on how things might have been different, had the ban on male generation been lifted and a cohort of male Amazonian boxers been raised. She says:

(22) It could have been that every male Amazonian boxer$_i$ would have defeated his$_i$ Laconian opponent.

Arguably, Hippolyta's utterance is true, but in the context of utterance of (22) there is no set of actually male individuals which accounts for the truth of the utterance, since there are no actual male individuals which may be reasonably assumed to make up the set of male Amazonian boxers in the hypothetical situation Hippolyta is musing on. In (22), as in (20), the descriptive content of the pronoun must be met in the world introduced by the possibility modal, not in the world in which the sentence is uttered.[8,9]

8 Del Prete & Zucchi point out that this problem cannot be solved simply by requiring that the descriptive content of 3sg pronouns be satisfied at the world and time *of the circumstance* of evaluation. This would amount to assuming the following clauses for 3sg pronouns (see Sudo 2012: p. 41):

(i) $[\![he_i]\!]_{c,g,<w,t>} = g(x_i)$ if $g(x_i)$ is male at $<w,t>$, and it's undefined otherwise.

(ii) $[\![she_i]\!]_{c,g,<w,t>} = g(x_i)$ if $g(x_i)$ is female at $<w,t>$, and it's undefined otherwise.

This interpretation predicts that it should be possible to point at a woman and utter (iii) to claim that there is some possible circumstance in which she is a male university professor:

(iii) He could have been a university professor.

However, (iii) is not felicitous in a context of this kind.

9 Regarding sentence (20), an anonymous referee points out that it sounds worse in a scenario in which the US did not take part in the Olympics but, if they had, they would very likely have sent only a team of female boxers. In this case, the pronoun "her" may sound better than "him". We agree. But this does not require adopting IPA (a move that leads to trouble, as the Amazonian case shows). The preference for "her" in this case may be accounted for, consistently with the view that the gender presuppositions of pronouns are *not* indexical, by the fact that, against the described scenario, worlds in which the set of US gold medalists is made up of actually female individuals are more readily accessible.

According to Del Prete & Zucchi (2017: p. 17), here one faces a fundamental problem that arises for *any* account that treats bound and free uses of third person pronouns as occurrences of the same lexical items: while free uses of third person pronouns provide compelling reasons to assume that the descriptive gender content of the pronouns should be met in the world of the context, bound uses of the same pronouns show that this need not be the case.

So, if this is correct, in order to deal with the presuppositional behaviour of 3sg pronouns both a revision of Stalnakerian Semantics for indicative conditionals and a revision of IPA are called for. We head toward this goal in the next section.

5 Our proposal

5.1 A variablist account of 3sg pronouns

Before presenting our analysis of indicatives, we introduce a revision of IPA based on the proposal by Del Prete & Zucchi (2017) to deal with the problem posed by (20).[10] The proposal is framed in a Kaplanian two-dimensional semantics and is based on the following underlying assumptions:[11] (a) the semantic value of sentences containing free pronouns in a context of utterance is assignment sensitive (formally: their semantic value in a context is not a proposition, but a function from variable assignments to propositions); (b) context specifies a variable assignment and the proposition expressed in a context by a sentence containing free 3sg pronouns is the proposition one gets when one evaluates the sentence relative to the variable assignment of the context; (c) intensional operators manipulate the world-time coordinates of the circumstance; (d) quantifiers manipulate the assignment coordinate of the circumstance.

The idea that context provides an assignment of values to free variables is motivated as follows. A situation where a sentence is uttered, besides being part of a world w and including an agent who utters it at a certain time t and place p, may include certain referential intentions by the agent, possibly manifested by pointings or other gestures, which fix the referents of demonstratives (more generally, of expressions represented as free variables) that occur in the sentence. In this sense, introducing variable assignments as contextual coordinates is simply a way of

10 The proposal considered here differs minimally from Del Prete and Zucchi's in structuring variable assignment by introducing a temporal dimension in addition to a possible world dimension. This change is needed to deal with Kaufmann's examples.

11 Assumptions (a)-(b) provide what is called a *variablist* account of free 3sg pronouns. Rabern (2012) advocates a similar variablist account for sentences containing demonstratives.

representing these collections of contextual cues that accompany, for example, the utterance of demonstratives and contribute to fix their referents.[12]

More formally, we may spell out the proposal as follows:

A1. *Assignment as a contextual coordinate*
A context of utterance c specifies a variable assignment c_g as one of its coordinates.

A2. *Assignment as a circumstance coordinate*
A circumstance of evaluation includes a variable assignment as one of its coordinates.

A3. *Modally parameterized assignments*
Variable assignments are parameterized to a function s from individual variables to world-time pairs (called *the modal component of the assignment*), so they have the form g^s. The following principle is assumed, establishing a relation between the individual $g^s(x_i)$ and the world-time pair $s(x_i)$ (for any assignment function g^s and individual variable x_i):

Principle of localization
$g^s(x_i)$ is an individual *inhabiting* the world-time pair $s(x_i)$.

A4. *Quantifiers shift the assignment of the circumstance*
The formula in the scope of a quantifier $Q\nu$ must be true relative to assignments h^s identical to the assignment of the circumstance except for the fact that: (a) the modal component s of h^s assigns to the bound variable ν the world and time of the circumstance; (b) the individual assigned to ν by h^s may differ from the one assigned to ν by the assignment of the circumstance.

A5. *Intensional operators only shift the world and time of the circumstance*
Modal, temporal and belief operators require evaluating the formulae to which they apply with respect to worlds and times possibly different from the world and time of the circumstance (and leave the assignment of the circumstance unchanged).

A6. *Variablism*
The value of 3sg pronouns is fixed by the assignment of the circumstance of evaluation. More precisely, the denotation of 3sg pronouns is stated as

12 The insertion of variable assignments among the contextual coordinates to deal with free 3sg pronouns is proposed in Heim & Kratzer (1998: p. 243). Predelli (2012: p. 558) also makes use of sequences of individuals (hence assignments) as contextual coordinates in order to fix the referents of demonstratives. The idea was originally suggested in Kaplan (1989: p. 591). See also Rabern (2012), Rabern & Ball (2019) for discussion.

follows (where $<g^s, w, t>$ is a circumstance of evaluation, encompassing an assignment function coordinate besides a world and a time coordinate):

- $[\![\text{he}_i]\!]_{c,<g^s,w,t>} = g^s(x_i)$ if $g^s(x_i)$ is male in $s(x_i)$, and it's undefined otherwise.
- $[\![\text{she}_i]\!]_{c,<g^s,w,t>} = g^s(x_i)$ if $g^s(x_i)$ is female in $s(x_i)$, and it's undefined otherwise.

A7. *Truth in Context*

A sentence is true in a context c iff the semantic value it expresses in c is true at the time, world, and assignment of the context. The assignment provided by the context is specified thus:

Contextual assignment

c^s_g, where $s(x_i) = <c_w, c_t>$, for every variable x_i.

This account uniformly treats bound and free occurrences of 3sg pronouns as variables, namely bound and free occurrences are instances of the same lexical item. One consequence of the account is that, if a pronoun occurs free, its descriptive gender content must be satisfied in the world and at the time of the context of utterance, thus capturing generalization IGP. We can see why this generalization follows by means of the following reasoning. By the definition of Truth in Context in A7, the circumstance of evaluation is initialized to the world, time and assignment of the context. By the definition of contextual assignment in A7, the assignment of the context associates each variable with the world and time of the context. Since, by A6, the denotation of 3sg pronouns requires their descriptive content to be met at the world-time pair specified by the (modal component of the) assignment of the circumstance, then, in absence of operators shifting the assignment of the circumstance, the latter remains identical to the assignment of the context and the descriptive content of 3sg pronouns is required to be satisfied in the world and at the time of the context. Since, by A5, modal and belief operators do not change the assignment of the circumstance (only quantifiers do), (1)-(3) are correctly predicted to require that the denotation of "he" be male in the world and at the time of the context.

On the other hand, the pronoun "him$_i$" in (20) is bound by the quantifier *every US gold medalist*; by A4, this quantifier requires that the formula in its scope be defined with respect to assignments h identical to the assignment of the circumstance except for the fact that (a) the modal component of h assigns to x_i the world and time of the circumstance and (b) the individual denoted by x_i under h may differ from the one assigned to x_i by the assignment of the circumstance. Since the universally quantified sentence in (20) is in the scope of a possibility operator, the world at which the quantified sentence is evaluated is the counterfactual world introduced

by that operator. Thus, the descriptive content of "him$_i$" in (20) must be met in this counterfactual world.[13]

In short, like IPA, this account of 3sg pronouns captures generalization IGP. Unlike IPA, however, it avoids generating unwanted indexical presuppositions for bound pronouns.[14,15] We now turn to the semantics of conditionals.

13 An anonymous referee wonders how our account deals with cases like (i):

(i) If any$_i$ of the girls, Sasha, Natasha and Anna, were a boy, I would buy her$_i$/*him$_i$ a doll.

In this paper, we do not provide a treatment for conditional donkey anaphora (of which (i) is an instance). Del Prete & Zucchi (2017: pp. 34-35) adopt a Heimian treatment of donkey anaphora in conditionals: the indices of indefinites occurring in the antecedents of conditionals are copied onto the conditional operator, which introduces a universal quantification over world-assignment pairs. Thus, under the assumption that "any of the girls" in (i) is an indefinite, it should be treated as an open formula whose variable is bound by the conditional operator. By Del Prete & Zucchi's account, the conditional operator quantifies over assignments whose modal component assigns the world of the antecedent to the variables it binds, and this incorrectly predicts that "him$_i$" should be acceptable in (i).

The problem raised by (i) is an instance of a general problem posed by partitive NPs, as shown by the fact that it also arises for (ii):

(ii) If one$_i$ of the girls, Sasha, Natasha and Anna, were a boy, I would buy her$_i$/*him$_i$ a doll.

So, something more needs to be said about partitive NPs if one wants to pursue Del Prete & Zucchi's (2017) account of conditional donkey sentences. We think that the key observation to deal with (i)-(ii) is that the domain of the quantifier binding the partitive "any/one of the girls" *is restricted to individuals that are girls in the real world* and this in turn determines how the modal component of the assignments quantified over by the conditional operator is set. More generally, the condition that an empirically adequate analysis of partitives must satisfy is that the quantifier binding "any$_i$/one$_i$ of the Ns" sets the modal component to one that assigns to x_i the world in which the definite "the Ns" is interpreted. Here, we will not try to give a detailed implementation of this suggestion. We take it that a full treatment of quantificational domains and their interaction with the conditional operator should be given as part of a comprehensive treatment of donkey anaphora, which is beyond the scope of this paper.

14 For a detailed exposition and defense of this account of 3sg pronouns, we refer the reader to Del Prete & Zucchi (2017).

15 An anonymous reviewer pointed out that a natural prediction of our variablist account is that, when quantifiers are embedded in the consequent of subjunctive conditionals, we should expect them to be able to reset the gender of pronouns to match the world of the antecedent. We think that the prediction is correct. Indeed, the following sentence is acceptable (if uttered in a context in which Sasha is the only female athlete among the US gold medalists):

(i) If Sasha had been a man, then every US gold medalist$_i$ would have been male and would have defeated a Russian who challenged him$_i$.

5.2 Semantics for conditionals

An alternative to Jackson's account of the anomaly of (13) and (15) (repeated below) is proposed by Weatherson (2001) and Nolan (2003) and is based on the following suggestions:

- when using a subjunctive, the speaker evaluates the consequent in the closest world in which the antecedent is true;
- when using an indicative, the speaker evaluates the consequent in the closest world in which the antecedent is true, *by considering this world as actual*.

(13) ??If Oswald did not shoot Kennedy, things are different today from the way they actually are.

(15) ??If Warren Beatty becomes the next president, things will be different from the way they actually will be.

According to this view, the reason why (13) and (15) are anomalous is that the world referred to by "actually" is the closest world w in which the antecedent is true, and it can't be that the way things are in w is different from the way things are in w. In the Kaplanian framework we adopt, the suggestion by Weatherson and Nolan amounts to regarding indicatives as *monsters*: they shift the context of utterance c to a context k relative to whose world and time the antecedent is true.[16]

Let us first specify one more assumption concerning the context of utterance:

16 We do not take (13) and (15) by themselves to provide evidence for a monstrous semantics for indicatives. Paolo Santorio (p. c.) pointed out to us that the anomaly of (13) and (15) may also be explained consistently with Stalnaker's account. As Santorio observes, (i) is a plausible condition governing the use of indicative conditionals:

(i) whenever ⌜if A, B⌝ is uttered, A has to be an open epistemic possibility in the common ground of the context of utterance, and A also has to remain open in the updated common ground which is obtained if the conditional is accepted.

The key observation now is that conditional (15) entails a conjunction of the form in (ii) (where A is the proposition that Warren Beatty will become president and B the proposition that describes the way things will be if Warren Beatty becomes president):

(ii) [If A, B] and actually not-B.

It should be clear that, given condition (i), there is no coherent updated common ground that one can get to by accepting (ii). So, according to this account, (15) is anomalous since it entails something that leads to an incoherent updating. A similar story can be told to explain why (13) is anomalous. If this explanation can be pursued, then one does not need to suppose that indicative conditionals are monsters in order to account for (13) and (15). However, we take it that (13) and (15), together with Yanovich's conditionals in (6)-(7) and Santorio's (2012) data discussed in section 6.1 below, converge in supporting a monstrous analysis.

A8. *Body of knowledge as a contextual coordinate*
A context of utterance c specifies an information state – a *body of knowledge* c_ω – as one of its coordinates.

Whose body of knowledge does context provide? We assume that, normally, it's the speaker's, what the speaker knows in the context of utterance, but we leave open the possibility that someone else's or some other group's body of knowledge may be relevant.[17] We assume that a context c is compatible with an information state iff this condition is met: if someone is in that state, then, for all she knows, c might be the context she is in. A context c is compatible with the information state of the speaker iff, for all the speaker knows, she might be c_a, she might be located at the world c_w, at the time c_t, in the place c_p, and the value of free variables might be fixed by c_g^s. We now propose the Monstrous Semantics for indicatives below, while keeping to a standard Stalnakerian analysis of subjunctives (the circumstance of evaluation is now enriched with the assignment parameter g^s, which however plays no role in the semantics of conditionals):

- *Monstrous Semantics (Indicatives)*

i. $[\![if_{ind}\ \varphi, \psi]\!]_{c,<g^s,w,t>}$ is defined only if (a) $[\![\varphi]\!]_{c,<g^s,w,t>}$ is defined, and (b) $[\![\psi]\!]_{k,<k_g^s,k_w,k_t>}$ is defined, for every context k, among those compatible with the information state c_ω, such that k_w is the world closest to w meeting this condition: $[\![\varphi]\!]_{k,<k_g^s,k_w,k_t>} = 1$.

ii. If $[\![if_{ind}\ \varphi, \psi]\!]_{c,<g^s,w,t>}$ is defined, then $[\![if_{ind}\ \varphi, \psi]\!]_{c,<g^s,w,t>} = 1$ iff $[\![\psi]\!]_{k,<k_g^s,k_w,k_t>} = 1$, for every context k, among those compatible with the information state c_ω, such that k_w is the world closest to w meeting this condition: $[\![\varphi]\!]_{k,<k_g^s,k_w,k_t>} = 1$.[18]

17 Santorio (2012), which we'll discuss in section 6.1, assumes that the relevant body of knowledge to interpret epistemic conditionals is that of the speaker. However (as Santorio himself recognizes), the view that what matters for the interpretation of epistemic constructions is the speaker's knowledge might prove a simplifying assumption, as Hacking (1967), DeRose (1991) MacFarlane 2011, Yalcin 2007, and others have pointed out. One possibility is that the semantics developed here for epistemic conditionals should be modified in such a way that these conditionals are not true or false *simpliciter* (in a context), but true or false *relative to a body of knowledge*. We will not pursue this alternative here.

18 We introduce a universal quantification over contexts because some indicative conditionals may be true although it cannot be assumed that there is only one context k, compatible with c_ω, such that k_w is the world closest to w in which the antecedent is true at k_t. We come back to this point in footnote 24, section 6.4.

- *Stalnakerian Semantics (Subjunctives)*

i. $[\![if_{subj}\ \varphi, \psi]\!]_{c,<g^s,w,t>}$ is defined only if (a) $[\![\varphi]\!]_{c,<g^s,w,t>}$ is defined, and (b) $[\![\psi]\!]_{c,<g^s,w',t>}$ is defined, where w' is the world closest to w such that $[\![\varphi]\!]_{c,<g^s,w',t>} = 1$.

ii. If $[\![if_{subj}\ \varphi, \psi]\!]_{c,<g^s,w,t>}$ is defined, then $[\![if_{subj}\ \varphi, \psi]\!]_{c,<g^s,w,t>} = 1$ iff $[\![\psi]\!]_{c,<g^s,w',t>} = 1$, where w' is the world closest to w such that $[\![\varphi]\!]_{c,<g^s,w',t>} = 1$.[19]

Given the definition of truth in context in A7, Monstrous Semantics amounts to requiring that $\ulcorner if_{ind}\ \varphi, \psi \urcorner$ is true in a context c if and only if ψ is true in k, for every context k, among those compatible with the information state c_ω, meeting this condition: k_w is the world closest to c_w such that φ is true in k relative to the assignment k^s_g in the world k_w at the time k_t.

Assuming that "actually" anchors the circumstance of evaluation of the clause in its scope to the world of the context, as in (23) below,[20] Jackson's contrasts from

19 Clause (a) of the definedness condition for subjunctive and indicative conditionals is introduced to account for the fact that conditional antecedents project their presuppositions to the conditional as a whole. For example, (i)-(ii) both presuppose that Mary was smoking in the past:

(i) If Mary had stopped smoking, she would be healthy.

(ii) If Mary has stopped smoking, she is healthy.

Notice that (a) also correctly predicts that it should be odd to say things like (iii):

(iii) If she is female, we'll give her a toy car.

Indeed, by clause (a), (iii) is defined only if the referent of "she" is female in the context of utterance, however the use of the indicative suggests that the gender of the referent is not known.

20 This assumption is disputed by Mackay (2017). Mackay observes that the same contrast between subjunctives and indicatives obtains if we drop "actually" from (12) and (13), as shown in (i)-(ii):

(i) If Oswald had not shot Kennedy, things would be different today from the way they are.

(ii) ??If Oswald did not shoot Kennedy, things are different today from the way they are.

Based on this and other observations, Mackay argues that it is not "actually" that anchors the circumstance to the world of the context. In Mackay's proposal, "actually" is a presuppositional operator, similar to "even" and "too", signalling that the normal evolution of context is being disrupted (more precisely: "actually" presupposes that there is "a live body of knowledge from which the local context for the clause in the scope of 'actually' is not obtained simply by adding information from what was uttered").

If Mackay is right, the account of Jackson's contrast should not be based on clause (23). Wehmeier (2004) suggests that indicative mood is responsible for anchoring the sentence in its scope to the actual circumstances. In our system, this amounts to regarding indicative mood *as a Kaplanian actuality operator*. Once this assumption is made, our semantics of indicative and subjunctive conditionals predicts both the contrast between (12) and (13) and the contrast between (i) and (ii).

section 3 are now correctly predicted. We show this for the pair (12)-(13), repeated here:

(23) $[\![\text{actually } \varphi]\!]_{c,<g^s,w,t>} = 1$ iff $[\![\varphi]\!]_{c,<g^s,c_w,t>} = 1$

(12) If Oswald had not shot Kennedy, things would be different today from the way they actually are.

(13) ??If Oswald did not shoot Kennedy, things are different today from the way they actually are.

We predict truth-conditions (24) for counterfactual (12) and truth-conditions (25) for indicative (13):

(24) $[\![(12)]\!]_{c,<c^s_g,c_w,c_t>} = 1$ iff the way things are today in w' is different from the way things are today in c_w, where w' is the world closest to c_w such that Oswald has not shot Kennedy in w'.

(25) $[\![(13)]\!]_{c,<c^s_g,c_w,c_t>} = 1$ iff it is true in k that the way things are today is different from the way things are today, for every context k compatible with the speaker's knowledge such that k_w is the world closest to c_w in which Oswald did not shoot Kennedy.

For the indicative conditional in (13), but not for the counterfactual in (12), the world that "actually" refers to is the closest world at which the antecedent is true. This has the consequence of making (13) inconsistent.

The Monstrous Semantics we propose for indicatives is conceptually close to Santorio's (2012) semantics for epistemic conditionals. However, there are two points of difference with respect to Santorio's proposal. First, the technical implementation is different: in our proposal the monstrous character follows directly from the fact that indicative *if* requires that the consequent be evaluated at a context k which may be distinct from the context of utterance c, whereas Santorio's informational modals (which determine the semantics of epistemic conditionals) quantify over worlds and assignments. Second, the empirical scope of our analysis is not the same as Santorio's: our Monstrous Semantics applies to *all* indicative conditionals, whereas Santorio intends his analysis to be restricted to conditionals whose main modal is epistemic, which form *a subclass* of the conditionals bearing indicative mood. We come back to this point in section 6.3.

Notice that, while in our account indicatives and subjunctives differ in their semantics, hypothetical syllogism, contraposition and strengthening of the antecedent are predicted to be invalid inference patterns for both types of conditional, and the reason why they are invalid is essentially the same. To illustrate the point, let us focus on strengthening of the antecedent:

(26) a. If φ, then ψ.
b. Therefore, if φ and ξ, then ψ.

The argument schema may lead from a true premise to an unacceptable conclusion both for indicative and for subjunctive conditionals, as (27)-(28) show:

(27) a. If you add a pinch of salt, it'll taste good.
b. Therefore, if you add a pinch of salt and you add a pound of sugar, it'll taste good.

(28) a. If you had added a pinch of salt, it would have tasted good.
b. Therefore, if you had added a pinch of salt and you had added a pound of sugar, it would have tasted good.

Under Monstrous Semantics, argument (27) is predicted to be invalid. Let k be the context compatible with what the speaker knows in the context c in which (27) is uttered such that the world k_w is the world minimally different from c_w in which you add a pinch of salt. The world k_w need not be identical to the world k'_w minimally different from c_w in which you add a pinch of salt *and* you add a pound of sugar. Therefore, the fact that the consequent "it'll taste good" is true in k_w does not guarantee that it is true in k'_w. For the same reason, Stalnakerian Semantics predicts argument (28) to be invalid: the world w' minimally different from the world c_w in which you added a pinch of salt need not be identical to the world w'' minimally different from c_w in which you added a pinch of salt *and* you added a pound of sugar. In other words, under our account, strengthening of the antecedent turns out to be invalid both for indicative and subjunctive conditionals since the antecedent world of the premise may not be identical to the antecedent world of the conclusion. By similar reasonings, contraposition and hypothetical syllogism are both predicted to be invalid.

Finally, before we turn to the interaction of our semantics for conditionals with our semantics of 3sg pronouns, we point out another desirable consequence of Monstrous Semantics. Adams (1970) has called attention to minimal pairs of the following kind:

(29) If Oswald hadn't shot Kennedy in Dallas, then someone else would have.

(30) If Oswald didn't shoot Kennedy in Dallas, then someone else did.

Clearly, (29) and (30) are not equivalent: while (30) is clearly true, one might dispute that (29) is true. This difference is expected under our analysis of conditionals. According to Monstrous Semantics, (30) is true as uttered in a context c if and only if "someone other than Oswald shot Kennedy in Dallas" is true in every context k, compatible with what the speaker knows in c, such that k_w is the world closest

to c_w in which Oswald did not shoot Kennedy. Since it is common knowledge that Kennedy was shot, any context k, compatible with what someone uttering (30) knows, is such that it is true in k that Kennedy was shot. So, k_w is a world in which Kennedy was shot. Since in k_w Oswald did not do the shooting, someone else did, and (30) is correctly predicted to be true (in a context in which it is known that Kennedy was shot). On the other hand, by the Stalnakerian Semantics for subjunctives, (29) is true as uttered in a context c if and only if someone other than Oswald shot Kennedy in the world w' in which Oswald didn't shoot him which is closest to the utterance world. Since w' is not required to be a world in which what is known in the utterance context is true, one may dispute that w' is a world in which Kennedy gets shot. Thus, the truth of (29), unlike that of (30), is correctly predicted to be dubious, although we know that Kennedy was shot in the real world.[21]

We now turn to how our Monstrous Semantics captures the facts about 3sg pronouns presented in section 1.

5.3 Gender in conditionals explained

The contrast between Yanovich's conditional (7) and Kaufmann's (9) is now expected (we repeat the relevant sentences below):

(7) If Sasha$_i$ is a girl, I'll buy her$_i$ a toy car.

(9) ??If John$_i$ undergoes an operation to become a woman, we'll buy her$_i$ a toy car.

Let's consider (7) first. By Monstrous Semantics, we get the following:

(31) $[\![(7)]\!]_{c,<g^s,w,t>} = 1$ iff $[\![\text{I'll buy her}_i \text{ a toy car}]\!]_{k,<k^s_g,k_w,k_t>} = 1$, for every context k, among those compatible with the speaker's knowledge, such that k_w is the world closest to w meeting this condition:
$[\![\text{Sasha}_i \text{ is a girl}]\!]_{k,<k^s_g,k_w,k_t>} = 1$.

Since in the utterance context c Sasha's gender is not known, Sasha is a girl in some of the contexts compatible with the speaker's knowledge. Among these, let k be a context such that k_w is the world closest to w in which Sasha is a girl at k_t. By our analysis of 3sg pronouns in A6 and the way contextual assignment is specified by A7, the gender presupposition of "her$_i$" must be met at $<k_w, k_t>$, where $<k_w, k_t>$ is the world-time pair assigned to the pronoun's variable x_i by the modal component of

21 In essence, this is how Adams's minimal pair may be accounted for if one assumes Stalnaker's (1975) analysis of indicative and subjunctive conditionals: the truth of (30) depends on the fact that it is common knowledge that Kennedy was shot in Dallas.

the assignment k^s_g. Since Sasha is a girl at $<k_w, k_t>$, we correctly predict that (7) is felicitous.

Let's now turn to (9). This time, in the utterance context c John is known to be a man at the utterance time. Therefore, *any* context k compatible with the information state of c will be such that John is a man (hence, male) at $<k_w, k_t>$. As a consequence, the presupposition of "her$_i$" will not be met at the relevant world-time pair and we correctly predict that the utterance of (9) will turn out undefined.

We note in passing that, if we turn future tense conditional (9) into a conditional with a past time antecedent, the result is acceptable:

(32) If John$_i$ has undergone an operation to become a woman, we'll buy her$_i$ a toy car.

Our analysis can account for the contrast of acceptability between (9) and (32): a context c suitable for an utterance of (32) is such that John is no longer known to be a man at utterance time, which means that among the contexts k compatible with the information state of c, some are such that John is still a man at $<k_w, k_t>$ but, crucially, others are such that John is now a woman at $<k_w, k_t>$. By our Monstrous Semantics, the effect of (32) is precisely to select contexts k of the latter type – i.e., ks such that John has already undergone the operation to become a woman at $<k_w, k_t>$. In contexts of this type, the presupposition of "her$_i$" is met, and (32) is thus correctly predicted to be felicitous.[22]

22 We remain neutral about how to account for the disjunction data in (16)-(17) and (18) mentioned in section 3.1 above. We take it that an adequate account should make it possible for (16)-(17) to be true together and should predict that (18) is anomalous. Our proposal is compatible with different ways to get these predictions. One consists in pairing our variablist account with Strong Kleene. Supposing that Sasha is a boy and I'll buy him a doll, we expect (16) to be true since the right disjunct is true and we expect (17) to be true since the left disjunct is true (the truth of (16)-(17) is explained in a parallel way if Sasha is a girl and I'll buy her a toy car). Moreover, we also expect that (18) should be odd. Indeed, given that by our account the descriptive content of the pronoun "her" in (18) must be met in the world of utterance at the time of utterance (at which John is presupposed to be a man), the right disjunct is undefined whether or not the left disjunct is true. So, the speaker should not assert disjunction (18), given the plausible assumption that one should not assert a disjunction when one already knows of one of its disjuncts that it is not true. (Notice that, in this case, besides knowing that the right disjunct is not true, the speaker does not know whether the left disjunct is true or not. Thus, an assertion of (18) would also violate the rule of assertion by which one should only assert what one knows to be true).

Another way to deal with (16)-(17) and (18) is to suppose that disjunction is monstrous, namely the left disjunct provides the context of evaluation for the right disjunct. Here, we will not pursue this issue further and we'll leave open which is the best way to go.

6 Further predictions

In this section, we discuss some further predictions of our analysis. First we show how the Monstrous Semantics of indicatives deals with Santorio's (2012) cases of indexical shift involving the pronoun "I". Then we discuss some data involving temporal indexicals.

6.1 Epistemic shift

Santorio (2012: p. 363) describes the following case, under the heading of "epistemic shift" (the numbering of the examples is ours):

> Rudolf Lingens and Gustav Lauben are kidnapped. Lingens and Lauben are amnesiacs: each of them knows that he is one of the two kidnapped amnesiacs, but doesn't know which. They will be subjected to the following experiment. First, they will be anesthetized, then a coin will be tossed. If the outcome is tails, Lingens will be released in Main Library, Stanford, and Lauben will be killed. If the outcome is heads, Lauben will be released in Widener Library, Harvard, and Lingens will be killed. Lingens and Lauben are informed of the plan and the experiment is executed. Later, one of them wakes up in a library. He says:
>
> (33) If the coin landed tails, I am in Main Library, Stanford.
>
> (34) If the coin landed heads, I am in Widener Library, Harvard.

Santorio shows that, under the standard semantics in (35) below for the 1sg pronoun "I" (by which "I" rigidly denotes the speaker of the utterance context) and the intensional account for indicative epistemic conditionals in (36), one predicts that a joint utterance of (33) and (34) should sound contradictory, contrary to intuitions.

(35) $[\![\text{I}]\!]_{c,g,<w,t>} = c_a$

(36) $[\![\textit{if } \varphi, \psi]\!]_{c,g,<w,t>} = 1$ iff $[\![\psi]\!]_{c,g,<w',t>} = 1$, for all worlds w' compatible with what the speaker of c knows at $<w,t>$ and such that $[\![\varphi]\!]_{c,g,<w',t>} = 1$

Indeed, supposing that Lingens is the speaker in c, the truth-conditions predicted for an utterance of (34) in c are the following:

(37) $[\![(34)]\!]_{c,g,<c_w,c_t>} = 1$ iff $[\![\text{I am in Widener Library, Harvard}]\!]_{c,g,<w',c_t>} = 1$, for all worlds w' compatible with what Lingens knows at $<c_w, c_t>$ and such that $[\![\text{the coin landed heads}]\!]_{c,g,<w',c_t>} = 1$

> iff Lingens is in Widener Library, Harvard, in w' at c_t, for all worlds w' compatible with what Lingens knows at $<c_w, c_t>$ and such that the coin lands heads in w' at a time in the past of c_t.

The problem is that, among the worlds compatible with what Lingens knows in which the coin landed heads, there is none in which Lingens is in Widener Library at the time of utterance–in all such worlds, Lingens is dead at that time. So, if Lingens is the speaker, (34) should be false. On the other hand, by a parallel reasoning, if Lingens is the speaker, (33) should be true, since in every world compatible with what Lingens knows in which the coin landed tails Lingens is in Main Library at the time of utterance. By a similar reasoning, it is also easy to see that, by (35)-(36), sentence (34) is predicted to be true and (33) to be false if Lauben is the speaker. Thus, a joint utterance of (33) and (34) should sound contradictory, no matter whether the speaker is Lingens or Lauben. But this is clearly not so.

Santorio's intuitive diagnosis concerning (33)-(34) is that "*I* picks out not the actual speaker but whatever individual is speaking in the circumstances singled out by the antecedent. In short, the referent of *I* seems to shift on the basis of the antecedent of the conditional" (Santorio 2012: p. 365). His technical solution to the problem is based on the following assumptions:

S1. Indexical pronouns are variables which, in (33)-(34), are bound by a (silent) epistemic necessity operator.

S2. The epistemic necessity operator shifts the assignment of the context by quantifying over world-assignment pairs $<w, g>$ such that:

   (a) w is an epistemic alternative for the speaker that makes the antecedent of the conditional true;

   (b) g assigns to each indexical pronoun α an individual which, as far as the speaker knows, is the counterpart in w of the individual assigned to α by the assignment of the context.

Assumption S2 amounts for Santorio to assuming that indicative epistemic conditionals are monsters, since they shift a context parameter that is responsible for the assignment of a denotation to indexicals. Given S1-S2, Santorio predicts that "I" refers to Lingens in (33) and to Lauben in (34), no matter whether it is Lingens or Lauben who utters the conditionals, thus accounting for the intuition that a joint utterance of (33) and (34) by the amnesiac who wakes up (whether he is Lingens or Lauben) is true in the described scenario.

Our account, like Santorio's, correctly predicts that (33)-(34) should both be true if uttered by any of the two amnesiacs in the same scenario. Indeed, suppose

that Lauben utters (33) in c. The contexts compatible with what Lauben knows at $<c_w, c_t>$ are either contexts in which the coin landed heads, the speaker is Lauben and he is in Widener Library, or contexts in which the coin landed tails, the speaker is Lingens and he is in Main Library. However, any context k compatible with what Lauben knows at $<c_w, c_t>$ such that k_w is the world closest to the utterance world c_w in which the coin landed tails is a context in which the speaker is Lingens and he is in Main Library in k_w at k_t. Thus, (33) is true. Suppose now that Lauben utters (34) in c. Any context k compatible with what Lauben knows at $<c_w, c_t>$, where k_w is the world closest to the utterance world c_w in which the coin landed heads, is now a context in which the speaker is Lauben and he is in Widener library. Thus, (34) is true. By a parallel reasoning, it is easy to see that (33)-(34) can both be asserted truly by Lingens. Thus, we predict that (33)-(34) should both be true if uttered by anyone of the two amnesiacs.

6.2 Lack of first person shift in subjunctives

Santorio (2012: p. 364) points out that subjunctives behave differently with respect to the possibility of shifting a first person pronoun. Suppose that one of the amnesiacs, after waking up, is trying to sum things up about how possible outcomes of coin tossing would have determined which library he is in. In this context, as Santorio points out, both (38) and (39) sound odd:

(38) Suppose the coin landed heads. If the coin had landed tails, I would have been in Main Library, Stanford.

(39) Suppose the coin landed tails. If the coin had landed heads, I would have been in Widener Library, Harvard.

This fact is expected if subjunctives are not monstrous, as both Santorio and we assume. Indeed, suppose one of the amnesiacs utters (38). Since he is supposing that the coin landed heads, he is supposing that he is Lauben. Under this supposition, it makes no sense for him to go on asserting the subjunctive in (38). Indeed, given that he is a competent speaker and knows that subjunctives are not monstrous (they have the truth-conditions in Stalnakerian Semantics), he knows that, under the supposition that he is Lauben, conditional (38) would express the false proposition that if the coin had landed tails, Lauben would have been in Main Library, Stanford. By a similar reasoning, we can show that it would make no sense for anyone of the amnesiacs to assert (39).

6.3 Indicative conditionals lacking first person shift

Santorio (2012: p. 369) points out the following case (the numbering of the examples is ours):

> Suppose that, after having been informed about the experiment but before undergoing it, one of the amnesiacs says:
>
> (40) If the coin lands tails, I will be in Main Library, Stanford.
>
> (41) If the coin lands heads, I will be in Widener Library, Harvard.
>
> . . . (40)-(41) are not good utterances in the scenario. Intuitively, (40) sounds true only if the speaker is Lingens, (41) only if the speaker is Lauben. Since the speaker is uncertain of his identity, neither of them is felicitous (given the Gricean requirement that speakers should not assert what they don't have evidence for).

In the same passage, he remarks that "it is standard in formal semantics to assume that at least some indicative conditionals involving *will* express the same kind of modality that is expressed by counterfactuals." Santorio assumes that in (40)-(41), as in the case of the counterfactuals in (38) and (39), the modal operator taking antecedent and consequent as arguments is a non-epistemic modal, and thus it's unable to bind indexicals in its scope (unlike the silent epistemic necessity operator in (33)-(34)). This allows him to predict that (40) is only true if uttered by Lingens and (41) is only true if uttered by Lauben. Since the amnesiac does not know whether he is Lingens or Lauben, it follows that he is not in a position to assert either (40) or (41).

Notice that Santorio does not claim that whenever there is a "will" in a conditional there cannot be a monstrous shift (a shift in the reference of indexicals). As he states it, *some* conditionals involving "will" express a non-epistemic modality and, when this is the case, we should not expect a monstrous shift. More generally, his claim is that there is monstrous shift iff the main modal of a conditional is epistemic, otherwise no such shift is to be expected.

One question that Santorio's account raises concerns the factors determining which type of modal is selected. In order to explain the anomaly of (40)-(41), it is crucial according to Santorio that the main modal in these conditionals be non-epistemic. But, if future tense by itself does not require that the main modal be non-epistemic, what is it that would prevent an epistemic modal from occurring in (40)-(41)? We argue that, in fact, in order to account for the unassertability of (40)-(41), there is no need to suppose that the kind of modality involved changes

and that the conditional is non-epistemic. In section 5.3, we have already shown how Monstrous Semantics can successfully account for the anomaly of Kaufmann's conditional (9):

(9) ??If John$_i$ undergoes an operation to become a woman, we'll buy her$_i$ a toy car.

Recall that the observed divergent behaviour of (9) with respect to Yanovich's indicatives (6)-(7) was predicted in virtue of the fact that our Monstrous Semantics takes the temporal aspects into account, more precisely because it assumes that the relevant contexts for evaluating indicative conditionals are those which are compatible with what the speaker knows *at the time of utterance*. Here we submit that Santorio's conditionals (40)-(41) can be treated in a parallel way to (9): once we take the temporal aspect into account, their divergent behaviour with respect to (33)-(34) is explained away without giving up the monstrous account.

Let's focus on (40) – the same reasoning will apply, *mutatis mutandis*, to (41). For concreteness, we assume that its LF is (42).[23] The truth-conditions predicted by our Monstrous Semantics for (40) are given in (43):

(42) If FUT the coin lands tails, FUT I am in Main Library.

(43) $[\![(42)]\!]_{c,<c_g^s,c_w,c_t>} = 1$ iff $[\![$FUT I am in Main Library, Stanford$]\!]_{k,<k_g^s,k_w,k_t>} = 1$, for every context k, among those compatible with what the speaker of c knows at c_w, c_t, such that k_w is the world closest to c_w meeting this condition: $[\![$FUT the coin lands tails$]\!]_{k,<k_g^s,k_w,k_t>} = 1$.

Notice that, at the world and time of the utterance $<c_w, c_t>$, the speaker (whether he is Lauben or Lingens) is uncertain of his identity and does not know whether he'll survive the experiment. So, among the contexts compatible with the speaker's information state at the world and time of the utterance, there are both contexts of type (a) and contexts of type (b):

(a) contexts k in which Lauben is the speaker, the coin lands tails at a time in the future of k_t, and Lingens is in Main Library shortly after that future time;

(b) contexts k in which Lingens is the speaker, the coin lands tails at a time in the future of k_t, and Lingens is in Main Library shortly after that future time.

23 The assumption that the antecedents in (40)-(41) are under the future tense operator at LF may be unnecessary to account for the fact that they are about a future time. See Kaufmann (2005) for a proposal that accounts for the future reference of conditional antecedents which bear present tense morphology consistently with the assumption that the underlying tense is also present. This point, however, is orthogonal to the point we are making here and we will leave it aside.

Now, suppose that the contexts k compatible with what the speaker knows at $<c_w, c_t>$ and such that k_w is the world closest to c_w in which the antecedent of (42) is true at k_t are contexts of type (a), namely, the speaker of k is Lauben, the coin lands tails in k_w at some time later than k_t and Lingens is in Main Library in k_w shortly after that time. In this case, the consequent of (42) is false in k, for the following reason: by (35), the truth of the consequent of (42) in k would require that *Lauben* be in Main Library in k_w at a time later than k_t, while, in fact, it is *Lingens* who is in Main Library in k_w at a time later than k_t. So, if k is a context of type (a), the conditional is false in the context of utterance of c. Of course, if k were a context of type (b), and so the speaker of k were Lingens, conditional (40) would be true. However, since the speaker of (40) is uncertain of his identity, he does not know whether k is a context of type (a) or of type (b). Thus, the speaker of (40) (whether he is Lauben or Lingens) has no ground for asserting (40). By a similar reasoning, we can conclude that the speaker of (41) (whether he is Lauben or Lingens) has no ground for asserting (41). This is why (40) and (41) are anomalous. We conclude that a uniform monstrous analysis of indicatives is compatible with (40)-(41).

Notice that, as the account just outlined makes clear, the fact that the antecedents in (40) and (41) are future-oriented plays no role in accounting for why the conditionals are anomalous. Indeed, suppose that the amnesiacs have been informed about the experiment and the coin has been tossed, but the rest of the experiment has not been carried out yet (i.e. at the moment both amnesiacs are still alive, and they know it). In this case, (44)-(45) are still anomalous, although the antecedent is in the past tense:

(44) If the coin landed tails, I will be in Main Library, Stanford.

(45) If the coin landed heads, I will be in Widener Library, Harvard.

Our semantics accounts for (40)-(41) and (44)-(45) in the same way (we owe this point to Paolo Santorio, p. c.). Namely, among the contexts k compatible with the speaker's information state at the world and time of utterance, there are both (a) contexts in which the speaker is Lauben, the coin landed tails in the past of k_t and Lingens is in Main Library after k_t, and (b) contexts in which the speaker is Lingens, the coin landed tails in the past of k_t and Lingens is in Main Library after k_t. Since the speaker is uncertain of his identity, he cannot exclude that he is in a context of type (a), thus has no ground for asserting (44). A similar reasoning allows us to conclude that the speaker of (45) has no ground for asserting (45).

6.4 Temporal indexicals

As observed by Santorio, the phenomenon of "epistemic shift" generalizes to temporal indexicals. He considers the following conditionals, uttered in a context in which the speaker fell asleep at noon and wakes up without knowing whether he slept one or two hours (Santorio 2012: p. 369):

(46) If I slept one hour, it is now one.

(47) If I slept two hours, it is now two.

Both conditionals are felicitous and true in the described context. However, as Santorio points out, given the standard analysis of *now* in (48) below, conditionals (46)-(47) raise a problem for the intensional analysis in (36) that is exactly parallel to the problem that (33)-(34) raise for it.

(48) $[\![\text{now}]\!]_{c,g,<w,t>} = c_t$

Indeed, suppose that the speaker, call him "Bill", slept two hours and utters (46). In this context, the truth-conditions predicted for (46) under analysis (36) are the following:

(49) $[\![(46)]\!]_{c,g,<c_w,c_t>} = 1$ iff $[\![\text{It is now one}]\!]_{c,g,<w',c_t>} = 1$, for all worlds w' compatible with what Bill knows at $<c_w, c_t>$ such that $[\![\text{I slept one hour}]\!]_{c,g,<w',c_t>} = 1$
iff c_t = 1PM in w', for all worlds w' compatible with what Bill knows at $<c_w, c_t>$ such that Bill slept one hour in w' at c_t.

But (49) is not intuitively correct: there is no world compatible with what Bill knows in which Bill slept one hour and in which the actual time of utterance is the same as 1PM – in all worlds compatible with what Bill knows in which Bill slept one hour, the actual time of utterance is 2PM (despite the fact that Bill slept one hour in those worlds!). So, (49) incorrectly predicts that (46) is false if Bill slept two hours.

Our account makes correct predictions concerning (46)-(47), as we now show. Suppose c is a context in which Bill utters (46) after two hours of sleep, namely at 2PM. Since Bill knows that he fell asleep at noon, any context k compatible with what Bill knows at $<c_w, c_t>$, such that k_w is the world closest to the utterance world c_w in which Bill slept one hour, is a context whose time is exactly one hour later than noon. Thus, (46) is true in c, since k_t = 1PM. Suppose now that c is a context in which Bill utters (47) after two hours of sleep: this time, any context k compatible with what Bill knows at $<c_w, c_t>$, such that k_w is the world closest to the utterance world c_w in which Bill slept two hours, is a context whose time is exactly two hours later than noon. Thus, (47) is true in c, since k_t = 2PM. Thus, our semantics correctly

predicts that (46)-(47) are both true if uttered in a context in which the time of utterance is 2PM. It is easy to see, by a parallel reasoning, that (46)-(47) are both predicted to be true if uttered in a context whose time is 1PM.[24]

7 Conclusions

The data presented in this paper show that the gender presuppositions of 3sg pronouns display a complex behaviour: they project globally (i.e., behave indexically) when the pronouns occur free or are construed with proper names in some environments (belief reports, counterfactuals), but they project locally when the pronouns are bound by quantifiers under a modal or are construed with proper names in indicative conditional environments (except for some conditionals involving "will"). Since we take that it is a desirable goal to provide a uniform semantics for 3sg pronouns,[25] the task of accounting for this complex presuppositional behaviour becomes even more challenging. Our claim here is that a variablist account of 3sg pronouns paired with a monstrous semantics for indicative conditionals (and a standard semantics for subjunctives) achieves the goal of accounting for this complex behaviour compatibly with a uniform treatment of 3sg pronouns. Our semantics for indicative conditionals also accounts for previously described data involving *actually* and for the cases of "epistemic shift" with the indexicals *I* and *now* described by Santorio (2012). As it should be clear from our discussion, the semantics we propose for indicative

24 While in this case it may be assumed that there is only one context k whose world component is the closest world satisfying the antecedent relative to k's time component, it is not always so. Indeed, an anonymous referee pointed out the following case. Suppose that the speaker fell asleep either at noon or 1PM but is not sure which and does not know whether she has slept for one hour or two. In this context it seems appropriate for her to assert (i):

(i) If I slept one hour, it is now either 1PM or 2PM.

Yet, consider contexts k and k' meeting these conditions:

- k_w is the world closest to the world of utterance in which the speaker falls asleep at noon and $k_t = 1PM$,
- k'_w is the world closest to the world of utterance in which the speaker falls asleep at 1PM and $k'_t = 2PM$

Both k and k' are contexts compatible with the speaker's information state, moreover k_w is the world closest to the world of utterance such that $[\![\text{I slept one hour}]\!]_{k,<k^s_g,k_w,k_t>} = 1$ and k'_w is the world closest to the world of utterance such that $[\![\text{I slept one hour}]\!]_{k',<k'^s_g,k'_w,k'_t>} = 1$. Our semantics, which universally quantifies over contexts, correctly predicts that (i) should be true.

25 This is not to say that non-uniform accounts of the semantics of 3sg pronouns have not been proposed and defended. For a recent account which treats bound pronouns differently from free pronouns, see Kratzer (2009). See Del Prete & Zucchi (2017) for a discussion of Kratzer's proposal.

conditionals builds on Santorio's proposal. We have argued that, apart from technical differences, our version provides a simpler account of the facts.

Our proposal is based on the idea that indicative and subjunctive conditionals crucially differ in their semantics, since the former reset the context against which the consequent is to be evaluated while the latter don't. This raises a number of issues that we do not address here. One is how exactly the compositional semantics works for features like indicative and subjunctive as applied to conditionals. Another, perhaps related, issue is why indicative conditionals reset the context for the consequent and subjunctive conditionals do not. In principle, one might state the semantics of subjunctive conditionals by requiring that the consequent be true in the contexts whose world is the world closest to the base world in which the antecedent is true, without requiring that the context be compatible with the information state of the speaker. This would preserve a difference between indicatives and subjunctives, while treating the subjunctives as monstrous. The facts about gender and, more generally, about the behavior of indexicals indicate that this is not how the semantics of subjunctives works. But why is that? Does this reflect a fundamental distinction in the way suppositions are made in natural language? Or is this to be derived by other constraints? If our account is on the right track, it calls for these questions to be pursued.

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