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Syntactic and cognitive issues in investigating gendered coreference

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Abstract This paper presents a framework for how the multifaceted nature of “gender” (human and linguistic) interacts with grammatical operations such as coreference dependency formation. It frames the question through the lens of English, in which it focuses on how personal names and referents who identify as nonbinary can provide insight into the conceptual representations of gender. Additional data from a variety of modern languages supports a model of how gender might be cognitively represented such that the observed linguistic patterns are available. A three-tiered model of gender is proposed that unites grammatical, cognitive, social, and biological aspects and describes how implications of this model might be tested in future work.

Keywords: gender; features; coreference; pronouns; personal names

1 Introduction

1.1 Preface

The inspiration for this paper comes from the observation that gender agreement can sometimes follow different criteria cross-linguistically, and more crucially, in different contexts within a language and between individuals. This is not a new observation; this paper elaborates on it by examining typological variation and contextual variation to propose a system for discussing different types of “gender” that are linguistically encoded and how they affect the form that agreement takes. The novel contribution is a framework for integrating general and linguistic cognition as related to gender, broadly construed. This framework will allow theoretical and experimental work in this area to more clearly identify and navigate issues relating to human gender as both a categorical and gradient phenomenon.

To begin, I lay out my proposed terminology for discussing gender in a principled way. This sets the stage for examining data from English, which does not overtly mark gender agreement outside of third person singular pronouns, and comparing it to observations from a variety of other languages that have richer gender inflection systems. I also examine how some lexical innovations which encode nonbinary gender fit into the wider picture of coreference.

Finally, these observations provide the foundation for a proposal which places languages (or, potentially individual speakers of those languages) along a gradient of permissibility in gender agreement and relates this to how different types of gender, including nonbinary identities, are conceptualized and learned. The intention of this structure is to organize formal, empirical, and philosophical evidence to support the claim that gender is represented and accessed at different levels and to different degrees during the process of coreference resolution.

1.2 Gender as a complex phenomenon

The term *gender* is fraught in part because definitions given in the linguistics literature can vary dramatically across subfields or even specific works and are sometimes left as tacit assumptions, even within contexts like coreference resolution. This paper aims to clarify what kinds of gender might be relevant for real-time processing of syntactic agreement and coreference between an anaphor and a referring expression, noting proper names and genders outside of the male-female binary. It develops the hypothesis that the type of gender involved in coreference checking in English, and possibly other languages, is primarily a domain-general categorical representation of the referent which a formal syntactic or semantic feature can draw upon during agreement and checking operations. That is, the mechanism for

37 categorization of gender which is used to check gender congruency between a pro-
38 noun and its antecedent relies fundamentally on a general cognitive mechanism for
39 classifying and checking congruency of gender rather than relying on a mechanism
40 specific to linguistic processing, in line with the ‘mental model’ framework (e.g.
41 Garnham & Oakhill 1990; Garrod & Terras 2000). Finally, I suggest some lines of
42 research into individual variation that would be able to inform the questions brought
43 up herein.

44 I will explicitly and precisely define several types of gender in order to provide
45 consistent and unambiguous terminology to the study of coreference and pronouns.
46 These definitions of “gender” include grammatical gender, conceptual gender, gen-
47 der identity, gender expression, and biosocial gender. I iteratively develop a cri-
48 terion for checking gender congruency (whether or not two lexical items match
49 in gender), then suggest a gradient way in which languages might employ the fi-
50 nal formulation of the criterion to result in the typological variation observed. I
51 also describe a three-tiered schema for formalizing the process of gender checking
52 during coreference resolution. While English is the primary focus of this paper,
53 I will demonstrate that motivation for these three categories can be found cross-
54 linguistically. I draw on biological, social, cognitive, and grammatical evidence
55 for how gender is conceptualized and used in human interaction in order to argue
56 that coreference resolution (in English) relies primarily on a non-syntactic property,
57 conceptual gender, for determining whether or not a pronoun and antecedent match
58 or mismatch, which is domain-general in origin.

59 The relative difference in acceptability between sentences (1-a) and (1-b) (in-
60 dicated by a #) illustrates that English coreference is influenced by discourse-level
61 information and world knowledge. In order to develop a felicitous context for (1-a),
62 one almost must assume the speaker is communicating their disapproval of the ref-
63 erent through misgendering. That is, although the referent’s gender remains am-
64 biguous without further context, a salient interpretation would be that the speaker is
65 intentionally discussing the referent using gendered words (either pronouns or def-
66 initional nouns) that are incongruent with the gender identity (defined in Section 2)
67 and wishes of the referent.¹ In contrast, (1-b) provides a context that immediately
68 allows for a felicitous and not necessarily transphobic interpretation.

- 69 (1) a. # At the farmhouse, the cowgirl_i left his_i lasso in the kitchen.
70 b. At the Halloween party, the cowgirl_i left his_i lasso in the kitchen.

¹ Because ‘misgendering’, or referring to someone in a way that invalidates and devalues their identity, is known to cause mental, emotional and social distress, negatively impacting health and well-being, particularly in adolescents (K. Johnson et al. 2019; McLemore 2015).

71 The difference in apparent acceptability between these two sentences indicates that
 72 the property of gender relevant for coreference is, at the very least, more com-
 73 plex than a formal syntactic feature. This observation by itself is not novel (e.g.
 74 Collins & Postal 2012; Duffy & Keir 2004; Frazier et al. 2015; Garnham, Oakhill
 75 & Reynolds 2002; Gygax et al. 2008; Hess, Foss & Carroll 1995; Joseph 1979;
 76 Nieuwland & Van Berkum 2006; Pyykkönen, Hyönä & van Gompel 2010). Thus
 77 this paper develops a formal treatment of how certain “types” of gender can match
 78 or mismatch during coreference dependency resolution and what this means for the
 79 linguistic encoding of gender identity across languages.

80 One possible model to explain how gender is conceived and applied to linguistic
 81 referents is described in the following sections. It represent a self-consistent, com-
 82 prehensive model that can be tested empirically. Furthermore, it provides a starting
 83 point for interdisciplinary research into the many linguistic facets of gender. In
 84 particular, I anticipate this approach will benefit linguistic work which examines
 85 phenomena where an individual’s gender identity and/or gender expression is rel-
 86 evant, as well as work which makes use of biosocial gender, including phenotype
 87 and hormonal profiles. I especially hope to encourage linguists who make use of
 88 psycholinguistic properties of pronouns in their research to be aware of the issues
 89 surrounding the various ways in which gender broadly construed and cognition may
 90 interface.

91 2 Defining gender

92 In order to precisely distinguish different types of gender, the following section
 93 briefly defines the types of gender relevant to this proposal. These types have been
 94 derived from syntactic, semantic, typological, sociological, anthropological, and
 95 neuro-biological work on gender. They are not intended to be all-encompassing,
 96 rather they are a terminological starting point for a coherent and precise discussion
 97 across fields and subfields in which the word *gender* may be used for multiple dis-
 98 tinct concepts. The following definitions are elaborated upon in this section.

100 **Grammatical gender:** The formal syntactic and/or semantic feature that is morpho-
 101 syntactically defined. (e.g., Comrie 1999; Kratzer 2009; Ritter 1993; Schriefers
 102 & Jescheniak 1999; Harley & Ritter 2002)

103 **Conceptual gender:** The gender that is expressed, inferred, and used by a perceiver
 104 to classify a referent (typically human, but can be extended to anthropo-
 105 morphized non-humans). (e.g., McConnell-Ginet 2015; Ansara & Hegarty
 106 2013; Newman 1992; Gygax et al. 2008; Irmen & Kurovskaja 2010; Ar-
 107 mann & Bühlhoff 2012; Bussey & Bandura 1999)

108 **Gender role:** A set of norms conventionalized by society which are associated with
 109 clothing or appearance, behavior, preferences, and social expectations. (e.g.,
 110 Gabriel et al. 2008; Brutt-Griffler & Kim 2018)

111 **Gender expression:** The way a person appears and behaves, as relating to cultural
 112 norms for distinct gender roles. This type of gender can feed into others'
 113 perception, thus into conceptual gender as well. (e.g., Garnham, Oakhill &
 114 Reynolds 2002; Rubin & Greene 1991)

115 **Biosocial gender:** The gender of a person based on phenotype, socialization, cul-
 116 tural norms, gender expression, and gender identity. These attributes may
 117 conspire to influence conceptual gender and gender expression, but this is
 118 an ongoing debate in the field. (e.g., Ansara & Hegarty 2013; Eckert 2014;
 119 Waxman 2010; Taylor & J. A. Hall 1982)

120 **Gender identity:** The mental state of a person regarding that individual's associa-
 121 tion with conceptual gender, gender role, gender expression, and biosocial
 122 gender. When grammatical gender referring to a person and the gender iden-
 123 tity of that person mismatch, this is likely to be considered 'misgendering'.
 124 (e.g., Ansara & Hegarty 2013; K. Johnson et al. 2019; Zimman 2017)

125 **2.1 Grammatical gender**

126 *Grammatical gender* comprises formal morphosyntactic features. They are the
 127 properties of words that allows the formal grammatical process of agreement to
 128 be carried out. This includes agreement of grammatical gender categories such
 129 as *masculine*, *feminine*, *neuter*, *common*, etc.² These features are properties of
 130 the morphemes themselves, and may be independent from the real-world biosocial
 131 genders associated with the referents. However, Corbett (1991) notes that there is a
 132 tendency for languages to correlate grammatical gender with the gender of the ref-
 133 erent, particularly if human. Moreover, Comrie (2005) adds that there is a tendency
 134 for personification of animals and inanimate objects in languages with grammat-
 135 ical gender to correlate with the grammatical gender of the noun phrase. This is
 136 further supported experimentally by Konishi (1993), who suggests that perception
 137 of inanimate referents are semantically influenced by grammatical gender cross-
 138 linguistically. Finally, it may be noted that languages that use different noun classes
 139 for subdividing humans³ almost always divide along a male-female category line

² Grammatical gender may include other noun classes as well, although a detailed discussion of noun classes is beyond the scope of this paper.

³ Subdivision of humans across noun classes is a crucial point here, as noun classes that use animacy as a distinction will group humans in the animate category, independent of human gender. I am only aware of one language that encodes more than two human genders grammatically: Buginese, spoken by approximately five million people in the southwest region of Sulawesi, Indonesia (Graham 2004).

140 independently of how many other noun classes are present or what other types of
141 nouns are included in those two classes.

142 In (2), the Dagestani language Tsez places animals in a noun class that is dis-
143 tinct from ones that include humans and Comrie (2005) reports that grammatical
144 gender does not change to reflect the gender roles of personified animals. This
145 contrasts with languages like English, in which personification or anthropomor-
146 phization can result in the use of gendered third person pronouns to refer to non-
147 human animals and inanimate objects that would otherwise be referred to with *it*,
148 the inanimate/non-human pronoun. I argue that the variation in use of grammati-
149 cal gender points to a deeper, more complex system of gender categorization both
150 grammatically and conceptually. That is, grammatical gender is in principle in-
151 dependent from other types of gender but the way it is deployed and the way it
152 influences non-grammatical interpretation suggests it is not entirely decoupled.

153 The extracts in (2) come from a story in which a rooster (definitionally male)
154 and a hen (definitionally female) are married, but the rooster has another romantic
155 partner (a frog, no specified gender explicitly or grammatically) thus causing strife
156 in the rooster and hen's relationship (Comrie 2005). Although all animals fall into
157 the third noun class (III) in Tsez, the words for rooster (*mamalay*) and hen (*onoču*)
158 still have defined conceptual or semantic genders despite this not being reflected in
159 the grammatical features. That is, the grammatical gender of the frog, the hen, and
160 the rooster are all obligatorily noun class III, with agreement marked on the verb,
161 which is not used for humans of any gender.

162 (2) Tsez:

- 163 a. b - oħix - no loħr - ā eħi - n wit'-wiš ħin
164 III - appear - PAST+CVB frog - ERG say - PAST+UNW wit'wish QUOT
164 'The frog appeared and said "witwish".'
165 b. onoč - ā b - egir - xo zew - č'ey mamalay
166 hen - ERG III - send - PRES+CVB be - NEG+PAST+UNW rooster
166 neħ - de - r - tow b - ik'i mi yaq¹uħ - no ħin
166 it- APUD - LAT - EMPH III - go.IMP you today- and QUOT
167 'The hen wouldn't let the rooster in, saying, "Go to her⁴ again today".'

168 In (2), the gender roles of the three characters are inferred through cultural
169 norms, e.g. marriage, and expectations, e.g. housework and romantic liaisons,
170 rather than solely through grammatical gender such as noun class morphology. In
171 the case of *loħro* (*frog*) there is no lexical distinction between the males or fe-
172 males of the species. Thus, the interpretation that the frog is a female interloper in

⁴ Here, *her* refers to the frog because in translation to English, *it* would be ambiguous and unnatural.

173 the birds' marriage is not linguistically encoded. Comrie (2005) reports that Tsez
 174 speakers uniformly interpret the frog to be female and not male, although it would
 175 not be ungrammatical for the frog to be male. Thus, the interpretation of the frog as
 176 female must come from the cultural expectations of the speakers rather than from
 177 their language.

178 Compare *rooster* and *hen* in English and Tsez to languages like German (mas-
 179 culine *Hahn* and feminine *Henne*, respectively) and Russian (masculine *petux* and
 180 feminine *kurica*, respectively), in which the grammatical gender of the words and
 181 the real-world sex of the animals is congruent. In Russian, the word for *frog*
 182 (*ljaguška*) happens to be grammatically feminine, thus congruent with the anthro-
 183 pomorphic gender role of the frog character. However, in German the word for *frog*
 184 (*Frosch*) is grammatically masculine. Comrie (2005) reports that this makes it dif-
 185 ficult, potentially bordering on ungrammatical, to use *Frosch* in translation, since
 186 the grammatical gender is incongruent with the anthropomorphic gender role of the
 187 frog character. According to him, the way to translate this story without indicating
 188 a homosexual relationship between the rooster and the frog would be to change the
 189 species of the interloping character to a feminine word like *toad* (*Kröte*). This sug-
 190 gests that the grammatical gender a word and the gender role of the character are
 191 conceptually connected, even though this need not be the case (Konishi 1993; Irmen
 192 & Kurovskaja 2010). On the other hand, what might be called grammatical gender
 193 in English, which is restricted almost entirely to third person pronouns, appears to
 194 be fully coupled to conceptual gender since the pronoun used would determine how
 195 the character's gender role is interpreted. This leads us to the question: what role
 196 does grammatical gender play in English, if any?

197 It is unclear whether or not grammatical gender plays a role in English syntactic
 198 operations or psycholinguistic processes. It has been argued that English has com-
 199 pletely lost grammatical gender, based on historical changes and loss of productive
 200 gender morphology (Baron 1971). Certainly, there is no overt gender agreement
 201 between nouns, adjectives and articles. However, Bjorkman's recent treatment of
 202 gender agreement between names and pronouns makes a case for a limited gram-
 203 matical gender system in English, in which sentences like (3) display a contrast in
 204 acceptability (Bjorkman 2017).

- 205 (3) a. That surgeon_i operated on three of their_i patients today.
 206 b. ?* Johnathan_i operated on three of their_i patients today.

207 Bjorkman observes that sentences like (3-a) are more acceptable than (3-b), even
 208 when the surgeon is known to all parties, and suggests this is due to names having
 209 grammatical gender (i.e., a ϕ -feature) in English, which must then agree with the
 210 pronoun, at least for some speakers. A reviewer points out that (3-b)'s acceptabil-

211 ity is contextually dependent, as Johnathan’s gender identity and the interlocutors’
 212 knowledge of this will affect the acceptability of the sentence. For instance, how-
 213 ever, consider people like anti-bullying activist Jeffrey Marsh who is nonbinary and
 214 whose pronouns are *they/them*, but whose forename is strongly biased as masculine.
 215 In this case, it is unlikely that speakers will be have a lexical entry for *Jeffrey* that
 216 doesn’t have a masculine ϕ -feature, but this does not change that Jeffrey Marsh’s are
 217 *they/them* and using other pronouns would be misgendering. Speakers would then
 218 need to have explicitly acquired the knowledge of which pronouns are appropriate
 219 in order to avoid misgendering a person whose gender identity is not immediately
 220 inferred from culturally specific cues in gender expression and gender role.

221 Whether or not English makes use of grammatical gender to determine gender
 222 congruency between coreferring elements, an argument for ϕ -features on names
 223 must account for how gender (conceptual and/or grammatical) is associated with
 224 their referents, since gender bias of names is wildly variable and mutable, more
 225 akin to cultural shifts than language change (Van Fleet & Atwater 1997; Barry &
 226 Harper 1982; 1993; 2014; Lieberman, Dumais & Baumann 2000; Hahn & Bentley
 227 2003). Thus, for grammatical gender to play a role in English, it would need to be
 228 the case that names and a limited number of nouns have ϕ -features for gender, but
 229 that agreement with a coreferring pronoun is optional in cases where the antecedent
 230 does not have a ϕ -feature for gender. To this end, I will set aside the status of
 231 grammatical gender in English for the time being and return to it in Section 4.1.3.

232 **2.2 Conceptual gender**

233 *Conceptual gender* encompasses a large number of closely related terms currently
 234 in use in the literature. This includes semantic gender (e.g. Asarina 2009), defini-
 235 tional gender (Kreiner, Sturt & Garrod 2008) and notional gender (i.e. natural gen-
 236 der, but see McConnell-Ginet (2015) for why the term ‘natural’ is inappropriate),
 237 which are ways of associating lexical items with masculine or feminine properties,
 238 but without necessarily attributing formal features to them.

239 This may be illustrated by the strong gender biases of many English occupa-
 240 tional terms (e.g., Kennison & Trofe 2003; Duffy & Keir 2004; Garnham, Oakhill
 241 & Reynolds 2002; Gygax et al. 2008). These biases, although in principle mutable,
 242 seem to hold consistently and for large swathes of the population. This bias under-
 243 pins the confusion caused by the “riddle” cited in Kreiner, Sturt & Garrod (2008);
 244 Reynolds, Garnham & Oakhill (2006):

245 *A man and his son were away for a trip. They were driving along*
 246 *the highway when they had a terrible accident. The man was killed*
 247 *outright but the son was alive, although badly injured. The son was*

248 *rushed to the hospital and was to have an emergency operation. On*
 249 *entering the operating theatre, the surgeon looked at the boy, and*
 250 *said, “I cant do this operation. This boy is my son.” How can this*
 251 *be? (Sanford 1985: p. 311).*

252 The difficulty of interpreting the surgeon as being either the son’s mother or
 253 any other parental figure besides the previously mentioned father is reflected in the
 254 enduring nature of this riddle. In either case, *surgeon* is demonstrated to have a
 255 strong male bias despite there being no definitional requirement for surgeons to
 256 be men. While gender is not overtly morphologically or grammatically marked in
 257 English, there is still some sort of conceptual bias that can be difficult to override.

258 In Russian, conceptual gender and grammatical gender sometimes clash. *Asa-*
 259 *rina (2009; 2011)* observes that *doctor (vrach)* is in the first noun class (I) which
 260 typically includes human male nouns, among other things. However, when refer-
 261 ring to a doctor who is a woman, there are a few strategies that may be employed in
 262 different registers.⁵ This is a particularly clear case of a clash between grammatical
 263 and conceptual gender because there are two loci that agreement could target and
 264 the different structural positions each target a different locus.

265 The explanation Asarina gives for how Russian can have mixed case agreement
 266 is that there is a structural representation of the grammatical feature in the syntax
 267 (as opposed to in the semantic representation). This means that an unpronounced
 268 functional projection encodes something about conceptual gender. For example, in
 269 Russian, there is a functional projection in sentences like (4), and the agreement is
 270 triggered by the closest class feature in the tree, thus the adjective agrees with the
 271 grammatical gender of the noun (masculine/noun class I, because ‘doctor’ is in the
 272 first/masculine noun class), but the verb agrees with the conceptual gender of the
 273 noun phrase (feminine/noun class II, because the doctor is a woman).

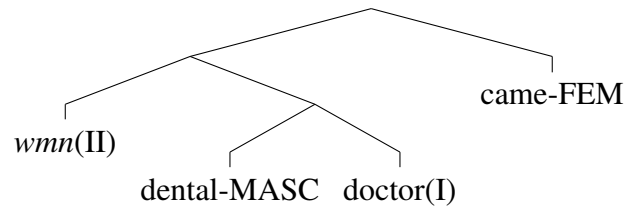
274 (4) Mixed agreement in Russian where *vrach (m)* refers to a woman and possi-
 275 ble structural representation, adapted from *Asarina (2009)*

276 a. Zubnoj vrach prishla.
 dental.MASC doctor(I) came.FEM
 277 ‘The [female] dentist has come.’

⁵ While Asarina does not address how nonbinary conceptual gender could be encoded in Russian, this is an issue which is being explored by nonbinary users of Russian (*Wilson 2018*).

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b.



279 In this representation, it's argued that 'dental' agrees with 'doctor' because
 280 the masculine ϕ -feature from *vračh* is the closest target of agreement in the tree,
 281 whereas the verb agrees with the (unpronounced) functional head *<wmn>* as it is
 282 the closer target of agreement. This requires the functional head be tied to the dis-
 283 course context, thus is more flexible and potentially more defeasible than if such
 284 a functional head were absent or unavailable in the language. In fact, this type of
 285 functional head only seems to be available for human referents and not animals,
 286 even when the animals are anthropomorphic (Comrie 2005). This suggests that
 287 there is some super-level of categorization in Russian that distinguishes animals
 288 and humans even in contexts where animals are filling human-like gender roles. I
 289 will set aside the question of distinguishing animals and humans grammatically, but
 290 I will also suggest that the categories could be cognitively structured in a manner
 291 similar to gender.

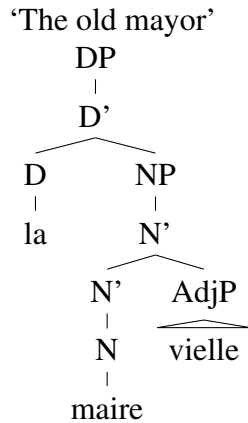
292 On the other hand, this is not also the case in formal registers of European
 293 French.⁶ In (5), the gender of the noun (masculine) does not change to match the
 294 gender of the referent, although this is at least partly for orthographic reasons.

295 (5) Mixed agreement in French where *mayor* (*m*) refers to a woman and possi-
 296 ble structural representation

297 a. la maire vielle
 det.FEM mayor.MASC old.FEM

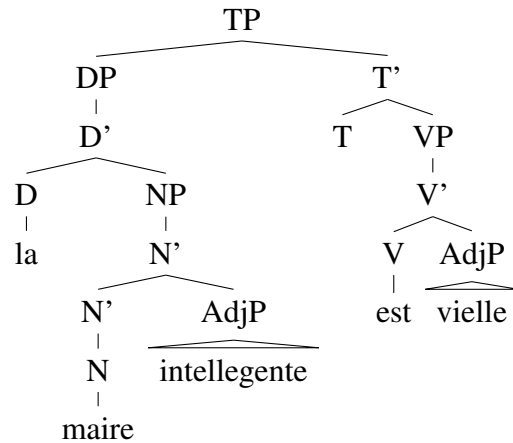
⁶ Speakers of Canadian French report the best solution is to use the feminine word *mairiess*. This is purportedly unavailable in formal registers of European French, as it means *the wife of the mayor* rather than the mayor herself.

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b. la maire intelligente est vieille
 det.FEM mayor.MASC intelligent.FEM is old.FEM
 ‘The intelligent (female) mayor is old.’



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In formal European French where the morphology on the noun does not change, then the determiner must agree with the noun, all gender agreement must match either the grammatical gender of the head noun or the conceptual gender of the referent. Thus, any mixed agreement should only occur when the conceptual gender of the reference mismatches the grammatical gender of the head noun. In this case, the <wmn> features Asarina proposed would be located above N but below any of its projections, which is *prima facie* counter-evidence for a syntactic head that governs gender agreement in French.

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Responses by Francophone colleagues to my informal queries indicate that mixed agreement in formal French is marginal in some speakers, since there is often an alternative form of the noun that would match the conceptual gender of the referent. Thus, further investigation into the nuances of mixed-agreement in French is warranted. Further investigation into agreement with nonbinary conceptual gender

316 will also become a viable line of research, as users of French (much like Russian)
 317 are in the early stages of developing gender-neutral or nonbinary grammatical solu-
 318 tions to conceptual gender (Shroy 2016).

319 Returning to sentence (1) for instance, *cowgirl* is definitionally female, but can
 320 be used for a male/masculine referent in certain circumstances. The feminine def-
 321 inition associated with *cowgirl* is thus defeasible, since gender agreement between
 322 *cowgirl* and *his* should be impossible if the property being checked is a morpho-
 323 syntactically defined ϕ -feature. This is not incompatible with English having for-
 324 mal gender features for some words, but I argue that it is strong evidence that what
 325 is primarily relevant for coreference resolution is not the morphosyntactic feature.
 326 This argument will be elaborated upon in Section 4.1, below.

327 Furthermore, there is evidence from developmental psychology and language
 328 acquisition that young children acquire labels for gender categories before they
 329 are able to consistently sort people into those categories (Fagot & Leinbach 1993;
 330 Waxman 2010; Zosuls et al. 2009; Fausto-Sterling 2012; Bussey & Bandura 1999;
 331 O’Brien et al. 2000; Welch-Ross & Schmidt 1996). At this point in development,
 332 (at least) two gender categories are present but not enough input has been received
 333 to develop a consistent rubric for evaluating the massive variation present in the
 334 population. For instance, children may be able to use the proper pronouns for com-
 335 mon and canonically gendered referents (e.g., “mommies” and “daddies”) but fail to
 336 generalize identification criteria to novel referents that deviate in one or more ways
 337 (e.g., men with long hair, women wearing collared shirts) (Fagot & Leinbach 1993;
 338 Taylor & J. A. Hall 1982; Ansara & Hegarty 2013; Armann & Bülthoff 2012). This
 339 may indicate that gender categories are developed and refined by repeated expo-
 340 sure to exemplars and top-down societal reinforcement. The acquisition of gender
 341 category labels could conceivably support the acquisition of the conceptual cate-
 342 gories. I am unaware of any cross-linguistic differences in age of acquisition of
 343 gender categories, but should such differences exist, this would support my claim
 344 that linguistic labels feed into non-linguistic categorization behaviors.

345 **2.3 Biosocial gender**

346 *Biosocial gender* is, fundamentally, an individual’s gender as it is experienced in-
 347 ternally. In addressing this type of gender, a few terminological clarifications are
 348 necessary. I will assert a distinction between sex and gender, which are widely
 349 confounded terms in linguistics and psychology (Ansara & Hegarty 2013; Cheshire
 350 2002). Herein, *sex* refers to biological properties such as karyotype (XX, XY, etc.)
 351 and phenotype (e.g., internal and external anatomy, circulating hormonal milieu).
 352 Even in biological terms, sex is not a binary property since the physical traits con-
 353 tributing to an organism’s sex can vary along multiple dimensions. As an example

354 of an edge case, people with Complete Androgen Insensitivity Syndrome (CAIS)
355 may have XY chromosomes but a predominantly female phenotype (e.g., [Hughes
356 et al. 2012](#)). However, sex is still often used as a shorthand for distinguishing the
357 bimodal nature of the male-female spectrum ([J. L. Johnson & Repta 2012](#); [Lorber
358 1996](#)).

359 This definition of sex overlaps with biosocial gender. More precisely, bioso-
360 cial gender is the multidimensional property of an individual as determined by their
361 biology and cultural norms of identity expression. What distinguishes biosocial
362 gender from other types of gender is that, as an external observer, one's accuracy
363 of categorization is impossible to assess without input from the individual's intro-
364 spection and medical history. That is, biosocial gender may not be something that
365 can be doubtlessly determined without detailed anthropological, introspective and
366 potentially invasive medical analyses. This is because social pressures and soci-
367 etal norms can contribute to an individual representing themselves in a way that is
368 inconsistent with the way they categorize themselves ([Fausto-Sterling 2012](#); [Ansara
369 & Hegarty 2013](#); [Zimman 2017](#)). One clear illustration is the case of transgender
370 people who are "in the closet" or otherwise representing themselves as the binary
371 gender category to which they were assigned at birth, despite not identifying as
372 this gender. Here, an individual's biosocial gender might be in direct conflict with
373 the gender with which other people would categorize them, that is, the conceptual
374 gender other people attribute to them.

375 Our present understanding of gender suggests that the majority of people have
376 a gender identity that fall into a bimodal distribution of biosocial genders (0.4% of
377 respondents in a UK survey reported thinking of themselves as a way other than
378 'male' or 'female'; [Glen & Hurrell 2012](#)). But many individuals do not categorize
379 themselves with a discrete binary label, and it would do the science and the indi-
380 viduals a disservice to gloss over the often subtle and diverse variations in gender
381 identity present in the population at large, even within male and female categories
382 ([J. L. Johnson & Repta 2012](#)). Despite the potential complications in identifying the
383 precise biosocial gender of an individual, it is still an important factor for phenom-
384 ena involving social identity and certain physiology relevant to linguistic processes
385 such as auditory brainstem responses ([Liu et al. 2017](#)). It can affect perception of
386 in-group versus out-group, indexical properties of speech properties, and mental,
387 emotional, and social well-being outcomes ([Zimman 2017](#); [K. Johnson et al. 2019](#);
388 [Rubin & Greene 1991](#)). Therefore, it is important to explicitly define biosocial gen-
389 der as distinct to ensure it is not confounded during investigation of phenomena
390 associated with either grammatical- or conceptual- genders.

3 Further evidence for distinguishing gender types

3.1 Personal names as antecedents

Personal names comprise a large portion of antecedents used in empirical investigations and syntactic judgments of English coreference, presumably due to their intuitive gender-specificity, although this has been identified as an issue in stimulus design (Gabriel et al. 2008; Kasof 1993; Merritt & Kok 1995; Van Fleet & Atwater 1997; Lieberman, Dumais & Baumann 2000). However, English lacks overt morphological marking on names to unambiguously distinguish a correct assessment of the gender identity of the referent, where a ‘correct assessment’ would result in a conceptual gender that is congruent with the referent’s gender identity. A clear example of this problem is illustrated in (6-a), in which the two given pronouns can corefer with the name equally well in the absence of disambiguating context (such as whether the Taylor in question is Taylor Swift, a woman, or Taylor Lautner, a man. As for Taylor Mason, a nonbinary character played by the nonbinary actor Asia Kate Dillon, (6-b) is the appropriate construction (Dillon 2017), although the processing cost and intuitive acceptability of this linguistic structure, in terms of linguistic judgments, is currently a subject of investigation and may vary in reported ‘acceptability’ (Ackerman 2018; Conrod 2018; Konnelly & Cowper 2017; Prasad, Morris & Feinstein 2018).

- (6) a. On the red carpet, Taylor_i’s fans screamed to get [his_i/her_i] attention.
 b. On the red carpet, Taylor_i’s fans screamed to get [their_i] attention.

One possibility is that the name *Taylor* is stored in the lexicon as discrete entries (e.g., Taylor_{<masc>}, Taylor_{<fem>}). The possibility of the lexicon containing Taylor_{<nonbinary>} is a logical possibility but cannot be discussed in much more detail at this point without introducing speculation because of the current dearth of empirical studies on nonbinary gender perception and its influence on lexical categories. If we consider the two binary grammatical genders, a comprehender may retrieve one of the two entries initially, but have to revise the selection if conflicting information is received at a later time during comprehension. The presence of different lexical entries for each string-identical name, each with a distinct valuation of a gender ϕ -feature, makes testable predictions regarding the learning and application of new lexical entries. One can quickly learn a new name or a new use of a common name, but if extensive previous experience with a common name (e.g., Michael_{<masc>}) influences the processing of a newly encountered and rare version of the name (Michael_{<fem>}), this might be observable in behavioral or psychophysical measures. If this is the case, it would need to be determined how names most often used by nonbinary people are stored in the lexicon, and if these entries are

428 associated with a specifically nonbinary feature or another configuration of gram-
429 matical gender. If names are stored generically with some gender label determined
430 by stereotypicality or statistical probability, then by familiarizing a naïve partici-
431 pant to an uncommon or novel pairing between a name and gender (e.g., a woman
432 named Michael or a boy named Sue), there should still be a detectable processing
433 cost to forming a coreference dependency between the pronoun and name. How-
434 ever, if names instead receive gendered properties from domain-general or world
435 knowledge, then retrieval of the uncommon entry should be facilitated more by the
436 context and less processing cost should be observed (Pyykkönen, Hyönä & van
437 Gompel 2010). See Cai et al. (2017) for examples of how long- and short-term
438 learning can be tested.

439 Another possibility is that “unisex” or names which are not strongly associated
440 with a particular gender category are morpho-syntactically underspecified for gen-
441 der (e.g., Taylor_{<0>}), and whatever gender assumptions are made about the referent
442 are done so without reference to the lexicon or morphosyntactic features. However,
443 it is not immediately clear what the implications of this configuration would be or
444 how this could be tested. At the very least, it would be necessary to conduct ex-
445 tensive evaluation of each individual participant’s experience with the target names
446 and gender nonconformity and examine effects from the perspective individual dif-
447 ferences (Lieberson, Dumais & Baumann 2000; Van Fleet & Atwater 1997; Barry
448 & Harper 1982; 1993; 2014).

449 **3.2 English as a leader of change**

450 More than just a language of convenience, English has certain properties that allow
451 dissociation of the three proposed types of gender. English marks gender (broadly
452 construed) on its third person pronouns (*she*, *he*), but it does not have consistently
453 overt or productive morphological agreement for gender. Numerous studies demon-
454 strate strong gender biases of certain noun phrases (e.g., *surgeon*, *pilot*, *nurse*,
455 *babysitter*), but these are defeasible which indicates the biases are tied to concep-
456 tual gender rather than grammatical gender (Kennison & Trofe 2003; Duffy & Keir
457 2004; Pyykkönen, Hyönä & van Gompel 2010; Garnham, Oakhill & Reynolds
458 2002; Kreiner, Sturt & Garrod 2008). Furthermore, English has some remnants of
459 gendered morphology (*actor/actress*, *aviator/aviatrix*) and definitionally gendered
460 nouns (*mother*, *father*, *cowgirl*, *bellboy*). It is conceivable that the morphologically
461 gender-marked words *do* have grammatical gender. At least those marked as *<fem>*
462 are the most likely to have retained grammatical gender in English, as those are
463 distinctly non-default and definitional. As for the definitionally gendered words, I
464 have already demonstrated that it is possible to find contexts where the gender is

465 defeasible. This suggests that these words are not grammatically gendered, or at
466 least the relevant type of gender is conceptual gender and not grammatical gender.

467 Finally, in cultural terms, English has been at the international forefront of in-
468 formal, community-based development of nonbinary language and so-called “neo-
469 pronouns” (e.g., Spivak pronouns introduced by Spivak (1990: xv), gender vari-
470 ant neologisms described in Centauri (2013); Hord (2016); Bradley et al. (2019),
471 a.o.). The combination of linguistic innovation, on-going sociological research, and
472 prominence of media exposure makes the English language uniquely situated (in the
473 present moment) to development and linguistic change regarding gender categories
474 inclusive of nonbinary gender(s) and gender neutrality (Page 2013; Brutt-Griffler &
475 Kim 2018).

476 **3.3 Other gender paradigms**

477 Many cultures around the world have established and traditional nonbinary, queer,
478 and third-gender categories. Navajo people called *nádleehí* are traditionally charac-
479 terized as participating in gendered behaviors of the “opposite sex” (Epple 1998).
480 However, the Western concepts of being ‘transgender’, ‘queer’, or ‘homosexual’
481 do not quite capture the Navajo cultural concept. To this end, the terms ‘alternate
482 gender’ and ‘two spirit’ have been used to describe *nádleehí*. While these cul-
483 tural concepts seem to provide potential for investigating concepts of gender cat-
484 egories and language, the Navajo language does not mark grammatical gender on
485 human pronouns. Furthermore, the strategy for speaking about *nádleehí* in English
486 is to use standard binary pronouns in a similar manner to how binary transmen and
487 transwomen use English pronouns, and “not neuter pronouns or pronouns specific
488 to *nádleehí*” (Epple 1998: 279).

489 This seems to be very similar to how Māori culture and language encodes gen-
490 der outside of the binary (Murray 2003). The terms *whakawāhine* and *whakatāne*
491 are “terms which translate roughly to ‘becoming’ or ‘making’ woman or man, in-
492 dicating a transcendent or permeable gendered identification” (Murray 2003: 240).
493 However, as in Navajo, Māori grammatical gender does not distinguish conceptual
494 gender on pronouns.

495 The *hijras* of India are similarly difficult to quantify in Western terms, consider-
496 ing themselves to be “‘deficiently’ masculine and ‘incompletely’ feminine” (K. Hall
497 & O’Donovan 1996: 229). Linguistically, they use the grammatical (and concep-
498 tual) gender system of Hindi to express their relationship to their gender identities
499 and their affiliation to the community with a mix of grammatical gender and fluid
500 interaction with binary gender roles.

501 Apparently few cultures speak languages that explicitly grammatically indicate
502 a nonbinary gender *on pronouns*. It appears that one potential exception to this is

503 Buginese, which has five genders which can correspond to five biosocial gender cat-
 504 egories that are defined culturally (Graham 2004). However, agreement is marked
 505 on the verb rather than a pronoun, for which further investigation is warranted. This
 506 property of Buginese may serve as a useful comparison to the ongoing language
 507 change in English as English incorporates and conventionalizes more nonstandard
 508 pronouns.

509 Generally, however, pronouns are likely to mark animacy as a ϕ -feature or
 510 when they do mark grammatical gender, nonbinary gender categories can be in-
 511 dicated through shifting use of standard binary gender agreement (e.g., K. Hall &
 512 O'Donovan 1996). Investigation of gender perception, category acquisition, and
 513 development in other cultural paradigms will bring crucial supplementary informa-
 514 tion to our understanding of how different types of gender are mentally represented
 515 and how they influence each other during linguistic and non-linguistic cognitive
 516 behaviors.

517 4 Gender in coreference resolution

518 Coreference resolution is said to compare the grammatical features of the anaphoric
 519 element and the candidate antecedent (Garnham, Oakhill & Reynolds 2002; Gar-
 520 nham & Oakhill 1990). Thus, there must be criteria for what counts as 'matching'
 521 or 'mismatching' in order for a coreference dependency to be resolved or rejected.
 522 In a case such as (1), restated below in (7), where coreference is resolvable but is
 523 not *a priori* congruent, one might expect the apparent mismatch in gender between
 524 *cowgirl* and *his* to create a processing slowdown in contexts that do not include
 525 clues or information about the referents ahead of time.

- 526 (7) a. # At the farmhouse, the cowgirl_i left his_i lasso in the kitchen.
 527 b. At the Halloween party, the cowgirl_i left his_i lasso in the kitchen.

528 In (7-a), without knowledge of the context, the conceptual gender of *the cowgirl*
 529 and *his* mismatch until a suitable alternative context is imagined. In (7-b), the con-
 530 text of a Halloween party (in which gender roles, expression, and possibly even
 531 conceptual categories are expected to be challenged) easily provides the alternative
 532 context. The difference, therefore, between (7-a) and (7-b) in terms of acceptability
 533 comes from the readers' ability to find a suitable situation in which the concep-
 534 tual genders match. However, the underlying mechanism for such a prediction is
 535 not transparently derivable from syntax-first models of real-time coreference reso-
 536 lution without incorporation of discourse-level knowledge. In what follows, I will
 537 set out and incrementally refine a criterion used to evaluate gender congruency in
 538 coreference resolution. A strict criterion for matching might look something like

539 this, loosely adapted from definitions of agreement by, e.g., Lasnik & Uriagereka
540 (1988); Carnie (2007); Payne & Huddleston (2002):

541 **Strict matching criterion:** Matching gender requires the formal grammatical fea-
542 ture (ϕ -feature) of the anaphor to be identical to the candidate antecedent.
543 If the features are not identical, the coreference dependency is rejected.

544 This strict version of a matching criterion can be rejected immediately because it
545 is insufficient to account for some common, well-described types of coreference.
546 Looking briefly at (7-b), *cowgirl* must either have no ϕ -feature for gender or the
547 ϕ -feature is <fem>, both of which necessarily mismatch with *him*<masc>. Another
548 example of how the strict matching criterion fails is when the antecedent is not ex-
549 plicitly or overtly present in the syntax, e.g., the ‘statue rule’ (Jackendoff 1992) and
550 “impostors” which are superficially 3rd person but conceptually 2nd or 1st (Collins
551 & Postal 2012), thus the ϕ -features do not directly match:

- 552 (8) a. Regarding a customer (Jackendoff 1992):
553 [The ham sandwich in the corner]_i needs his_i bill.
554 b. Spoken to a king (Collins & Postal 2012):
555 [Your majesty]_i must protect yourself_i/himself_i/*herself_i/*themselves_i.

556 Even still, in these cases of apparent feature mismatch, some formal level of rep-
557 resentation could contain formal features that can be checked during coreference
558 resolution, i.e. what Collins & Postal (2012) term a ‘source’. These formal features
559 could be located in either (or both) the semantic and syntactic representations, but
560 the strict definition can only account for the apparent gender mismatch in (7) if we
561 posit that a masculine ϕ -feature is attributed to *cowgirl* only after it is identified
562 as the candidate antecedent of *his*. In order to account for more data, a slightly
563 less strict criterion might be formulated as such, adapted for coreference processing
564 from Collins & Postal (2012: 182).⁷:

565 **Less strict matching criterion:** The act of resolving a coreference dependency re-
566 quires an identity relation between the ϕ -features of a pronoun and either
567 (a) ϕ -features of the antecedent, or (b) ϕ -features of the antecedent as de-
568 termined by the semantic properties of the notional ‘source’. If the features
569 are not identical, the coreference is rejected.

570 One reviewer noted that this less strict criterion might account for sentences like
571 in (9-a), where the source of *person*<0> could be *woman*<fem> is fairly acceptable
572 due to the reduction in ambiguity from the antecedent to its source (Foraker &

⁷ I have taken liberties in adapting this condition in order to present it in a relatively theory-agnostic manner.

573 McElree 2007). Compare this to (9-b), in which *woman*_{<fem>} could have a source
 574 of *person*_{<0>}, creating a noticeable reduction in acceptability, presumably because
 575 *woman* is a proper subset of *person* and thus increases ambiguity unnecessarily.

- 576 (9) a. One person_i said she_i lost her_i sunglasses.
 577 b. ? One woman_i said they_i lost their_i sunglasses.

578 Yet, this next formulation still might not quite cover the case of (7), where the con-
 579 ceptual gender of the antecedent *cowgirl* is female but the coreference between
 580 the masculine pronoun and the (female) antecedent is licit. That is, unless the
 581 sources is “man_{<masc>} [dressed as a cowgirl_{<fem>}]”, the source could easily also
 582 be “rancher_{<0>}” or “party-goer_{<0>}”, which cannot match as they do not have the
 583 <masc> feature, which would form an identity relationship with *his*_{<masc>}. Neither
 584 does this less strict criterion fully explain (8), in which the antecedents might or
 585 might not be interchangeable with sources that have matching gender ϕ -features
 586 (a: ✓ “The man_{<masc>}”, ✗ “The customer_{<0>}”; b: ✓ “The king_{<masc>}”, ✗ “The
 587 monarch_{<0>}”). This might be accounted for in two ways. First, there might be a
 588 way to override the feature checking criteria through modeling the parser as having
 589 earlier access to pragmatics and world knowledge, or second, the feature checking
 590 process has a broader criterion of what can count as matching. The latter could be
 591 formulated as such:

592 **Broad matching criterion:** Matching gender requires at least one level of the men-
 593 tal representation of gender to be identical to the candidate antecedent in order
 594 to match. A conceptual property might include a probabilistic representa-
 595 tion of the semantic set of possible referents, but also would be susceptible
 596 to environmental context, e.g., pragmatics, world knowledge, or discourse
 597 context (Cai et al. 2017; Arnold et al. 2018).

598 This final formulation can account for (7) as it directly references the conceptual
 599 gender of the referents. It can also account for some of the cross-linguistic variation
 600 observed in the literature (e.g., Comrie 2005). While one of the stricter formulations
 601 would be sufficient to account for data in some languages, the broad criterion allows
 602 for language-specific variation in strategy for checking gender matching, which can
 603 address language-internal variation and hypothetical change over time. This makes
 604 it both powerful and testable, as it still requires a parameter setting or a clearly defined
 605 discourse context and theory of gender categories. Languages with very strong
 606 or strict matching criteria would then find it difficult to have pragmatic context
 607 override the formal gender features of the anaphor which triggered the coreference
 608 dependency.

609 However, all of this assumes that languages that have formal gender features on
 610 anaphoric elements also have formal features that can be checked on the candidate
 611 antecedents. What then, would happen if the candidate antecedent didn't have a ϕ -
 612 feature in any instantiation? Would this cause a processing slowdown because the
 613 initial checking operation would automatically fail? If so, we should expect to see
 614 processing slowdowns for coreference dependencies which connect gender- unbi-
 615 ased or undefined antecedents and gender-specific anaphora as compared to coref-
 616 erence dependencies which connect gender-specific antecedents to gender-specific
 617 anaphora, (Cf. Foertsch & Gernsbacher 1997).

618 With this 'broad' matching criterion, I have shifted the formal problem of ty-
 619 pological variation from the process of checking for gender congruency to the type
 620 of gender that is checked. This is addressed by the three-tier model illustrated in 1,
 621 which provides a formal structure that languages and individuals can use to deter-
 622 mine gender congruency all using the same standardized criterion.

623 **4.1 Checking for congruency**

624 If formal morphosyntactic gender features are present in a language like English,
 625 but cannot be used to model how the parser checks for congruency in coreference
 626 dependency formation, what purpose do they serve? I will not argue for or against
 627 English having formal grammatical features for gender, but rather that such fea-
 628 tures are irrelevant during coreference dependency formation. Instead, English and
 629 languages with similar gender systems rely on conceptual gender for evaluating
 630 gender congruency in real time. In order to describe how such a system operates,
 631 a three-tiered scheme of linguistically and cognitively encoding gender is posited
 632 below.

633 The three tiers comprise an Exemplar Tier, a Category Tier, and a Feature Tier
 634 (Figure 1). These tiers are not meant to represent actual processing mechanisms or
 635 structures in the mind. Rather, they are abstract categories of processes or represen-
 636 tations that can be used to map behaviors and empirical observations to theoretical
 637 properties of grammars and other mental mechanisms and modules. Thus, each tier
 638 is designed to be as theory-agnostic as possible to provide the most utility across
 639 the various popular frameworks.

640 The first tier, the Exemplar Tier, is represented by a strongly bimodal contin-
 641 uum indicative of how biosocial gender and conceptual gender can vary within a
 642 population. Although only color and height vary in this diagram, one may imagine
 643 that this tier has many more dimensions that could align with variation in gender
 644 role, gender expression, and overt biosocial properties. The second tier, the Cate-
 645 gory Tier, comprises two discrete, non-overlapping spaces overlaid on the Exemplar
 646 Tier. These categorically distinct spaces represent the binary genders as might be

647 conceptualized by someone from a society that reinforces a strictly binary gender
 648 schema. However, even so, one might not be able to categorize all individuals into
 649 one of these spaces, so the gap between the categories allows for ambiguous, non-
 650 conforming, and ‘other’ instances to exist outside the binary. If the Exemplar Tier
 651 is, indeed, multidimensional beyond what can be represented on paper, I request
 652 that the reader accept that these two categories are not as simple as the rectangles
 653 depicted, and their apparent shapes simply due to the limitations of the medium.
 654 For instance, if one dimension encodes hair length as a gendered property of ap-
 655 pearance, then a man who otherwise fits all other stereotypically masculine traits
 656 but has long hair would align predominantly but not completely with the Cate-
 657 gory Tier’s binary (masculine) category. Finally, the third tier is the Feature Tier
 658 which, unlikely the previous two, comprises labels associated with spaces rather
 659 than spaces themselves. In this illustration, the labels are the grammatical features
 660 <fem> and <masc>, corresponding to a language that has two noun classes. A lan-
 661 guage with more noun classes (or fewer) would have a different configuration for
 662 the labels.

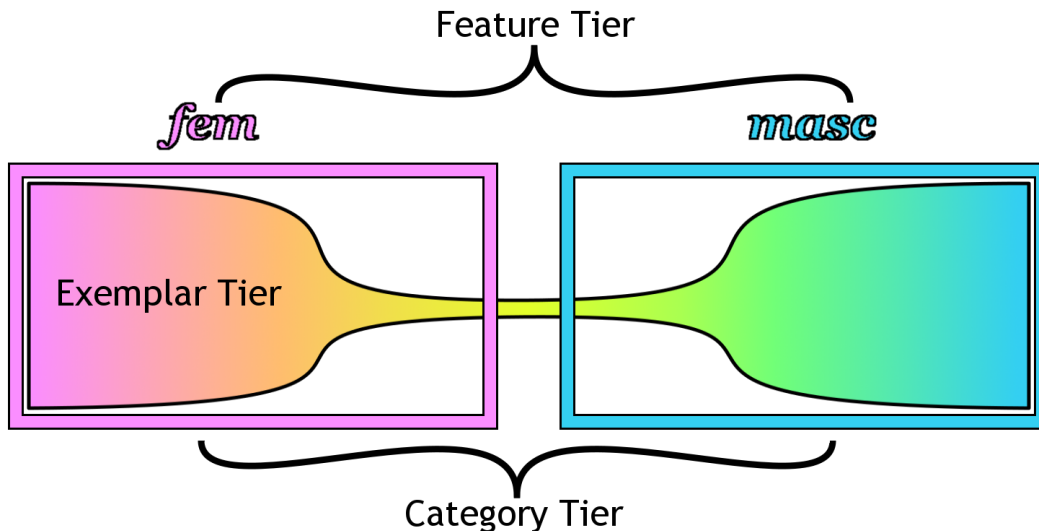


Figure 1: A schema depicting the three proposed tiers, overlaid.

663 **4.1.1 The Exemplar Tier**

664 The Exemplar Tier consists of observations from individual’s exposure to the vari-
 665 ety of observable gender expression. This may include tokens of phenotypic vari-
 666 ation, non-conformity of gender expression, and variation of cultural norms. Cru-
 667 cially, most individuals will be primarily exposed to other individuals who have

668 unambiguous binary gender expression, thus will have distinctly bimodal input
669 represented in this tier (Fagot & Leinbach 1993; Glen & Hurrell 2012). Individ-
670 uals who are members of or adjacent to non-conforming or nonbinary communities
671 may have a different distribution of input, especially if exposure occurs during early
672 acquisition of gender categories.

673 It cannot be that this tier includes the perceiver’s categorization of the gender
674 of the person which they interact with, because that requires a secondary (categor-
675 ical) behaviour that is crucially not a component of this tier. Instead, the tokens in
676 this tier might be conceptualized as matrices of perceived properties that are used
677 downstream to categorize the gender of the individual. For example, hair length and
678 style, face shape, pitch range of voice, clothing style, sociolinguistically marked
679 properties of speech, etc, could be dimensions of each token. These properties can
680 be used to categorize an individual’s gender (Fagot & Leinbach 1993; Ansara &
681 Hegarty 2013; Armann & Bülthoff 2012; Bussey & Bandura 1999; Fausto-Sterling
682 2012; Zimman 2017), but are not inherently properties of biosocial genders. Fur-
683 thermore, few of these properties are purely linguistic, so the parser will not interact
684 with the information stored in this tier. It therefore represents a way of organizing
685 general perceptual input about individuals who a person encounters and interacts
686 with throughout the lifespan.

687 **4.1.2 The Category Tier**

688 The Category Tier consists of categories that are established through cognitive pro-
689 cesses relying on bottom-up input from the Exemplar Tier and top-down informa-
690 tion from semantics (e.g., gender schema; Bem 1981; Fagot & Leinbach 1993;
691 Bussey & Bandura 1999; Zosuls et al. 2009; O’Brien et al. 2000). The categories
692 of gender encoded in this tier may shift if the distribution of input to the Exemplar
693 Tier changes. As an individual accumulates more exemplars over the lifespan, each
694 new token will comprise a smaller proportion of the total input, thus will have less
695 influence on the shape of the Category Tier. The way someone sorts individuals
696 into gender categories should take into account a subset of the dimensions cata-
697 logued in the Exemplar Tier. Whichever way an individual categorizes people into
698 genders and whatever information is used to make those determinations, the Cat-
699 egorary Tier holds coarse-grained information about the parameters of each gender
700 category. The structure and robustness of this tier relies on the assumption that gen-
701 der is most frequently perceived categorically (Fagot & Leinbach 1993; Armann &
702 Bülthoff 2012).

703 For example, this could manifest as recognition of variance in feminine gender
704 expression and what it means to “self-identify” as a gender (e.g., Zimman 2017).
705 However, humans are still eager to and adept at categorizing people with clearly

706 binary gender expressions into categories (leaving aside the accuracy or relevance
 707 of these categories) (Waxman 2010; Bussey & Bandura 1999). This suggests that
 708 the categorical perception of gender is complex and culturally specific. The details
 709 of this perceptual categorization process are beyond the scope of this paper. What
 710 remains relevant is that the boundaries of these categories may slightly differ be-
 711 tween individuals within a culture or society. Thus the boundaries may differ more
 712 between individuals belonging to different cultures or societies.

713 These categories are not strictly linguistic, but contribute to assessments of
 714 whether linguistic meanings are consistent or felicitous when concerning the gender
 715 of referents. For instance, when discussing a known person (who is, say, catego-
 716 rized by both interlocutors as *female*), it may be relevant for the comprehension
 717 mechanism to refer to the category when assessing the plausibility of statements
 718 (Prasad, Morris & Feinstein 2018; Kreiner, Sturt & Garrod 2008).

719 (10) Did that student_i email you her_i follow-up questions yet?

720 Imagine that the person who uttered (10) was a guest lecturer and doesn't know
 721 referenced the student personally. The guest lecturer told the student to email the
 722 regular lecturer with any questions and those questions would be forwarded on.
 723 Then, when the guest lecturer approaches the regular lecturer to ask about the status
 724 of the awaited email, the gender of the student is assumed based on visual and
 725 perhaps auditory cues. In this type of situation, the gender of the student may
 726 also be important for communicative efficiency if it potentially disambiguates the
 727 referent (Newman 1992; Foraker & McElree 2007).

728 The interaction of the Exemplar Tier and the Category Tier may generate and
 729 assign probabilities of genderedness to gender-biased (or equi-biased) lexical items,
 730 including names. In being exposed to instances of *surgeons* or *Michaels*, the tokens
 731 that have *surgeon* or the name *Michael* as a property fall predominantly into the
 732 male category. If this is the mechanism for generating gender stereotyping, then the
 733 stereotype would be accessed in one of several ways (that all have the same conse-
 734 quence): An aggregate of all *surgeon/Michael* tokens is assessed as a probability;
 735 an individual token of *surgeon* or *Michael* is evaluated for gender category (thus
 736 drawn at random from all tokens of *surgeon/Michael*); or the evaluation of gender
 737 is assessed at an earlier time and is a property that is rarely updated in the lexicon,
 738 independent of the content and structure of the Exemplar and Category tiers. Cru-
 739 cially, whatever the process for determining gender bias associated with a lexical
 740 item, its meaning, or gender plausibility, this information is stored separately from
 741 the grammatical information stored in the Feature Tier.

742 Speculatively, if an individual were to have a substantial proportion of their life-
 743 time experiences involving nonbinary people, we could assume that the distribution

744 of their personal Exemplar Tier would not be so bimodal as depicted in Figure 1.
 745 This might make the shapes of the Category Tier more complex, or possibly cre-
 746 ate discontinuous categories, categories with fuzzy boundaries and other categories
 747 besides those designating the masculine and feminine modes of the Exemplar Tier.

748 4.1.3 The Feature Tier

749 The Feature Tier consists of discrete ϕ -features or labels which may include *<fem-*
 750 *inine>* and *<masculine>*, among others. These labels can be mapped one-to-one
 751 onto the conceptual categories in the Category Tier, but need not be. During coref-
 752 erence resolution, whether or not the Feature Tier is used to determine gender con-
 753 gruency is graded from languages that rigidly rely on the Feature Tier for corefer-
 754 ence evaluation to languages without grammatical gender that do not map separate
 755 (grammatical) labels onto human gender categories (see [Corbett \(2015\)](#) for exam-
 756 ples).

757 This tier differs from the Category tier in that the ϕ -features are strictly linguis-
 758 tic and are formally encoded in the grammar of a language. That is, where the Cat-
 759 egory Tier concerns categorization of people and animate gendered referents based
 760 on social/cultural norms, the Feature Tier does not categorize anything: it consists
 761 of linguistic labels that are used in purely grammatical operations like agreement.
 762 These labels do not need to correspond to human gender (e.g. Bantu noun class sys-
 763 tems, etc.), and can apply to inanimate lexical items. Furthermore, they do not apply
 764 to the *referents* of the relevant lexical items, but to the lexical items (antecedents)
 765 themselves. For instance, languages that have strict gender agreement will ignore
 766 the conceptual gender of the referents (Category Tier) in using grammatical gender
 767 to satisfy agreement relations (Feature Tier). This is elaborated on in Section 4.2.

768 Together, these tiers are three levels at which the parser could assess gender
 769 congruency during coreference resolution. Once an anaphor is linked to a candidate
 770 antecedent, the parser may access one of the tiers to check gender congruency ([Sturt](#)
 771 [2003](#)). If the Feature Tier does not supply relevant formal features for both lexical
 772 items (e.g., if it supplies gender ϕ -features for pronouns but not unisex names or
 773 gender-stereotyped nouns in English, Cf. [Bjorkman \(2017\)](#)), it cannot compare like
 774 to like and an identity relationship will not be established. In this case, using the
 775 Category Tier as a holistic congruency assessment would be preferable because,
 776 presumably, any referring expression will be located in a category that can provide
 777 a property to be assessed against. Speculatively, if the Exemplar Tier were to have
 778 a third mode (e.g., a nonbinary human gender), this might affect the structure of the
 779 other tiers and provide organic support for the genesis of novel personal pronouns
 780 (e.g., [Centauro 2013](#)). That is, the space depicted between the two categories is
 781 present to suggest that ambiguous or distinctly nonbinary tokens in the Exemplar

782 Tier can be accommodated by this model. The presence or increased prominence
 783 of these sorts of tokens may lead the structure of the categories to adapt and de-
 784 velop a new categorical space, which may then provide a distinct space for a novel
 785 (grammatical gender) label to designate.

786 **4.2 Typological evidence**

787 Together, these tiers describe three levels of encoding of gender, broadly construed,
 788 that a language (or an individual) may draw upon in order to determine the gender
 789 congruency of an anaphor and candidate antecedent during real-time coreference
 790 resolution. In (11), I describe three possible configurations of languages based on
 791 the broad criterion and the three tiers of mental representation of gender. These
 792 three configurations are points within a hierarchy of how rigidly a language (or
 793 individual) adheres to matching the gender encoded on the Feature Tier to assess
 794 gender congruency. While I list languages as examples of these points in the hier-
 795 archy, I also suggest that individuals may vary within what an individual language
 796 permits. That is, a speaker of French who finds any mixed agreement to be unac-
 797 ceptable would be applying the description of a Strict feature rather than where I
 798 have categorized French on the whole (Mixed feature).

799 (11) **Strict matching strategy:** Languages with no exception to grammatical
 800 gender agreement which access only the Feature Tier during corefer-
 801 ence resolution. (e.g., Tsez, possibly German)

802 **Mixed matching strategy:** Languages with grammatical gender (to any
 803 extent) will start with the Feature Tier, but draw on the Category Tier
 804 in certain specific contexts, such as when the Feature Tier is incongru-
 805 ent with referent's conceptual gender. (e.g., Russian, possibly French)

806 **Absent matching strategy:** Languages without grammatical gender do
 807 not have labels in the Feature Tier to be checked, so they must make
 808 use of the Category Tier where gender plausibility and discourse con-
 809 text is concerned. (e.g., Turkish, possibly English)

810 Tsez exemplifies a strict matching strategy, with (2) demonstrating a rigid grammat-
 811 ical gender system for anthropomorphic animals and other noun phrases (Comrie
 812 2005; Corbett 2015). Thus, no matter what the conceptual genders of the characters
 813 in the story are, the agreement is consistent with the morphosyntactic features of
 814 the lexical items. This may also be the case for some speakers of French for whom
 815 *maire* is necessarily <masc> and *mair^{ess}* (mayor<fem>) is a viable alternative. While
 816 I am being careful to avoid a neo-Whorfian claim that language shapes or limits our
 817 thought, I think it is reasonable to posit that the categories present in one language

818 and not in another could draw attention to different non-linguistic properties of the
 819 members of those categories, thus creating subtle distinctions in the boundaries and
 820 shape of the categories. In this way, we might explain how grammatical gender
 821 can limit conceptual gender in practical translation without necessarily claiming
 822 that German speakers think toads are necessarily feminine [Konishi \(1993\)](#); [Irmen](#)
 823 [& Kurovskaja \(2010\)](#). Languages with intermediate strategies like French and Rus-
 824 sian would then show some mixed properties wherein formal features are checked
 825 during coreference resolution, but may be overridden given contextually appropri-
 826 ate information ([Asarina 2011](#); [2009](#)). Moreover, languages without grammatical
 827 gender would then rely entirely on the conceptual categorization of the antecedent
 828 to evaluate coreference feasibility.

829 (12) Agreement patterns in Russian where *vrač* (*m*) refers to a woman (%=marked
 830 in certain registers) ([Asarina 2009](#))

- 831 a. Umnaja vrach prishla
 smart.FEM doctor(I) came.FEM
- 832 b. %Umnyj vrach prishel
 smart.MASC doctor(I) came.MASC
- 833 c. %Umnyj vrach prishla
 smart.MASC doctor(I) came.FEM
- 834 d. *Umnaja vrach prishel
 smart.FEM doctor(I) came.MASC
- 835 ‘The smart [female] doctor has come.’

836 Where does English fit into this hierarchy? As it has been claimed that English
 837 no longer has grammatical gender (except, possibly on pronouns) ([Baron 1971](#)),
 838 it might be an absent feature language. However, [Bjorkman \(2017\)](#) suggests that
 839 English does have limited use of grammatical gender agreement, particularly when
 840 referring to named individuals. If so, we might expect such cases to elicit psy-
 841 cholinguistic/cognitive behaviors that are similar to those observed in languages
 842 that make use of the Feature Tier. However, testing this is made difficult by the lim-
 843 ited circumstances in which English could have grammatical gender. The potential
 844 environments for detecting grammatical gender in English are largely overlapping
 845 with environments where conceptual gender (as determined by the Category Tier)
 846 could be an alternative source for checking during coreference resolution. That
 847 is, words that could have formal gender features (as [Bjorkman](#) suggests, personal
 848 names) should also typically receive a gender property from the cognitive gender
 849 of the referent, encoded in the Category Tier.

5 Future directions and conclusions

There are myriad ways to test the hypotheses described in this paper. It is my hope that readers will be inspired to use this as a starting point for investigating this relatively new line of research into the links between cognition of gender (as a gradient, nonbinary property) and how gender is encoded linguistically. If definitionally gendered nouns or personal names have formal grammatical gender in English, then there should be a failure in coreference resolution for the link between *cowgirl*_{<fem>} and *his*_{<masc>} in (1)/(7), or *Johnathan*_{<masc>} and *their*_{<0>} in (3). At this stage of processing, the parser may need to draw upon the Category Tier (rather than Feature Tier, as it may have originally attempted). This could presumably cause a processing slowdown or electrophysiological effect comparable to one that might be observed for a plausibility mismatch.

Since the anaphor in (1)/(7) is also definitionally masculine/male, in conjunction with the pragmatic context (a Halloween party, in which costumes allow people some flexibility in identity performance), the parser may reassign the gender of the lexical item *cowgirl* in a process similar to that of impostor anaphora (Collins & Postal 2012). This should be detectable in behavioral and psychophysiological measures (e.g., Nieuwland & Van Berkum 2006; Kuperberg et al. 2003; Canal, Garnham & Oakhill 2015). However, the tiered schema I propose predicts that individuals who have extensive exposure to third genders or gender nonconforming communities will have differently shaped exemplar distributions, thus also differently shaped category tiers. If the category tier is shaped in such a way that the boundaries between gender categories are overlapping or ‘fuzzy’, this may ease the processing cost of reanalysis.

The three types of gender distinguished in this proposal comprise a model for exposure to variance in gender expression, cognition, and linguistic encoding. The model is designed to be broadly applicable and testable across interfaces of linguistic, cognitive, psychological and sociological work. I describe some applications of the model to psycholinguistic topics and suggest future directions for development. Since forays into research on nonbinary gender are few and recent, the three-tiered model is intended to lead to better informed hypotheses about individual variation related to gender, language processing, and experience. Moreover, nonbinary people often suffer social stigma for their gender identities (McLemore 2015; K. Johnson et al. 2019). This puts empirical studies touching on nonbinary issues in a position to set the standard for ethical and compassionate research on and in conjunction with nonbinary people. This paper provides a set of terminology and the beginnings of a framework from which formal, empirical, and experimental linguistic research on nonbinary issues can grow, while incorporating the varied experiences of the people directly affected by it.

889 Abbreviations

890 <MASC> = masculine ϕ -feature, <FEM> = feminine ϕ -feature, <0> = no gender
 891 ϕ -feature, I = declension class I, III = noun class III, APUD = location near, COND
 892 = conditional, CVB = converb, ERG = ergative, IMP = imperative, INF = infinitive,
 893 NEUT = neuter, NEG = negative, PAST = past, PRES = present, PREP = prepositional,
 894 QUOT = quotative, UNW = unwitnessed

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896 Competing interests

897 The author has no competing interests to declare.

898 References

- 899 Ackerman, Lauren. 2018. Being themselves: processing and resolution of singular
 900 (im)personal they. In *The 31st CUNY Conference on Human Sentence Process-*
 901 *ing*. osf.io/qba7d.
- 902 Ansara, Y Gavriel & Peter Hegarty. 2013. Misgendering in english language con-
 903 texts: applying non-cisgenderist methods to feminist research. *International*
 904 *Journal of Multiple Research Approaches* 7(2). 160–177. [http://dx.doi.org/](http://dx.doi.org/10.5172/mra.2013.7.2.160)
 905 [10.5172/mra.2013.7.2.160](http://dx.doi.org/10.5172/mra.2013.7.2.160).
- 906 Armann, Regine & Isabelle Bühlhoff. 2012. Male and female faces are only per-
 907 ceived categorically when linked to familiar identities—and when in doubt, he is
 908 a male. *Vision research* 63. 69–80. [http://dx.doi.org/10.1016/j.visres.2012.05.](http://dx.doi.org/10.1016/j.visres.2012.05.005)
 909 [005](http://dx.doi.org/10.1016/j.visres.2012.05.005).
- 910 Arnold, Jennifer E, Iris M Strangmann, Heeju Hwang, Sandra Zerkle & Rebecca
 911 Nappa. 2018. Linguistic experience affects pronoun interpretation. *Journal of*
 912 *Memory and Language* 102. 41–54. [http://dx.doi.org/10.1016/j.jml.2018.05.](http://dx.doi.org/10.1016/j.jml.2018.05.002)
 913 [002](http://dx.doi.org/10.1016/j.jml.2018.05.002).
- 914 Asarina, Alevtina. 2009. Gender and adjective agreement in Russian. In *The 4th*
 915 *Annual Meeting of the Slavic Linguistics Society*. Zadar, Croatia.
- 916 Asarina, Alevtina. 2011. *Case in Uyghur and beyond*. Massachusetts Institute of
 917 Technology dissertation.
- 918 Baron, Naomi S. 1971. A reanalysis of English grammatical gender. *Lingua* 27.
 919 113–140. [http://dx.doi.org/10.1016/0024-3841\(71\)90082-9](http://dx.doi.org/10.1016/0024-3841(71)90082-9).
- 920 Barry, Herbert & Aylene S Harper. 1982. Evolution of unisex names. *Names* 30(1).
 921 15–22. <http://dx.doi.org/10.1179/nam.1982.30.1.15>.

- 922 Barry, Herbert & Aylene S Harper. 1993. Feminization of unisex names from 1960
923 to 1990. *Names* 41(4). 228–238. <http://dx.doi.org/10.1179/nam.1993.41.4.228>.
- 924 Barry, Herbert & Aylene S Harper. 2014. Unisex names for babies born in pennsyl-
925 vania 1990–2010. *Names* 62(1). 13–22. [http://dx.doi.org/10.1179/0027773813Z.
926 00000000060](http://dx.doi.org/10.1179/0027773813Z.00000000060).
- 927 Bem, Sandra Lipsitz. 1981. Gender schema theory: a cognitive account of sex typ-
928 ing. *Psychological Review* 88(4). 354–364. [http://dx.doi.org/10.1037/0033-
929 295X.88.4.354](http://dx.doi.org/10.1037/0033-295X.88.4.354).
- 930 Bjorkman, Bronwyn M. 2017. Singular they and the syntactic representation of
931 gender in english. *Glossa: A Journal of General Linguistics* 2(1). [http://dx.doi.
932 org/10.5334/gjgl.374](http://dx.doi.org/10.5334/gjgl.374).
- 933 Bradley, Evan D, Julia Salkind, Ally Moore & Sofi Teitsort. 2019. Singular ‘they’
934 and novel pronouns: gender-neutral, nonbinary, or both? *Proceedings of the Lin-
935 guistic Society of America* 4(1). 36:1–7. [http://dx.doi.org/10.3765/plsa.v4i1.
936 4542](http://dx.doi.org/10.3765/plsa.v4i1.4542).
- 937 Brutt-Griffler, Janina & Sumi Kim. 2018. In their own voices: development of en-
938 glish as a gender-neutral language. *English Today* 34(1). 12–19. [http://dx.doi.
939 org/10.1017/S0266078417000372](http://dx.doi.org/10.1017/S0266078417000372).
- 940 Bussey, Kay & Albert Bandura. 1999. Social cognitive theory of gender develop-
941 ment and differentiation. *Psychological Review* 106(4). 676–713.
- 942 Cai, Zhenguang G, Rebecca A Gilbert, Matthew H Davis, M Gareth Gaskell, Lau-
943 ren Farrar, Sarah Adler & Jennifer M Rodd. 2017. Accent modulates access to
944 word meaning: evidence for a speaker-model account of spoken word recogni-
945 tion. *Cognitive Psychology* 98. 73–101. [http://dx.doi.org/10.1016/j.cogpsych.
946 2017.08.003](http://dx.doi.org/10.1016/j.cogpsych.2017.08.003).
- 947 Canal, Paolo, Alan Garnham & Jane Oakhill. 2015. Beyond gender stereotypes in
948 language comprehension: self sex-role descriptions affect the brain’s potentials
949 associated with agreement processing. *Frontiers in Psychology* 6:1953. [http:
950 //dx.doi.org/10.3389/fpsyg.2015.01953](http://dx.doi.org/10.3389/fpsyg.2015.01953).
- 951 Carnie, Andrew. 2007. *Syntax: a generative introduction*. Wiley-Blackwell.
- 952 Centauri, Widow. 2013. *Gender variant neologisms*. San Diego State University
953 dissertation. <http://dx.doi.org/10211.10/4199>.
- 954 Cheshire, Jenny. 2002. The Handbook of Language Variation and Change. In: J. K.
955 Chambers, Peter Trudgill & Natalie Schilling-Estes (eds.). Blackwell Publish-
956 ing Ltd. Chap. Sex and gender in variationist research, 423–443. [http://dx.doi.
957 org/10.1002/9780470756591.ch17](http://dx.doi.org/10.1002/9780470756591.ch17).
- 958 Collins, Chris & Paul Martin Postal. 2012. *Imposters: a study of pronominal agree-
959 ment*. MIT Press.

- 960 Comrie, Bernard. 1999. Grammatical gender systems: a linguist's assessment. *Journal of Psycholinguistic Research* 28(5). 457–466. <http://dx.doi.org/10.1023/A:1023212225540>.
- 961
- 962
- 963 Comrie, Bernard. 2005. Grammatical gender and personification. In *Perspectives on language and language development*, 105–114. Springer.
- 964
- 965 Conrod, Kirby. 2018. Pronouns in motion. In *Lavender Linguistics 2018 (LavLang)*. Providence, RI.
- 966
- 967 Corbett, Greville. 1991. *Gender (Cambridge Textbooks in Linguistics)*. Cambridge University Press.
- 968
- 969 Corbett, Greville. 2015. *The expression of gender*. Vol. 6. Walter de Gruyter.
- 970 Dillon, Asia Kate. 2017. *As It Happens: CBC Radio*. Interview with Carol Off.
- 971 Duffy, Susan A & Jessica A Keir. 2004. Violating stereotypes: eye movements and comprehension processes when text conflicts with world knowledge. *Memory & Cognition* 32(4). 551–559. <http://dx.doi.org/10.3758/BF03195846>.
- 972
- 973
- 974 Eckert, Penelope. 2014. The problem with binaries: coding for gender and sexuality. *Language and Linguistics Compass* 8(11). 529–535. <http://dx.doi.org/10.1111/lnc3.12113>.
- 975
- 976
- 977 Epple, Carolyn. 1998. Coming to terms with Navajo Nádleeh: a critique of “berdache,” “gay,” “alternate gender,” and “two-spirit”. *American Ethnologist* 25(2). 267–290. <http://dx.doi.org/10.1525/ae.1998.25.2.267>. <http://www.jstor.org/stable/646695>.
- 978
- 979
- 980
- 981 Fagot, Beverly I & Mary D Leinbach. 1993. Gender-role development in young children: from discrimination to labeling. *Developmental Review* 13(2). 205–224. <http://dx.doi.org/10.1006/drev.1993.1009>.
- 982
- 983
- 984 Fausto-Sterling, Anne. 2012. The dynamic development of gender variability. *Journal of homosexuality* 59(3). 398–421.
- 985
- 986 Foertsch, Julie & Morton Ann Gernsbacher. 1997. In search of gender neutrality: is singular they a cognitively efficient substitute for generic he? *Psychological Science* 8(2). 106–111. <http://dx.doi.org/10.1111/j.1467-9280.1997.tb00691.x>.
- 987
- 988
- 989 Foraker, Stephani & Brian McElree. 2007. The role of prominence in pronoun resolution: active versus passive representations. *Journal of Memory and Language* 56. 357–383. <http://dx.doi.org/10.1016/j.jml.2006.07.004>.
- 990
- 991
- 992 Frazier, Michael, Lauren Ackerman, Peter Baumann, David Potter & Masaya Yoshida. 2015. Wh-filler-gap dependency formation guides reflexive antecedent search. *Frontiers in Psychology* 6(1504). <http://dx.doi.org/10.3389/fpsyg.2015.01504>.
- 993
- 994
- 995 Gabriel, Ute, Pascal Gyax, Oriane Sarrasin, Alan Garnham & Jane Oakhill. 2008. Au pairs are rarely male: norms on the gender perception of role names across english, french, and german. *Behavior Research Methods* 40(1). 206–212. <http://dx.doi.org/10.3758/BRM.40.1.206>.
- 996
- 997
- 998

- 999 Garnham, Alan & Jane Oakhill. 1990. Mental models as contexts for interpreting
1000 texts: implications from studies of anaphora. *Journal of Semantics* 7(4). 379–
1001 393. <http://dx.doi.org/10.1093/jos/7.4.379>.
- 1002 Garnham, Alan, Jane Oakhill & David J Reynolds. 2002. Are inferences from
1003 stereotyped role names to characters' gender made elaboratively? *Memory &*
1004 *Cognition* 30(3). 439–446. <http://dx.doi.org/10.3758/BF03194944>.
- 1005 Garrod, Simon & Melody Terras. 2000. The contribution of lexical and situational
1006 knowledge to resolving discourse roles: bonding and resolution. *Journal of*
1007 *memory and language* 42(4). 526–544. [http://dx.doi.org/10.1006/jmla.1999.](http://dx.doi.org/10.1006/jmla.1999.2694)
1008 [2694](http://dx.doi.org/10.1006/jmla.1999.2694).
- 1009 Glen, Fiona & Karen Hurrell. 2012. *Technical note: measuring gender identity*.
1010 Tech. rep. Manchester: Equality & Human Rights Commission.
- 1011 Graham, Sharyn. 2004. It's like one of those puzzles: conceptualising gender among
1012 bugis. *Journal of Gender Studies* 13(2). 107–116. [http://dx.doi.org/10.1080/](http://dx.doi.org/10.1080/0958923042000217800)
1013 [0958923042000217800](http://dx.doi.org/10.1080/0958923042000217800).
- 1014 Gygax, Pascal, Ute Gabriel, Oriane Sarrasin, Jane Oakhill & Alan Garnham. 2008.
1015 Generically intended, but specifically interpreted: when beauticians, musicians,
1016 and mechanics are all men. *Language and Cognitive Processes* 23(3). 464–485.
1017 <http://dx.doi.org/10.1080/01690960701702035>.
- 1018 Hahn, Matthew W & R Alexander Bentley. 2003. Drift as a mechanism for cultural
1019 change: an example from baby names. *Proceedings of the Royal Society of Lon-*
1020 *don. Series B: Biological Sciences* 270(S1). S120–S123. [http://dx.doi.org/10.](http://dx.doi.org/10.1098/rsbl.2003.0045)
1021 [1098/rsbl.2003.0045](http://dx.doi.org/10.1098/rsbl.2003.0045).
- 1022 Hall, Kira & Veronica O'Donovan. 1996. Rethinking Language and Gender Re-
1023 search. In: Victoria Lee Bergvall (ed.). Longman. Chap. Shifting gender posi-
1024 tions among Hindi-speaking hijras. <http://dx.doi.org/10.13140/2.1.3369.3760>.
- 1025 Harley, Heidi & Elizabeth Ritter. 2002. Person and number in pronouns: a feature-
1026 geometric analysis. *Language* 78(3). 482–526. [http://dx.doi.org/10.1353/lan.](http://dx.doi.org/10.1353/lan.2002.0158)
1027 [2002.0158](http://dx.doi.org/10.1353/lan.2002.0158).
- 1028 Hess, David J, Donald J Foss & Patrick Carroll. 1995. Effects of global and local
1029 context on lexical processing during language comprehension. *Journal of Ex-*
1030 *perimental Psychology: General* 124(1). 62–82. [http://dx.doi.org/10.1037/](http://dx.doi.org/10.1037/0096-3445.124.1.62)
1031 [0096-3445.124.1.62](http://dx.doi.org/10.1037/0096-3445.124.1.62).
- 1032 Hord, Levi C R. 2016. Bucking the linguistic binary: gender neutral language in
1033 english, swedish, french, and german. *Western Papers in Linguistics/Cahiers*
1034 *linguistiques de Western* 3(1, Art 4). 1–29.
- 1035 Hughes, Ieuan A, John D Davies, Trevor I Bunch, Vickie Pasterski, Kiki Mastroy-
1036 annopoulou & Jane MacDougall. 2012. Androgen insensitivity syndrome. *The*
1037 *Lancet* 380(9851). 1419–1428. [http://dx.doi.org/10.1016/S0140-](http://dx.doi.org/10.1016/S0140-6736(12)60071-3)
1038 [6736\(12\)](http://dx.doi.org/10.1016/S0140-6736(12)60071-3)
[60071-3](http://dx.doi.org/10.1016/S0140-6736(12)60071-3).

- 1039 Irmen, Lisa & Julia Kurovskaja. 2010. On the semantic content of grammatical
1040 gender and its impact on the representation of human referents. *Experimental*
1041 *Psychology*. <http://dx.doi.org/10.1027/1618-3169/a000044>.
- 1042 Jackendoff, Ray. 1992. Mme. tussaud meets the binding theory. *Natural Language*
1043 *& Linguistic Theory* 10(1). 1–31. <http://dx.doi.org/10.1007/BF00135357>.
- 1044 Johnson, Joy L & Robin Repta. 2012. Designing and conducting gender, sex, and
1045 health research. In: John L. Oliffe & Lorraine Greaves (eds.). SAGE: Thousand
1046 Oaks, CA. Chap. Sex and gender, 17–37.
- 1047 Johnson, Kelly, Colette Auerswald, Allen J LeBlanc & Walter O Bockting. 2019.
1048 Invalidation experiences and protective factors among non-binary adolescents.
1049 *Journal of Adolescent Health* 64(2). S4. [http://dx.doi.org/10.1016/j.jadohealth.](http://dx.doi.org/10.1016/j.jadohealth.2018.10.021)
1050 [2018.10.021](http://dx.doi.org/10.1016/j.jadohealth.2018.10.021).
- 1051 Joseph, Brian D. 1979. On the agreement of reflexive forms in english. *Linguistics*
1052 17. 519–523.
- 1053 Kasof, Joseph. 1993. Sex bias in the naming of stimulus persons. *Psychological*
1054 *bulletin* 113(1). 140–163. <http://dx.doi.org/10.1037/0033-2909.113.1.140>.
- 1055 Kennison, Shelia M & Jessie L Trofe. 2003. Comprehending pronouns: a role for
1056 word-specific gender stereotype information. *Journal of Psycholinguistic Re-*
1057 *search* 32(3). 355–378. <http://dx.doi.org/10.1023/A:1023599719948>.
- 1058 Konishi, Toshi. 1993. The semantics of grammatical gender: a cross-cultural study.
1059 *Journal of Psycholinguistic Research* 22(5). 519–534. [http://dx.doi.org/10.](http://dx.doi.org/10.1007/BF01068252)
1060 [1007/BF01068252](http://dx.doi.org/10.1007/BF01068252).
- 1061 Konnelly, Lex & Elizabeth Cowper. 2017. The future is they: the morphosyntax of
1062 an english epicene pronoun. Ms., *University of Toronto*. [https://ling.auf.net/](https://ling.auf.net/lingbuzz/003859)
1063 [lingbuzz/003859](https://ling.auf.net/lingbuzz/003859).
- 1064 Kratzer, Angelika. 2009. Making a pronoun: fake indexicals as windows into the
1065 properties of pronouns. *Linguistic Inquiry* 40(2). 187–237. [http://dx.doi.org/10.](http://dx.doi.org/10.1162/ling.2009.40.2.187)
1066 [1162/ling.2009.40.2.187](http://dx.doi.org/10.1162/ling.2009.40.2.187).
- 1067 Kreiner, Hamutal, Patrick Sturt & Simon Garrod. 2008. Processing definitional
1068 and stereotypical gender in reference resolution: evidence from eye-movements.
1069 *Journal of Memory and Language* 58(2). 239–261. [http://dx.doi.org/10.1016/j.](http://dx.doi.org/10.1016/j.jml.2007.09.003)
1070 [jml.2007.09.003](http://dx.doi.org/10.1016/j.jml.2007.09.003).
- 1071 Kuperberg, Gina R, Tatiana Sitnikova, David Caplan & Phillip J Holcomb. 2003.
1072 Electrophysiological distinctions in processing conceptual relationships within
1073 simple sentences. *Cognitive Brain Research* 17(1). 117–129. [http://dx.doi.org/](http://dx.doi.org/10.1016/S0926-6410(03)00086-7)
1074 [10.1016/S0926-6410\(03\)00086-7](http://dx.doi.org/10.1016/S0926-6410(03)00086-7).
- 1075 Lasnik, Howard & Juan Uriagereka. 1988. *A course in GB syntax: lectures on bind-*
1076 *ing and empty categories*. MIT Press.

- 1077 Lieberon, Stanley, Susan Dumais & Shyon Baumann. 2000. The instability of an-
1078 drogynous names: the symbolic maintenance of gender boundaries. *American*
1079 *Journal of Sociology* 105(5). 1249–1287.
- 1080 Liu, Jinfeng, Dan Wang, Xiaoting Li & Ningyu Wang. 2017. Association between
1081 sex and speech auditory brainstem responses in adults, and relationship to sex
1082 hormone levels. *Medical Science Monitor: International Medical Journal of*
1083 *Experimental and Clinical Research* 23. 2275–2283. [http://dx.doi.org/10.](http://dx.doi.org/10.12659/MSM.904651)
1084 [12659/MSM.904651](http://dx.doi.org/10.12659/MSM.904651).
- 1085 Lorber, Judith. 1996. Beyond the binaries: depolarizing the categories of sex, sex-
1086 uality, and gender. *Sociological Inquiry* 66(2). 143–160. [http://dx.doi.org/10.](http://dx.doi.org/10.1111/j.1475-682X.1996.tb00214.x)
1087 [1111/j.1475-682X.1996.tb00214.x](http://dx.doi.org/10.1111/j.1475-682X.1996.tb00214.x).
- 1088 McConnell-Ginet, Sally. 2015. The Expression of Gender. In. Greville G. Corbett
1089 (ed.). De Gruyter Mouton Berlin. Chap. Gender and its relation to sex: the myth
1090 of ‘natural’ gender, 3–38.
- 1091 McLemore, Kevin A. 2015. Experiences with misgendering: identity misclassifica-
1092 tion of transgender spectrum individuals. *Self and Identity* 14(1). 51–74. [http:](http://dx.doi.org/10.1080/15298868.2014.950691)
1093 [//dx.doi.org/10.1080/15298868.2014.950691](http://dx.doi.org/10.1080/15298868.2014.950691).
- 1094 Merritt, Rebecca Davis & Cynthia J Kok. 1995. Attribution of gender to a gender-
1095 unspecified individual: an evaluation of the people= male hypothesis. *Sex Roles*
1096 33(3-4). 145–157. <http://dx.doi.org/10.1007/BF01544608>.
- 1097 Murray, David AB. 2003. Who is Takatapui? Maori language, sexuality and identity
1098 in Aotearoa/New Zealand. *Anthropologica* 42(2). 233–244. [http://dx.doi.org/](http://dx.doi.org/10.2307/25606143)
1099 [10.2307/25606143](http://dx.doi.org/10.2307/25606143).
- 1100 Newman, Michael. 1992. Pronominal disagreements: the stubborn problem of sin-
1101 gular epicene antecedents. *Language in Society* 21. 447–475. [http://dx.doi.org/](http://dx.doi.org/10.1017/S0047404500015529)
1102 [10.1017/S0047404500015529](http://dx.doi.org/10.1017/S0047404500015529).
- 1103 Nieuwland, Mante S & Jos JA Van Berkum. 2006. When peanuts fall in love: N400
1104 evidence for the power of discourse. *Journal of Cognitive Neuroscience* 18(7).
1105 1098–1111. <http://dx.doi.org/10.1162/jocn.2006.18.7.1098>.
- 1106 O’Brien, Marion, Vicki Peyton, Rashmita Mistry, Ludmila Hrudá, Anne Jacobs,
1107 Yvonne Caldera, Aletha Huston & Carolyn Roy. 2000. Gender-role cognition
1108 in three-year-old boys and girls. *Sex Roles* 42(11-12). 1007–1025. [http://dx.doi.](http://dx.doi.org/10.1023/A:100703660)
1109 [org/10.1023/A:100703660](http://dx.doi.org/10.1023/A:100703660).
- 1110 Page, Ann I. 2013. Shaping the english language – gender-neutral pronouns in EIL.
1111 *Thammasat Review* 16(3). 164–175.
- 1112 Payne, John & Rodney D Huddleston. 2002. The Cambridge Grammar of the En-
1113 glish Language. In. Rodney D Huddleston & Geoffrey Pullum (eds.). Cam-
1114 bridge, UK: Cambridge University Press. Chap. Nouns and noun phrases.
- 1115 Prasad, Grusha, Joanna Morris & Mark Feinstein. 2018. The P600 for singular
1116 ‘they’: how the brain reacts when John decides to treat themselves to sushi.

- 1117 In *The 31st CUNY Conference on Human Sentence Processing*. [https://osf.io/](https://osf.io/2vjyp/)
1118 [2vjyp/](https://osf.io/2vjyp/).
- 1119 Pyykkönen, Pirita, Jukka Hyönä & Roger PG van Gompel. 2010. Activating gender
1120 stereotypes during online spoken language processing. *Experimental Psychol-*
1121 *ogy* 57(2). 126–133. <http://dx.doi.org/10.1027/1618-3169/a000016>.
- 1122 Reynolds, David J, Alan Garnham & Jane Oakhill. 2006. Evidence of immediate
1123 activation of gender information from a social role name. *The Quarterly Journal*
1124 *of Experimental Psychology* 59(05). 886–903. [http://dx.doi.org/10.1080/](http://dx.doi.org/10.1080/02724980543000088)
1125 [02724980543000088](http://dx.doi.org/10.1080/02724980543000088).
- 1126 Ritter, Elizabeth. 1993. Where's gender? *Linguistic Inquiry* 24(4). 795–803.
- 1127 Rubin, Donald L & Kathryn L Greene. 1991. Effects of biological and psycho-
1128 logical gender, age cohort, and interviewer gender on attitudes toward gender-
1129 inclusive/exclusive language. *Sex Roles* 24(7/8). 391–412. [http://dx.doi.org/10.](http://dx.doi.org/10.1007/BF00289330)
1130 [1007/BF00289330](http://dx.doi.org/10.1007/BF00289330).
- 1131 Sanford, Anthony J. 1985. *Cognition and cognitive psychology*. New York: Basic
1132 Books, Inc.
- 1133 Schriefers, Herbert & Jörg D Jescheniak. 1999. Representation and processing of
1134 grammatical gender in language production: a review. *Journal of psycholinguis-*
1135 *tic research* 28(6). 575–600. <http://dx.doi.org/10.1023/A:1023264810403>.
- 1136 Shroy, Alyx J. 2016. Innovations in gender-neutral french: language practices of
1137 nonbinary french speakers on twitter. *Ms., University of California, Davis*.
- 1138 Spivak, Michael. 1990. *The Joy of TEX: a gourmet guide to typesetting with the*
1139 *AMS-TEX macro package*. American Mathematical Society.
- 1140 Sturt, Patrick. 2003. The time-course of the application of binding constraints in
1141 reference resolution. *Journal of Memory and Language* 48(3). 542–562. [http:](http://dx.doi.org/10.1016/S0749-596X(02)00536-3)
1142 [//dx.doi.org/10.1016/S0749-596X\(02\)00536-3](http://dx.doi.org/10.1016/S0749-596X(02)00536-3).
- 1143 Taylor, Marylee C & Judith A Hall. 1982. Psychological androgyny: theories, meth-
1144 ods, and conclusions. *Psychological bulletin* 92(2). 347–366. [http://dx.doi.org/](http://dx.doi.org/10.1037/0033-2909.92.2.347)
1145 [10.1037/0033-2909.92.2.347](http://dx.doi.org/10.1037/0033-2909.92.2.347).
- 1146 Van Fleet, David D & Leanne Atwater. 1997. Gender neutral names: don't be so
1147 sure! *Sex roles* 37(1-2). 111–123. <http://dx.doi.org/10.1023/A:102569690>.
- 1148 Waxman, Sandra R. 2010. Names will never hurt me? naming and the development
1149 of racial and gender categories in preschool-aged children. *European Journal of*
1150 *Social Psychology* 40(4). 593–610. <http://dx.doi.org/10.1002/ejsp.732>.
- 1151 Welch-Ross, Melissa K & Constance R Schmidt. 1996. Gender-schema develop-
1152 ment and children's constructive story memory: evidence for a developmental
1153 model. *Child Development* 67(3). 820–835. [http://dx.doi.org/0.1111/j.1467-](http://dx.doi.org/10.1111/j.1467-8624.1996.tb01766.x)
1154 [8624.1996.tb01766.x](http://dx.doi.org/10.1111/j.1467-8624.1996.tb01766.x).

- 1155 Wilson, Cecil Leigh. 2018. Can you be nonbinary in russian? *Slavic and East Eu-*
1156 *ropean Journal Blog*. [http://u.osu.edu/seej/2018/10/25/can-you-be-nonbinary-](http://u.osu.edu/seej/2018/10/25/can-you-be-nonbinary-in-russian/)
1157 [in-russian/](http://u.osu.edu/seej/2018/10/25/can-you-be-nonbinary-in-russian/).
- 1158 Zimman, Lal. 2017. Representing Trans: linguistic, legal and everyday perspectives.
1159 In. Evan Hazenberg & Miriam Meyerhoff (eds.). Wellington, New Zealand: Vic-
1160 toria University Press. Chap. Trans People's Linguistic Self-determination and
1161 the Dialogic Nature of Identity, 226–248.
- 1162 Zosuls, Kristina M, Diane N Ruble, Catherine S Tamis-LeMonda, Patrick E Shrout,
1163 Marc H Bornstein & Faith K Greulich. 2009. The acquisition of gender labels in
1164 infancy: implications for gender-typed play. *Developmental Psychology* 45(3).
1165 688–701. <http://dx.doi.org/10.1080/00918369.2012.653310>.