

Imprecision, personae, and pragmatic reasoning*

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Abstract Recent work at the interface of semantics and sociolinguistics showed that listeners reason about the semantic/pragmatic properties of linguistic utterances to draw social inferences about the speaker (Acton and Potts 2014; Beltrama 2018; Jeong 2021). These findings raise the question of how, conversely, social meanings impact the interpretation of semantic/pragmatic meanings. Using (im)precision as a case study, we investigate this question by exploring the effect of the **speaker persona** on the interpretation of numerals. We provide experimental evidence that (i) numerals receive stricter interpretations when uttered by **Nerdy** (vs. **Chill**) speakers; and that (ii) this effect is stronger for comprehenders who don't (strongly) identify with the speaker, suggesting that pragmatic reasoning is crucially shaped by social information about both the speaker and the comprehender. These findings suggest that different layers of meanings inform one another in a bi-directional fashion – i.e., semantic information can invite social inferences, and social information can guide meaning interpretation.

Keywords: imprecision, personae, social meaning, processing, experimental Pragmatics

1 Introduction

Linguistic forms carry information on (at least) two levels. On a *descriptive* level, they convey content about the world – a package of information typically resulting from integrating the logical meaning of the expression with a variety of contextual cues (e.g., conversational assumptions, prior discourse, world knowledge; Grice 1975; Horn 1984; Roberts 1996/2012 i.a.). On a *social* level, they convey content about the speakers – a constellation of demographic, relational, and ideological features constitutive of the identity and personality of the interlocutors, typically

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known as *soci(o-indexic)al meaning* (Labov 1966; Ochs 1992; Silverstein 2003; Eckert 2008; Campbell-Kibler 2011 i.a.).

While the study of these two layers of content has by-and-large proceeded on independent tracks in linguistics, it's long been suggested that a comprehensive understanding of meaning and communication requires paying attention to both of them, as well as their interaction (Silverstein 1985; Eckert 2019). This enterprise has been recently advanced by a growing body of work showing that social meanings can be conveyed by and inferred from (often very subtle) semantic and pragmatic properties of linguistic expressions. Such inferences have been linked to a variety of phenomena and expressions, including demonstratives (Acton & Potts 2014), intensifiers (Beltrama & Staum Casasanto 2017, 2021), determiners (Acton 2019), modals (Glass 2015; Karawani & Waldon 2017), exclusives (Thomas 2021) and particular types of speech acts (e.g., rising declaratives, Jeong 2021). Moreover, it's been suggested that, conversely, social information can impact interpretation at the semantic and pragmatic level, though this specific directionality of the link has been tested to a considerably lesser extent (see in particular Mahler 2020 on projective content.) Combined with other findings from the sociolinguistic literature, these results motivated the development of proposals aiming to capture the signaling and uptake of social meaning via frameworks similar to those used to formalize semantic and pragmatic content (e.g., Smith, Hall & Munson 2010; Acton 2019; Burnett 2019; Henderson 2019; see Beltrama 2020 for an overview).

In this paper, we advance our understanding of the interface between social and semantic dimensions of meaning by exploring these layers of content from a novel angle. Specifically, we ask: how does the speaker's social identity – and precisely, the *persona* that they embody in the conversational context – impact the interpretation a given form receives at the semantic and pragmatic level? We tackle this issue through the lens of (*im*)precision resolution – the computation of the margin of deviation from the literal meaning that can be tolerated in the interpretation of numerical expressions such as “The ticket costs \$300.” (Lasersohn 1999; see §2 for further details). Based on evidence from two picture selection experiments, we show that descriptions uttered by nerdy speakers, who are socially expected to speak more precisely, are taken to adhere to higher standards of precision than descriptions uttered by chill speakers. We additionally find that this effect is modulated by the social identity of the experimental participant whose interpretations of the experimental stimuli we measure. Taken together, these findings provide novel insights into the interplay of semantic-pragmatic and social content in communication, ultimately laying the groundwork for developing a new, more comprehensive perspective on the study of meaning in natural language.

The paper is organized as follows. §2 introduces our research questions in greater detail, presenting imprecision resolution as an ideal test case to illuminate these

issues; §3 reports on our experiment. §4 provides a general discussion. §5 concludes.

2 (Im)precision: at the intersection of meaning dimensions.

Numerals such as those in (1) present two distinctive properties.

- (1) a. The ticket costs \$300.
- b. It's 3 o' clock.

The first property is that, on a pragmatic level, their interpretation is *indeterminate*: although times or prices might be taken to denote specific and precise values, they can be routinely used in a way that doesn't fully adhere to their literal meaning – a phenomenon known as *imprecision* (Lewis 1979; Pinkal 1995; Lasersohn 1999; Syrett, Kennedy & Lidz 2009; Kennedy 2007; Solt 2014; Solt, Cummins & Palmovic 2017; Klecha 2014; Aparicio 2017). For instance, it's perfectly possible to imagine someone uttering (1-a) when the price is in fact \$295 or \$305, and still take the utterance to be felicitous (and, on some theories, true; see Solt 2014 for further discussion). As a result, when assigning an interpretation to these utterances, comprehenders need to make decisions about what constitutes an appropriate precision threshold, reasoning about the particular cues that are offered by the communicative setting to settle what price, time or other quantitative range can be appropriately described by the expression. While this process has been widely investigated in the semantic and pragmatic literature (see Dubois 1987; Lasersohn 1999; Van Der Henst, Carles & Sperber. 2002; Krifka 2007; Van Der Henst et al. 2002; Kennedy 2007; Syrett et al. 2009; Morzycki 2011; Leffel, Xiang & Kennedy 2016; Solt et al. 2017; Aparicio 2017; Klecha 2018; Beltrama & Hanink 2018; Thomas & Deo 2020; Beltrama 2021), the question remains open as to what sources of contextual information comprehenders recruit in the process, and how this information is incorporated into the process leading to settling on their final interpretation.

The second property is that the level of precision at which an utterance serves as a salient index of speaker features and qualities, and thus actively contributes to the emergence and circulation of social meaning. In particular, Beltrama (2018) and Beltrama, Solt & Burnett (2021) found that speakers describing events by means of sharp numbers (e.g., 49), which typically signal a higher precision level, are rated as more articulate, intelligent and educated, but also as more annoying and pedantic, than speakers using round numbers (e.g., 50), which typically signal a lower precision. Consistent results on the evaluation of sharp vs. round numbers are also found in the social psychology and marketing literature (Zhang & Schwarz 2011; Xie & Kronrod 2012; Mason, Lee, Wiley & Ames 2013; Pena-Marin & Bhargave 2016). More broadly, associations between precise speech and social features can be framed as part of a larger associative pattern between detail-orientedness in speech

and detail-orientedness as part of one's identity – as extensively pointed out in work on the *hyper-articulation* of sounds. For instance, Bucholtz (2001) suggests a principled link between the act of resisting the phonological pressure to simplify the realization of a phoneme and the practice of resisting assimilation to the crowd – an association that illuminates the central role of detail-orientedness for indexing personae such as *nerds* (see Eckert 2012; Podesva, Reynolds, Callier & Baptiste 2015; D'Onofrio & Eckert 2020 for other instances of links between phonetic detail and social meaning).

Taken together, the interpretive indeterminacy and rich social indexicality linked to (im)precision provide the opportunity of exploring an important question: is the relationship between social and semantic/pragmatic meaning bi-directional? That is, just like listeners can infer social meaning from the semantic and pragmatic properties of linguistic forms, can they conversely reason about social meaning to infer information about their descriptive content? Applied to (im)precision, addressing this question entails exploring whether, and how, comprehenders recruit social information about the speaker to determine the level of precision required to interpret a numeral, and eventually resolve the indeterminacy associated with these expressions.

We believe that addressing this issue would break new ground in the study of meaning on two different levels. On broad level, it provides the opportunity of advancing our understanding of how different dimensions of meaning relate to one another: in particular, it affords the possibility of complementing the angle of previous work at the interface of semantics, pragmatics, and sociolinguistics, which by-and-large focused on testing how social inferences can be computed on the basis of semantic/pragmatic features; and of expanding and strengthening the scope of existing findings suggesting that the arrow does indeed flow in both directions (see §1). On a more specific level, it makes it possible to further our understanding of how comprehenders recruit contextual information to assign an interpretation to numerical expressions, opening a novel window onto the link between pragmatic reasoning and imprecision resolution.

The next section introduces an experimental paradigm designed to explore these issues.

3 The experiment

We rely on a picture selection task based on the *covered box* paradigm (see Huang, Spelke & Snedeker 2013; Schwarz 2016), which we utilize to investigate two questions. First, we ask whether, and how, the social persona embodied by the speaker affects the resolution of (im)precision for numeral expression deployed in an utterance. We hypothesize that an utterance produced by a speaker who is

socially expected to speak precisely – here, one embodying a *Nerdy* persona, as we discuss below – will be held to a higher standard of precision than the same utterance uttered by a speaker who is socially expected to speak less precisely in comparison – here, one embodying a *Chill* persona. Second, we investigate whether, and how, this effect is modulated by the extent to which the person who interprets such utterances identifies with these social categories, measured by the degree to which respondents in the experiment indicate themselves to be Nerdy and Chill in a post-experiment questionnaire. We’re particularly interested in exploring whether the hypothesized trend towards a more precise interpretation with nerdy speakers – if present – is enhanced or weakened when respondents identify themselves as nerdy (in comparison to the overall distribution in the participant population).

3.1 Methods & Design

Our stimuli utilized visually displayed dialogues, with variants resulting from manipulations that crossed two factors in a 2x3 design. Before outlining the logic and procedure of the experiment, we introduce each manipulation separately.

3.1.1 Persona Manipulation

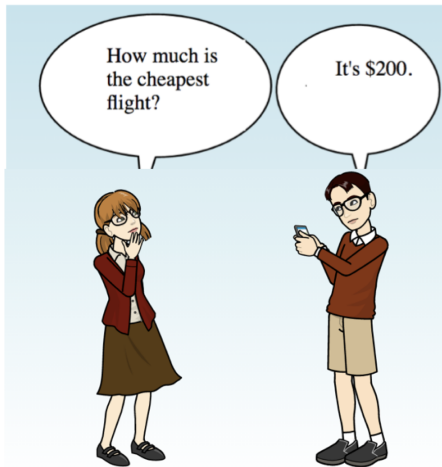
Our first manipulation varied the social identity of the displayed characters, and was implemented as a between-subjects factor. Building on findings from the sociolinguistics literature, as well as on the constellation of social qualities that have been shown to be conveyed by variation in precision (see §2), we identified the contrast between a *Nerdy* and a *Chill* persona as especially suitable for our goals, with a speaker embodying a Nerdy persona expected to be associated with a higher standard of pragmatic precision than one embodying a Chill one. We implemented this manipulation by creating two types of visually presented characters engaged in conversation, which were realized with the cartoon drawing software Pixton.¹ The first conversation consisted of stereotypically Nerdy characters, called Arthur and Rachel; and the second of two stereotypically *Chill* characters, named Alex and Eva. The dialogues, prefaced by a brief context sentence, shared a common structure: Rachel or Eva would ask a question, and Arthur or Alex would respond based on information they accessed by looking at their phone, uttering a quantity expression in the form of a round number. Figure 1 illustrates the respective images that were used in the experimental trials.

The effectiveness of the manipulation of the visual traits signaling the persona of the respective characters was appropriately ascertained in a norming study.²

¹ <https://www.pixton.com>

² In the norming study participants were asked to provide several attributes and a specific stereotype that

"Rachel and Arthur are looking for a one-way plane ticket"



"Alex and Eva are looking for a one-way plane ticket"

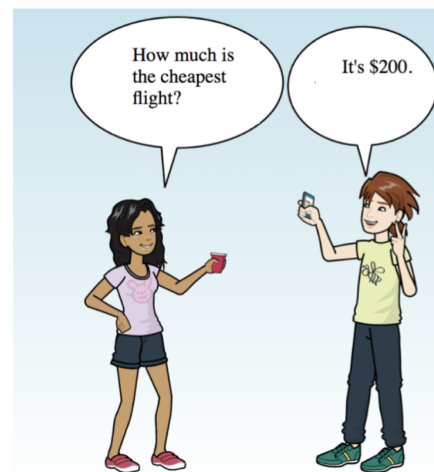


Figure 1 Persona Manipulation: Nerdy vs. Chill characters

3.1.2 Screen Fit Manipulation

The second manipulation served as a proxy for the degree of fit between the content of the utterance and a given state of affairs. Specifically, after seeing the dialogue, participants were asked "Which phone is Arthur/Alex looking at?" and were shown two images of a phone. In one image, the phone was turned face down, making the content of the screen invisible (COVERED screen). In the other image, the phone was turned face up with the display fully visible (VISIBLE screen). The visible screen displayed a number indicating cost, distance, or time, whose relation to the character's utterance came in three variants. In the *Match* condition, the number on the screen fit the number uttered by the character up to the decimal point for cost and distance, with a small divergence in cents and fractions of a mile respectively.³

would fit the character, as well as to rate how precisely they would expect each of the two characters to speak by providing a rate on a 1 (maximally imprecise) to 100 (maximally precise) scale. The results confirmed that Arthur and Alex were indeed associated with considerably distinct sets of attributes and stereotypes. In particular, common adjectives provided to describe Arthur included *nerdy*, *studious*, *smart*, *intelligent* and *uptight*, while stereotypical characterizations unanimously converged on *nerd*. For Alex, common attributes included *fun*, *nice*, *laid-back*, *cool*, *friendly*, while stereotypes included *hipster*, *millennial*, *skater*, *hippie*. Furthermore, Arthur was indeed expected to speak more precisely than Alex ($M = 87.22$; $sd = 17.69$ vs. $M = 48.03$; $sd = 31.45$).

³ For time, including seconds in the display seemed like it might have too strong of an effect of imposing high precision standards, since standard digital time displays on phones do not include



Figure 2 Screen Fit Manipulation

In the *Mismatch* condition the uttered and displayed numbers diverged by a very large amount. Finally, in the critical *Imprecise* condition the uttered and displayed numbers diverged only slightly, to an extent that, depending on the precision threshold adopted in the context, could be seen as either acceptable or unacceptable for the conversation. Figure 2 illustrates the screen fit manipulation.

3.2 Materials

24 experimental items were created, each varied across 6 different conditions resulting from the 2×3 manipulation of Persona and Screen Fit. The Persona manipulation was administered between-subjects: a participant was either assigned to dialogues between the Nerdy characters or between the Chill characters. The Screen Fit manipulation was administered within-subjects: each participant saw 6 items in the Match and the Mismatch conditions and 12 items in the Imprecise condition. The range of deviation from the uttered number in the Imprecise condition ranged from 5% to 18% of the relevant dimension of magnitude (100 for prices and distance, 60 minutes for time). Item-condition pairings were counterbalanced in a Latin Square Design. 8 items contained utterances describing prices; 8 items utterances describing

seconds. Concerning miles and prices, a complete match would have required the prices/distances on the visible screen to have “.00” as their decimal part – an outcome that would be highly unlikely in real world outputs from searches on the phone. Hence, our decision to ensure the match until the integral part, and let the decimal show a potentially minor discrepancy. However, in subsequent work using a version of the study with a Match condition showing a match all the way down to decimal figures, we find qualitatively parallel result patterns. More information on this study, which couldn’t be included here for reasons of space, can be found in [Beltrama & Schwarz \(2021\)](#).

distances (in miles); and 8 items describing times (in hours and minutes).

The experiment also included 24 fillers, featuring a dialogue between two separate characters and containing instances of the quantifier *some* standing in three different relationships with the visible screen (False: Visible=none; True: Visible=some but not all; Underinformative: Visible=all). The fillers were alternated with the experimental items, so that participants would never see two filler or experimental items consecutively.

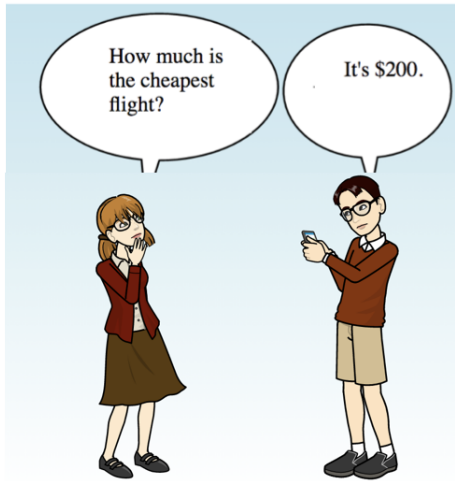
3.3 Procedure

The study was implemented and administered online on the PCIBex platform (<https://www.pcibex.net>; see Zehr & Schwarz 2018 for details). After providing informed consent, participants were instructed to select the visible screen if they believed it was the phone the speaker was looking at, and to select the covered screen if they believed it wasn't.⁴

For each item, the context sentence was introduced first on the top left of the screen. After a 4-second pause to provide time to read this, images of the two characters would appear; after another 3-second pause to allow time to look at these characters (and the critical visual cues on their persona, on critical trials), the question asked by the first character was shown in the form of a speech bubble; following another 3 second pause, the answer from the other character was displayed to complete the dialogue. Finally, the question reminding the participant of the experimental task as well as the two pictures of the phone appeared on the right-hand side of the screen. Participants entered their responses by pressing a key matching the letter displayed under the picture on the keyboard. The experimental items were preceded by three practice filler items in which the response would involve the use of a quantifier, and the content of the visible screen would be either a perfect match or an obvious mismatch. Feedback was provided on the practice items, so as to help the participants familiarize themselves with the task. Besides the screen choice, response times for making this choice were also recorded; however, they will not be

⁴ **Full instructions:** "We're going to play a little guessing game: you'll see some cartoon-like dialogues where one person asks another one a question. That person checks their phone and responds based on information they see there. You'll then be presented with two phone pictures. In one of them, you can see the details of the screen, while in the other one the phone is turned upside down. Your goal will be to guess which of the two phones is the one that the person is looking at, based on what this person is saying in the picture. As a general rule, you'll select the phone with the visible screen if you think that the information on the screen fits what is being said. You'll select the one turned upside down, instead, if you think that the information on the visible screen does not fit with what the person said. Note that just one of the pictures goes with what the second person responds. So you should only choose the phone that's turned upside down if you don't think the person giving the answer would have said what they did if they had been looking at the visible phone screen".

"Rachel and Arthur are looking for a one-way plane ticket"



Which phone is Arthur looking at?



F



J

Figure 3 Display before making the choice (Condition: Nerdy, Imprecise)

discussed here. Figure 3 provides a full illustration of the display that participants would see once all the elements appeared.

At the end of the study, all participants, regardless of whether they had been assigned to the Nerdy or the Chill condition, were asked to complete an exit questionnaire aimed at assessing their own positioning with respect to the two social personae. The questionnaire consisted of the two questions below; participants responded by selecting a value on a 1(min)-10(max) scale. The two questions were presented incrementally.

- (2) a. How nerdy do you consider yourself to be? 1... 10
- b. How chill do you consider yourself to be? 1... 10

3.4 Participants

168 participants were recruited on Prolific and compensated \$ 1.30 for participating in the experiment. In order to take part in the study, subjects were required to self-identify as native speakers of English. All participants provided informed consent approved by the University of Pennsylvania's Institutional Review Board.

3.5 Predictions

We expected the Match and the Mismatch conditions to lead to COVERED responses at floor and ceiling levels respectively. By contrast, we expected responses in the Imprecise condition to crucially depend on imprecision standards employed by participants in the specific response context: a strict interpretation – i.e., one with a standard of precision that excludes the value displayed on the visible screen – should lead to a COVERED screen response; and a more lenient interpretation – i.e., one with a lower level of precision, which includes the value displayed on the visible screen – should lead to a VISIBLE screen choice. It follows that, if the social identity of the speaker plays a role in resolving imprecision in the direction we hypothesize, a higher rate of COVERED choices for Nerdy speakers than for Chill speakers in the Imprecise condition should be observed.

3.6 Results and Statistical Analysis

Our data analysis proceeded in three steps: **Step 1**: ascertaining that our Imprecise condition across Personae shows mixed response choices compared to the controls; **Step 2**: exploring our central hypothesis concerning the impact of the Persona manipulation on the rate of COVERED responses in the Imprecise condition only; **Step 3**: testing the extent to which the Persona effect is modulated by participants' own identity.

3.6.1 Step 1: Imprecise vs. Match vs. Mismatch

Figure 4 illustrates the overall proportion of COVERED choices across the three Screen Fit conditions. These graphs suggest a clear step-wise effect of differences, with ceiling and floor-level response rates for the controls, and the imprecise condition in the middle, as expected.

For statistical analysis, we fit a mixed-effects logistic regression with Screen Fit as a fixed effect, and by-Subject and by-Item random intercepts (the maximally complex random effect structure that would converge). To assess whether response choice rates in the Imprecise condition were significantly different from those in the controls, we set it as our reference level for the model. The model – and all the other models throughout the paper – was computed with the “glmer” function from the *lmerTest* package (Kuznetsova, Brockhoff & Christensen 2017). The outcome of the model indicates that both the Mismatch and the Match conditions significantly differ from the Imprecise condition (Match vs. Imprecise: $\beta = -4.67$; $SE=0.41$; $p<0.01$; Mismatch vs. Imprecise: $\beta = 6.66$; $SE=0.28$; $p<0.01$). This confirms that the Imprecision condition does pattern differently from either control, suggesting that

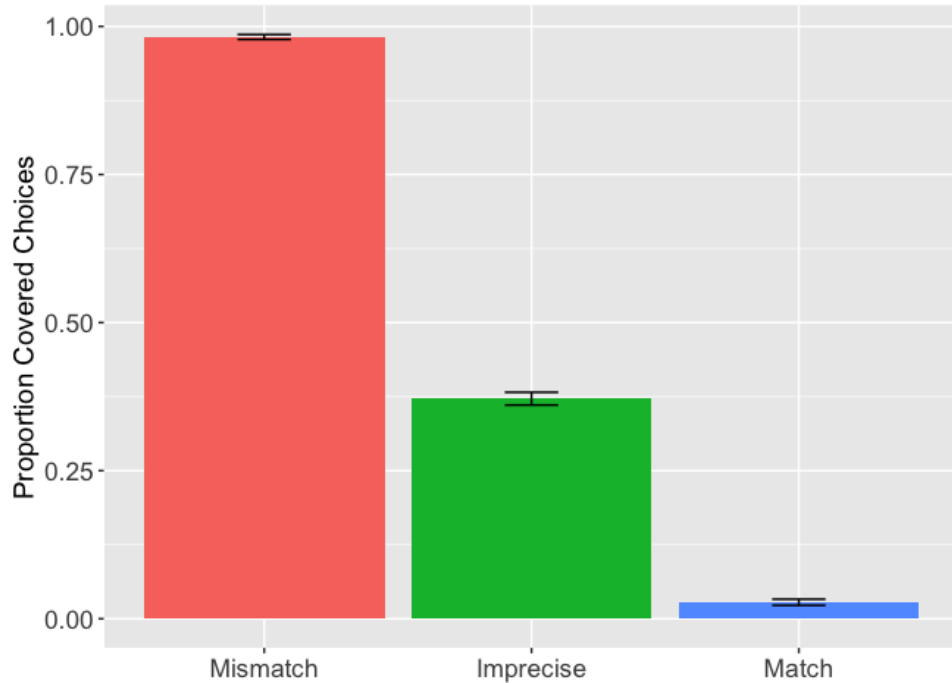


Figure 4 Overall COVERED choices across Screen Fit

we are in the appropriate range of divergence to tap into variation in the imprecision thresholds that participants adopt; it thus establishes the basis for assessing our main question about the impact of social identity on imprecision resolution.

3.6.2 Step 2: The Persona effect

To explore the Persona effect on screen choices, we exclusively focus on the Imprecise condition, and also incorporate the range of imprecision as an additional factor. Specifically, this range was further divided into two subranges: the NEARMATCH (12-18 % deviation from the uttered number) and NEARNEARMATCH ranges (5-11%).⁵ In line with our predictions, inspection of the graphs suggests higher rates of COVERED choices for Nerdy speakers in both (im)precision ranges, as well as overall lower rates of COVERED choices in the more narrow (im)precision range condition.

⁵ In the NEARMATCH range, cost and distance diverged from the uttered value by 12, 14, 16, or 18; and time diverged by 7, 9, 11, or 13. In the NEARNEARMATCH range, cost and distance diverged from the uttered value by 5, 6, 8, or 9; and time diverged by 1, 2, 3, 4 or 5. The ranges of divergence for times were smaller since proportionally, a minute makes up a greater proportion of an hour (1/60th) than 1 mile or dollar makes of a 100 miles/dollars.

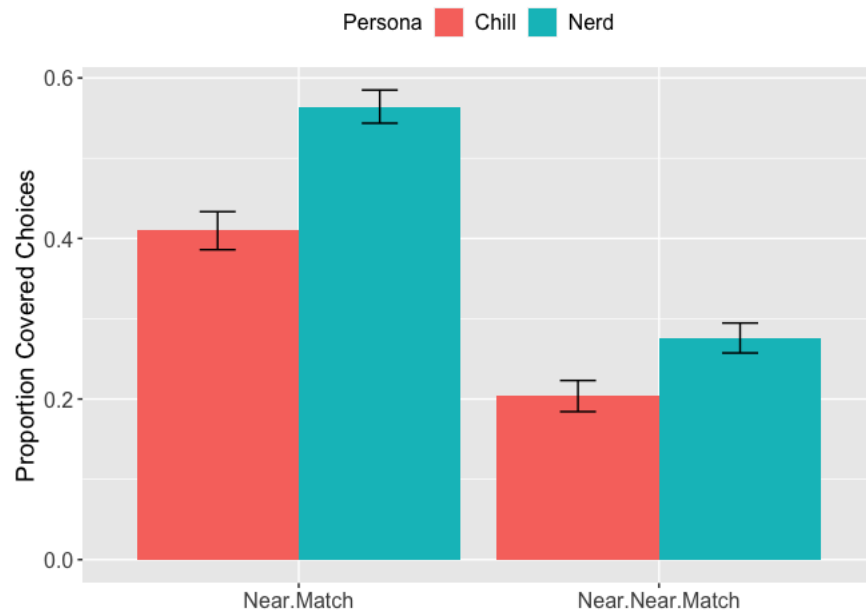


Figure 5 COVERED choices across Persona and imprecision range; Imprecise condition only

To assess these contrasts statistically, we fit a mixed-effects logistic regression with Imprecision range (NearMatch vs. NearNearMatch), Persona and their interaction as fixed effects, and by-Subject and by-Item random intercepts (models including random slopes did not converge). We centered both predictors,⁶ to explore the key main effect of Persona, as well as of Imprecision range and a potential interaction of the two. As predicted, we found a significant main effect of Persona ($\beta=1.23$; $SE=0.45$; $p<0.05$), confirming a higher rate of COVERED choices for Nerdy speakers. We additionally found a main effect of Imprecision range ($\beta=-2.47$; $SE=0.17$; $p<0.001$), confirming that the COVERED choices rate is higher in the NearMatch condition than in the NearNearMatch condition, as is intuitively plausible. However, we did not find a significant interaction ($\beta=-0.49$; $SE=0.43$; $p=0.14$), suggesting comparable Persona effects across both ranges.

3.6.3 Step 3: the modulation of participants' Identity

We finally explored whether, and to what extent, the Persona effect was modulated by respondents' own identity and its relation to the speaker's persona. As reported

⁶ This effectively corresponds to sum-coding, with slight deviation in values due to some imbalances across the various cells of our design.

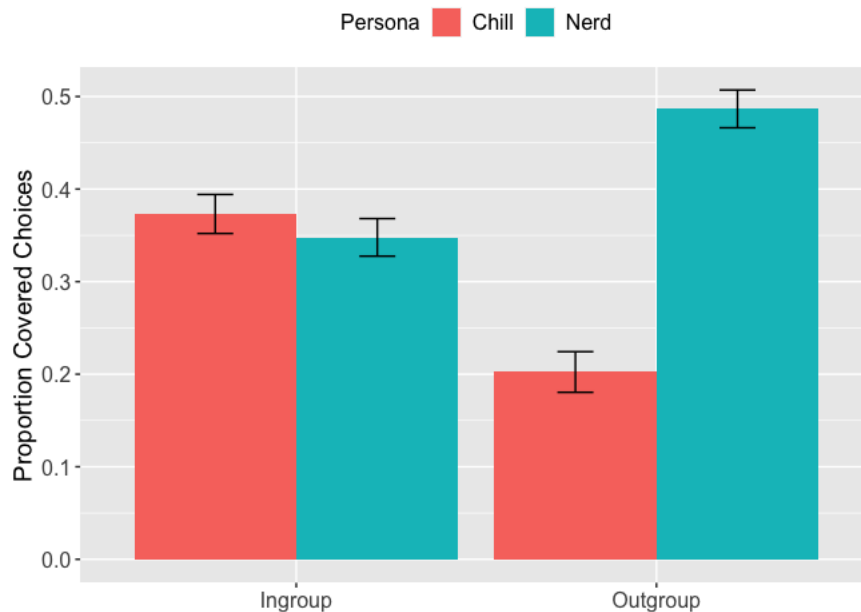


Figure 6 COVERED choices by participants' identity

above, participants from either list provided a score for their self-ascribed degree of nerdiness and chilliness, which ranged from 1 to 10. Using the median of these scores, we divided participants in two independent categories: Nerdy vs. non-Nerdy; and Chill vs. non-Chill.⁷

These groupings were then used to create a new factor, named Ingroupness. The factor had level INGROUP if, for a given data point, the participant's and the speaker's identity matched, i.e., when a nerdy participant performed the screen choice task with nerdy Arthur as speaker; or when a chill participant performed the screen choice task with chill Alex. This factor had level OUTGROUP if the two identities didn't match, i.e., when a non-nerdy character performed the screen choice task with nerdy Arthur; or when a non-chill character performed the screen choice task with chill Alex. The results broken down by Persona and Ingroupness are shown in Figure 6. We fit a further mixed-effect model with Persona (i.e., Chill vs. Nerd) and Ingroupness as fixed effects and random intercepts for Items and Subjects for each experiment. The predictors were again centered to test for main effects and an interaction. The model output shows a significant interaction between Persona and Ingroupness ($\beta=1.44$; $SE=0.20$; $p < 0.001$): in the Outgroup condition, the rate of

⁷ The distribution of participants across the self-ascribed ratings was as follows. **Nerdiness**: Nerdy: 86; Non-Nerdy 82; Median 8; Average: 6.92. **Chilliness**: Chill: 91; Non-Chill: 77; Median: 8; Average: 7.21.

covered screen responses was considerably higher for the Nerdy characters than for the Chill characters; but no difference was found in the Ingroup condition.

3.7 Summary of our findings

Our findings provide evidence in support of the following claims. First, the Imprecise condition successfully tapped into imprecision resolution, as shown by the fact that the rate of COVERED choices in this condition differs from the one observed for either the Match and the Mismatch controls (**Step 1**). It follows that response patterns in this condition can be seen as a viable testing ground to investigate the process whereby comprehenders determine the appropriate imprecision threshold in the context.

Second, imprecision resolution is affected by the persona embodied by the speaker in the context, as shown by the higher rate of COVERED choices observed for Nerdy speakers than for Chill ones (**Step 2**).

Finally, the persona effect is crucially modulated by the respondents' own social identity in relation to the speaker, as shown by the fact that the Persona effect was only observed in the Outgroup data, in which the social identity of the participants and the speaker do not align (**Step 3**).

4 General discussion

We now turn to a general discussion of the findings, focusing on what they can reveal about the interaction between semantic, pragmatic, and social dimensions of linguistic meaning. §4.1 addresses the influence of speaker persona on the resolution of imprecision; §4.2 discusses the role of participants' own identity in mediating the persona effect.

4.1 Speaker persona and imprecision resolution

The first central takeaway of our results is that the social identity of the speaker can affect the precision with which their utterances are interpreted: given identical utterances, listeners overall utilize stricter precision standards when the speaker embodies a persona that is stereotypically expected to speak precisely – i.e., the Nerdy character – than when the speaker embodies a persona who is expected to speak more loosely (or at the very least less distinctively precisely). This finding provides evidence supporting the idea that the interplay between social and descriptive dimensions of meaning is genuinely bi-directional: not only do interlocutors recruit the semantic and pragmatic properties of linguistic expressions to form an evaluation of the speaker's identity and behavior, as shown in prior work (see Section 1); they

also rely on their evaluation of the social identity of the speaker to navigate the uncertainties inherently involved in putting precise meanings to use, and ultimately settle on a contextually appropriate interpretation of linguistic expressions.

We take this effect to be highly relevant to the study of social meaning, as well as to semantic and pragmatic theory. Particularly important, in this perspective, is the idea that the speaker properties emerge as a factor that can impact relatively fine-grained aspects of constructs formally modeled in the theoretical literature, such as – in the case at hand – the setting of imprecision thresholds. As noted in §2, previous work highlighted a variety of contextual elements as impacting the process whereby the indeterminacy associated with the interpretation of number words is resolved – e.g., the situational relevance of details (Lasersohn 1999); the interlocutors’ conversational goals (Kennedy 2007; Aparicio 2017); or the modality of presentation of the information (Van Der Henst et al. 2002). Our results crucially expand on this inventory by highlighting the social perception of the individuals as an essential part of the factors impacting the interpretation of an utterance.

On the one hand, this result should not be seen as particularly surprising: to our knowledge, previous endeavors to model context-sensitivity in numerals (and semantic) interpretation never explicitly introduced the claim that speaker identity should not impact semantic interpretation, and therefore remain essentially compatible with the findings from our study. At the same time, this work primarily focused on the impact of contextual elements that could be immediately reconciled with a Gricean view of communicative practices – one in which speakers can be construed as fully rational and cooperative agents, whose linguistic choices, other things being equal in the context, are expected to by-and-large align. In this perspective, our results contribute to enriching this outlook by showing that imprecision resolution is shaped by the contrast in social identity between our two characters, as everything except for the persona represented by the speaker – including the content of the utterances and the overall discourse context — was kept constant across conditions. This crucially indicates that semantic interpretation is shaped by information and expectations about inter-speaker differences, highlighting an important, yet thus far largely uncharted, situational parameter that comprehenders track when resolving meaning indeterminacy.

Looking at the broader picture, we believe this finding raises important question for semantics and pragmatics. One issue revolves around the generalizability of speaker identity effects across different linguistic phenomena. While imprecision represented an obvious case study to begin investigating this topic, it remains to be seen whether persona considerations likewise inform the interpretation of other linguistic forms that are embedded in indeterminacy, but whose link to identity-level categories is more tenuous – or at least has not been investigated in detail yet. A natural candidate are expressions licensing scalar implicatures, a phenomenon that

has been widely explored in pragmatic processing (Noveck 2001; Papafragou & Musolino 2003 among many others), and whose interpretation has also been linked to social considerations broadly construed (see Bonnefon & Villejoubert 2006; Mazarella, Trouche, Mercier & Noveck 2018 on the effects of politeness and face; and Fairchild, Mathis & Papafragou 2020 on the effect of native vs. non-native accent), raising the question as to whether identity-level social constructs like personae or clusters of social qualities also serve as a resource for comprehenders to assign an interpretation to utterances containing these types of expressions. By the same token, isolating the role of speaker identity among the different sources of contextual information could lead to important insights concerning the study of context-sensitive expressions whose interpretation is crucially anchored to the speaker's perspective – e.g., predicates of personal taste (Lasersohn 2005) expressives (Potts 2007) or other varieties of non-at-issue content (Tonhauser, Beaver, Roberts & Simons 2013), among many others.

The other issue concerns the online processing mechanisms involved in integrating the various dimensions of meaning. One way of shedding light on this will be to assess the time-course with which the information on the social identity of the speaker is integrated in processing. More specifically, it will be interesting to assess whether social information is brought into play in pragmatic reasoning simultaneously with other dimensions that have been shown to play a role in the process – e.g., the interlocutors' goals, contextual relevance etc. – or whether there are sequential steps in which different streams of information are considered. Since our discussion here is limited to offline judgments on screen choices, we cannot dive into this issue here further; but we see the analysis of the response time data in our results, as well as more fine-grained temporal dependent measures (e.g., eye movements in a visual world paradigm) as holding promise to shed light on this issue.

We see this direction of investigation important not only for experimental semantics and pragmatics, but also for the broader question of how social meaning affects language process across different levels of the grammar – a question that work on phonetic (Niedzielski 1999; Staum Casasanto 2008; Hay 2009; D'Onofrio 2015, 2018; D'Onofrio 2020; Wade 2022) and, to a lesser extent, syntactic processing (Campbell-Kibler 2010; Weatherholtz, Campbell-Kibler & Jaeger 2014; Squires 2013; Choe, Sloggett, Yoshida & D'Onofrio 2019) has begun to address, but still remains largely uncharted.

4.2 The role of participants' identity in modulating persona effects

The second important finding of our study concerns the role of participants' own identity in relation to the speaker's persona effects on meaning interpretation: in

particular, we found that the Persona effect on imprecision resolution is only present when the respondent's own social identity does not align with the one of the speaker – i.e., when self-ascribed non-nerdy participants are adjudicating nerdy characters, or self-ascribed non-chill participants are adjudicating chill characters.

This result enriches our perspective on how identity considerations affect pragmatic processing. In particular, it points to the need to go beyond considering speaker identity in isolation, in line with the perspective-dependent nature of social meanings already widely theorized in sociolinguistic research: speaker identity effects on interpretation – and thus the relationship between social meaning and semantics and pragmatics – are indeed shown to crucially depend on the listeners' own positioning with respect to the relevant identity categories. What remains to be explained is why, in our particular case, persona effects are enhanced in the Outgroup condition, as opposed to the Ingroup one. While further research is needed to fully address this, one possibility we would like to suggest is that participants can generally and readily access (consciously or unconsciously) the stereotypical association between a particular persona and the relative social expectations as they perform the task, but vary in how this affects their response choices. For example, respondents identifying themselves as nerdy might have been reluctant to respond in a way that would have contributed to confirming – and possibly reinforcing – a negative stereotype of them as exceedingly detail oriented and scarcely attuned to flexible pragmatic behavior. By the same token, respondents identifying themselves as chill might have been refusing to behave in a way that would have indexed themselves as sloppy or not particularly articulate (see [Beltrama 2018](#) for further discussion of the negative and positive traits indexed by precise speech in relationship to numerical expression). In contrast, in the Outgroup conditions, participants would have lower stakes in the identity construction game, and thus be more susceptible to let these stereotypes impact their behavior – and ultimately their responses.

While this hypothesis remains speculative, investigating the unfolding process of participants' decision-making over time (e.g., with online methods such as visual world eye-tracking), may help us test it empirically. For example, if the participants' pragmatic reasoning in an Ingroup configuration involves a step of initially considering relevant indexical associations, and a subsequent step of discarding them for purposes of settling on a response, this could be reflected in an overall longer response time course, as well as discernible behavioral patterns along the way, e.g., in terms of different eye movement trajectories between the visual representations of the response options, compared to when the indexical associations are not discarded or not entering the picture at all.

Looking at the broader picture, there is much to gain from better understanding what role comprehenders' identity and perspective play in the overall interpretation process. From a methodological perspective, this endeavor highlights the importance

of better understanding how social or ideological differences between participants could shape the outcome of experimental tasks – including in studies in which social information is not part of the object of investigation, and thus neither manipulated nor controlled for. From a theoretical perspective, the impact of both speaker and experimental participants' identity in affecting meaning interpretation highlights the importance of developing pragmatic models that adequately reflects the dynamics of alignment (or lack thereof) between the speaker and the listener in conversation – an endeavor that has recently been spear-headed in work at the interface of pragmatics and sociolinguistics (see in particular Burnett 2017, 2019), and which could be further informed by findings collected via paradigms such as the one used in our studies.

5 Conclusion

We believe that these findings open up a novel angle on the study at the interface of semantics, pragmatics and sociolinguistics, highlighting the importance of further exploring the interaction between these dimensions of meaning in future research.

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