

## **The impact of schizotypy on pragmatics: analyzing if context-information is integrated into the semantic meaning of definite singular DPs**

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High levels of linguistic referential failures are associated with liability to develop schizophrenia-spectrum disorders, and it has been shown that these failures can differentiate healthy subjects, high-schizotypal and schizophrenics groups. Nevertheless, few investigations have focused on whether or not schizotypal traits in nonclinical populations can also impact linguistic reference. In Brazilian Portuguese, only one previous study (acceptability judgements task) had been conducted, and its results suggest association between schizotypal traits and a more rigid preference for assignment of specific readings to definite singular DPs. Here, we present another experimental study in Brazilian Portuguese, a comprehension task designed to examine possible effects of schizotypal personality traits on the interpretation of definite singular DPs. The findings, in line with the previous results, support the conclusion that schizotypy does affect the interpretation of definite singular DPs in Brazilian Portuguese. Together, these two experiments suggest that schizotypal personality traits impact the integration of linguistic contextual information into the semantic meaning of definite DPs. This is consistent with the general hypothesis that schizotypy, similarly to schizophrenia, is associated with pragmatic difficulties. Yet, our results emphasize that the impact of schizotypal traits on pragmatics can be observed even in healthy (nonclinical) speakers.

**keywords:** schizotypy traits, definite DPs, semantic meaning, pragmatic meaning.

Los altos niveles de fallas referenciales lingüísticas se asocian con la propensión a desarrollar trastornos del espectro de la esquizofrenia, y se ha demostrado que estas fallas pueden diferenciar grupos con sujetos sanos, con alta esquizotipia y con esquizofrenia. Sin embargo, pocas investigaciones se han centrado en si los rasgos esquizotípicos en poblaciones no clínicas también pueden afectar la referencia lingüística. En portugués brasileño, solo se había realizado un estudio previo (tarea de juicios de aceptabilidad), y sus resultados sugieren una asociación entre rasgos esquizotípicos y una preferencia más rígida por la asignación de lecturas específicas a DP singulares definidos. Aquí, presentamos otro estudio experimental en portugués brasileño, una tarea de comprensión diseñada para examinar los posibles efectos de los rasgos de personalidad esquizotípicos en la interpretación de DP singulares definidos. Los hallazgos, en línea con los resultados anteriores, apoyan la conclusión de que la esquizotipia afecta la interpretación de DP singulares definidos en portugués brasileño. Juntos, estos dos experimentos sugieren que los rasgos de personalidad esquizotípicos impactan en la integración de la información contextual lingüística en el significado semántico de DP definidos. Esto es consistente con la hipótesis general de que la esquizotipia, al igual que la esquizofrenia, está asociada con dificultades pragmáticas. Sin embargo, nuestros resultados enfatizan que el impacto de los rasgos esquizotípicos en la pragmática se puede observar incluso en hablantes sanos (no clínicos).

**palabras clave:** rasgos de esquizotipia, DP definidos, significado semántico, significado pragmático

# 1 Introduction

Building linguistic reference is a complex process that arguably involves different components of Grammar, syntax, semantics and pragmatics, and linguistic reference failures are rather commonly observed in our daily speech. However, when these failures are constant and too many, they flag vulnerability for schizophrenia (Docherty 1995; Hinzen 2017). In fact, the language difficulties observed in schizophrenia are also observed, though to lesser degree, in high schizotypal individuals (Bleuler 1911; Kraepelin 1919; Docherty et al. 1999; Docherty et al. 2003 among others), corroborating the idea that there is a set of subclinical expressions of schizophrenia (Claridge 1994).

Schizotypy refers to a set of personality traits related to schizophrenia symptoms, manifesting in various forms and degrees in a continuum, from nonclinical individuals to patients with schizophrenia (Claridge 1994; Raine 2006; Lenzenweger 2010). The so-called schizotypy construct is a theoretical model representative of a latent liability for schizophrenia (Meehl 1962; Meehl 1990), providing a framework for research on schizophrenia-spectrum disorders (Claridge 1994; Lenzenweger 2006; Lenzenweger 2015; Debbané and Barrantes-Vidal 2014 among others). In this model, schizotypy manifests in a wide range of personality traits — tendencies to think and behave qualitative similar to schizophrenia— that, depending on social, physical or environmental factors, might or might not be triggered into a psychotic breakdown (Claridge 2003). Importantly, from a fully dimensional development perspective (see Debbané and Barrantes-Vidal 2014; Claridge and Beech 1995), schizotypy is not in itself considered deviant; it defines “psychological characteristics that vary along a continuum in the population, being, at the same time, a predisposition to psychotic disorder” (Debbané and Barrantes-Vidal 2014: 387).

Here we present a study conducted by us, aiming at investigating whether schizotypy affects the process of building the meaning of singular definite DPs. We focus on pragmatics, examining the integration of linguistic contextual information into the semantic meaning of definite DPs, in a sample of healthy speakers of Brazilian Portuguese, considering, in particular, the prevalence of schizotypy traits in a subsample of these speakers. Our results show that, in general, speakers integrate context-specific information into the meaning of definite singular DPs, with failures in this process associated with schizotypy traits. This is in line with the more general observation that schizotypal traits affect language in a way similar to schizophrenia.

The paper is organized as follows: Section 2 contains a summary of the literature on the meaning of definite singular DPs in Brazilian Portuguese (BP), and the role played by pragmatics, in special integration of context-specific information, in specifying this meaning. Section 3 contains a summary of the literature on schizophrenia, schizotypy and language, focusing on the pragmatic domain. Section 4 presents the experiment we conducted, its results and its implication for studies on language and on schizotypy. Section 5 is devoted to conclusions.

## 2. Language and reference

In natural language, words are used in acts of reference connecting external objects, events and individuals to inner concepts stored in our minds. Yet, acts of reference are never performed by words alone. The combinatorial system of Grammar is an essential component of reference building (Hinzen 2016; Hinzen 2017). For example, a noun such as *cat* does not refer, it only addresses a concept that carries a certain descriptive content. However, when combined to functional categories such as determiner and number, nouns form Determiner phrases (DPs), providing a description of a referent, as in *a cat*, *the cat* and *this cat*. Yet, the final denotation

of the referent is only reached by merging the thus formed DPs with a predicate, forming a verbal phrase, which is then merged with functional categories, forming full sentences, propositions.

The content noun *cat* gets different meanings depending on the determiner it is combined to. For example, the DP *the cats* makes reference to all instances of the kind whose description matches that of the concept CAT, and *a cat* refers to an arbitrary instance of such kind, both yielding generic readings. Conversely, The DP *the cat* and *this cat* refer to a particular individual of the kind cat, both yielding specific readings. Thus, as argued by Hinzen (see interview by França and Maia 2015), the very possibility of attributing referential meanings to lexical items follows from the combinatorial system of Grammar.

In many languages, including Brazilian Portuguese (BP), definite singular DPs (DefSingDPs), such as *o gato* “the cat”, can be used to refer either to a particular individual or to arbitrary members of a certain kind, being, thus, compatible with both generic and specific readings. Nevertheless, these two readings may not enjoy the same linguistic status, as it has being argued that the specific reading is the semantic/default interpretation of DefSingDPs in BP. Generic readings emerge only at the pragmatic level, when supported by linguistic (or extra linguistic) contextual information (Dayal 2004; Dobrovie-Sorin and Oliveira 2008; Ferreira and Correia 2016).

At the pragmatic level, when linguistic contextual information is considered, one needs to examine how we built coherent representations of narrative discourses. These can involve many different processes, such as pronominal coreference and resolution of elliptical material, but one crucial step is linking the propositions that compose the narrative. On this, sentential connectives are important cues on how to integrate upcoming information. Connectives such as *and*, *so* and *but* play the role of integrating sentences and clauses, but a caveat is necessary: although they all introduce sentences, they do it by carrying different semantic loads. For

example, the connective *and* is used when linguistic material is added keeping the flow and semantic content of previous information, while *so* marks causality and *but* marks a change (or discontinuity) of the content being informed. That is, the connectives' inherent meanings establish different sorts of relations among propositions, giving explicit cues on how upcoming material is to be integrated into the discourse (Kintsch and Van Dijk 1978; Blakemore 2002). Murray (1994, 1997) demonstrated the different roles connectives play in the integration of information between sentences. In one of the experimental tasks, participants were asked to read a sentence (e.g., *Ronny cleaned up the house for his girlfriend's visit.*), followed by a blank line, in which a new sentence was to be written by the participants. The blank line was either preceded by no-connective or by a connective, which was either an additive connective (e.g. *and, also*), a causal connective (e.g., *so, thus*), or an adversative connective (e.g., *yet, but*). When no-connective was given, participants gave preference for continuing the content of the previous sentence. The same pattern was found with additive and causal connectives, with adversative connectives, however, participants' written sentences were discontinuous with respect to the content of the previous sentence. This shows that adversative connectives mark discontinuity in the flow of information within a narrative, while additive and causal ones indicates continuity of semantic content (Murray 1997: 235).

In the experiment presented in section 4, we take advantage of the role played by the connectives *and* and *but* (*e* and *mas* in BP) as propositional linkers, in order to accommodate at the discourse level, contextual readings assigned to definite DPs.

### 3. Language and schizotypy

As already stated in the introduction, schizotypy can be taken as a theoretically constructed continuum of personality traits ranging from a set of various personality organization found among the general population to schizophrenia-spectrum symptoms (Debbané and Barrantes-

Vidal 2014). These traits are characterized by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM V – APA 2013) in relation to schizophrenia symptomatology. In nonclinical population, they are assessed by psychometric scales. (We made use of two of these scales (SPQ and FDT-S) in our experiment, and they are described on section 4.1.3.)

A myriad of research suggests that language processes involved in building reference are hindered in schizophrenia (see Rochester and Martin 1999; Docherty et al. 2003, Hinzen 2017 among others), with patent pragmatics deficits (Champagne-Lavau et al. 2006; Mitchel and Crow 2005). For example, schizophrenia has long been associated with inability to decode metaphors, irony, indirect requests, proverbs etc., which has often been explained in terms of deficits in processing, at the pragmatic level, the linguistic and non-linguistic contextual information necessary to go beyond literal meaning.

Ditman and Kuperberg (2011), following Ditman et al. (2007)<sup>1</sup>, report N400 amplitude effects in schizophrenics and controls. Their results suggest that schizophrenics, compared to controls, fail at interpreting definite DPs, privileging lexico-semantic associations over linguistic contextual specific information.

In accordance, Chapman et al. (1964) demonstrated that schizophrenic patients, compared to control, are more influenced by the semantic/default meaning of words than by the linguistic context in which they appear. When participants with schizophrenia were given a two-clause sentences such as *when the farmer bought a herd of cattle, he needed a new pen*, and were asked to choose a meaning matching option for the last word, (*pen*), such as (a) *a new writing instrument*, (b) *fenced enclosure*, (c) *pick-up truck*, they showed a significant preference for the dominant meaning option (*a new writing instrument*), as opposed to the contextually appropriate meaning option (*fenced enclosure*), indicating, thus, difficulties in using linguistic contextual information to build interpretation.

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<sup>1</sup> Adult controls in this experiment replicated those of the college-aged healthy adults examined in Ditman et al. (2007).

In summary, failures at the pragmatic level of language flags schizophrenia liability (Docherty 1995; Docherty et al. 1998; Docherty et al. 1999; Docherty et al. 2003).

As for schizotypy in nonclinical population, investigations are rather scarce (Nunn et al. 2001), although neuroanatomic studies indicate neural similarities between nonclinical high-schizotypy individuals and people with schizophrenia (Rapp et al. 2010; Kuperberg 2008). In addition, language seems to be affected by schizotypy in a way similar to that observed in schizophrenia. First, there is a dissociative pattern in the use of non-literal language. Nunn and Peters' (2001), for instance, shows that high levels of schizotypal traits are associated with poor performance on several language tasks, with higher positive traits being predictive of poor comprehension of proverbs. Langdon and Coltheart (2004) found the ability to understand irony to be significantly impaired in high-schizotypal with positive traits.

Similarly to schizophrenia, schizotypy is also associated with increase spread of activation in semantic network at early intervals and decrease use of linguistic context to activated related concepts at later intervals (see Kiang 2010). In addition, high-schizotypal individuals, compared to controls, produced higher frequency of normative semantic associations.<sup>2</sup> (Lenzenweger et al. 2007).

Also, Kimble et al. (2000) found that subjects scoring higher on schizotypy traits show abnormal semantic processing compared to low schizotypy subjects, at sentence level. Their N400 effect to sentence incongruent final words (e.g., *John wanted to eat one more sleeve*) was significantly smaller, indicating an inability to catch incongruencies at the semantic-pragmatic level.

All in all, language processes are arguably impaired at the semantic-pragmatic level in both schizophrenia and schizotypy (Langdon and Coltheart 2004), although there are some

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<sup>2</sup> Normative semantic associations consist of words most frequently produced in free word-association tests (see Kiang 2010)

noticeable differences in processing and recognition of metaphors, as reported in Langdon et al. (2002).

The interpretation of definite DPs is another productive topic of investigation in the realm of schizophrenia and schizotypy. Çoka et al. (2018) studied the production the definite DPs by patients with schizophrenia, first-degree relatives of schizophrenics (high schizotypal individuals in accordance with PANS results)<sup>3</sup> and controls. While patients with schizophrenia, especially those with formal thought disorder, produce the fewest definite DPs, high schizotypy individuals produced the most definite ones. This suggest issues in the use of definite DPs in both schizophrenia and schizotypy.

Chaves (2017) using an acceptability judgment task on a sample of “healthy” adult native speakers of BP, shows correlations between preference for the semantic/default meaning of DefSingDPs and schizotypal traits of constricted affect and unusual perceptual experiences. Participants, using a 4-point Likert scale, were asked to rate (based on their intuitive knowledge of BP) generic and specific meanings attributed to DefSingDPs couched within linguistic contexts containing either a generic or a specific antecedent for the target DefSingDP. Results indicate that BP speakers in general have a significant preference for attributing specific readings to DefSingDPs, accommodating, however, generic readings. Contrastively, individuals with high traits of constricted affect and unusual perceptual experiences (assessed by the psychometric scales SPQ and FTD-S), were more constrained in their reading, being significantly more hooked to specific readings whenever the antecedent given in the context was specific. These findings are accordance with the idea that specific reading is the semantic/default meaning of DefSingDPs in BP, suggesting, in addition, that schizotypal

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<sup>3</sup> The Positive and Negative Syndrome Scale (PANSS) is a medical scale used for measuring symptom severity of patients with schizophrenia.



individuals are less capable of inhibiting context-specific information that favored the semantic/default meaning of DefSingDPs.

Next section, we will present a follow-up on Chaves (2017). Targeting the interpretation of DefSingDPs, we examined possible associations between the interpretation of DefSingDPs and schizotypy traits using a comprehension task.

## 4. DefSingDPs and schizotypy: present study

The present experimental study is a comprehension task, exploring spontaneous responses, aiming at providing information on interpretation of DefSingDPs in face of schizotypy traits.

Given the literature discussed on sections 2 and 3, two hypotheses were considered:

*Hypothesis 1 (H1)* — The specific reading is the semantic/default meaning of DefSingDPs.

The generic interpretation emerges only when the linguistic context robustly emphasizes a generic meaning. That is, the generic interpretation is pragmatic meaning.

*Hypothesis 2 (H2)* — Schizotypy impacts pragmatics, specially integration of the contextual information into semantic meaning. Hence, traits of schizotypy should have an impact on the interpretation for DefSingDPs.

### 4.1 Materials and methods

#### 4.1.1 Participants

Participants, volunteer graduate and undergraduate students, were recruited at PUC-Rio. The final sample consisted of 43 participants, aging from 17 to 42 ( $23.5 \pm 6.3$ ), as in table 1.

Background information					
<i>Age</i>	<b>range</b>	<b>mean</b>	<i>Family History of mental illness</i>	<b>no</b>	<b>yes</b>
	17–42	23.5 ± 6.3		24	19
<i>Sex</i>	<b>male</b>	<b>female</b>	<i>Knowledge of other languages</i>	<b>no</b>	<b>yes</b>
	12	31		5	38
<i>Handedness</i>	27.9%	72.1%		11.6%	88.4%
	<b>right-handed</b>	<b>left-handed</b>	<i>Level of education</i>	<b>Undergrad.</b>	<b>Grad.</b>
	37	6		29	14
	86.0%	14%		67.4%	32.6%

**Table 1:** Participants' background descriptive information.

#### 4.1.2 Language test

A comprehension task eliciting oral responses assessed participants' interpretation of target DefSingDPs. The experimental stimuli consisted of two-clause sentences connected by a sentential connective, with each clause presenting a DP that could anchor the interpretation to the target DefSingDP, being, thus, possible contextual antecedents (examples in (1)-(4) below). These DP-antecedents were compatible with either specific reading (indefinite DPs) or generic reading (bare plural DPs). Also, among themselves, the DP-antecedents were either congruent in interpretation (being both specific or both generic) or incongruent (being one specific and the other generic). Semantic congruency *and* incongruency was accommodated within the context-discourse by the type of sentential connective chosen: clauses containing semantically congruent DPs were connected by the connective *e* “*and*”, whereas clauses containing semantically incongruent DPs were connected by *mas* “*but*” (see section 2 for a discussion on the role played by these connectives in maintaining or not the flow and content of information within discourse). These gave rise to the 4 conditions, exemplified below. (NB: type of connective was controlled for, but not manipulated. *Additive* and *adversative* connectives were used only to accommodate, at the discourse level, semantic congruency/incongruency between the two DPs that could serve as interpretative anchors, contextual antecedents, to the target DefSingDPs.).

(1) C1: context with incongruent DP-antecedents (DP<sub>specific</sub> + DP<sub>generic</sub>):

Luiz ama **uma baleia cachalote que nasceu no aquário**, mas ele sempre estuda *baleias diferentes* para entender o ciclo de vida de animais marinhos do Oceano Pacífico. Ele me disse que a baleia dorme na vertical.<sup>4</sup>

(2) C2: context with congruent DP-antecedents (DP<sub>specific</sub> + DP<sub>specific</sub>):

Luiz ama **uma baleia cachalote que nasceu no aquário**, e ele sempre estuda **essa baleia** para entender o ciclo de vida de animais marinhos do Oceano Pacífico. Ele me disse que a baleia dorme na vertical.

(3) C3: context with incongruent DP-antecedents (DP<sub>generic</sub> + DP<sub>specific</sub>):

Luiz ama *baleias*, mas ele sempre estuda **uma baleia cachalote que nasceu no aquário** para entender o ciclo de vida de animais marinhos do Oceano Pacífico. Ele me disse que a baleia dorme na vertical.

(4) C4: context with congruent DP-antecedents (DP<sub>generic</sub> + DP<sub>generic</sub>):

Luiz ama *baleias*, e ele sempre estuda *baleias diferentes* para entender o ciclo de vida de animais marinhos do Oceano Pacífico. Ele me disse que a baleia dorme na vertical.

“Luiz loves *whales*/a **cachalot whale that was born in the aquarium**, and/but he always studies *different whales*/**this whale** to understand the life cycle of Pacific-Ocean marine animals. He told me that the whale sleeps vertically.”

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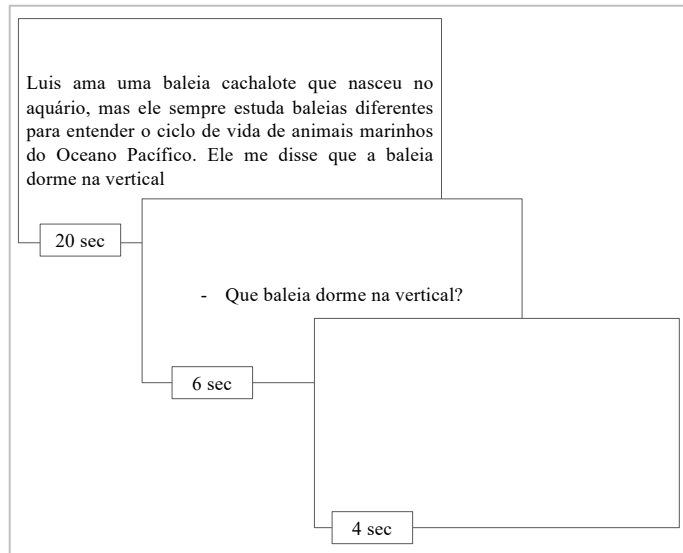
<sup>4</sup> In these examples, **bold** and *italic* were used to highlight specific and generic DPs, respectively.

In each presentation, the given linguistic context was immediately followed by a prompting-an-answer question to assess the readings assigned by the speakers to the target DefSingDPs, such as *Que baleia dorme na vertical?* “Which whale sleeps vertically?”

As illustrated in (1)-(4), the stimuli were all symmetrical, consisting of a linguistic context starting with a two-clause sentence, which contained the two possible contextual antecedents for the target DP, followed by a second sentence consisting of a *dicendi* verb with a complement clause whose subject was the target DefSingDP. As for length, the stimuli varied randomly between 2 lines and 2 lines and a half, as shown in the examples above.

A Latin square design was adopted to counterbalanced possible effects of the 24 lexical items that rotated through conditions. So, a total of four lists were randomly distributed to the 43 participants, each consisting of 24 experimental stimuli —6 per condition— plus 40 distractors. The 40 fillers were composed by 20 cases of VP ellipsis and 20 of inalienable possession. In addition, three training items, 1 VP ellipsis, 1 inalienable possession, and 1 quantification were included at the beginning of the experiment.

Each stimulus was presented in a sequence of 3 automatically-paced slides (figure 1), with different duration times. The first slide (duration of 20 seconds) contained the linguistic context, the second one (duration of 6 seconds) contained the prompting-an-answer question, and the third one (duration of 4 seconds) was blank. Participants were instructed to read the first slides and wait for the blank one to give their oral responses. The duration time of each slide was calculated based on how long a proficient reader would take to read each slide thoroughly.



**Figure 1:** Experimental stimuli example.

After being transcribed, participants' responses were grouped in accordance with the readings attributed to the target DefSingDPs: (a) specific, (b) generic, (c) other.<sup>5</sup>

Based on our H1, we expected the following responses per condition:

- C1 ( $DP_{\text{specific}} + DP_{\text{generic}}$ ): Specific
- C2 ( $DP_{\text{specific}} + DP_{\text{specific}}$ ): Specific
- C3 ( $DP_{\text{generic}} + DP_{\text{specific}}$ ): Specific
- C4 ( $DP_{\text{generic}} + DP_{\text{generic}}$ ): Generic

Note that on conditions 1 and 3, where there is semantic incongruency among the DP-antecedents, we expected a preference for *specific* reading, given that this is the semantic/default meaning attributed to DefSingDPs. That is, when the context does not provide strong, non-contradictory information supporting a generic reading, we expect speakers to

<sup>5</sup> Responses examples: Specific: A baleia que nasceu no aquário (*The whale that was born in the aquarium*); Generic: Todas as baleias (*All whales*); Other: Ele não especificou que baleia, ficou ambíguo (*He didn't specify which whale, it was ambiguous*); Acho que nenhuma (*I think it's none of them*); A baleia grande que ele cria (*The big whale he raises*); and, Não sei (*I don't know*), or when participants simply did not say anything.

maintain the semantic/default meaning. Therefore, only in condition 4, *generic* readings are expected.

Clearly, the expected responses could have been projected taken into consideration a recency effect. According to which, in conditions 1 and 3, we would expect the responses to be modeled after the second DP-antecedent, being, thus, *generic* in C1 and *specific* in C3. This is an important issue, and we will come back to it on section 5, where we discuss our results.

#### 4.1.3 Schizotypy assessment

The presence of schizotypy traits was assessed by two psychometric scales designed for measuring schizotypy in nonclinical population: *Schizotypal Personality Questionnaire* (SPQ) (Raine 1991), and *Formal Thought Disorder Self* (FTD-S) (Barrera et al., 2015). Both are self-report questionnaires whose items are presented in the format of questions and affirmative statements to be answered according to participants' awareness of themselves. This approach favors assessing schizotypy differences within the normal population and in small sample groups, tapping into high and mild effects of different personality profiles (Langdon and Coltheart 2004).

SPQ questionnaire consists of 74 questions to be answered on a binary basis (yes = 1 and no = 0). It covers the full domain of schizotypal personality features based on DSM criteria for SPD (APA 2013) and shows 9-factor criteria: *ideas of reference*, *magical thinking*, *unusual perceptual experiences*, *suspiciousness/paranoia*, *social anxiety*, *no close friends*, *constricted affect*, *odd speech* and *odd behavior*. This scale also shows 3-factor structure corresponding to positive, negative and disorganized dimensions of schizotypy, as shown in Table 2.

SPQ					
9-factor criteria				3-dimension structure	
	range	Sample mean		range	Sample mean
<i>Ideas of reference</i>	(0–9)	4.6 ± 2.5	Positive	(0–33)	14.1 ± 7.3
<i>Magical thinking</i>	(0–7)	2.5 ± 2.4			
<i>Unusual perceptual experiences</i>	(0–9)	3.8 ± 2.3			
<i>Suspiciousness (or paranoia)</i>	(0–8)	3.2 ± 2.1	Negative	(0–33)	12.5 ± 6.3
<i>Social anxiety</i>	(0–8)	4.4 ± 2.6			
<i>No close friends</i>	(0–9)	2.3 ± 2.1			
<i>Constricted affect</i>	(0–8)	2.5 ± 1.7	Disorganized	(0–16)	6.5 ± 3.5
<i>Odd speech</i>	(0–9)	4.2 ± 2.2			
<i>Odd behavior</i>	(0–7)	2.6 ± 2.0			

**Table 2:** SPQ organization in both 9-and 3-factor structures with respective ranges and mean scores of our final sample.

A global measure of schizotypy (Total SPQ) can be derived from the sum of the 9-factors, with scores ranging from 0 to 74. However, since the suspiciousness/paranoia factor have loads on positive and negative dimensions, when considering the 3-factor structure, scores are derived from the sum of the items in each subscale as in table 2 above.

Although SPQ assesses the full domain of schizotypy personality features, only the odd speech factor is grafted to measure language features. Thus, as our investigation is language related, participants also answered the FTD-S — Formal Thought Disorder-Self questionnaire, specially designed to assess language features of schizotypy.

FTD-S consists of 29 items to be answered in a 4-point Likert scale (1 = “almost never”, 2 = “sometimes”, 3 = “often”, 4 = “almost always”), which, according to the authors, is more sensitive to the range of responses of general populations than the binary format.

Similar to SPQ, this questionnaire has a 3-dimension structure, reflecting schizophrenia symptomatology. And, as presented in table 3, it measures *odd speech*, *conversation ability* and *working memory deficits*. A global measure (Total FTD-S) is derived by the sum of all the items, which is equal to the sum of the 3 subscales.

FTD-S			
3-factor criteria		3-dimension structure	
		range	Sample mean
<i>Odd Speech</i>	Positive	(15–60)	26.2 ± 6.3
<i>Conversation ability</i>	Negative	(8–28)	12.6 ± 4.3
<i>Working Memory deficits</i>	Disorganized	(8–28)	13.1 ± 3.8

**Table 3:** FTD-S organization in both 9- and 3-factor structures with respective ranges and mean scores of our final sample.

In accordance to our second hypothesis (H2), we predicted that participants' responses in the language task should be associated with traits of both psychometric scales.

#### 4.1.4 Background questionnaire

Participants also completed a background questionnaire. See information given on table 1, section 4.1.1

#### 4.1.5 Research protocol

The protocol was approved by the Ethical Committee of Pontificia Universidade Católica do Rio de Janeiro, PUC-Rio, and followed the principals of *Plataforma Brasil*. Participants read and signed a consent form, informing details of the experiment, in accordance to the Brazilian CNS-CONEP resolution N°196/96 version 2012.

#### 4.1.6 Procedure

The questionnaires were presented in a written format. Tasks were executed in the following order: FTD-S, language test, SPQ, and background questionnaire, and performed in the presence of an experimenter with use of a MacBook Pro computer. Participants' oral responses were taped and later transcribed. Both psychometric scales and the background questionnaire were presented in a single page format, with every question being obligatory. The language test was presented in the format of automatically paced slides, as already said.



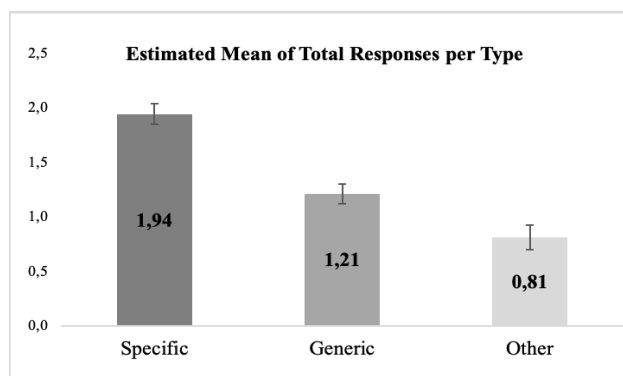
## 4.2 Statistical analyses<sup>6</sup>

All statistical analyses were conducted on SPSS software (version 21). First, language data was converted on ratio scores based on the number of responses per condition. Then, General Linear Model (GLM) multivariate analyses of the language data were conducted with the following dependent variables: (i) with total of each response type; (ii) with specific, generic, other response between conditions and (iii) with expected responses between conditions. Multiple regression analyses were conducted between language data and both psychometric scales (FTD-S and SPQ) to check for possible association between interpretation of DefSingDPs and schizotypal traits.

## 4.3 Results

### 4.3.1 Language test

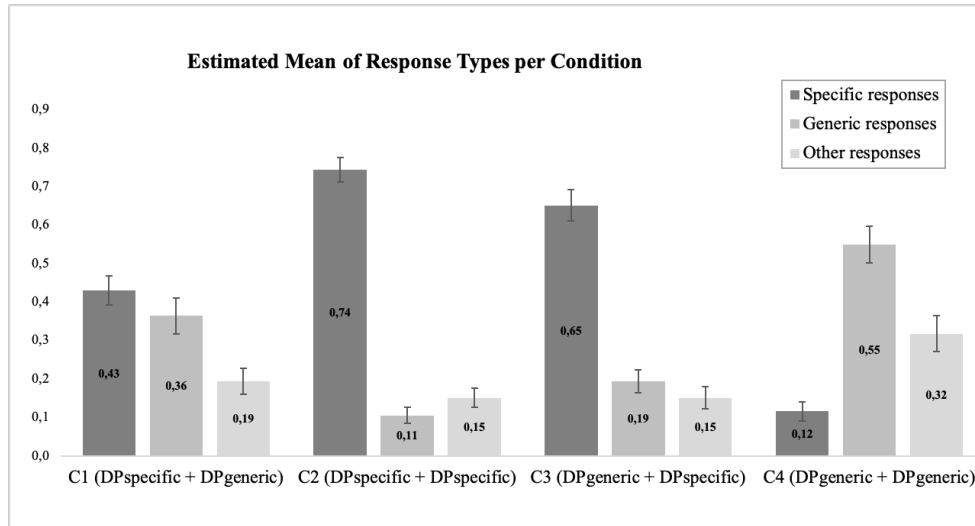
The multivariate analysis showed significant main effect of total response type ( $p = .000$ ) (see figure 2. After Bonferroni correction ( $p \leq .017$ ), pairwise comparison reached significance between the total of specific vs. generic ( $t_{(42)} = 4.917$ ;  $p = .000$ ), specific vs. other ( $t_{(42)} = 6.194$ ;  $p = .000$ ) responses, but not in the total of generic vs. other ( $t_{(42)} = 2.318$ ;  $p = .025$ ) responses.



**Figure 2:** Estimate mean of total ratio of each response type considering all conditions. Pairwise comparisons significant.

<sup>6</sup> Thanks to first reviewer's comments, modifications were made in the original statistical analysis. According to suggestions, multiple regression analyses were conducted, which led to a better presentation of the experimental data. Nevertheless, our results kept their significance level. I have to thank Thiago Graça Ramos for his most valuable help with the final statistical analysis.

The multivariate analysis showed significant main effect of response type between conditions ( $p = .000$ ), with significant between-subject effect of all responses: specific response ( $p = .000$ ); generic response ( $p = .000$ ); and other response ( $p = .000$ ) (see figure 3).

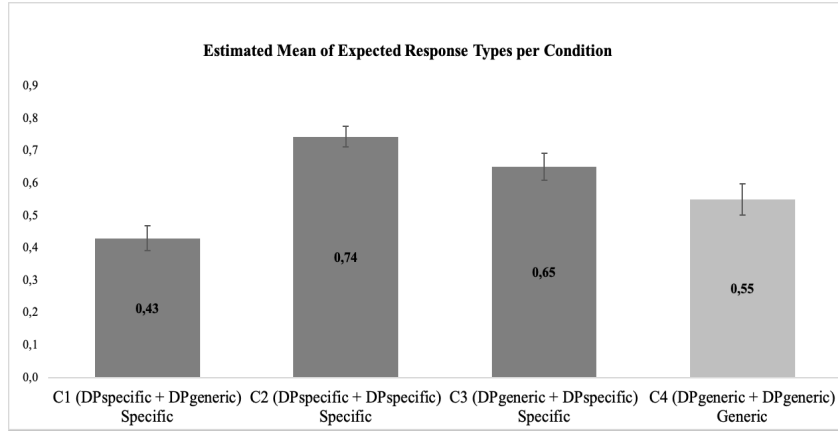


**Figure 3:** Estimated mean of ratio scores per condition. Condition 1: DP specific + DP Generic; Condition 2: DP specific + DP specific; Condition 3: DP generic + DP specific; and Condition 4: DP generic + DP generic. Pairwise comparisons significant.<sup>7</sup>

The multivariate analysis showed significant main effect of expected responses between conditions ( $p = .000$ ), with significant between-subject effects in all conditions: C1 (DP<sub>generic</sub> + DP<sub>specific</sub>): Specific ( $F_{1,42} = 130.151$ ;  $p = .000$ ); C2 (DP<sub>specific</sub> + DP<sub>specific</sub>): Specific ( $F_{1,42} = 574.291$ ;  $p = .000$ ); C3 (DP<sub>specific</sub> + DP<sub>generic</sub>): Specific ( $F_{1,42} = 256.138$ ;  $p = .000$ ); and, C4 (DP<sub>generic</sub> + DP<sub>generic</sub>): Generic ( $F_{1,42} = 133.917$ ;  $p = .000$ ) (see figure 4).<sup>8</sup>

<sup>7</sup> After Bonferroni correction ( $p \leq .008$ ), pairwise comparisons of specific responses reached significance in C1 – C2 ( $p = .000$ ), C1 – C3 ( $p = .000$ ), C1 – C4 ( $p = .000$ ), C2 – C4 ( $p = .000$ ), and C3 – C4 ( $p = .000$ ); but not between C2 – C3 ( $p = .017$ ) comparisons. Pairwise comparisons of generic responses reached significance in all comparisons: C1 – C2 ( $p = .000$ ), C1 – C3 ( $p = .002$ ), C1 – C4 ( $p = .003$ ), C2 – C3 ( $p = .007$ ), C2 – C4 ( $p = .000$ ), and C3 – C4 ( $p = .000$ ). Pairwise comparison between other responses reached significance in C1 – C2 ( $p = .000$ ), C4 – C2 ( $p = .000$ ), and C4 – C3 ( $p = .000$ ) comparisons, but did not reach significant between C1 – C2 ( $p = .140$ ), C1 – C3 ( $p = .175$ ), and C2 – C4 ( $p = 1.000$ ) comparisons.

<sup>8</sup> Pairwise comparison of expected responses between conditions reached significance in C1 – C2 ( $p = .000$ ), C1 – C3 ( $p = .000$ ), and C2 – C4 ( $p = .000$ ) comparisons. However, comparisons between C1 – C4 ( $p = .054$ ), C2 – C3 ( $p = .017$ ), and C3 – C4 ( $p = .061$ ) did not reach significance after Bonferroni correction ( $p \leq .008$ ).



**Figure 4:** Estimated mean of ratio scores of Expected responses between conditions: Condition 1 (DP specific + DP Generic): Specific; Condition 2 (DP specific + DP specific): Specific; Condition 3 (DP generic + DP specific): Specific; and Condition 4 (DP generic + DP generic): Generic.

#### 4.3.2 Psychometric scales and language test

In this section, we explore associations between the results obtained in the two psychometric scales used to measure schizotypy (SPQ and FTD-S) and the results obtained in the language test.

First, an association involving C1 of the language test, the SPQ Disorganized dimension and the FTD-S Disorganized dimension was found, such that attribution of specific readings to DefSingDPs in C1 is predicted by SPQ Disorganized dimension ( $\beta = -.484$ ;  $p < .005$ ) and FTD-S Disorganized dimension ( $\beta = .359$ ;  $p < .040$ ). The overall model fit was statistically significant ( $F_{(2,40)} = 4.556$ ;  $p < .017$ ;  $R^2_{adj} = .145$ ).

Second, an association was also found between C2 and the SPQ Positive dimension: the SPQ Positive dimension was a significant predictor of assignment of specific readings to DefSingDPs in C2 ( $\beta = -.359$ ;  $p < .018$ ). The overall model fit was statistically significant ( $F_{(2,40)} = 6.069$ ;  $p < .018$ ;  $R^2_{adj} = .108$ ).

## 5. Discussion

The results above indicate that in general participants' responses varied according to the information given in the linguistic context (type of DP-antecedents and semantic congruency/incongruency among them). This indicates that the experiment was successful in anchoring the interpretation of the target DefSingDPs in given linguistic contexts.

The specific reading was dominantly assigned. This reading prevailed in C1, C2 and C3. In C4, where the context robustly emphasized a generic interpretation, the generic reading was significantly preferred, with the specific reading being the least preferred one. This is in accordance with our (H1). Nevertheless, two observations are in order: (a) in C1, where there was semantic incongruency ( $DP_{\text{specific}} + DP_{\text{generic}}$ ), the difference between specific and generic readings did not reach significance, although there was a preference for specific readings; (b) in C4, the number other-reading responses was significantly higher than in any of other conditions. These two issues were not predicted by our H1. Let us tackle issue (a) first.

The high number of generic-reading responses in C1 was not expected by H1 because H1 predicted that in contexts with semantic incongruency (conditions 1 and 3), speakers would maintain the semantic reading, which is specific. Importantly, the results obtained for C3 are in accordance with H1, as speakers showed significant preference for the specific reading. The difference between C1 and C3 is the order of the DP-antecedents. In C1, the last DP-antecedent is generic (a bare plural DP), while in C3 it is specific (indefinite specific DP). This shows a recency effect in our results, with the last DP given in the context taken to be the antecedent of the target DefSingDP. This effect not projected in our expected responses; hence, the results obtained were not fully in accordance with H1.

It has been shown that recency is a cognitive bias that is present in different psychological activities, being related to our short-term memory capacity (Baddeley and Hitch 1993; McElree 2006; Morrison et al. 2014 among others). It plays a relevant role in language processes, such

as lexical activation (Griffin 2002) and syntactic processing (Frazier 1978; Gibson et al. 1996; Frazier and Clifton 2005 among others). Our results show that, at the Pragmatic level, integration of contextual information to semantic meaning may also display recency effects. Frazier and Clifton (2005) argue, based on processing of ellipsis, that syntactic and discourse level differ in that the first display recency effects, while the second is subject to effects of antecedent saliency. This is not in tension with our findings. In our experiment, neither the first nor the second DP-antecedent were more salient than the other. Putting these two studies together, we may say that recency plays a role at the pragmatic level if salience is not at play.<sup>9</sup> As for issue (b), we believe it is consistent with analyses according to which the specific reading is the semantic reading of DefSingDPs. The mean of other-reading responses across conditions was higher in C1 and C4, with no difference whatsoever between C2 and C3; but it was significantly higher in C4 than C1. In C1, due to a recency effect, the generic reading was higher than in C2 and C3, and in C4, where the context robustly reinforced generic interpretation, the generic reading was significantly higher. Hence, in all conditions in which the generic reading was supported by the contextual information, an increase on the number of other-reading responses was observed. We interpret this as suggesting that whenever the semantic meaning is disfavored at the pragmatic level, the possibility of non-at-stake (irrelevant) interpretations increases. Being bold, we may say that conflicting semantic and pragmatic information may increase interpretation errors involving intrusion information. Let us now consider our H2 and the associations reported above, crossing, in terms of probability, the results of the psychometric scales (SPQ and FTD-S) and the results of the language test.

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<sup>9</sup> A reviewer observed that the connective chosen to link the first two clauses of the given linguistic context might have affected the obtained results. We disagree. The additive connective (*e*) was used when there was semantic congruency (C2 and C4), while the adversative connective (*mas*) was used in the presence of semantic incongruency (C1 and C3). There is no common pattern between results obtained in conditions C1-C3, and C2-C4.

It was found that the SPQ positive dimension (which encompass traits of ideas of reference, magical thinking and unusual perceptual experiences) is a predictor of specific-reading-responses in C2. This is accordance with H2, and with the general literature which reports that schizotypy can lead to pragmatic issues. Chaves (2017) reports that individuals with schizotypal traits of constricted affect and unusual experiences were more hooked to the specific reading of DefSingDPs, whenever this reading were favored by the given linguistic context. Our present finding is, thus, in line with Chaves (2017). In C2, the given context undoubtedly reinforced the specific-reading, as both DP-antecedents were triggers for specific interpretations.

Our results also indicate that specific-reading responses for C1 were significantly predicted by the SPQ Disorganized dimension and the FTD-S Disorganized dimension. We believe this is also due to the fact that these speakers have a tendency to be locked on semantic meaning. Although it has been reported that the schizotypy leads to a decreased short-term memory (Bergman et al. 1998; Voglmaier et al. 2000; Marsh et al. 2017), it has been shown that recency is preserved (Frame and Oltmanns 1982; Stephane and Pellizzer 2007). Hence, lack of recency might not be playing a role in the association we obtained. It seems that high levels of schizotypy traits, especially those related to the disorganized dimension of SPQ and FTD-S, also affect language interpretation processes in that speakers carrying these traits are more tune in to semantic meaning. We empathize, though, that more research is needed to investigate the associations found and short-term memory impairments.

Importantly, our results suggest that, among nonclinical population, variations on interpretation processes can be related to variations in the expression of schizotypal traits within the population. This is potentially relevant to investigations within linguistics in general, calling attention to issues related to selection of speakers to compose experimental samples.

To close this section, let us acknowledge that a linear regression analysis showed an association between other-reading responses in the language test and the item familial history of mental disorders present in the background questionnaire. We did not analyze this association. We did not have an expressive number of other-reading responses, and speakers reported, as familial mental disorders, a variety of independent disorders that are not associated to psychosis breakdown, such depression and anxiety.

## 6. Conclusion

The present study aimed at further investigating whether native speakers of BP had a preference for attributing specific readings to DefSingDPs. It also aimed at further investigating effects of schizotypy on the interpretation of DefSingDPs in general population, building on Chaves (2017). Results showed a general preference for the specific reading, which is understood as the semantic reading of DefSingDPs.

We also indicate that schizotypy traits affect the responses obtained: high scores on the positive dimension of SPQ and on the disorganized dimensions of SPQ and FTD-S are predictors on specific-reading responses in C1 and C2. This suggests these traits interfere with the integration of linguistic contextual information into semantic meaning at pragmatics. This is in line with Chaves' (2017) findings and with the general literature about language in the face of schizotypy and schizophrenia.

The literature on language and schizotypy continuum, including schizophrenia, reports several difficulties at the pragmatic level of grammar. Our results do not point towards difficulties, pointing rather towards a tendency to be locked on semantic meaning.

Our results bring out the possibility of understanding variations in language interpretation in function of variations in the expression of schizotypal traits within the population, particularly in nonclinical populations.

Future experiments should aim at increasing the sample, including a more diverse set of participants, demographically and otherwise; it should also consider a potential effect of decreased short-term memory on recalling contextual information. In addition, usage of instruments other than psychometric scales to assess individual differences in schizotypy, such as third-person informants and/or structured interviews, might be relevant. The use of different methodologies to collect linguistic data should also be implemented.

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