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Atypical Regional Accent in Autistic Children: A Perception Study

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ABSTRACT

Autistic children are frequently said to speak with accents that markedly differ from those of their linguistic communities. To date, these anecdotal reports have never been tested or explained. We ran two perception studies using short audio recordings of autistic and typically developing children from the Campania region in Italy. The variety of Italian to which children are exposed in this region markedly differs from those spoken in the rest of Italy. Participant responses about the children's geographical origin show: (a) That autistic children's accent is devoid of the regional features of their community; (b) resembles the standard variety used in cartoons and child television programs. The judgments about children's accents are, furthermore, independent of the overall perception of speech atypicality. This paper shows that the accent of autistic children may diverge from that of their caregivers and peers because of the lasting influence of non-interactional, screen sources on their speech.

Non-autistics frequently perceive the speech of autistic individuals, including those with structural language levels within the typical ranges, as atypical (Grossman 2015; Sasson et al. 2017). Autistic children and adults are also often said to speak with a "weird" or "posh" accent, something that is widely discussed in social media and blogs,[1] and is targeted within a standardized self-report communication questionnaire (Bishop, Whitehouse, and Sharp 2009). However, such perceptions of accent atypicality have never been experimentally attested, and there is also no available explanation for why autistic children would speak with unusual accents. Yet, investigating atypical accents in autism has crucial societal implications. The perceptions of atypicality non-autistics form about autistic speakers may give raise to negative impressions (Geelhand et al. 2021) and lead to prejudice. Dialectal features are routinely associated with negative stereotypes that extend beyond geographical information (see Eckert 2008; Snell 2015), and may thus contribute to the exclusion of autistic individuals. Better understanding what may make the speech of autistic individuals sound atypical is thus crucial to unveil the structural sources of mutual misapprehension between autistics and neurotypicals.

In some instances what sounds like an atypical accent might be partly due to speech disability, but such an explanation is unlikely to be sufficient. To begin with, there is little evidence that autism is characterized by oro-motor difficulties that would systematically impact articulatory movements, unlike, for instance, in apraxia of speech or dysarthria (see Maffei et al. 2023; Shriberg et al. 2011). Furthermore, perceptions of atypicality triggered by the speech of autistic individuals do not straightforwardly map on acoustic features (Patel et al. 2020). Atypical accents in autism are also often described with a striking regional precision, which makes an articulatory explanation rather unlikely. For instance, three autistic English children have been described as speaking with a strong American accent, despite not having been in exposed to speakers of American English,

Summary

- The accent of autistic individuals, children and adults, may seem somewhat “foreign” or “posh.” Our study suggests that this is so because the way autistic children speak is shaped by the language of screen medias, which may differ from the dialectal properties of the language spoken around them.

in what was framed as a mysterious case of Foreign Accent syndrome (Rambathla and Rao 2013). On the other side of the Atlantic, typing [peppa pig autistic accent] in the X (Twitter) search bar yields many testimonies of American caregivers whose autistic children speak with a British accent after watching Peppa Pig shows.

Our favorite explanation is that autistic children's accents diverge from those of their communities because, unlike in typical development, their language acquisition is strongly shaped by exposure to screen media. Early speech in autistic children is usually dominated by echolalic productions, i.e. verbatim repetitions, immediate or delayed, of a limited number of linguistic chunks, which often preserve fine prosodic and phonetic details of the echoed source (Maes, La Valle, and Tager-Flusberg 2024; Stiegler 2015; Werner and Dawson 2005). Rehearsing previously heard linguistic material plays an important role in language acquisition, allowing extensive reanalysis and facilitating the chunking of new sequences of speech (Christiansen and Chater 2016; Eghbaria-Ghanamah et al. 2020). In autism, delayed echolalia may thus constitute an opportunity to induce linguistic categories from iterated perception-production loops outside inter-subjective communicative contexts. In typically developing children, the acquisition of linguistic categories stems, to an important extent, from mirroring, reanalyzing and adapting the phonological templates, drawn from different communicative contexts by different speakers (Pierrehumbert 2003; Vihman and Croft 2007). In autistic children, however, the range of interactional experiences is likely more reduced, and the sources of linguistic input that shape child's speech characteristics less varied.[2]

Caregivers and professionals frequently report that the sequences echoed by young autistic children are drawn from limited linguistic material to which the child is recurrently exposed; idiosyncratic expressions by the child's caregivers, but also often a few songs, online videos or cartoons for which the child displays an intense preference (Stiegler 2015). Imitating characters from television or cartoons is, indeed, a sign of child speech atypicality (targeted by the CCC-2 Bishop 2003, item 23). Therefore, while the speech of some autistic preschoolers may closely reflect the way they are spoken to by primary caregivers, for some others, the main acquisition source could be non-interactional, such as repeatedly and very frequently watching a favorite movie or some excerpts of it.

Several studies have now documented unexpected bilingual profiles in autistic children, who displayed productive mastery of a language that was not used in communication around them and that they could have learned only from socially unmediated exposure to screens. Vulchanova et al. (2012) described a Bulgarian autistic girl who reached an impressive mastery of German, including productive morpho-syntax, exclusively from television; Zhukova et al. (2021) reported an analogous screen-based learning of English in a Russian autistic boy and Kadiri and Anasse (2023) for a Moroccan one. Recently, Dumont et al. (2024) described a group of 12 autistic children from French-speaking Belgium who acquired English exclusively from passive exposure to screens (and who displayed enhanced auditory skills).

There are also frequent reports in Arabic-speaking countries of pre-school or early school age autistic children who display a remarkable mastery of the Standard variety of Arabic. Such linguistic profiles are as surprising as the unexpected bilinguals just discussed, because the Standard Arabic is reserved for very formal, mostly written settings, is never used in everyday communication, and, in typically developing children, is only mastered after protracted explicit instruction in school (e.g., Khamis-Dakwar, Froud, and Gordon 2012). Interestingly, though, Standard Arabic is also used in television programs and cartoons that are broadcast across the Arab-speaking world. Kissine et al. (2019) described the linguistic profiles of five young autistic Tunisian boys who spontaneously and productively used Standard Arabic, with a striking mastery of its phonological and morpho-syntactic features. None of these children had benefited from explicit instruction in Standard Arabic, so that passive exposure to television remains the only possible source of learning. The same phenomenon has now been attested in Arabic Israeli (Abd El-Raziq, Meir, and Saiegh-Haddad 2024) and Kuwaiti (Francis et al. 2024) autistic children.

Strikingly, there is well-established evidence that, for typically developing children, passive screen exposition to linguistic input, as opposed to active child-directed interaction, does not suffice to extract core linguistic properties (Kuhl, Tsao, and Liu 2003; Sachs, Bard, and Johnson 1981). In fact, child language acquisition from television or internet is deemed so unlikely that it is usually recommended in the bilingualism literature that such sources be excluded when assessing children's exposition to different languages (Byers-Heinlein 2015).

A provocative, but plausible line of thought is that, in autism, such language learning from passive screen exposure is not necessarily limited to foreign languages. If some autistic children ground their speech acquisition on non-interactional sources, their dialect may differ from that of their caregivers. We already evoked the pioneering case study of EV, the Bulgarian autistic girl who learned German exclusively from passive exposure to television programs. Interestingly, EV was also speaking Bulgarian with a standard accent, markedly different from that of her parents (Vulchanova et al. 2012).

To be sure, there could be other, not necessary mutually exclusive explanations for atypical accents in autism. For instance, adopting a more standard accent could reflect a preference for more formal register, which is consistent with frequent reports of “pedantic” language in autism (Luyster, Zane, and Wisman Weil 2022). Beyond screen media, such a formal communication style could be further reinforced by interest in written language, frequently attested in autism (Ostrolenk et al. 2024).

The linguistic development of autistic children thus qualitatively differs from that of their typically developing peers, including in the possible influence of screen-based media. We hypothesize that, for this reason, the speech productions of autistic children should be perceived as being close to the variety found in the child screen media. Such varieties are usually associated with accents normatively perceived as "standard." This is the prediction that is tested in this paper.

We investigated regional and atypicality perceptions based on short audio recordings of autistic and typically developing (TD) children from the Campania region in Italy, which includes Naples urban area; this region is represented in red on the Italy map in Figure 1A. Crucially, the Neapolitan dialect is very prominent in Campania region (e.g., Berruto 2018), so that the variety of Italian to which children in Campania are exposed markedly differs from those spoken in the rest of Italy, and especially the Center and North regions (Cardinaletti and Munaro 2009; Crocco, Gili Fivela, and D'Imperio 2022; De Blasi 2014 a.o.). The map in Figure 1B illustrates the three linguistic regions that are used in this paper: North, Center and South, the later comprising the Campania region. In Exp. 1, we asked adults from different Italian regions to guess the origin of the recorded children. We expected that participants from the South region would have no trouble identifying TD children as coming from their own region. We also predicted that the speech of autistic children may not always display the same dialectal characteristics but be more strongly shaped by the Italian variety of cartoons or child movies to which they may be exposed. A clear limitation of our study is that we did not have any direct measure of the

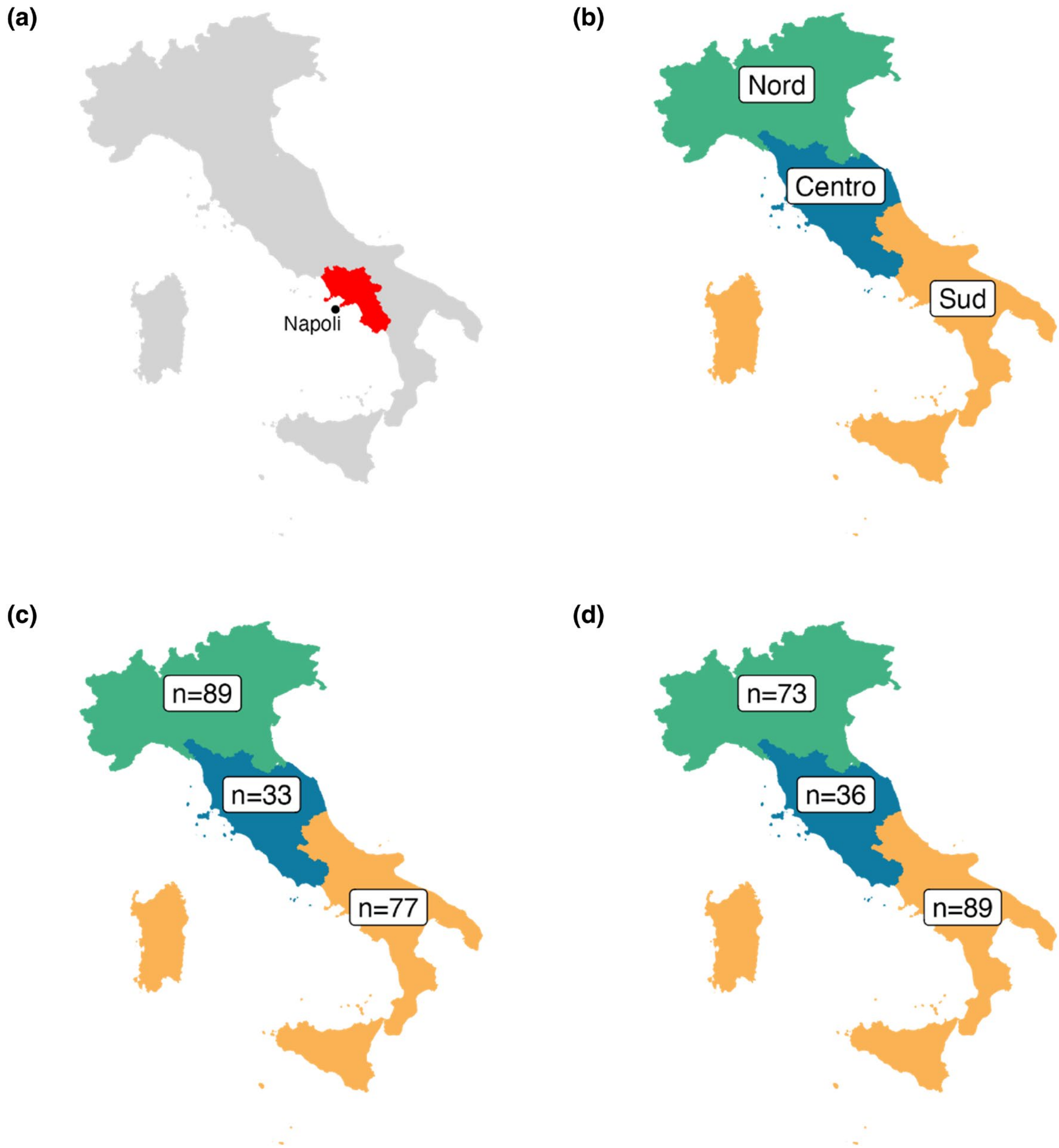

FIGURE 1 | Maps of Italy. (a) The geographical origin of the children recorded in the experimental stimuli. (b) The geographical (isoglossic) division presented as option for responding to participants and used to stratify participants' linguistic region for control items in Exp. 1 and 2 and experimental items in Exp. 1. (c) Exp. 1. Number of participants per geographical region (based on self-reported city of secondary education) (d) Exp. 2. Number of participants per geographical region (based on self-reported city of secondary education).

amount or the content of children's screen exposure. However, the dubbing of both international (e.g., *Masha and the Bear*, *Peppa Pig*, *Barbapapa*, *Pip and Posy*, *Mystery Lane*, *PJ Masks*, *Gigantosaurus* or *Oggy and the Cockroaches*) and Italian (e.g., *Pimpa*, *Grisù*, *Topo Tip*, *Winx Club* or *Nina* and *Olga*) cartoons is characterized by the use of a very "controlled," standard Italian without marked regional features. Now, the regional accents of Italian are associated with different levels of prestige, with northern accents having the highest one—to the extent that they are reevaluated as corresponding to the "standard" pronunciation (De Pascale and Marzo 2016). Therefore, if the accent of autistic children bears the characteristics of the "neutral" variety used in cartoons, their recordings are likely to be assessed as coming from the North region.

Participant's judgments in Exp. 1 might be influenced by speech atypicality, for instance, because speech disfluency would prompt adult raters to classify the recording as originating from outside their own region. To control for this possibility, in Exp. 2 we asked a new sample of adult participants, stratified by region in the same way as in Exp. 1, to rate the recorded children on a typicality slider scale.

1 | Methods

1.1 | Materials

The stimuli used in Exp. 1 and 2 were extracted from the recordings of 13 autistic and 13 typically developing (TD) children from the *ItaASD: the Italian Speech Corpus on Autism Spectrum Disorder* (Imparato et al. 2023). This corpus, collected in 2022, comprises recordings of semi-spontaneous speech from children with an official clinical diagnosis of autism (described as "high-functioning" at the diagnosis time) and typically developing peers, all from the Campania region of Italy (see Figure 1A). There is growing evidence that female autistics may differ from male autistics in linguistic profiles, camouflaging their autism (e.g., Parish-Morris et al. 2017; Sturrock et al. 2020). However, the *ItaASD* corpus features a predominant number of males (13/17 in each group), and, to avoid multiplying stimuli heterogeneity, we decided to only include recordings by boys as experimental stimuli. The mean chronological age of these autistic boys at the time of recording was 9:10 years (sd = 2:5), and that of TD boys 9:9 (sd = 2:5).

Each recorded child has completed three tasks—a complex image description, a narrative storytelling, and a narrative retelling task—with their production being fully annotated using ELAN software. We selected, for each of the 26 boys, the recordings of three utterances per task. The sentences were selected by excluding those that contained the main morphosyntactic and lexical regional traits described in the literature as salient of the linguistic area of southern Italian variants (below the Roma-Ancona isogloss; e.g. De Blasi 2014; Ledgeway 2009). By excluding these linguistic features, we ensured that our perception study targeted primarily phonetic and phonological aspects. Next, we kept three recordings per child, selecting the longest ones (in duration and number of words). As shown in Table 1, the stimuli had comparable length and number of words across groups. We also measured the fundamental frequency (F0), F0 range, harmonicity to noise ratio, jitter, and shimmer, which are robust acoustic correlates of speech disabilities. The productions by autistic children had higher F0, conforming to a general tendency for higher pitch in autistic (male) individuals (Fusaroli et al. 2017, 2022; but see Kissine and Clin 2024 for a more nuanced view); stimuli from autistic children also had higher jitter and shimmer, although well below values considered as pathological.

Finally, we also created a control condition, with the objective to ensure that participants in the Exp. 1 and 2, described below, were able to identify geographical origin based on short speech excerpts. We had six control items, which were sentences, identical to those found in the *Ita-ASD* corpus, read by six adult speakers, two from the North region, two from the Center region, and two from the South region. These main linguistic regions were delimitated by the two main boundaries (isoglosses) between Italian linguistic areas, La Spezia-Rimini isogloss and Roma-Ancona (e.g., Istituto dell'Atlante Linguistico Italiano n.d.).

1.2 | Experimental Tasks

Exp. 1 and 2 were programmed on PsychoPy2 (Peirce et al. 2019), hosted online on Pavlovia.org and fully administered online via Prolific.

TABLE 1 | Experimental stimuli. Average values (se) per diagnostic group of the recorded child and fitted difference.

	Autistic	TD	β (se)[a]
Word number	5.9 (2.07)	6.95 (1.67)	0.16 (0.09)
Duration (s)	2.81 (0.94)	2.82 (0.88)	0.01 (0.2)
F0 (Hz)	273.64 (47.05)	240.39 (34.27)	−33.25 (9.32)***
F0 range (semi-tones)	15.2 (6.62)	16.55 (8.55)	1.34 (1.7)
Noise to harmonicity ratio	9.69 (2.63)	10.89 (3.65)	1.19 (0.72)
Jitter	0.02 (0.01)	0.02 (0.04e^{-1})	−0.03e^{-1} (0.01e^{-1})*
Shimmer	0.16 (0.02)	0.13 (0.03)	−0.03 (0.01)*

Note: See Supporting Information for statistical analyses.
[a]Coefficients from Poisson (word number) or linear regression (other measures); the autistic group is the intercept.
*$p < 0.05$.
***$p < 0.001$.

1.2.1 | Experiment 1: Accent Detection

In each experimental trial of Exp. 1, participants were presented with an audio and asked to decide from which region of Italy—North, Center or South—they thought the recorded adult (Control items) or child (Experimental phase) was from. Participants responded by clicking on one of the three buttons with the region name, displayed on the right of the map of Italy divided into three parts according to the two main La Spezia-Rimini and Roma-Ancona isoglosses, and with the same color codes for regions as on this map. Figure 2 displays a screenshot of an experimental trial of Exp. 1. The experiment began with the six control trials, in which stimuli were presented in a fixed order: North, Center, and South. In the experimental phase that followed, the 60 child recordings were presented in a fully random order. Finally, as a proxy for the linguistic region of the participants, they were asked to fill in a text box with the city in which they had done their secondary education.

1.2.2 | Experiment 2: Typicality Judgment

The procedure of Exp. 2 was very similar, except that in each experimental trial, participants were asked to assess how typically developing was the recorded child. They were presented with a slider scale, going from "Certainly atypical" to "Certainly typical," and asked to position the cursor on the point of scale that corresponded to their judgment of whether the development of the recorded child was typical or atypical. Figure 3 displays a screenshot of an experimental trial of Exp. 1. The other difference with Exp. 1 was that the control phase, which tested participants' perception of regional dialects, followed the experimental trials. This was because we did not want participants' atypicality judgments to be biased by drawing their attention to dialectal features of the stimuli.

FIGURE 2 | Screenshot of an experimental trial of Experiment 1.

1.3 | Participants

Two hundred participants per experiment were recruited via Prolific, with the pre-screening condition to have Italy as the main residence country before the age of 18, to have Italian as a first language and to self-report as neurotypical (with the additional constraint not to have taken part in Exp. 1 for participants in Exp. 2). Figure 1C,D display participant stratification per linguistic region (based on self-reported city of secondary education); Table 2 displays demographic information.

Participants were invited to take part in a study on regional accents of Italian and compensated £3 for their participation. All participants reported having Italian nationality; as can be seen from Table 2, the sample was almost evenly split by gender, with a majority of participants reporting living in Italy and being white. Based on the self-reported city of secondary education (one self-report missing), we stratified participants by linguistic region, using the same boundaries as the ones used in the response option. As shown in Figure 1C, in Exp. 1 there were 89 participants from the North, 33 from the Center, and 77 from the South. As shown in Figure 1D, in Exp. 2 there were 73 participants from the North, 36 from the Center, and 89 from the South.

1.4 | Analytical Plan

For control items of Exp. 1 and 2, our dependent variable was Accuracy, defined as the correct identification of the speaker's

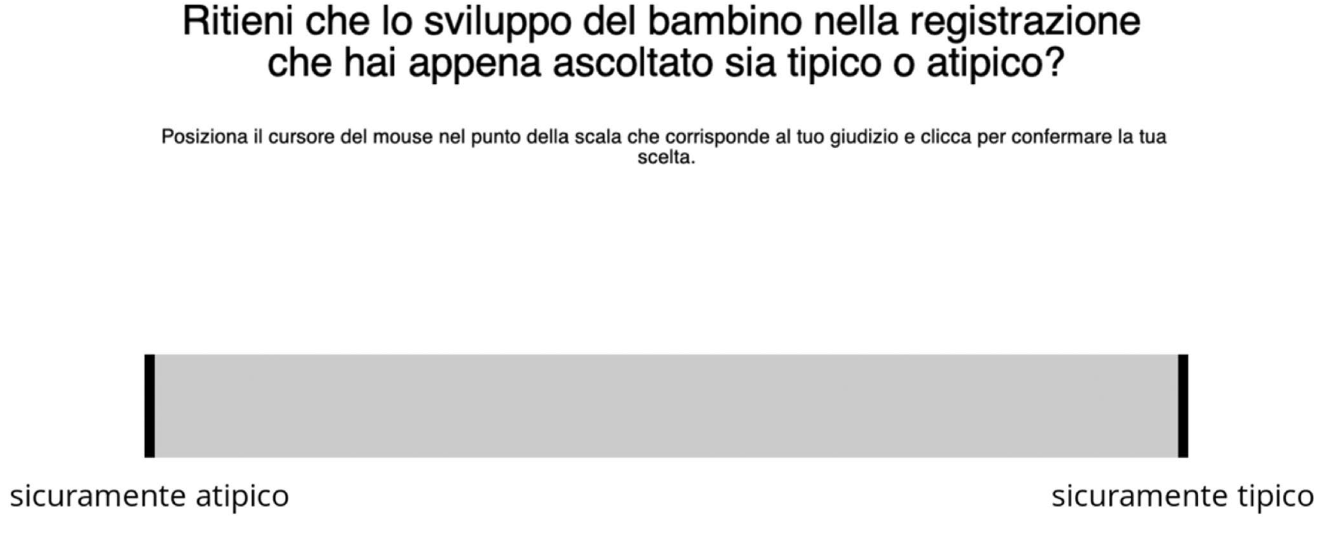

FIGURE 3 | Screenshot of an experimental trial of Experiment 2.

TABLE 2 | Participant characteristics (self-reported on Prolific).

	Gender	*n*	Mean age (sd)	White (*n*)	Residing in Italy (*n*)
Exp. 1	Female	90	32.99 (10.49)	90	74
	Male	110	35.09 (9.88)	106	106
Exp. 2	Female	100	32.68 (10.33)	92	86
	Male	100	33.71 (10.6)	97	90

region, and the independent variables were the Recording origin (North vs Center vs South), the participant's self-reported Linguistic region (North vs Center vs South), as well as their interactions.

For the experimental stimuli of Exp. 1, our main prediction was that participants should perceive the recordings of autistic children as closer to a more standard variety of Italian, that is, as more similar to the varieties found in mainstream television or cartoon programs. Southern varieties of Italian, such as the one from the Campania region from where the recorded stimuli were collected, feature considerably less in such media than Northern varieties. On the one hand, we predicted that participants from the South region would identify the recordings of the TD children as originating from their own region, but less so the recordings of the autistic children; on the other hand, we expected that participants from the North would identify the recordings of autistic children as coming from their own region, but not so for the recordings of autistic children. Accordingly, to analyze the experimental trials of Exp. 1 we created a Congruence dependent variable, coded as 1 whenever the chosen region (see Figure 1B) was identical to the participant's own region (see Figure 1C), and 0 otherwise. The independent variables were the Group of the recorded child (Autistic vs TD), the participant's self-reported Linguistic region (North vs Center vs South), as well as their interaction.

For experimental stimuli of Exp. 2, the underlying scale of the slider on which participants made their atypicality judgments went from 0 ("Certainly atypical") to 5 ("Certainly atypical"), and the position of the cursor was the dependent variable. The independent variables were, again, the Group of the recorded child (Autistic vs TD), the participant's self-reported Linguistic region (North vs Center vs South), as well as their interaction.

All statistical analyses were conducted in R. Accuracy on experimental trials of Exp. 1 and 2 and Congruence in Exp. 1 were binomial variables and hence were modeled with multilevel logistic regressions; atypicality judgments in Exp. 2 were modeled with multilevel linear regressions. These models were implemented using the *lme4* package (Bates et al. 2015), along with *lmerTest* for *p*-value estimates (Kuznetsova, Brockhoff, and Christensen 2017) and *emmeans* (Lenth et al. 2020) for Tukey post hoc comparisons. The effect of fixed factors was assessed in a forward stepwise fashion, using log-likelihood comparisons between a model with this factor and a model without it but with an otherwise identical structure. All models included the maximal theoretically motivated random structure: Group by participant random slopes, by participant random intercepts, and, given that each of the 20 children contributed 3 recordings, by recorded child random intercepts. Detailed commented statistical code, including model comparisons and analyses of control items is provided as Supporting Information.

1.5 | Ethics

All procedures were approved by the Ethical Committee of the Faculty of Letters, Translation and Communication of the Université libre de Bruxelles.

2 | Results

2.1 | Experiment 1

2.1.1 | Control Items

There was an effect of the Recording origin ($\chi^2(2)=16.08$; $p<0.001$), no effect of the Linguistic region ($p=0.72$), but a Recording origin x Linguistic region interaction ($\chi^2(4)=54.33$; $p<0.001$). Participants were generally well above chance level, and especially so for the stimuli of their own region for participants from the North and the Center regions (see Supporting Information).

2.1.2 | Experimental Items

The classifications of recordings of autistic children as coming from the North region outnumbered the other classifications by participants North region, while the same trend was observed for the classification of TD children as coming from the South region by participants from the North and the South regions. This is illustrated in Figure 4, which summarizes the number of responses, for each Group, per Recording origin and Linguistic region.

There was a significant Group x Linguistic region interaction ($\chi^2(2)=31.17$; $p<0.001$): in the North region, Congruence was higher for recordings of autistic versus TD children ($\beta=0.38$; $se=0.08$; $p<0.001$), while the difference went in the opposite direction direction for participants from the South region ($\beta=-0.22$; $se=0.08$; $p=0.007$). As can be seen from Figure 5, which displays the predicted Congruence probability, participants from the North classified the recordings of autistic, but not

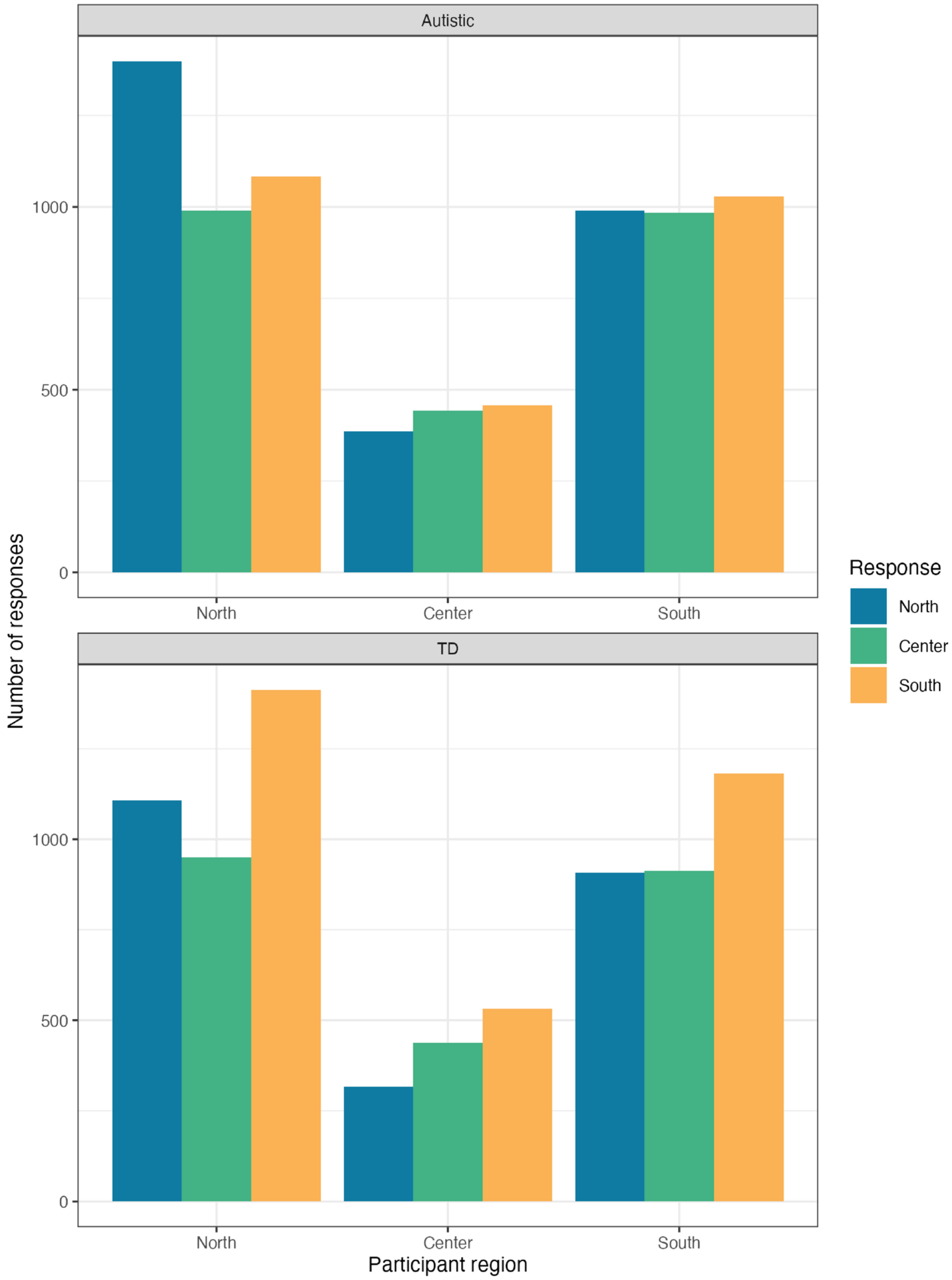

FIGURE 4 | Exp. 1. Responses by recorded child's Group and participant's Linguistic region.

TD, children as coming from their own, North region well above chance. Participants from the South region, by contrast, classified the recordings of TD, but not autistic, children as coming from South above chance.

2.2 | Experiment 2

2.2.1 | Control Items

There was an effect of the Recording origin ($\chi^2(2)=20.2$; $p<0.001$), no effect of the Linguistic region ($p=0.92$), but a Recording origin x Linguistic region interaction ($\chi^2(4)=29.44$; $p<0.001$). As in Exp. 2, participants were generally well above chance level, and especially so for the stimuli of their own region for participants from the Center region (see Supporting Information).

2.2.2 | Experimental Items

Atypicality judgments per Linguistic region and the recorded child Group are displayed in Figure 6. Recordings of autistic children were judged as more atypical than those of their TD peers, irrespective of the linguistic region of the participant ($\chi^2(1)=22.94$; $p<0.001$). While fitted atypicality ratings of recordings of autistic children hovered mid-scale (2.61; 95%CIs [2.26;2.96]), those of the recordings of TD children were closer to the "Certainly typical" end of the scale (4.04; 95%CIs [3.7;4.39]).

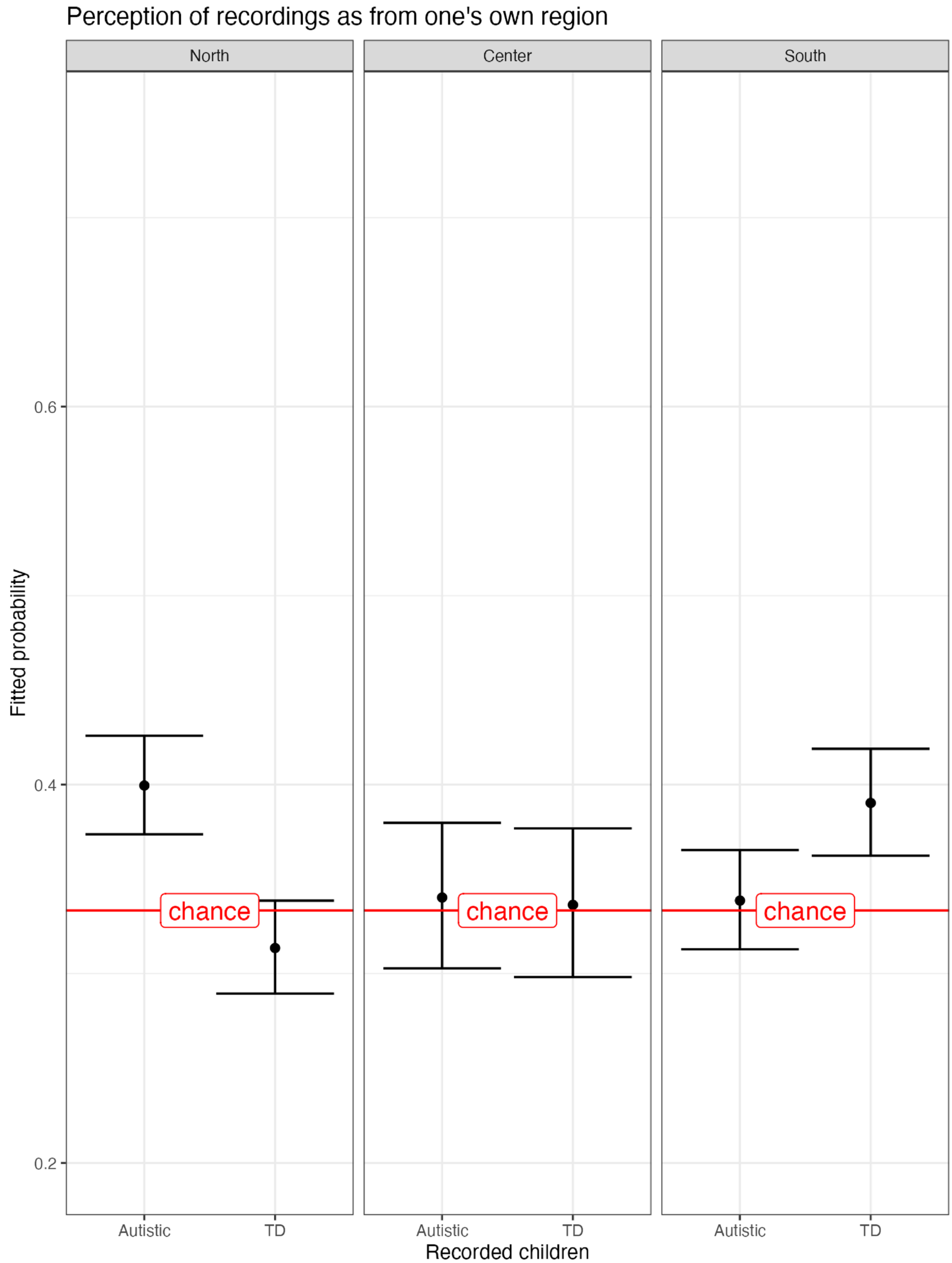

FIGURE 5 | Exp. 1. Predicted Congruence probability by recorded child's Group and participant's Linguistic region.

3 | Discussion

Exp. 1 unambiguously shows that the speech of autistic children does not bear the dialectal features that may be detected by adult speakers from their own linguistic region, which is the first experimental confirmation of the atypicality of autistic individuals' accents to date. Based on very short speech excerpts, participants from the South region detected, above chance, that TD children came from their own region, but did not do so for the recordings of autistic children. Note also that accuracy was high on control items in both Exp. 1 and 2, showing that the kind of accent detection task we used in Exp. 1 is not inherently difficult.

The results of Exp. 1 are consistent with a lasting influence of non-interactional, screen sources on the speech of autistic children. Participants from the North region miscategorized the

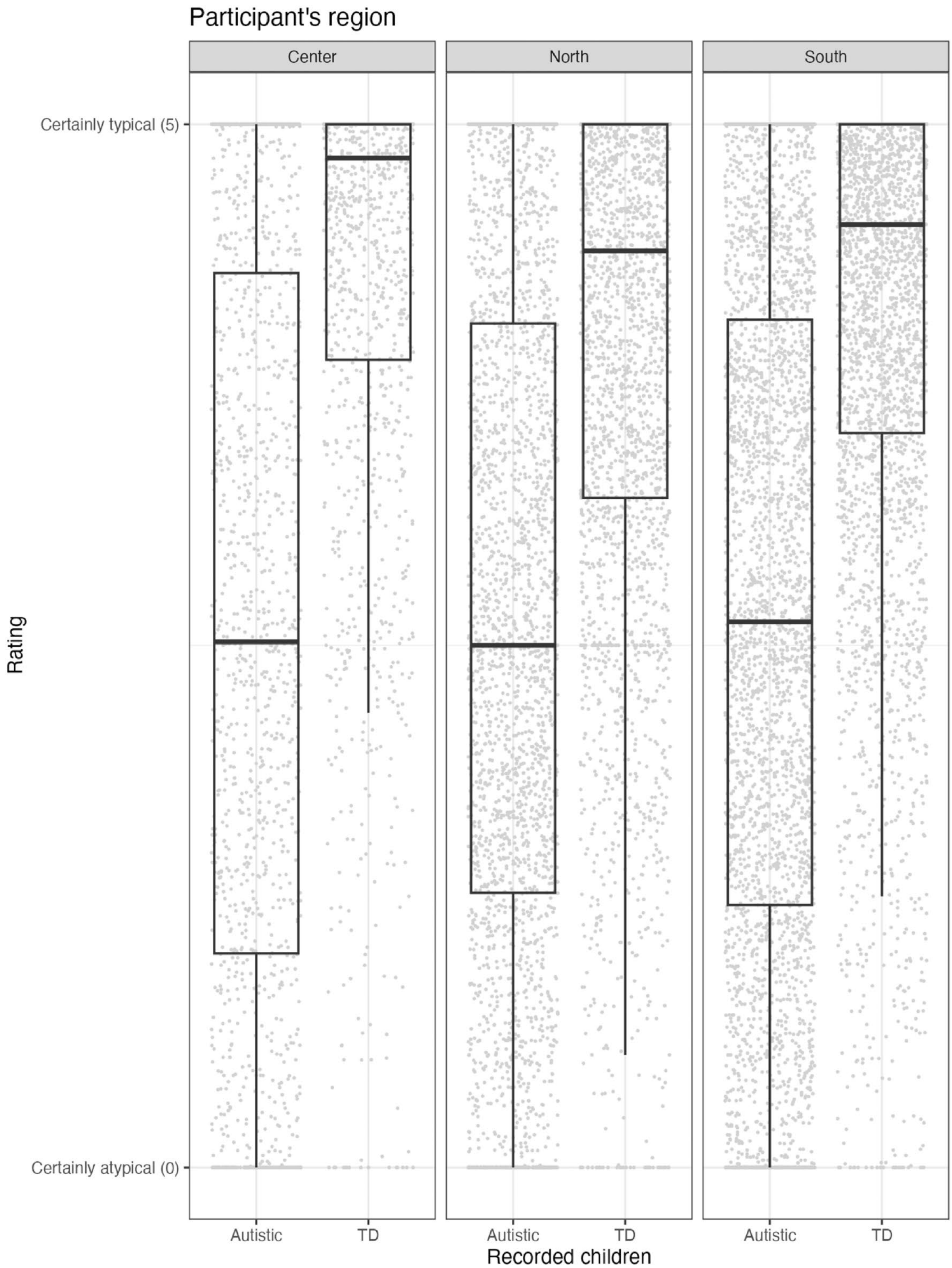

FIGURE 6 | Exp. 2. Ratings on an atypicality slider by recorded child's Group and participant's Linguistic region.

speech recordings of autistic, but not TD children, as coming from their region. Television programs and cartoons are usually cast in a neutral Italian dialect, devoid of any regional characteristics and strongly diverging from the dialect dominant in the recorded children's Campania region. As discussed above, such a neutral, "standard" pronunciation tends to be equated with the northern variety of Italian. The fact that participants from the North region miscategorized, well above chance, the recordings of autistic children as coming from their own region is thus consistent with these recordings bearing the neutral characteristics of cartoons.

One may speculate that this result simply owes to the fact that the speech of autistic children is atypical, which is confirmed by the atypicality perception Exp. 2. In line with the literature on first impressions triggered by autistic children (Boucher et al. 2023; Grossman 2015) and adults (Geelhand et al. 2021; Sasson et al. 2017), Exp. 2 does reveal that non-autistic adult raters rapidly form impressions of atypicality based on very short speech excerpts of autistic children. However, this trend appears to be uniform across the participants' linguistic regions. One would have to surmise, then, that oro-motor disabilities somehow entail the loss of regional accentual characteristics. While not impossible, this hypothesis is rather difficult to articulate. Moreover, it would not easily square with the fact that, in Exp. 1, participants from the North classified, above chance, recordings of autistic children as coming from their own, North region. Since in Exp. 2 the recordings of autistic children were perceived as atypical by participants of all regions, it is difficult to explain the results from the North region in Exp. 1 in terms of speech atypicality, as it would entail that speech disability would somehow give raise to articulatory realizations superficially close to Northern Italian dialects. The same line of reasoning applies to the acoustic differences in F0, shimmer and jitter between recordings of autistic and TD children. It is possible that these differences contribute to the higher perception of atypicality triggered by the recordings of autistic children. However, there is no reason to believe that the same acoustic characteristics are associated with Northern Italian dialects. What seems more likely is that the speech of autistic children resembled the more neutral varieties of Italian, found in child screen media, and, as discussed in the Introduction, that such absence of clear dialectal features has been assimilated by Northern Italians to a "standard" northern variety.

As already mentioned in the introduction, autistic individuals have been frequently described as pedantic—in fact, from the very first descriptions that predate widespread screen media (Asperger 1991; Ghaziuddin and Gerstein 1996). Pedantic speech in autism has mostly been characterized in terms of unusual lexical choice, idiosyncratic or infrequent phrase construction or conversationally inadequate information load (de Villiers et al. 2007; Ghaziuddin and Gerstein 1996; Luyster, Zane, and Wisman Weil 2022), but the unexpected presence of dialectal features that are (normatively) associated with a standard accent would also be consistent with such impressions. That said, framing things in terms of pedantic style still leaves to be explained where, beyond screen media, the autistic children whose speech we used in this study may have picked up these standard phonetic characteristics. School education may prompt the use of more formal lexical or morpho-syntactic speech register. However, it not very likely, although not impossible, that education professionals with whom these autistic children in the Campania region were in contact would have systematically shed their regional pronunciation in favor of a more neutral variety.

It is worth noting that, in Exp. 1, participants from the Center region performed at chance for all types of stimuli. They were, however, less numerous than participants from the North and the South. It is also possible that their intermediate position neutralized their judgments.

Our study highlights the importance of better understanding both the origins of atypical dialectal marking in the speech of autistic individuals and the impressions they trigger in their non-autistic peers. We proposed that autistic children's speech is perceived as closer to standard varieties because their language development is strongly influenced by non-interactional exposure to screen media. If confirmed, such an alternative acquisition path would raise crucial theoretical questions about constraints on language learnability (Kissine 2021).

Dialectal features associated with more normative variants may be reinterpreted as indexing (see Eckert 2008) other stereotypical and negative representations, such as a "pedantic" way of speaking, commonly associated with autism. Such atypical dialectal characteristics likely remain durably present in the speech of autistic children, and further contribute to subjective impressions of "pedantic" speech. Young typically developing speakers' dialect is very rapidly and deeply transformed by the influence of their peers: children and (pre-)adolescents are the driving force beyond the ongoing changes in linguistic systems (e.g., Eckert 1989; Labov 2007; Smith and Holmes-Elliott 2022). Autistic children have difficulties decoding and integrating neuro-typical networks (Bauminger-Zviely et al. 2014), and the speech of autistic children is, therefore, likely to be less prone to such peer influence.

It would be crucial, therefore, to investigate the impact of other sociolinguistic factors on atypicality impressions. Further fine-grained research should also attempt to map the dialectal features of autistic children onto candidate sources of linguistic input, including non-interactional ones. Finally, future research should keep investigating languages other than English, and, ideally, outside Western countries.

Several limitations call for further research. The most obvious one is that, as we relied on the independently collected *ItaASD* corpus (Imparato et al. 2023), all our recordings originated from the same region. It would be important to check whether our results replicate when participants are presented with recordings from different linguistic regions. Another limitation inherent in the corpus we used is that, for ethical reasons, detailed information about the autistic children's profiles was unavailable. Even though our statistical modeling was extremely conservative, and controlled for the influence of particular children on group effects, it would be of paramount importance in future research to carefully link individual characteristics with dialectal profiles. Finally, the atypicality judgments in Exp. 2 were very coarse and may have targeted different types of atypicality. Future research on the perception of accent of autistic individuals could rely on finer-grained scales (e.g., Geelhand et al. 2021; Sasson et al. 2017).

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Raw data that support the findings of this study are available upon reasonable request from the corresponding author. The commented code for all statistical analyses is available in the supplementary material of this article.

Endnotes

[1] See, for instance, (https://neurospicynonsense.com/the-autism-accent) (https://thelifeautistic.com/2018/06/21/the-life-autistic-whats-with-the-accent) (https://www.reddit.com/r/autism/comments/1afb547/is_having_a_strange_accent_a_symptom_of_autism/?rdt=40414).

[2] Emphatically, this should not be read, in any way, as a commitment to a putative "gestalt language acquisition style" autism (for a cogent and critical review, see Hutchins, Knox, and Fletcher 2024).

References

Abd El-Raziq, M., N. Meir, and E. Saiegh-Haddad. 2024. "Lexical Skills in Children With and Without Autism in the Context of Arabic Diglossia: Evidence From Vocabulary and Narrative Tasks." *Language Acquisition* 31, no. 3–4: 199–223. https://doi.org/10.1080/10489223.2023.2268615.

Asperger, H. 1991. "'Autistic Psychopathy' in Childhood." In *Autism and Asperger Syndrome*, edited by U. Frith, 37–92. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511526770.002.

Bates, D., M. Mächler, B. Bolker, and S. Walker. 2015. "Fitting Linear Mixed-Effects Models Using lme4." *Journal of Statistical Software* 67, no. 1: 1–48. https://doi.org/10.18637/jss.v067.i01.

Bauminger-Zviely, N., E. Karin, Y. Kimhi, and G. Agam-Ben-Artzi. 2014. "Spontaneous Peer Conversation in Preschoolers With High-Functioning Autism Spectrum Disorder Versus Typical Development." *Journal of Child Psychology and Psychiatry* 55, no. 4: 363–373. https://doi.org/10.1111/jcpp.12158.

Berruto, G. 2018. "The Languages and Dialects of Italy." In *Manual of Romance Sociolinguistics*, edited by W. Ayres-Bennet and J. Carruthers, 494–525. Berlin, Germany: De Gruyter.

Bishop, D. V. M. 2003. *The Children's Communication Checklist, version 2 (CCC-2).* London, UK: Pearson.

Bishop, D. V. M., A. J. O. Whitehouse, and M. Sharp. 2009. *The Communication Checklist-Self Report (CC-SR).* London, UK: Pearson.

Boucher, T. Q., J. N. Lukacs, N. E. Scheerer, and G. Iarocci. 2023. "Negative First Impression Judgements of Autistic Children by Non-autistic Adults." *Frontiers in Psychiatry* 14: 1241584. https://doi.org/10.3389/FPSYT.2023.1241584.

Byers-Heinlein, K. 2015. "Methods for Studying Infant Bilingualism." In *The Cambridge Handbook of Bilingual Processing*, edited by J. W. Schwieter, 133–154. Cambridge: Cambridge University Press.

Cardinaletti, A., and N. Munaro. 2009. *Italiano, italiani regionali e dialetti*. Milan, Italy: Franco Angeli.

Christiansen, M. H., and N. Chater. 2016. *Creating Language: Integrating Evolution, Acquisition, and Processing*. Cambridge, Massachusetts: MIT Press.

Crocco, C., B. Gili Fivela, and M. D'Imperio. 2022. "Comparing Prosody of Italian Varieties and Dialects: Data From Neapolitan." In *Proceedings of 11th International Conference on Speech Prosody*, edited by S. Frota, M. Cruz, and M. Vigário, 140–144. Lisbon: University of Lisbon.

De Blasi, N. 2014. *Geografia e storia dell'italiano regionale*. Bologna, Italy: il Mulino.

De Pascale, S., and S. Marzo. 2016. "Gli italiani regionali. Atteggiamenti linguistici verso le varietà geografiche dell'italiano." *Incontri: Rivista Europea di Studi Italiani* 31, no. 1: 61–76.

de Villiers, J., J. Fine, G. Ginsberg, L. Vaccarella, and P. Szatmari. 2007. "Brief Report: A Scale for Rating Conversational Impairment in Autism Spectrum Disorder." *Journal of Autism and Developmental Disorders* 37, no. 7: 1375–1380. https://doi.org/10.1007/s10803-006-0264-1.

Dumont, C., M. Belenger, I.-M. Eigsti, and M. Kissine. 2024. "Enhanced Pitch Discrimination in Autistic Children With Unexpected Bilingualism." *Autism Research* 17: 1844–1852. https://doi.org/10.1002/AUR.3221.

Eckert, P. 1989. *Jocks and Burnouts. Social Categories and Idenitities in High School*. New York, USA: Teachers College Press.

Eckert, P. 2008. "Variation and the Indexical Field." *Journal of SocioLinguistics* 12, no. 4: 453–476. https://doi.org/10.1111/j.1467-9841.2008.00374.x.

Eghbaria-Ghanamah, H., R. Ghanamah, Y. Shalhoub-Awwad, E. Adi-Japha, and A. Karni. 2020. "Recitation and Listening to Nursery Rhymes in the Familiarization With a Literacy Language in Kindergarteners: Not kids' Stuff." *Developmental Psychology* 56: 2195–2211. https://doi.org/10.1037/dev0001124.

Francis, K., N. Alshammari, N. Alsulaihim, et al. 2024. "The Use of Formal Language as a Strong Sign of Verbal Autistic Children in Diglossic Communities: The Case of Arabic." *Autism Research* 17: 2579–2587. https://doi.org/10.1002/AUR.3237.

Fusaroli, R., R. Grossman, N. Bilenberg, C. Cantio, J. R. M. Jepsen, and E. Weed. 2022. "Toward a Cumulative Science of Vocal Markers of Autism: A Cross-Linguistic Meta-Analysis-Based Investigation of Acoustic Markers in American and Danish Autistic Children." *Autism Research* 15, no. 4: 653–664. https://doi.org/10.1002/aur.2661.

Fusaroli, R., A. Lambrechts, D. Bang, D. M. Bowler, and S. B. Gaigg. 2017. "Is Voice a Marker for Autism Spectrum Disorder? A Systematic Review and Meta-Analysis." *Autism Research* 10, no. 3: 384–407. https://doi.org/10.1002/AUR.1678.

Geelhand, P., F. Papastamou, G. Deliens, and M. Kissine. 2021. "Judgments of Spoken Discourse and Impression Formation of Neurotypical and Autistic Adults." *Research in Autism Spectrum Disorders* 82: 101742. https://doi.org/10.1016/j.rasd.2021.101742.

Ghaziuddin, M., and L. Gerstein. 1996. "Pedantic Speaking Style Differentiates Asperger Syndrome From High-Functioning Autism." *Journal of Autism and Developmental Disorders* 26, no. 6: 585–595. https://doi.org/10.1007/BF02172348.

Grossman, R. B. 2015. "Judgments of Social Awkwardness From Brief Exposure to Children With and Without High-Functioning Autism." *Autism* 19, no. 5: 580–587. https://doi.org/10.1177/1362361314536937.

Hutchins, T. L., S. E. Knox, and E. C. Fletcher. 2024. "Natural Language Acquisition and Gestalt Language Processing: A Critical Analysis of Their Application to Autism and Speech Language Therapy." *Autism & Developmental Language Impairments* 9: 1–20. https://doi.org/10.1177/23969415241249944.

Imparato, S. C., M. Izzo, O. Liguori, et al. 2023. "ItaASD: Italian Speech Corpus Autism Spectrum Disorder." https://dspace-clarin-it.ilc.cnr.it/repository/xmlui/handle/20.500.11752/OPEN-990.

Istituto dell'Atlante Linguistico Italiano. n.d. "ALI Atlante Linguistico Italiano." Accessed August 2, 2024. https://www.atlantelinguistico.it/.

Kadiri, F., and K. Anasse. 2023. "Do Autistics Need Human Interaction to Acquire Language? A Case Study From Morocco." *Journal of Psychology and Behavior Studies* 3, no. 1: 26–31. https://doi.org/10.32996/jpbs.2023.3.1.3.

Khamis-Dakwar, R., K. Froud, and P. Gordon. 2012. "Acquiring Diglossia: Mutual Influences of Formal and Colloquial Arabic on children's Grammaticality Judgments." *Journal of Child Language* 39, no. 1: 61–89.

Kissine, M. 2021. "Autism, Constructionism, and Nativism." *Language* 97, no. 3: e139–e160. https://doi.org/10.1353/lan.2021.0055.

Kissine, M., and E. Clin. 2024. "Voice Pitch and Gender in Autism." *Autism*. https://doi.org/10.1177/13623613241287973.

Kissine, M., X. Luffin, F. Aiad, R. Bourourou, G. Deliens, and N. Gaddour. 2019. "Non-colloquial Arabic in Tunisian Children With Autism Spectrum Disorder. A Possible Instance of Language

Acquisition in a Non-interactive Context." *Language Learning* 69, no. 1: 44–70. https://doi.org/10.1111/lang.12312.

Kuhl, P. K., F.-M. Tsao, and H.-M. Liu. 2003. "Foreign-Language Experience in Infancy: Effects of Short-Term Exposure and Social Interaction on Phonetic Learning." *Proceedings of the National Academy of Sciences* 100, no. 15: 9096–9101.

Kuznetsova, A., P. B. Brockhoff, and R. H. B. Christensen. 2017. "lmerTest Package: Tests in Linear Mixed Effects Models." *Journal of Statistical Software* 1, no. 13: 1–26. https://doi.org/10.18637/jss.v082.i13.

Labov, W. 2007. "Transmission and Diffusion." *Language* 83, no. 2: 344–387. https://doi.org/10.1353/lan.2007.0082.

Ledgeway, A. N. 2009. "Grammatica Diacronica Del Napoletano." In *Grammatica Diacronica Del Napoletano*. Berlin, Germany: Walter de Gruyter.

Lenth, R., H. Singmann, J. Love, P. Buerkner, and M. Herve. 2020. *Package Emmeans*. CRAN Repository.

Luyster, R. J., E. Zane, and L. Wisman Weil. 2022. "Conventions for Unconventional Language: Revisiting a Framework for Spoken Language Features in Autism." *Autism & Developmental Language Impairments* 7: 1–19. https://doi.org/10.1177/23969415221105472.

Maes, P., C. La Valle, and H. Tager-Flusberg. 2024. "Frequency and Characteristics of Echoes and Self-Repetitions in Minimally Verbal and Verbally Fluent Autistic Individuals." *Autism and Developmental Language Impairments* 9: 1–15. https://doi.org/10.1177/23969415241262207.

Maffei, M. F., K. V. Chenausky, S. V. Gill, H. Tager-Flusberg, and J. R. Green. 2023. "Oromotor Skills in Autism Spectrum Disorder: A Scoping Review." *Autism Research* 16: 879–917. https://doi.org/10.1002/aur.2923.

Ostrolenk, A., D. Gagnon, M. Boisvert, et al. 2024. "Enhanced Interest in Letters and Numbers in Autistic Children." *Molecular Autism* 15, no. 1: 1–12. https://doi.org/10.1186/S13229-024-00606-4/TABLES/4.

Parish-Morris, J., M. Y. Liberman, C. Cieri, et al. 2017. "Linguistic Camouflage in Girls With Autism Spectrum Disorder." *Molecular Autism* 8, no. 1: 1–12. https://doi.org/10.1186/S13229-017-0164-6/TABLES/5.

Patel, S. P., K. Nayar, G. E. Martin, et al. 2020. "An Acoustic Characterization of Prosodic Differences in Autism Spectrum Disorder and First-Degree Relatives." *Journal of Autism and Developmental Disorders* 50, no. 8: 3032–3045. https://doi.org/10.1007/S10803-020-04392-9/FIGURES/3.

Peirce, J., J. R. Gray, S. Simpson, et al. 2019. "PsychoPy2: Experiments in Behavior Made Easy." *Behavior Research Methods* 51, no. 1: 195–203. https://doi.org/10.3758/s13428-018-01193-y.

Pierrehumbert, J. B. 2003. "Phonetic Diversity, Statistical Learning, and Acquisition of Phonology." *Language and Speech* 46, no. 2–3: 115–154. https://doi.org/10.1177/00238309030460020501.

Rambathla, S., and V. Rao. 2013. "Foreign Accent Syndrome (FAS) in Association With Autistic Spectrum Disorder (ASD). A New Syndrome?" *Archives of Disease in Childhood* 98, no. 1: A36. https://doi.org/10.1136/archdischild-2013-304107.082.

Sachs, J., B. Bard, and M. L. Johnson. 1981. "Language Learning With Restricted Input: Case Studies of Two Hearing Children of Deaf Parents." *Applied PsychoLinguistics* 2, no. 1: 33–54. https://doi.org/10.1017/S0142716400000643.

Sasson, N. J., D. J. Faso, J. Nugent, S. Lovell, D. P. Kennedy, and R. B. Grossman. 2017. "Neurotypical Peers Are Less Willing to Interact With Those With Autism Based on Thin Slice Judgments." *Scientific Reports* 7, no. 1: 40700. https://doi.org/10.1038/srep40700.

Shriberg, L. D., R. Paul, L. M. Black, and J. P. Van Santen. 2011. "The Hypothesis of Apraxia of Speech in Children With Autism Spectrum Disorder." *Journal of Autism and Developmental Disorders* 41, no. 4: 405–426. https://doi.org/10.1007/S10803-010-1117-5/FIGURES/2.

Smith, J., and S. Holmes-Elliott. 2022. "Tracking Linguistic Change in Childhood: Transmission, Incrementation, and Vernacular Reorganization." *Language* 98, no. 1: 98–122. https://doi.org/10.1353/lan.2021.0087.

Snell, J. 2015. "Linguistic Ethnographic Perspectives on Working-Class children's Speech: Challenging Discourses of Deficit." In *Linguistic Ethnography: Interdisciplinary Explorations*, edited by J. Snell, S. Shaw, and F. Copland, 225–245. Houndmills: Palgrave.

Stiegler, L. N. 2015. "Examining the Echolalia Literature: Where Do Speech-Language Pathologists Stand?" *American Journal of Speech-Language Pathology* 24, no. 4: 750–762. https://doi.org/10.1044/2015_AJSLP-14-0166.

Sturrock, A., N. Yau, J. Freed, and C. Adams. 2020. "Speaking the Same Language? A Preliminary Investigation, Comparing the Language and Communication Skills of Females and Males With High-Functioning Autism." *Journal of Autism and Developmental Disorders* 50, no. 5: 1639–1656. https://doi.org/10.1007/S10803-019-03920-6/TABLES/8.

Vihman, M., and W. Croft. 2007. "Phonological Development: Toward a "Radical" Templatic Phonology." *Linguistics* 45, no. 4: 683–725. https://doi.org/10.1515/LING.2007.021.

Vulchanova, M., J. B. Talcott, V. Vulchanov, and M. Stankova. 2012. "Language Against the Odds, or Rather Not: The Weak Central Coherence Hypothesis and Language." *Journal of Neurolinguistics* 25: 13–30. https://doi.org/10.1016/j.jneuroling.2011.07.004.

Werner, E., and G. Dawson. 2005. "Validation of the Phenomenon of Autistic Regression Using Home Videotapes." *Archives of General Psychiatry* 62, no. 8: 889–895. https://doi.org/10.1001/archpsyc.62.8.889.

Zhukova, M. A., O. I. Talantseva, I. An, and E. L. Grigorenko. 2021. "Brief Report: Unexpected Bilingualism: A Case of a Russian Child With ASD." *Journal of Autism and Developmental Disorders* 53: 2153–2160. https://doi.org/10.1007/s10803-021-05161-y.

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