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EMPIRICAL STUDY

Noncolloquial Arabic in Tunisian Children With Autism Spectrum Disorder: A Possible Instance of Language Acquisition in a Noninteractive Context

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We have documented the significant presence of spontaneous and productive use of Modern Standard Arabic (MSA) in the speech of five Tunisian boys with autism, an unusual phenomenon. In typical development, MSA is not fully acquired before the late school years. The Arabic language in Tunisia is in a state of diglossia, and (unlike the colloquial Tunisian Arabic variety) MSA is virtually never used in everyday conversation. Television programs broadcast across the Arabic-speaking world constitute the most important source of MSA for preschool children. Typically developing children require active social interaction to develop language, but some children with autism may use television and cartoons as noninteractional input to acquire language. This study highlighted the existence of a noninteractional language-learning strategy that may partly compensate for the sociopragmatic deficits that characterize autism.

Keywords autism; diglossia; language acquisition; Arabic; television; input; interaction

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Introduction

Autism spectrum disorder (ASD) is a neurobiological developmental disorder characterized in *The Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric Association, 2013) by the combination of two sets of symptoms: (a) severe difficulties in social interaction and in verbal and nonverbal communication and (b) the presence of repetitive and stereotyped behaviors as well as of restricted interests. The prevalence of ASD, under one form or another, is currently estimated at more than 1 child in 70 (Autism and Developmental Disabilities Monitoring Network Surveillance, 2010). There is great heterogeneity in the autism phenotype and especially so in the trajectory of language acquisition. The current definition of the DSM-5 recognizes only a unified diagnostic category of autism. However, it draws a distinction between individuals with a history of significant language delay and those who present a typical development of structural language. In a great proportion of children with autism, first words appear only around the age of 3 years, and as many as 25% of individuals with ASD never acquire functional language at all (e.g., Kim, Paul, Tager-Flusberg, & Lord, 2014).

During the 1980s and the early 1990s, much effort was put into isolating these linguistic deficits as a comorbid condition—more precisely, as a form of specific language impairment distinct from a core symptomology of autism. However, there is growing consensus that the causal origins of atypical language development in ASD are at least partly inherent in the disorder itself (see Boucher, 2011, for a lucid overview). Language acquisition processes are probably disrupted by the difficulties that children with ASD experience from an early age in attending to and following their social partners' perspective (e.g., Jones & Klin, 2013; Zwaigenbaum et al., 2015). The capacity to monitor eye-gaze direction, to establish joint attention, and, more generally, to show sensitivity to social cues and speakers' intentions bootstraps language development (e.g., Luyster, Kadlec, Carter, & Tager-Flusberg, 2008; Tomasello, 2008; Yeung & Werker, 2009). Poor orientation to social information in the early stages of life may thus have a cascading effect on the acquisition of language (e.g., Kuhl et al., 2013; Preissler & Carey, 2005). In a sense, then, language development delays and deficits in ASD underscore the importance of sociopragmatic factors for language learning.

Although difficulties in attending to and processing social information emerge as a robust behavioral characteristic of ASD at the end of the first year of life (e.g., Elsabbagh & Johnson, 2010; Ozonoff et al., 2010; Zwaigenbaum et al., 2015), an important proportion of children with ASD nevertheless do

acquire language in spite of persisting interactional difficulties. Of course, one could think of the emergence of language in these children as evidencing a capacity to partially overcome initial social deficits. Yet sociopragmatic impairment constitutes a persistent hallmark of autism, even in individuals whose structural language lies within a typical range (e.g., de Villiers, Fine, Ginsberg, Vaccarella, & Szatmari, 2007; Deliens, Papastamou, Ruytenbeek, Geelhand de Merxem, & Kissine, 2018; Fine, Bartolucci, Szatmari, & Ginsberg, 1994; Kissine, 2012; Surian, Baron-Cohen, & Van der Lely, 1996). It is, therefore, also plausible that language development in ASD may unfold along an alternative acquisition path that does not relate so closely to the communicative function of language.

A better understanding of which language acquisition strategies may be specific to ASD is crucial to increase the effectiveness of early interventions. Additionally, gaining insights into nontypical developmental pathways to language is of great theoretical interest, especially if they highlight the existence of alternative routes to language. Yet little is known about how children with ASD may circumvent their social impairment to acquire language or about potential ways to facilitate these alternative learning routes. We approach this issue through a puzzling phenomenon, familiar to anyone who has worked with ASD in the Arabic-speaking world, but (to the best of our knowledge) one that is still left unexplored in the scientific literature.

The Current Study

Most Arabic-speaking communities are inherently diglossic, combining a vernacular, colloquial variety used in everyday interaction with Modern Standard Arabic (MSA). Unlike colloquial varieties, MSA is used in very formal, mostly written settings but also in television programs and cartoons broadcast across the Arabic-speaking world. Because recourse to MSA in adult speakers is limited to a very restricted set of religious or scholarly registers, children only come in contact with MSA before starting school in its spoken form through exposure to television programs and books. It is therefore not surprising that comprehension of MSA in typically developing preschoolers is significantly out of step with that of the colloquial variety (e.g., Leikin, Ibrahim, & Eghbaria, 2014). In a study on Palestinian Arabic, Saiegh-Haddad and Spolsky (2014) found that only 20% of the lexicon of 5-year-old children consisted of words that have phonologically identical cognates in MSA. Children also have difficulties in recognizing the MSA phonemes that are absent from their colloquial varieties, and the production of such MSA phonemes is considerably delayed (Amayreh, 2003; Saiegh-Haddad, 2007; Saiegh-Haddad, Levin, Hende, & Ziv,

2011). Phonological distance between MSA and colloquial varieties also impacts word and nonword repetition both in typically developing children and in children with specific language impairment (Saiegh-Haddad & Ghawi-Dakwar, 2017). In the same vein, a forced-choice grammaticality judgement study in Palestinian Arabic strongly suggested that full mastery of morphosyntactic structures of MSA was still not in place at the fifth grade (Khamis-Dakwar, Froud, & Gordon, 2012). Consistently with the relatively late education that preschool children receive in MSA, to the best of our knowledge, preschool children in the Arabic-speaking world never use MSA in a spontaneous and consistent way.

However, a relatively frequent experience among practitioners working with ASD in North Africa is to meet children with ASD who, in spite of their preschool or early school age, display a remarkable mastery of MSA. These children also tend to favor MSA in everyday conversations even though adults around them use the colloquial variety. Puzzling as it is, this phenomenon has never been reported in the scientific literature. A first step, then, was to formally establish and describe it, awaiting a more quantitative investigation. In this article, we report preliminary qualitative analyses from five Tunisian children with autism who displayed this striking use of MSA.

A crucial source of exposure to MSA in the Arab world comes from cartoons broadcast on national television networks. Active child-directed interaction, as opposed to passive exposure to linguistic input thorough television, has for long been acknowledged as a crucial determinant for language acquisition in typically developing children (Kuhl, Tsao, & Liu, 2003; Sachs, Bard, & Johnson, 1981). However, for children with ASD, such passive exposure to language may represent an opportunity to develop linguistic competence. We have hypothesized that some children with ASD may prefer this type of input, devoid as it is of social and interactional pressure, to internalize language rules. This learning path would contrast with that followed by typically developing infants, who are more dependent on social interaction for acquiring linguistic categories (Kuhl, 2004, 2007; Kuhl et al., 2003).

Method

Context: Arabic in Tunisia

Like in the rest of the Arab world, the Arabic language in Tunisia is in a state of diglossia. MSA (called *Fuṣḥā* in Arabic) is seen as the high variety and, outside of television programs, is generally reserved for formal situations—mainly the written register and religious and political discourse.[1] Colloquial

Arabic (ʕ*Āmmiyya* or *Dārija*), by contrast, is seen as the low variety and is used in informal, everyday conversations. (In reality, even politicians and religious leaders often switch, intentionally or not, from MSA to colloquial Arabic.) MSA and colloquial Arabic present differences in phonology, morphology, syntax, and lexicon. Different Arabic dialects coexist in Tunisia, but the main dialect is that of Tunis (for an overview, see Baccouche & Mejri, 2000), which is itself a koineized form of Arabic (i.e., a variety that has emerged from contact between two or more other varieties). All children described in this article lived in Monastir or Tunis areas, where the main dialect spoken is Tunis Arabic. For this reason, we focus on this dialect to present the main structural difference between MSA and colloquial Tunisian Arabic (TA). Most of our examples in this section are borrowed from Gibson (2009).

Starting with phonology, there are some differences between the consonant inventories of MSA and TA. MSA /q/ and /ʒ/ may have /g/ and /z/, respectively, as TA cognates. For instance, MSA *baqara* "cow" and *jazzār* "butcher" may be realized as *bagra* and *zazzār* in TA. In some cases, the interdental /*θ*/ may also be realized as /t/: for example, TA *tlāṯa* "three" for MSA *ṯalāṯa*. The phoneme /ʔ/ generally occurs in TA in loans from MSA; some additional consonants like /p/ and/v/ appear only in the loans from French, for example, *pisīn* "swimming pool" and *garīv* "strike." TA has three vowel qualities—/i, a, u/, and length is always contrastive as in MSA. However, there may be differences in vocalic templates between MSA and TA (e.g., TA *ktib* "he wrote" for MSA *kataba*). In addition, MSA diphthongs are generally realized as long vowels in TA as, for instance, in TA *līl* "night" for MSA *layl*, with /ai/ realized as /iː/. Phonotactic constraints on syllable structure in TA and MSA are also different: Consonant–consonant (CC) onsets and CCC codas may occur in TA, but they are impossible in MSA. For instance, TA *kla* "he ate" is the equivalent of MSA *ʾakala*, and *ma ktabt- š* "I did not write" is the equivalent of *mā katabt*.

TA is characterized by a clearly simplified morphosyntactic system relative to MSA. Unlike MSA—and like other colloquial varieties of Arabic—TA has no case markers. For instance, the TA *bāb* "door" and *al-bāb* "the door" correspond to the MSA *bāb*^{un} (nominative), *bāb*^{an} (accusative), *bāb*^{in} (genitive), *ʾ*al-*bāb*^{u} (nominative), *ʾal-bāb*^{a} (accusative), and *ʾal-bāb*^{i} (genitive). The MSA indefinite marker, the suffix $^{-n}$, does not exist in TA: MSA *bāb*^{un} "a door" is realized as *bāb* "door" in TA. Although MSA has gender marking in the second and third persons and a dual form for verbs and pronouns, TA has only a gender marking for the third person and no dual form. Adjectives are marked

for gender in the singular but not in the plural in TA (e.g., *rājil kbīr* "an old man," *mra kbīra* "an old woman," *rjāl kbār* "old men," *nsa kbār* "old women"), but in MSA gender marking extends to plural (*rajul kabīr* and *marʾa kabīra* vs. *rijāl kibār* and *nisāʾ kabīrāt*). The usual demonstrative in TA is *ha-* or *had* for both genders, singular and plural—*had rrājil* "this man," *had lbint* "this girl"—where MSA has *hadā r-rajul* and *hadihi l-bint*.

The verbal inflection of MSA includes perfective and imperfective aspects as well as subjunctive and jussive moods, for example, for the verb "to write": *kataba*, *yaktubu*, *yaktuba*, *yaktub*, but TA marks only the perfective and the imperfective, for example, *ktib* "he wrote," *yiktib* "he writes." Future tense is analytically marked by the preposition *bāš* (or *biš*) in TA whereas MSA uses the prefix *sa–* or *sawfa* (e.g., "he will write" would be *biš yiktib* in TA, but *sa-yaktubu* or *sawfa yaktubu* in MSA). As in all North African dialects, in TA, the first-person singular of the imperfect is marked by an initial *n–*: TA *niktib*, for MSA *aktubu*, "I write." Although tense and/or aspect in MSA are associated with different verbal negation markers (*mā*, *lā*, *lam*, *lan*), TA has only *ma . . . š*. For instance, in MSA, *mā kataba* "he did not write" and *lā yaktubu* "he does not write" instantiate different negation markers, but negation in TA is identical for both tenses (*ma-ktib-š* and *ma-yiktib-š*). Finally, although MSA has a canonical Verb–Subject order, in TA the Subject–Verb order is the most frequent (e.g., *ir-rājil ma-yixtarš martu* "the man does not choose his wife" in TA, for MSA *ar-rajulu lā yaxtāru marʾata-hu*).

The TA lexicon mainly stems from the Arabic pool, even though many words with an Arabic etymology have a root different from the corresponding MSA lexeme (e.g., TA *škūn* "who" vs. MSA *man*; TA *waqtāš* "when" vs. MSA *matā*; TA *ġudwa* "tomorrow" vs. MSA *ġadan*). In addition, TA also features many loans from Berber, Turkish, Spanish, Italian, and French (like *zufri* "laborer" for the MSA *ʕāmil*, or *trīnu* or *trã* "train" for the MSA *qiṭār*).

Participants

In their practice in autism diagnosis and intervention in Monastir, Tunisia, the fourth and sixth authors identified seven children who had displayed spontaneous use of MSA on previous occasions. Five children were selected for this study. The chronological age of these children at the time of the study ranged from 5 to 10 years. Each child had received a formal diagnosis of autism from a panel of expert clinicians based on two standard assessment tools, the Childhood Autism Rating Scale (Schopler, Van Bourgondien, Wellman, & Love, 2010) and the Autism Diagnostic Interview-Revised (Lord, Rutter, & Le Couteur, 2003).[2] Verbal and nonverbal IQ were assessed using an Arabic translation

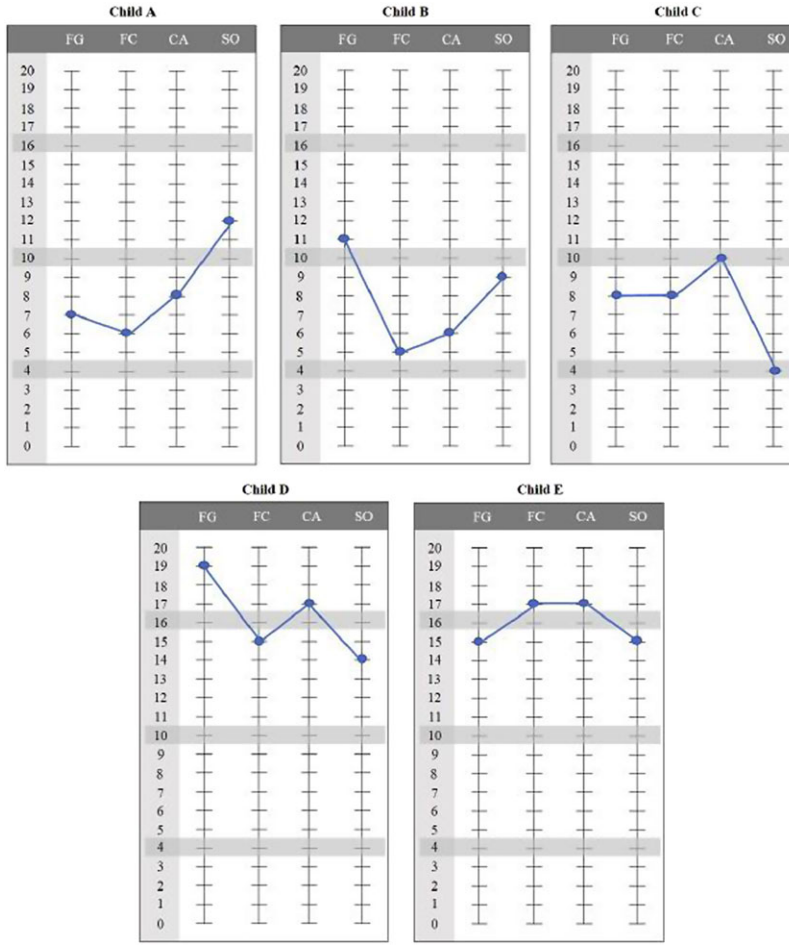

Figure 1 Cognitive profile of each child as assessed by the Leiter International Performance Scale (Roid *et al.*, 2013): FG = figure ground; FC = form completion; CA = classification analogies; SO = sequential order.

(Abou Allam & Hady, 1998) of the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981) and Leiter International Performance Scale (Roid, Miller, Pomplun, & Koch, 2013), respectively.[3] For all children, nonverbal IQs ($M \pm SD = 85.8 \pm 8.93$, range: 77–97) and verbal IQs (range: 91–160+) were within the typical range or above. Figure 1 illustrates the cognitive profile of each child as assessed by the Leiter International Performance Scale, and Table 1 summarizes participant characteristics.

Table 1 Children's background information

Variable	Child				
	A	B	C	D	E
Age (years;months)	5;6	7;11	10;11	8;7	8;1
CARS (cutoff = 30)	36	40	43.5	29	33
Reciprocal social interaction[a] (cutoff = 10)	10	20	23	11	27
Communication[a] (cutoff = 8)	6	8	19	9	18
Restricted and repetitive behaviors[a] (cutoff = 3)	1	10	9	5	8
Figure ground[b]	7	11	8	19	15
Form completion[b]	6	5	8	15	17
Classification[b]	8	6	10	17	17
Sequential order[b]	12	9	4	14	15
Leiter composite scale (norm = 100±15)	84	78	77	93	132
PPVT (norm = 100±15)	91	>160	102	146	113

Notes. CARS = Childhood Autism Rating Scale; PPVT = Peabody Picture Vocabulary standard score.
[a]Autism Diagnostic Interview-Revised.
[b]Leiter scaled score.

Procedure

For each child, an informal conversation ranging from 10 to 20 minutes with the fourth author was videotaped.[4] The conversation was inspired by Module 3 of the Autism Diagnostic Observation Schedule (Lord et al., 2012), which is a standardized instrument for diagnosing autism consisting of a semi-structured interaction between a child and an interviewer. A set of standard activities (e.g., construction game, conversation, description of a picture) provides the interviewer with direct observations of the child's social and communicative behaviors. The recorded conversations touched on familiar topics, such as the child's last birthday party, family, and friends. To ensure that all instances of the use of MSA by the child were spontaneous, the adult exclusively used TA, independently of whether the child's previous conversational contribution was in TA or in MSA.

Each recording was then transcribed and coded by a trained, native Arabic-speaking research assistant with an extensive knowledge of North African varieties of MSA. This research assistant was not informed of the objectives of the study. The following conventions were followed: An utterance was first delimited as a prosodic and/or syntactic unit and then was coded as belonging to one of three categories:

- TA: the utterance unambiguously belonged to the colloquial Arabic variety spoken in Tunis and Monastir areas;
- MSA: the utterance unambiguously included all the elements of fully productive use of MSA;
- TMSA (mixed Tunisian and Modern Standard Arabic): the utterance included elements of MSA and of TA; typically, TMSA utterances contained lexical items from TA, which were, however, fully inflected following the rules of MSA (more examples of this category are provided below).

The reliability of transcription was checked by the third author, a native Arabic speaker, who independently coded the recordings of the five children whose data are analyzed in detail below. First, there was 75.7% agreement on the utterance boundaries. Second, based on those units for which perfect agreement was observed in terms of boundary location, there was strong agreement on the assignment of TA, MSA, and TMSA categories, Cohen's $\kappa = 0.69$, 95% confidence interval [0.65, 0.74]. The second and third authors then systematically reviewed all coded data, removing from further analyses all utterances for which agreement was difficult to reach.

Results

A first index of the presence of MSA in the verbal production of each child was drawn from the total proportions of MSA and TMSA utterances. For five of the seven children, all boys, the proportion of utterances that were either in MSA or TMSA ranged from 39% to 68%. Table 2 summarizes the characteristics of the recording of these five children, including the mean length of utterance for the utterances delimited for coding. Although the other two children did exhibit elements of MSA, these occurred to a much lesser extent (13% and 1.8%), so we do not report qualitative analyses of their recordings. In what follows, we detail the distribution of MSA in the production of each child and provide qualitative examples aimed at illustrating the particularities of their use of MSA.

Child A

Child A was a boy who was aged 5;6 (years;months) at the time of recording and attended kindergarten. He was diagnosed with autism at age 4;7. He reached the cutoff for autism in the Autism Diagnostic Interview reciprocal social interaction domain (score = 10) but presented a score below the threshold for the communication and language subscale (score = 6, cutoff = 8) and the restricted and repetitive behaviors domain (score = 1, cutoff = 3). Suspicion of

Table 2 Characteristics of the recordings and mean length of utterance statistics (means and standard deviations)

	Child				
Measure	A	B	C	D	E
Analyzed utterances	144	101	67	115	185
Recording length (minutes)	10	15	9	12	11
MSA utterances (%)	27	27	56	22	9
TMSA utterances (%)	26	32	12	16	30
Total MLU (words)	4.14 (2.79)	4.50 (3.40)	3.43 (2.42)	4.57 (4.30)	4.16 (2.26)
MLU in MSA (words)	4.25 (2.01)	3.70 (2.33)	3.42 (2.15)	1.27 (0.53)	3.47 (1.90)
MLU in TMSA (words)	5.43 (3.76)	5.90 (3.41)	4.25 (2.37)	8.26 (4.47)	4.74 (1.90)
MLU in TA (words)	3.73 (2.79)	3.90 (3.70)	3.28 (2.90)	4.80 (4.18)	3.98 (2.42)

Notes. MSA = Modern Standard Arabic; TMSA = mixed Tunisian and Modern Standard Arabic; MLU = mean length of utterance; TA = Tunisian Arabic.

autism was confirmed by the Childhood Autism Rating Scale with a score of 36 (cutoff = 30). The Leiter scale showed a nonverbal IQ of 84 and the Peabody Picture Vocabulary Test indicated a vocabulary level of 91. Out of a total of 144 coded utterances for Child A, 27% were MSA and 26% were TMSA.

A significant proportion of Child A's MSA utterances was accounted for by answers in MSA to questions asked in TA. For instance, in Example 1, from a conversation about a cartoon, the adult asked a question that clearly contained lexical units (*škūn hūma hadūma*) that belonged to TA (the equivalent in MSA would have been *man humā Gāmbul wa-Kārwi?*). Child A's answers, by contrast, strikingly included the formal characteristics of MSA. In TA, the nominal case marking never occurs, but it is compulsory in MSA. Child A used the case marking affixes: the nominative singular affix /u/ in *ṣadīqat^{u}-na* and *al-muġāmarāt^{u}* and the accusative singular /a/ in *mušāhadat^{a}-hā*. On the lexical level, the MSA verbs *ʾunẓur* and *ʾaradnā* are never used in TA (the TA equivalents would have been *šuf* and *bġīna*). Interestingly, given the meaning of Child A's utterance, these two verbs were clearly not part of what would have been an echoic reproduction of a cartoon segment. Finally, MSA glides are realized as long vowels in TA. Here, Child A used a glide in *layl* [lail] instead of the TA variant [li:l]. In this and subsequent examples, we provide rough morphological glosses, mainly limited to the features characteristic of the MSA–TA contrast, using the following abbreviations: ACC = accusative case, ART = article, FEM = feminine, IMP = imperative, IPFV = imperfective,

MASC = masculine, NEG = negation, NOM = nominative case, POSS = possessive, PL = plural, REL = relative, SG = singular, SBJV = subjunctive, and VOC = vocative.

Example 1

Adult:	*škūn*	*hūma*	*hadūma*	*(.) Gumball*	*wa*	*kārwi*
	who	they	these	Gumball	and	Karwi
	"Who are they, these Gumball and Karwi?"					
Child:	*aaa*	*wa*	*sāra*	*ṣadīqat^{u}-na*		
	yeah	and	Sara	friend.NOM.SG-POSS.1PL		
	l=waḥida		*min*			
	ART=only		from			
	"Yes, and Sara our only friend . . . "					
	unẓur (.)	*'al=muġāmarāt^{u}*		*l=mumti^{ʕ}a*	*li*	*li*
	look.IMP	ART=adventures		ART=wonderful	for	for
	gāmbul	*wa gārwi*	*wa*	*sāra miskīna*	*aradnā*	
	Gambul	and Garwi	and	Sara poor.FEM	wanted.PFV.1PL	
	mušāhadat^{a}=hā		*qabl*	*layl*		
	view=them.FEM		before	night		
	"Look, the wonderful adventures of Gambyl, Gari and Sara, the poor one, we wanted to watch them last night."					

An even more complex, productive use of MSA by Child A is illustrated by Example 2, drawn from a sequence where Child A was retelling a sequence of a cartoon movie. In TA, the only verbal negation is *ma . . . š*; yet here Child A used one of the most complex MSA negation markers, *lam*. Interestingly, the use of *lam* entails three embedded constraints, all of which he respected: First, the verb must be cast in the imperfective aspect even though the meaning conveyed is that of a completed action; second, the final vowel must be elided, which, finally, triggers the shortening of the second vowel. Such complex usage of MSA was striking because the simpler alternative to *lam* would have been *mā*, which only mandates the perfective aspect on the verb, here predicted by the verbal meaning. Interestingly, this complex use of MSA was nevertheless combined with the elision of the first vowel in *ḥrām* ([ħraːm]), which was a phonological realization typical of TA. The phonological equivalent in MSA would have been [ħaraːm].

Example 2

Child:	*wa*	*ba^{ʕ}ad-hā*	*wa*	*ba^{ʕ}da-hā*	*lam*	*yaqul*
	and	afterwards	and	afterwards	NEG	say.IPFV.3SG

ḥāja	*ḥrām*
thing	bad

"And then, he didn't say anything bad."

Mastery of another complex morphosyntactic feature of MSA showed up a bit later in the same sequence as shown in Example 3. Here Child A used the subjunctive form, nonexistent in TA and marked in MSA by the use of the particle *'an* and the suffix *–a* on the verb *yanḍima*, which entails the elision of the first vowel of the article *al-* on the following word. In TA, the same sequence would be rendered as *qarrar yanḍim al-qiṣaṣ*.

Example 3

Child: *wa*	*baˁda-hā*	*qarrar-a*	*'an*	*yanḍim-a*
and	afterwards	decide-PFV.3SG	PART	compose.SBJV.3SG.MASC
l=qiṣaṣ				
ART=story.PL				

"And then, he decided to compose stories."

The fact that Child A, in spite of not having attended school, internalized MSA morphosyntactic structure was further evidenced by his use of TA lexemes with an MSA morphology. In Example 4, Child A used the TA verb *ḥall* "open"—the MSA verb would be *fataḥa*—but inflects it with the MSA perfective third-person singular affix *–a*.

Example 4

Child: *wa ḥall-a*	*la-hu*	*'abū-hu*
and open-PFV.3SG	for-POSS.3SG.MASC	father-POSS.3SG.MASC
abū-hu	*l=bāb*	
father-POSS.3SG.MASC	ART=door	

"And his father opened the door for him."

More interestingly, the MSA and TMSA sequences in Child A's output occurred almost exclusively when he was talking about cartoons or attempted to build a narrative based on a picture. Although this restriction suggested a strong influence of television on Child A's use of MSA, it is important to stress that such instances of MSA were not echoic because they clearly involved a productive retelling of a story.[5]

Child B

Child B was age 7;11 at the recording time and was enrolled in the second year of primary school. He was diagnosed with autism at age 3;3. Child B's

Autism Diagnostic Interview scores were 20 for the social domain (cutoff = 10), 8 for the communication domain (cutoff = 8), and 10 for the restricted and repetitive behaviors domain (cutoff = 3). These results were consistent with the Childhood Autism Rating Scale showing a score of 40 (cutoff = 30). Nonverbal IQ reached 78 and vocabulary level exceeded 160. Out of a total of 101 coded units for Child B, 27% were in MSA, and 32% were in TMSA. Unlike Child A, Child B spontaneously used MSA in conversations on topics other than those about television or video games. The excerpt in Example 5 is a full sentence in MSA, characterized by the use of *al-ʕā'ila*, instead of the TA *al-ʕayla*, as well as the verbal form with *u–* as the first-person singular marker and the final *–u* as the imperfective marker (where TA would have *nḥibb*).[6]

Example 5

Child:	*'al=ʕā'ila*	*'ana*	*uḥibbu=ha*
	ART=family	I	love.IPFV.1SG=it.FEM
	"My family, I love them."		

Child B's mastery of MSA was revealed in many other units. In MSA, inflected verbal and nominal forms may be produced with or without the final vowel, the former being characteristic of a more formal register (see Note 6). The excerpt in Example 6 suggests that Child B mastered both variants. Both occurrences of the verb "scuffle" by Child B belong to MSA (TA would have been *naṭ'ārak*), with the first, but not the second, produced with the final *–u*. Furthermore, unlike the adult in the next turn, Child B used the MSA verbal negation *lā*, instead of *ma . . . š*, and the MSA *'aṣdiqā'ī* for "my friends", and not the TA *ṣḥābi*.

Example 6

Child:	*lā*	*lā*	*'ataḥāṣam-u*	*maʕa*	*'aṣdiqā'ī*
	NEG	NEG	scuffle-IPFV.1SG	with	friends.PL./POSS.1SG
	lā	*'ataḥāṣam*			
	NEG	scuffle. IPFV.1SG			
	"I don't fight with my friends."				
Adult:	*mā*	*taʕārak=š*			*mʕa*
	NEG	scuffle.IPFV.2SG.MASC=NEG			with
	ṣḥābik		*'anti*		
	friend.PL\POSS.2SG.MASC		you		
	"You, you don't fight with your friends."				

In some cases, Child B mixed MSA and TA. For instance, the utterance in Example 7 started in MSA, but the second part was in TA using the double negation *ma . . . š* and the first-person singular verbal prefix *n–*.

Example 7

Child:	*ʕand=i*	*kull*	*alʕāb*	*ma*	*n-aʕraf-hum-š*
	for=me	all	toy.PL	NEG	1SG-know.IPFV=them=NEG

"I have all the toys, I don't know [how to call] them."

At least some of such mixed TMSA cases suggested that Child B's use of MSA was partly driven by conscious choice. For instance, 10 seconds after the exchange in Example 7, Child B started the utterance in Example 8 using the very same lexemes in TA, but (in an apparent self-correction) stopped in the middle of the TA *aṣḥābi* "my friends" to switch to the TMSA *'aṣdiqā'i*.

Example 8

Child:	*ʕindma*	*natʕārk*	*(.)*	*maʕa*	*'aṣḥā . . .*	*'aṣdiqā'i*
	when	argue-IPFV.1SG		with	fri . . .	friends-POSS.1SG

"When I argue with my friends."

Sometimes the choice of MSA did seem to be triggered by the topic. In Example 9, Child B said that he liked to take care of cats, and he justified his hobby through a sentence that sounded like a religious formula. In doing so, Child B used MSA even though the question was formulated in TA, which could be explained by a religious-like register. However, this sentence was very probably not echoic, as we could not find any evidence of it being produced as a standard religious formula.

Example 9

Child:	*ʕināyat*	*al=qiṭaṭ (.)*	*hāḏa*	*šayyʹun*	*jamīl*
	care	ART=cat.PL	this	thing	nice
	ṣaḥīḥ	*jamīl*	*šayyʹun*		
	right	nice	thing		
	šayyʹun	*ġayru (.)*	*ġayru*	*šayṭāni*	*inna=hu*
	thing	not	not	satanic	FOC=that
	min	*al='imān*	*ʕināyatu*	*l=qiṭaṭ*	*huwa*
	from	ART=faith	care	ART=cat.PL	this

min	*al='imān*					
from	ART=faith					

"Taking care of the cats is something nice, right, it's nice, it is something which is not satanic, it's an act of faith, taking care of the cats is an act of faith."

The whole sequence in Example 9, though a bit hesitant, was in MSA: Diphthongs and interdentals were preserved (like in *ġayru* "other" and *haḏa* "this"); every word belonged to MSA vocabulary (e.g., *qiṭṭa* for TA *qaṭṭūs* "cat" and *šayyʾun* for TA *ḥāja* "thing"); and case endings, like *–un* in *šayyʾun* or *–u* in ġayru "other," were correctly expressed. In addition, Child B used a fairly complex focus structure, consisting of the combination of the particle *inna* with a pronoun.

Child C

Child C was age 10;11 at the recording time and was enrolled in the fifth grade in primary school. He was diagnosed with autism at age 3 years. He met the criteria for autism in all three Autism Diagnostic Interview domains: 23 for social domain (cutoff = 10), 19 for communication domain (cutoff = 8), and 9 for restricted and repetitive behaviors domain (cutoff = 3). These results were consistent with his Childhood Autism Rating Scale score of 43.5 (cutoff = 30). His nonverbal IQ reached 77, and his vocabulary score was 102.

Out of the 296 units transcribed for Child C, 56% were in MSA and only 12% were in TMSA. That is, Child C mostly alternated between TA and MSA utterances without mixing MSA and TA. When Child C used MSA, he displayed striking mastery of both its phonology and its morphosyntax, as Examples 10 and 11 illustrate.

Example 10

Child:	*ʾaḫaḏū=nī*	*ʾila*	*wilāyat*	*gafṣa*
	take.PFV.3PL=me	to	province	Gafsa
	wa- *baˁda=ha*	*ʾaḫaḏū=nī*		*ʾila*
	and after=that	take.PFV.3PL=me		to
	al=qayrawān			
	Kairouan			

"They took me to the province of Gafsa, and then they took me to Kairouan."

Example 11

Child:	*ʾaḥḍarū=nī*		*baskla wa=kurata*		*qadamin*
	give.PFV.3PL=me		bicycle and=ball		foot
	wa=luˁbata	*spajdarma:n*	*wa-*	*ʾuxrata*	*ʾuxra*
	and-game	Spiderman	and	other	other

"They offered me a bicycle, a ball, a Spiderman game, and another another [game]."

Except for the use of the French-loan *baskla* in Example 11 instead of MSA *darrāja* for "bicycle," these examples demonstrated a consistent and productive use of MSA, including the complex use of the definite accusative suffix *–a* for in *kurata* and *luˤbata* and of the indefinite genitive *–in* in *qadamin*. More interestingly, Example 11 also featured an instance of self-correction, when Child C started by using *uxrata* instead of *uxrā* "other," which is a sophisticated feminine form. In the same context, Child C used the MSA form *ṣaġīra* "small" in Example 12 even though the same word had been uttered in TA (*ṣġīra*) by the adult. This suggested that Child C's use of MSA was a fully productive discursive strategy.

Example 12

Adult:	*kbīra*	*wala*	*ṣġīra*	*al=baskla?*
	big.FEM	or	small.FEM	ART=biycle
	"The bicycle was big or small?"			
Child:	*ṣaġīra*			
	small.FEM			

Child D

Child D was age 8;7 at the recording time and was enrolled in the second grade of primary school. He received a diagnosis of autism at age 7 years. His Childhood Autism Rating Scale score was 29, suggesting that Child D was just below the mild range of the autistic spectrum (cutoff = 30). However, his Autism Diagnostic Interview confirmed the diagnostic with a score above the threshold in the three domains: 11 for the social domain (cutoff = 10), 9 for the communication domain (cutoff = 8), and 5 for the restricted and repetitive behaviors domain (cutoff = 3). His nonverbal IQ reached 93 and his vocabulary level 146.

Out of the 141 units transcribed for Child D, 22% were in MSA and 16% were in TMSA. Unlike children A, B, and C, who displayed complex and productive mastery of MSA morphosyntax, in Child D's speech, MSA was mostly limited to lexical borrowing, which most probably originated from the contexts where MSA was used: video or roleplaying games based on television cartoons and official school terminology.

Child D often answered the adult questions entirely in TA, as in Example 13, where the vocabulary clearly belonged to TA (like *kima* "like," *ḥūta* "fish," *ʾamal* "to do").

Example 13

Child:	*ʾamā*	*rayān*	*huwa*	*yˤūm*
	but	rayan	he	swim.IPFV.3SG
	kima	*al=ḥūta*	*ˤamal*	*haka*
	like	ART=fish	do. PFV.3SG. PERF	so

"But Rayan, he swims like a fish, he did so."

However, Child D sometimes interspersed his TA sentences with single words or short sentences in MSA, especially when he described his roleplaying. For instance, Example 14 is a whole sentence in TA, with the exception of the expressions related to the supranatural power Child D gets through some gestures—*quwwat al-riyāḥ* and *quwwat al-barq*.

Example 14

Child:	*haka haka*	*ʾanī*	*kunt*	*naˤmal*	*haka*	*wa=baˤdīka*
	so so	I	be.PFV.1SG	do.IPFV.1SG	so	and=then
	ǧāt		*-nī*	*wa=baˤdīka*		
	come.IPFV.FEM.3SG		me	and=then		
	ǧāt		*-nī*	*quwwat*	*al=riyāḥ*	
	come.IPFV.FEM.3SG		me	power	ART=wind.PL	
	wa-baˤdīka'al=barq			*ˤmal*	*haka*	
	and.then ART=thunder			do. IPFV. 3SG	so	
	sar ˤandī	*quwwat*		*al=barq*		
	cometo-me	power		ART=thunder		

"I was doing so, and then I got the power of the wind, and then the power of the thunder, I did so, and I got the power of the thunder."

In Example 15, Child D's use of MSA was likely an echoic reproduction of official denomination of school grades (*ath-thāniya*); the rest of the utterance bears the marks of TA, such as the verb *qra* and the first-person singular imperfective prefix *n–*.

Example 15

Child:	*n-aqra*	*ʾani*	*fi*	*s=sana*	*ath=thāniya*
	study.IPFV	I	in	ART=year	ART=second

"I study in the second grade."

Child E

Child E was age 8;1 at the time of recording and was repeating the first year of primary school. He had been diagnosed with autism at age 4;3. He met the criteria for autism in all three Autism Diagnostic Interview domains: a score of 27 for the social domain (cutoff = 10), 18 for the communication domain

(cutoff = 8), and 8 for the restricted and repetitive behaviors domain (cutoff = 3). His Childhood Autism Rating Scale score of 33 (cutoff = 30) corroborated this diagnosis. His Leiter International Performance Scale results showed a nonverbal IQ of 132 and a Peabody Picture Vocabulary Test score of 113.

Very few of the 185 utterances coded for Child E were in pure MSA, but about 30% involved a switch between TA and MSA. In Example 16, the verbs *najjam* and *bazaz* belong to the TA lexicon and were inflected with the TA first-person singular prefix *n–*; the rest of the sentence, however, was in MSA.

Example 16

Child:	*'aḥyānan*	*nnajjam*		*nbazaz=hum*	*aa*
	often	can.IPFV.1SG		provoke.SBJV.1SG=them	yes
	fī	*waqt*	*muḥaddad*		
	in	time	limited		

"Sometimes I can provoke them too, yes, in some particular cases."

Although he did not produce full sentences in MSA, Child E's utterances were often close to the morphosyntactic MSA structure. Example 17 only deviated from MSA by the elision of initial *a–* in *ʕṭa* (instead of *aʕṭa*) and the absence of final *–a* in *ṭarad* (instead of *ṭarada*). As for syntax, the expected structure would rather be Verb–Subject–Object, albeit Subject–Verb–Object is also often heard in spoken MSA.

Example 17

Child:	*'al=mudīr*	*ʕṭa=hum*	*ʕuqūba*	*wa=ṭarad=hum*	*min*
	ART=director	give=them	punishment	and=expell=them	from
	al=madrasa				
	ART=school				

"The director expelled all of them from the school."

However, after the adult followed up with a question in TA in Example 18, Child E continued in TA.

Example 18

Adult:	*ʕal=mudīr*	*ṭarad=hum*	*kul=hum*	*m*
	ART=director	expel=them	all=them	from
	al=madrasa			
	ART=school			

"The director expelled all of them from school?"

Child:	*ṭarad*	*j=jmāʕa*	*lli*	*bazzū=ni*
	expell	ART=group	REL	insult.PFV.3PL=me

"He expelled the group that insulted me."

The last illustration, Example 19, was again very close to MSA. However, some phonological features were clearly part of TA (*b–* for *bi–*, *ġrīb* for *ġarīb*), and the verb *yatṣarrfū* was inflected almost like in TA (but *yataṣarrafūna* would be expected in MSA).

Example 19

Child: *'aḥyānan*	*l='aṭfāl*	*yatṣarrfū*
often	ART=kid.PL	behave.IPFV3PL
b=šakl	*ġrīb*	
with=way	strange	

"Kids often behave in a strange way."

Discussion

One firm conclusion that can be drawn from the case studies presented in this article is that the phenomenon of MSA use in the speech of children with ASD is real. The transcription and coding of 10 to 20 minutes of semi-structured conversations revealed that the speech of five children with ASD (out of seven initially recruited for this study) included many instances of spontaneous and productive use of MSA. Some of these uses demonstrated striking productive mastery of morphosyntactic features of MSA. Although this linguistic behavior has often been observed by professionals in the field of ASD in North Africa, to the best of our knowledge, it has never been formally documented until now. The first aim of this study, then, was to augment the existing evidence of exceptional language learning skills in children diagnosed with ASD (cf. Pring, 2005; Smith & Tsimpli, 1995; Vulchanova, Talcott, Vulchanov, & Stankova, 2012). In the speech of the five children whose verbal production is reported here, the presence of MSA varied from fully productive, morphosyntactically complex sentences to uses mixing MSA lexemes or morphology with the colloquial TA variety; regardless of this variation, MSA was present in at least 39% of their utterances. This phenomenon was intriguing because MSA is virtually never used in Tunisia in spontaneous interaction, and, as discussed above, is not fully mastered by typically developing children until advanced years of formal learning in school. None of the children whom we describe in this article could have possibly benefited from such formal instruction and especially not Children A, B, and C, who—in spite of their young age—demonstrated the most complex mastery of the MSA linguistic system. Given the formal complexity of MSA relative to TA, neither is it plausible to surmise that MSA would somehow be easier to learn for children with

ASD, who have notorious difficulties in communication and whose language development is often considerably delayed.

Let us now turn to a potential explanation for this phenomenon. As mentioned in the introductory section, television programs and, increasingly, video games constitute the main source of MSA to which children are consistently exposed in the diglossic context of Arabic-speaking countries. Other contexts of exposure to MSA are mainly academic, journalistic, political, or religious speeches as well as most of written material in Arabic. Understandably, young children are not frequently exposed to such sources, and even when they are, these formal levels of language are not expected to be reproduced in other contexts. Judging from the relatively late age by which typically developing children achieve proficiency in MSA, this source of exposure does not seem to suffice for typically developing children to acquire the noncolloquial variety of Arabic (see Amayreh, 2003; Khamis-Dakwar et al., 2012; Leikin et al., 2014; Saiegh-Haddad et al., 2011). In fact, there seems to be no correlation between preschool and primary school typically developing children's mastery of MSA and the extent of exposure to television and books (Khamis-Dakwar et al., 2012; Leikin et al., 2014). This strongly suggests that an active learning process, initiated in primary schools, is required for typically developing children to acquire MSA.

That typically developing children do not manage to acquire MSA through passive exposure to screen media is consistent with evidence from hearing children whose deaf parents extensively exposed them to radio and television in the hope that they would acquire speech. In spite of passive exposure to spoken English, these children exhibited severe language delays (Sachs et al., 1981). Furthermore, in a landmark experimental study, Tsao, Liu, and Kuhl (2004) showed that, although American infants were capable of acquiring phonological categories of Mandarin Chinese from live exposure to speakers of the language, no such acquisition resulted from watching comparable video recordings. In the same vein, lexical learning by typically developing toddlers seems to be more efficient in live interaction than through exposure to equivalent video stimuli (Krcmar, Grela, & Lin, 2007).

The importance of active social interaction for language development is fully in line with constructivist theories of language acquisition. These models posit that an innate drive to communicate allows language structures to be gradually induced from communicative experience. That is, language structures are claimed to progressively emerge from interactional experience of form–meaning pairs in which joint attention skills play a central role (e.g., Kuhl, 2007; Tomasello, 2008). However, there is empirical evidence that language

learning is possible in the absence of joint attention in both typical and atypical populations (for a review, see Akhtar & Gernsbacher, 2007). It is important to emphasize that constructivist theories, which emphasize sociopragmatic interaction and view language as an evolved tool with a complex communicative function, are not universally accepted among linguists. Competing, nativist theories of language hold that most linguistic knowledge is innate (e.g., Berwick & Chomsky, 2016; Chomsky, 2000). According to nativists, early linguistic input is crucial, but its role is restricted to parametrizing the development of language in one of the few possible directions predetermined by a child's innate linguistic competence.

Without necessarily espousing nativism in its strongest version, one can draw from it the idea that the structure of the linguistic input—independent of how and why it is used—may provide enough evidence for some individuals to build their own internal language competence. An intriguing possibility is then that young children with ASD rely, perhaps to a greater extent than their typically developing peers, on structural properties of the linguistic input, and not (so much) on the communicative function of linguistic interaction, to acquire language. This would explain why our ASD children were better than their typically developing peers at learning MSA from television.

This explanation is also consistent with the explanation that savant skills in autism emerge from selective attention to and from atypical implicit extraction of deep structural regularities from restricted types of stimuli (Mottron, Dawson, Soulières, Hubert, & Burack, 2006). It is also in line with the preliminary evidence in favor of video-based learning tools for children with ASD. For instance, Charlop-Christy, Le, and Freeman (2000) reported that video modeling interventions were more efficient in teaching and promoting generalization of language skills than in-vivo modeling intervention. Children with ASD have also been known to have high daily screen (television and video games) activity time, even though it is unclear whether it is significantly higher relative to their typically developing peers (see Mazurek & Wenstrup, 2013; Montes, 2016), and there are anecdotal reports of cases where video movies have provided support for language development (Suskind, 2014). Finally, Vulchanova et al. (2012) reported a case of EV, a girl with ASD who learned German almost exclusively from exposure through television.[7]

Conclusion

No firm conclusion about language acquisition through passive exposure in MSA can be reached from the five case studies reported here. Many crucial issues raised by our data will have to be tackled by more extensive and

quantitative investigation (which we are currently conducting). First, it is important to quantify the extent of use of MSA across the entire ASD population in Arab-speaking countries and to relate it to different subtypes of the autism spectrum. Second, it would be informative to find out whether a similar phenomenon arises in other diglossic communities in which children's exposure to one of the language varieties is limited to television. Third, longitudinal studies are needed to determine whether in those children with ASD who use MSA, proficiency in MSA also boosts the development of colloquial varieties, thus opening a new window on the potential of screen technologies for supporting language development in autism. Finally, even though our data do not suggest any link between amount of MSA use and cognitive profiles or autism severity scores, further research is needed to investigate whether development of MSA might be tied to a specific cognitive profile. Although our study leaves these questions open, we hope to have demonstrated the potential of diglossic contexts, including those outside Western countries, to shed new light on autism.

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Notes

1 Here and in the transcribed examples below, we have used romanization of Arabic phonology as in Versteegh, Eid, Elgibaly, Woidich, and Zaborski (2006). The International Phonetic Alphabet has been used when necessary for the discussion of phonetic or phonological details.

2 The Childhood Autism Rating Scale is a behavioral rating scale used to objectify parents' reports and subjective clinical judgments and to quantify the severity of the disorder. It is composed of 15 subscales corresponding to the core symptoms of autism, each scored on a Likert scale of 1 (*normal*) to 4 (*severely atypical or inappropriate*). A higher total score indicates a more severe autistic disorder. The Autism Diagnostic Interview is a structured parent interview covering developmental history and current presentation of symptoms of ASD across three functional domains: language and communication; reciprocal social interactions; and restricted, repetitive, and stereotyped behaviors and interests.

3 In the Peabody Picture Vocabulary Test, children are instructed to choose from four pictures the one that corresponds to the item uttered by the experimenter. The Leiter International Performance Scale is a nonverbal measure of intellectual ability. Instructions are given to the child using the method of pantomime. The cognitive battery of the Leiter is composed of four subtests related to visualization and reasoning. The figure ground subtest targets identification skills of stimulus drawings embedded in complex pictures. The form completion subtest measures a child's ability to recognize a whole object from its fragmented parts. In the

classification/analogies subtest, a child has to categorize objects and geometric forms and to solve matrix analogies. The sequential order subtest assesses a child's ability to detect visual sequences and select the stimulus block that best completes the illustrated sequence. Scaled scores ranging from 0 to 20 ($M = 10$, $SD = 3$) are obtained for each subtest. A global composite score is computed using normalized standard scores on the IQ scale ($M = 100$, $SD = 15$).

4 For one child, at the request of the parents, only an audio recording was kept.

5 In contrast, consider a genuinely echoic use of MSA by Child A. At some point, he was asked to sing a song and reproduced the national anthem. Although the original form was clearly in TMSA, here the child also was influenced by TA phonology, which probably caracterized the original delivery: *al-ḥurriyya* was pronounced [ɛlħorrɛjːa] instead of the MSA variant [alħurrija].

Child:	*yā*	*tūnis*	*yā*	*tūnis*	*yā*	*'ard*	*al=ḥurriyya*
	VOC	Tunisia	VOC	Tunisia	VOC	land	ART=freedom

"Oh Tunisia, Oh Tunisia, land of freedom!"

6 An anonymous reviewer observed that not all final case markings were present in Example 5. This was also true for some other examples below. However, neutralization of final long vowels, as well as the elision of final short vowels, is extremely frequent in spoken MSA (Ryding, 2005). More generally, case markings are very often omitted in the MSA used in television programs, even by highly educated speakers in very formal settings (Hallberg, 2016). This type of neutralization was clearly inherent in the spoken MSA input to which the children described here were exposed, and it was therefore not surprising that they alternated between full and neutralized forms.

7 Vulchanova et al. (2012) explain EV's linguistic profile in terms of the weak coherence theory of ASD (Happé & Frith, 2006). The idea that EV relied on local properties of the linguistic output to learn German is fully consistent with the foregoing.

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