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PITCH-RELATED FEATURES IN THE SPEECH OF FINNISH- AND FRENCH-SPEAKING BOYS WITH AUTISM IN DATA COMING FROM GROUP THERAPY SESSIONS

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1. INTRODUCTION

It is often said that the *manner* in which we speak conveys as much meaning as the words we use (Couper-Kuhlen 2000: 2). It is also well known that prosodic features constitute a large part of this *manner*. In phonetics, *prosody* encompasses phenomena related to speech rhythm, melody, stress, phrasing and voice quality. These are related to duration (timing), pitch (voice fundamental frequency), loudness (intensity) and speech rate (Crystal 1969, 1980). Prosodic phenomena are suprasegmental; that is, they typically involve units of at least one syllable in length.

1.1. Previous studies concerning autistic persons' prosody

Autistic people often have deviant prosodic features in their speech. For example, they may have a limited range of intonation, their speech can be overly fast, 'jerky' or loud, or it can be characterized by large pitch excursions, a quiet voice, an inconsistent pause structure, deviant word stress and/or by a creaky or nasal voice (Baltaxe and Simmons 1985, 1992; Fay and Schuler 1980; Ghaziuddin and Gerstein 1996; Lehtinen 2010; Paul et al. 2005a; Paul et al. 2005b; Shriberg et al. 2001; Provonost et al. 1966; Rutter and Lockyer 1967; Ornitz and Ritvo 1976; Tager-Flusberg 1981; Paul 1987; McPartland and Klin 2006; Tager-Flusberg 2000; Thorson et al. 2016).

According to Thorson et al. (2016), who studied spontaneous productions of minimally verbal children and adolescents with autism, average pitch and pitch range vary as a function of verbal ability. That is, average pitch and pitch range both decrease as the number of lexical items uttered increase. When Thorson et al. (2016) compared their own data to previous data from Diehl et al. (2009), the data together formed a linear trend, with greater pitch ranges found for the least verbal group.

Baltaxe (1984) compared the speech of children (aged 4-12) with autism spectrum disorder (ASD) with the speech of children with language impairment, as well as a control group. Their results showed that the group with ASD and the control group exhibited wider fundamental frequency (f_0) ranges than the group of children with language impairment. Fosnot and Jun (1999), in turn, have found that children with ASD also show a greater f_0 variation and range than age-matched typical controls.

According to Peppé et al. (2007), children with ASD perform less well than typically developing children and normal adult controls in receptive and expressive prosody tasks. Fine et al. (1991) have, however, reported that ASD subjects are able to employ useful prosodic patterns for communication. Producing appropriate stress patterns can, nevertheless, be difficult for them (Paul et al. 2005a, 2005b). Shriberg et al. (2001) report that people with ASD have notable difficulties with the pragmatic and affective use of prosody, but they do not have difficulties with the grammatical functions of prosody. The same study shows that ASD people also have more disfluencies in their speech than neurotypical speakers (for disfluencies in autistic persons' speech, see also Wiklund and Laakso 2019).

Olivati et al. (2017) analysed prosodic elements of speech segments of students with ASD and compared them with those of a control group. They found significant differences for the variables *tessitura*, melodic amplitude of tonic vowel, melodic amplitude of pretonic vowel, maximum intensity, minimum intensity, tonic vowel duration, pretonic vowel duration and phrase duration.

Deviant prosodic features of speech do not, however, concern every individual with autism (Simmons and Baltaxe 1975; Paul et al. 2005b). Nevertheless, when these features occur, they constitute a significant obstacle to social acceptance of the individual (Paul et al. 2005a: 205). Indeed, deviant prosodic features may create an immediate impression of "oddness" (Van Bourgondien and Woods 1992), and they affect autistic speakers' ratings of social and communicative competence (Paul et al. 2005b).

1.2. Objectives of this study

The aim of this paper is to present and analyse different subjectively salient, prosodically characteristic speech types occurring in mildly autistic preadolescents' speech. The paper focuses on the following types: 1) flat (monotonous) pitch, 2) large pitch excursions, and 3) bouncing pitch. In addition to the phonetic descriptions of the phenomena, the paper discusses the other participants' possible reactions to these prosodic features, and occurrences of the features are studied in a larger context from an interactional point of view.

1.3. Data and methods

The data comes from authentic group therapy sessions during which 11 to 13-year-old Finnish-speaking boys (n = 7) and French-speaking boys (n = 4) talked to each other and their two therapists. The Finnish data was recorded in Helsinki (Finland) and the French data in Geneva (Switzerland). The total duration of the recording is three hours.

Phonetic analyses were carried out for pitch (voice fundamental frequency, f_0). We measured means, standard deviations (in Hz) and aggregate pitch movement (semitones/second) (Vainio et al. 2012). These (taken together) should give us measures for overall liveliness of the speech prosody.

Interactional analyses concerning the contexts in which the prosodic features occurred were carried out using Conversation Analysis (e.g. Hutchby and Wooffitt 2008).

2. ANALYSES

2.1. Flat pitch

A machine-like intonation and deficits in the use of pitch were noted as prosodic characteristics of individuals with ASD in early observational reports (McPartland and Klin 2006; Paul et al. 2005a; Shriberg et al. 2001; Tager-Flusberg 2000). This feature does not, however, concern all individuals with ASD. In our data, only one Finnish-speaking and one French-speaking informant had a flat, machine-like, pitch. If the phenomenon occurs, it is a general feature of the informant's speech, occurring all the time (and not only in certain types of contexts). Both informants who have a flat pitch also speak very little and with a very quiet voice. The first example presents a brief extract from the speech of the French-speaking informant. A list of transcription conventions used in the examples is given at the end of the article. The names of the participants have been changed.

In this extract, the session has just started, and the group is talking about how everyone is feeling that day. The therapist says to Alexandre that he looks tired (line 01), and the boy replies (line 02). This launches a discussion about going to bed too late and being tired in the morning.

Example (1)

01 Therapist: (--) Alexandre (0.2) tu m'as l'air fatigué toi.

Alexandre you look tired to me

02 Alexandre: oui je suis fatigué (et content),

yes I am tired (and happy)

03 Therapist: pourquoi t'es fatigué,

why are you tired

→04 Alexandre: parce que: je me suis couché à dix heures,

because I went to bed at ten o'clock

05 Therapist: comment ça >se fait que tu t'es couché< aussi tard,

how come you went to bed so late

06 Marcus: mais dix heures c'est pas /tard,

but ten o'clock is not late

07 Therapist: mais pour /lui c'est /tard,

but for him it's late

08 Marcus: di- dix heures,

te- ten o'clock

09 Alexandre: [que chaque fois],

that every time

10 Michel: [dix heures] c'est quand on se lève.

ten o'clock it's when you get up

11 Therapist: à vingt-deux heures (0.2) °dix heures du soir° ouais,

at ten p.m. ten in the evening yeah

12 Alexandre: parce que chaque /fois (évidemment) je me (2.0) je me réveille

because every time (obviously) I wake up

13 mail- (0.2) mal pendant le matin,

baid- badly in the morning

14 Therapist: c'est dur de se réveiller le /matin? (0.4) et t'arrives pas à te

is it hard to wake up in the morning and you don't manage to

15 coucher plus tôt?

go to bed earlier

16 Alexandre: (-) (tard),

(late)

17 Therapist: t'arrives pas à te coucher un peu plus /tôt?

you don't manage to go to bed a bit earlier

18 (0.2) pour être plus en forme?

in order to be in better shape

19 Alexandre: si j'essaye,

yes I try

20 Therapist: ouais.

yeah

The participant (Alexandre) speaks with remarkably flat pitch in all the turns that he produces in this extract (lines 02, 04, 09, 12, 16 and 19). The flatness does not, however, seem to make it difficult to understand him or elicit unusual reactions from the other participants in the conversation. First (line 02), Alexandre produces a turn, *oui je suis fatigué et content* ('yes I am tired and happy'), which is a reaction to the therapist's preceding turn (line 01): *Alexandre tu m'as l'air fatigué toi* ('Alexandre you look tired to me'). It is noteworthy that the boy is able to react to the therapist's turn, even though it is not a direct question. The therapist reacts to this turn by a direct question, *pourquoi t'es fatigué* ('why are you tired', line 03), and Alexandre answers the question by saying *parce que: je me suis couché à dix heures* ('because I went to bed at ten o'clock', line 04). The therapist reacts immediately to his answer by a new question: *comment ça se fait que tu t'es couché aussi tard* ('how come you went to bed so late', line 05). One of the other boys, Marcus, reacts to this by a comment, *mais dix heures c'est pas tard* ('but ten o'clock is not late', line 06), to which the therapist immediately replies *mais pour lui c'est tard* ('but for him it's late', line 07). After that (line 08), Marcus continues with a brief turn that he interrupts: *di- dix heures* ('te- ten o'clock'). Alexandre and a third boy, Michel, then start to talk at the same time: Alexandre starts a turn (*que chaque fois*, 'that every time', line 09) but interrupts it, and Michel says *dix heures c'est quand on se lève* ('ten o'clock it's when you get up', line 10). The therapist reacts to this with an outright correction: *à vingt-deux heures dix heures du soir ouais* ('at ten p.m. ten in the evening yeah', line 11), because Michel has clearly misunderstood.

After the therapist's turn, Alexandre takes the floor again (lines 12–13) and starts to explain why he is tired (*parce que chaque fois évidemment je me je me réveille mail- mal pendant le matin,* 'because every time obviously I wake up baid- badly in the morning'). The boy is however not really answering the therapist's original question, *comment ça se fait que tu t'es couché aussi tard* ('how come you went to bed so late', line 05). Indeed, autistic children have a tendency to respond in a non-contingent (i.e. off-topic) manner in conversation (Hale and Tager-Flusberg 2005; Lehtinen 2012; Wiklund 2016). The therapist reacts to this by asking Alexandre *c'est dur de se réveiller le matin* ('is it hard to wake up in the morning', line 14). The boy does not react to this immediately. Consequently, the therapist adds a new question to her turn (lines 14–15): *et t'arrives pas à te coucher plus tôt,* 'and you don't manage to go to bed earlier'. Alexandre's answer is not clear (line 16). Therefore the therapist repeats the question (*t'arrives pas à te coucher un peu plus tôt,* 'you don't manage to go to bed a bit earlier', line 17). As the boy does not answer immediately, the therapist adds a new element to her question: *pour être plus en forme?* ('in order to be in better shape', line 18). Alexandre then answers the question adequately: *si j'essaye* ('yes I try', line 18), and the therapist reacts to this with the particle *ouais* ('yeah', line 20).

The extract shows that the flatness of the pitch does not affect the fluidity of the interaction in any way. As it is a feature that occurs all the time in this informant's speech, the interlocutors do not seem to pay attention to it.

Figure 1 below gives the pitch (f_0) curve illustrating the flat pitch occurring in one of the informant's turns (line 04) in Example 1.

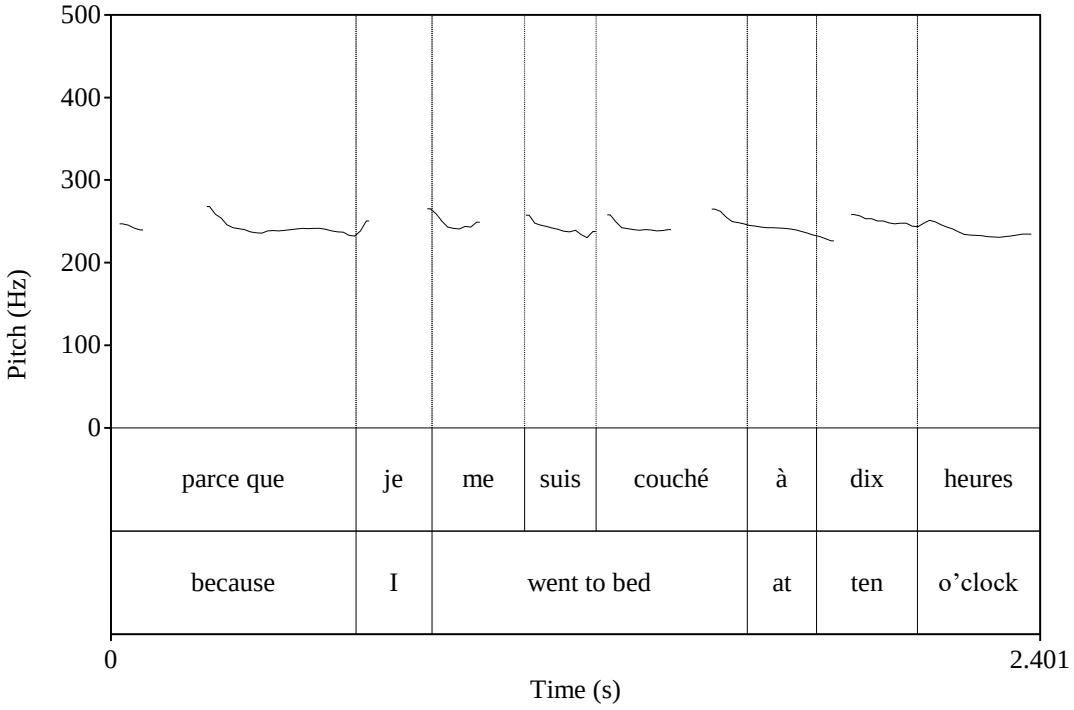

Figure 1: Pitch curve illustrating a flat speech in the speech of a French-speaking informant

The f_0 mean is in this extract is 227.8 Hz, which corresponds to a normal value for a preadolescent boy. The standard deviation of the f_0 is 21.1 Hz (2.6 semitones). This corresponds to a 'small range' as a typical utterance would have twice the value. The pitch movement value is 18.2 st/sec, which is uncharacteristically low and corresponds to a small movement-range ratio.

2.2. Large pitch excursions

The intonation of people with ASD can also be marked with large pitch excursions. Indeed, Fosnot and Jun (1999) have found that children with ASD show a greater f_0 variation and range than age-matched typical controls (see also Baltaxe 1984; Thorson et al. 2016; Diehl et al. 2009). In our data, three Finnish-speaking informants have salient pitch excursions in their speech. The phenomenon does not occur in the French data. The phenomenon can take different forms when it

appears, and it does not necessarily occur all the time in the speech of the informant in question. The following sound sample illustrates an 'extreme case' in which the pitch excursions are so large that it sounds almost as if the speaker was singing. This particular feature does not occur in the informant's speech all the time, but only in this type of context where the speaker is telling a story or describing something.[1]

In this extract, the session has just started, and the female therapist asks the group what they will start with (line 01).

Example (2)[2]

01 FT: mm-h? (1.0) millä me aloitamme,

mm-h *what do we start with*

02 Toni: kuulumisilla?

catching up

03 FT: joo

yes

04 MT: mm.

mm

05 (2.0)

06 FT: kuka aloittaa. ((katselee ympärilleen))

who starts *((looks around))*

07 Jaakko: ((viittaa)) >mää voin mul on ainakin<

((raises his hand)) I can I have at least

((raises his hand)) *I* *can* *at least*

08 kolmen viikos jotain tapahtu, (.) mää

three-(GEN) weeks-(INE) something has happened I

there are things that have happened to me of three weeks

09 ko- ää onks se (.) ↑viime viikon sitä

ko- er is-(CLI) it last week's it

ko- er is it *last week's*

10 edellisel viikolla: mul mää jouduin

[1] In the transcriptions of the Finnish data, 'FT' refers to the female therapist, and 'MT' refers to the male therapist.

[2] The same extract has already been analysed from another point of view in Wiklund and Laakso (2019).

previous week I-(ALL) I-(NOM) got into

preceding week I I got into

11 kahteen (.) kouluonnettomuuteen?

two school accidents

two school accidents

12 MT: mm? ((nyökkää))

mm ((nods))

→ 13 Jaakko: eka oli luistelul↑la mää kaaduin ja

the first one was on skating-(ADE) I fell and

the first one happened on skating I fell and

14 mun #polve (.) ja: polvi vähän (.) ää no#

my kne- and the knee got a little er well

15 (.) venähti eh↑kä mä en osaa sanoo.

strained maybe I can't tell

16 MT: mm-m,?

mm-m

Toni answers the female therapist's question by saying that they start *kuulumisilla* (with 'catching up', line 02), and the therapists accept the answer (lines 3–4). After that, the female therapist asks who wants to start (line 06). Jaakko volunteers to start (line 07), and he starts immediately to tell his latest news. The beginning of the turn is hard to understand because Jaakko speaks fast and his articulation is unclear. In the segment appearing on line 07, the speech rate is seven syllables per second. Following that (line 08), there is a wrong case ending: the boy says *kolmen viikos*, where the first word ('three') is in the genitive case, and the second word ('weeks') is in the inessive case. Both words should be in the inessive case to form a grammatically correct proposition with congruent case endings. *Kolmessa viikossa* 'within three weeks', both words in inessive, would also better fit the utterance. After that (lines 08–09) is a disfluent sequence, where Jaakko has difficulties finding words. Further, the expression *viime viikon sitä edellisel viikolla* ('last week's at preceding week') (lines 09–10) is a bit clumsy, even if it is more or less comprehensible.

The turn is remarkably disfluent (see also Wiklund and Laakso 2019). The impression of disfluency here is created most of all by prosodic features, such as changes in pitch, intensity and speech rate, as well as by incoherent and/or disconnected syntactic structures. Disconnectedness is also enhanced by Jaakko's frequent self-repairing: for example, he cuts off and changes the morphosyntactic form of his utterance from *mul* ('I-ALL', projecting *I had X*) to *mää* ('I-NOM') (line 10) and from *polve* ('knee-CASE') to *polvi* ('knee-NOM'). The end of the turn (*mää jouduin kahteen kouluonnettomuuteen*, 'I got into two school accidents', lines 10–11) is, however, rather fluent. Indeed, the therapist does not make a repair

initiation, but he reacts to Jaakko's turn with the discourse particle *mm* (line 12), which indicates that he is listening (ISK 2004: § 798). The rising pitch at the end of the particle implies that the therapist is expecting Jaakko to continue his story. Jaakko correctly interprets the interactional meaning of the discourse particle and continues speaking.

The beginning of Jaakko's second turn contains a wrong case ending: the boy says *eka oli luistelulla* (line 13), where the word *luistelu* ('skating') is in the adessive case instead of the inessive case, which would be the right form here. After this, the turn continues fluently. The prosody of the turn is however unusual: the pitch goes up and down almost as if the speaker is singing. During the production of the word *luistelulla* ('skating'), the pitch level increases 10.7 semitones between the first and the last syllable, and during the production of the word *kaaduin* ('I fell'), the pitch rises 8.2 semitones. The therapist reacts to this turn by producing the discourse particle *mm-m* with a rising pitch (line 16). This minimal response signals that the therapist is still listening and expects Jaakko to continue speaking (ISK 2004: § 798). Jaakko again correctly interprets the interactional meaning of the minimal response and continues speaking. The turn that he produces is coherent and does not include any salient prosodic features.

Figure 2 below presents an extract of Jaakko's second turn (lines 13–15), which includes large pitch excursions.

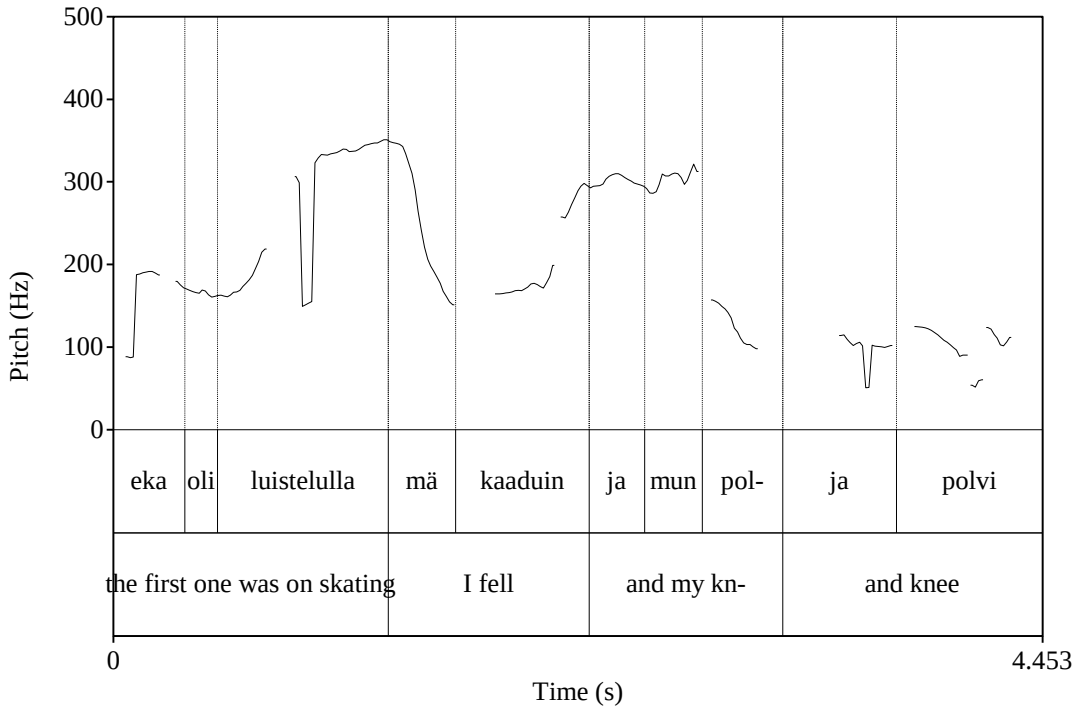

Figure 2: Pitch curve illustrating large pitch excursions in the speech of a Finnish-speaking informant

The f_0 mean in this speech sample is 242.3 Hz which is a normal value for a preadolescent boy. The standard deviation of the f_0 is 76.0 Hz (that is, 7.7 st), which corresponds to a large range (the absolute range being almost two octaves, or over 20 st). The pitch movement value is 36.6 st/sec, which corresponds to a large movement-range ratio.

2.3. Bouncing pitch

Use of aberrant stress patterns is another prosodic characteristic of autistic people's speech noted in early observational reports (Paul et al. 2005a; Shriberg et al. 2001). An example of a salient stress pattern in our Finnish data is a repetitive strong stress that creates an impression of 'bouncing' speech. Note also that the Finnish informants often produce a pitch peak on the unstressed syllable of a word (in Finnish the lexical stress is on the first syllable of the word and typically the peaks occur there). Three of the seven Finnish-speaking informants have salient features related to stress. These features occur all the time in their speech, but there are moments when the features are particularly salient and other moments when the features are milder. The following speech sample illustrates the 'bouncing pitch' phenomenon in the speech of one of the Finnish-speaking informants. The phenomenon cannot be found as such in the French data.

In this extract, the session has just begun, and the group is about to start sharing news. One of the therapists has just asked who wants to be the first one to share his news, and Harri volunteers.

Example (3)

01 Harri: ↑minä voin alot°taa°. ((kohottaa kulmia))

I can start *((raises eyebrows))*

02 MT: no ↑kerro vähän kuulumi°sia°.

well tell us some news

03 FT: °↑mm°

mm

(.)

→ 04 Harri: jaa: ↓niin t'ta:? (.) hhhh (0.6) ↑hy↑vin ↓om

PRT PRT PRT well is

well yeah er *it has gone well*

05 mennyk koulussa ja::, (.) >ollu< tota: (.) on

gone at school and has been PRT is

at school and *it has er* *there is*

06 yks kaveri jota mä en oot tavannup pitkää aikaan

one friend that I not have seen long time

a friend that I have not seen for a long time

07 nii: (.) se ↑vihdoinkip pääs tänä viikolloppuna

PRT he finally could come this weekend

so he finally could come this weekend

08 tapaa tuli meil↓le: (0.4) hh ja: (.) pelattii (.)

to meet came to our place and we played

to meet me he came to our place and we played

09 >p'la-< #p'lattii# hyvii pele:j ja oli iha: (.)

pla- played good games and was quite

pla- played good games and we had quite

10 kivaa keskenää?

fun together

fun together

(0.8)

11 MT: mm m? ((katsoo Harria, nyökkää))

mm ((looks at Harri and nods))

12 FT: ↓kiva:? ((katsoo Harria))

nice ((looks at Harri))

that's nice

(.)

13 Harri: >tai< se:, (.) >se on sellanen ↑kaveri jota mä

or it it is that kind of friend that I

14 en oo< tavannum melkei yhteen ↑kuu↓kautee koska

not have met almost one month because

have not met for almost one month because

15 sillä o ollu niim paljom menoja.

he has had so many things to do

he has been so busy

16 (0.6)

17 MT: mm m? .nsss ((katsoo Harria ja nyökkää))

mm ((looks at Harri and nods))

In this extract, Harri's pitch is bouncing all the time when he is speaking. This does not, however, make it difficult to understand him or elicit particular unusual reactions from the other participants in the conversation. In his first turn (line 01) Harri volunteers to start (*minä voin alottaa*, 'I can start'). The male therapist reacts to this immediately by saying *no kerro vähän kuulumisia* ('well tell us some news', line 02). The female therapist reacts to Harri's turn with the discourse particle *mm* (line 03), which indicates that she is listening (ISK 2004: § 798). After that, Harri produces a rather long turn in which he tells his latest news (lines 04 –10). In addition to a bouncing pitch, this turn includes several fillers and sound prolongations, as well as repetition and a false start. It is not, however, difficult to understand him: the male therapist reacts to his turn with the discourse particle *mm m* (line 11) which indicates, here too, that he is listening (ISK 2004: § 798). The rising pitch at the end of the particle implies that the therapist is expecting Harri to continue his story. The female therapist produces a lexical turn in which she says *kiva* ('that's nice', line 12), which also implies that she has understood what has been said and expects Harri to continue. Harri interprets these interactional cues correctly and continues speaking (line 13). His turn (lines 13–15) has a bouncing pitch and includes one prolongation, but is otherwise fluent. The male therapist reacts to this turn, too, by the discourse particle *mm m* with a rising pitch (line 17), positioning himself as a listener. Thus, despite the bouncing pitch, this turn is not difficult to understand either.

Figure 3 below presents an extract from Harri's second turn (lines 04–10), which has a bouncing pitch.

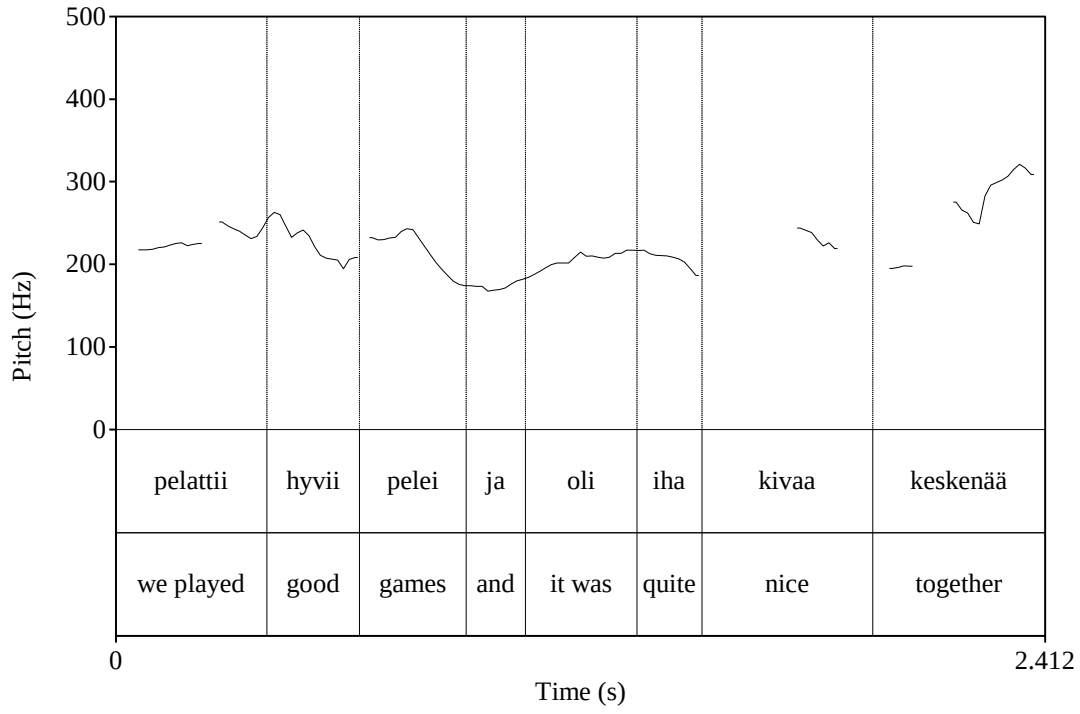

Figure 3: Pitch curve illustrating a bouncing pitch in the speech of a Finnish-speaking informant

In this extract, the f_0 mean is 223.9 Hz, which is a normal value for a preadolescent boy. The standard deviation of the f_0 is 42.3 Hz (that is, 3.1 st), which indicates a moderate range. The pitch movement value is 30.6 st/sec, which indicates a large movement-range ratio. Thus, as the standard deviation value is moderate but the movement value is large, these values indicate that this prosodic pattern is different from the two previous ones. That is, there is a relatively high level of movement with respect to time in a moderate range, causing the bouncing pattern characterizing the speech.

3. CONCLUSIONS

This paper has focussed on three salient prosodic features in the speech of autistic preadolescents: 1) flat pitch, 2) large pitch excursions, and 3) bouncing pitch. The occurrences of these phenomena show that prosodic extremes are typical of preadolescents with ASD. However, it is noteworthy that in our data, only one Finnish-speaking and one French-speaking informant had a flat machine-like pitch, which is often said to be typical of people with autism (McPartland and Klin 2006; Paul et al. 2005a; Shriberg et al. 2001; Tager-Flusberg 2000).

Fosnot and Jun (1999) found that children with ASD show a greater f_0 variation and range than age-matched typical controls (see also Baltaxe 1984; Thorson et al. 2016; Diehl et al. 2009). In our data, three Finnish-speaking informants have salient pitch excursions in their speech. The phenomenon does not occur in the French data. Thus, our study suggests that this phenomenon is at least to some extent a language-specific feature. A larger data corpus would however be needed to confirm this hypothesis.

Use of aberrant stress patterns is another well-known prosodic characteristic of autistic people (Paul et al. 2005a; Shriberg et al. 2001). We have described a prosodic phenomenon typical of our Finnish data: repetitive strong stress that creates an impression of bouncing speech. It is also noteworthy that the Finnish informants often produce a pitch peak on the unstressed syllable of a word. Three of the seven Finnish-speaking informants have salient features related to stress. As stress is a language-specific feature, prosodic phenomena related to stress are also language-specific. However, it can be stated that the bouncing pitch phenomenon, found in the Finnish data, cannot be found as such in the French data.

One new aspect of the current study was to investigate the prosodic phenomena under consideration in the contexts in which they occur. Our interactional analyses show that typically these phenomena do not make understanding difficult (but see Wiklund 2016 for occurrences of these phenomena in trouble-source turns), and that the other participants in the conversation do not typically react to them. Our interactional analyses also confirm previous findings (Wiklund 2012) that preadolescents with ASD are able to correctly interpret interactional meanings of combinations of discourse particles and pitch movements.

In the future, we plan to study these prosodic features in a larger data corpus in order to find out if similar prosodic shapes can be found in larger datasets. We also plan to compare these prosodic features and phonetic values statistically with the ones found in our control group data, and to statistically compare the Finnish and the French data. In addition, we plan to

carry out perception tests that will allow us to find out if neurotypical (that is, non-autistic) people find these features salient, and, if so, to what extent.

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TRANSCRIPTION CONVENTIONS

.	strongly falling pitch at the end of a prosodic unit
;	slightly falling pitch at the end of a prosodic unit
,	flat pitch at the end of a prosodic unit
,?	slightly rising pitch at the end of a prosodic unit
?	strongly rising pitch at the end of a prosodic unit
↓	segment produced on a lower pitch level than the surrounding speech
↑	segment produced on a higher pitch level than the surrounding speech
s<u>i</u>ka	prominent stress
>tosi<	accelerated speech rate
<paitsi>	slowed speech rate
joo:	lengthened vowel
MITÄ	increased level of loudness
.hhh	clearly audible inhalation (one ‘h’ corresponds to 0.1 sec)
hhh	clearly audible exhalation (one ‘h’ corresponds to 0.1 sec)
.joo	word produced with an inhalation
@just@	marked voice
k(h)iva	word produced laughingly
£niimpä£	word produced smilingly
·nii·	word produced more quietly than the surrounding speech
[	overlap of speech begins
]	overlap of speech ends
(.)	micropause (duration of less than 0.2 sec)

(0.6)	pause (duration measured in seconds)
(lapset)	unclear speech
st	semitone
PRT	particle

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