Listening behaviour of preschool children with Autism Spectrum Disorder

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Introduction

The atypical listening behaviours of children with Autism Spectrum Disorder (ASD) are increasingly investigated in

- Neurophysiological research, using different techniques, test stimuli and age groups

but

- there appears to be limited systematic descriptions of listening behaviour in this population as observed in natural conditions

LISTENING

- A skill, learnt behaviour: identify a sound, localise and discriminate between sounds
- Foreground – background discrimination, select and prioritise (filter), then process further to understand the sound stimulus
- Essential for language acquisition
- Begins to develop before birth
- Hearing attentively
- Requires
  - Hearing ability
  - Ability to sustain attention
  - An interest in sound or speech

Aims

- Theoretical rationale
  - What do we know already?
- Clinical rationale
- Aims and methods
- Results
- Discussion

Theoretical rationale for the study

- Poor listening skills of children with ASD are not directly stated in the diagnostic criteria (DSM-V, APA, 2013; McPartland, Reichow & Volkmar, 2012)
- or in the American Speech Language Hearing Association's (ASHA, 2006) ASD Guidelines for speech-language therapists

DSM-V (APA, 2013)

- Indirectly addressed under *sensory processing disorder*, together with tactile, proprioceptive & kinaesthetic, visual, taste and smell in "restrictive and repetitive behaviours" domain
  - "Hyper- or hypo-reactivity to sensory input"
  - "Adverse response to specific sounds" (APA, 2013)

To *amplify* the function of listening skills

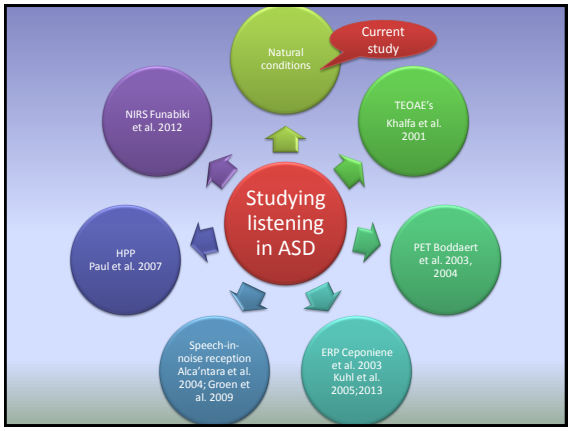
- Speech and language development depends on good hearing, the ability to attend, listen and understand language
- Language is a unique vehicle for thought and a social tool (Owens, 2012)
- Language is a predictor of the current status and future outcome of school-aged children with ASD (Kuhl et al., 2005)
- Listening and auditory processing deserve special attention from researchers and clinicians

Literature descriptions of poor listening skills in children with ASD

1. Appear deaf, under-responsivity, a-typical responding, difficulties with auditory responding, they tune out language
   - On average 77.6% of participants with ASD displayed difficulty with auditory filtering compared to TD children (Tomchek & Dunn, 2007)
2. Hyper-reactivity, cover their ears, adverse reaction to specific sounds

*The **Enhanced Perceptual Functioning** model (Mottron et al., 2006) provides an explanation how these opposite reactions to sound are related in children with ASD*

Investigating the underlying (listening) deficits in autism (Siegal & Blades, 2003)



To conclude literature findings

- Neurophysiological evidence that HF and LF children with ASD respond differently to sound and speech
- Early responses to speech are now a highly predictive factor of the functioning and progress of children with ASDs (Kuhl et al., 2013)
- Is it a problem of attention or are there underlying auditory processing difficulties?
- Decreased interest in speech: child-directed
- Observed in early, late childhood and adults

Literature findings cont …

- A number of neural systems may be involved: MOC efferent system, left hemisphere
- Neurophysiological and behaviour evidence for difficulty to attend to speech
- Speech-in-noise is more difficult to attend to
- Difficulties increase if listening tasks are complex

Clinical rationale for the investigation

Picture this

- He is 60 months old and his name is Katlego
- It is a play-based speech-language assessment
- The two of us, sitting on a blanket, his dad sitting on a chair close by
- Their home language is Setswana, his nursery school is multilingual, so English is the common language
- I have my six bags with age appropriate toys and visually interesting objects:
  - construction toys, symbolic toys, books, noise makers, objects for problem solving and an oral-motor kit

Aim of the assessment

- My aim is to elicit as much as possible, behaviours that will tell me what he likes and dislikes, how he regulates my behaviour, what are the functions and means of his subtle or sometimes very abrupt behaviours, and try to stretch those golden moments of joint attention as long as possible
- So that I can say something about his sensory processing, behaviour, play, socio-communicative skills, LISTENING skills and understanding of spoken language

Admittedly,

- I do not speak Setswana
- I cannot evaluate his Setswana listening skills and understanding
- But his nursery school teacher talks English to him everyday

And his name means Victory (Katlego)

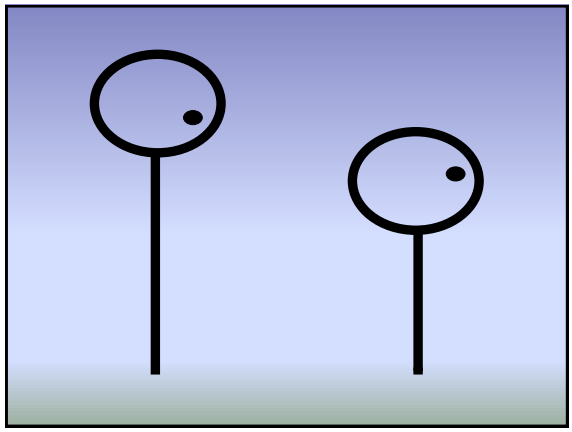
On the blanket

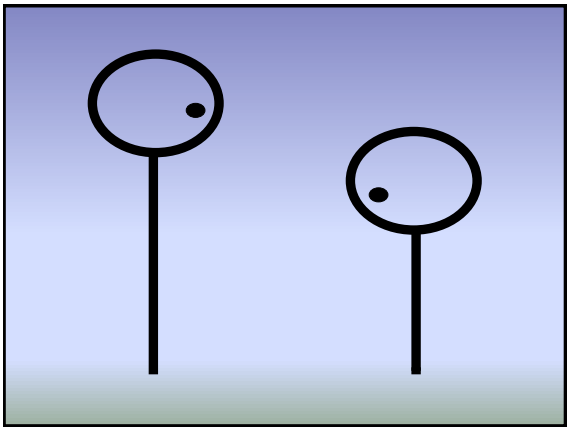
- I watch his movements, his hands, his face
- I listen to every vocalization, word approximation and possible words
- Is there anything that I do or say that will tell me we connect and share meaning?
- I OWL - observe, wait and listen (Pepper & Weitzman, 2004)
- I R.O.C.K. (repeat, give opportunities to communicate, cue and keep it fun) (Sussman, 1999)
- I follow him, talk close to his ear, back off when I get a cue from him ...

I use every technique and strategy

that I know and do not know ….

- He doesn't look at me, gesture or say anything when I ask him a question, point out a picture or talk about an object he holds in his hands
- He vocalises, occasionally repeats a word or a phrase
- We are mostly out of sync
- We make fleeting connections during the half hour play session
- There are some brief periods of joint attention with a toy as go-between





Until I say

"Katlego, it's time to go, you can go home to mommy now"

Without any warning
or looking back at me,
he instantly gets up,
walks to the door,
turns around,
and looks at his father

What happened?

- I think it means that he understood my remark
- Could I have given him any visual cues to assist his understanding?
- Does he understand much more language than he appears to?
- Why doesn't he show clearly what he understands?
- Why do I find it so extremely difficult to evaluate his level of receptive language?

Aim of study

The aim was to investigate the naturally occurring listening behaviours of children with ASD and to compare those behaviours to a matched group of neurotypical children as controls

Research design

- Matched-pair design
- Once-off individual observations in three different conditions at the two group's respective nursery schools:
  1. Quiet environment, away from peers, with researcher talking to him/her
  2. Classroom with peers and teacher
  3. Playground with peers

Research ethics

- The study was approved by the ethics committee of the Faculty of Humanities, University of Pretoria
- Parental consent was obtained

Method

- Five children with ASD were matched with five neurotypically developing children, aged 48-72 months / 4-6 years
- The five children with ASD attended a private school for autistic children in South Africa
- The control group attended a private nursery school in the same community
- Data were collected by means of video recordings

Participant matching criteria

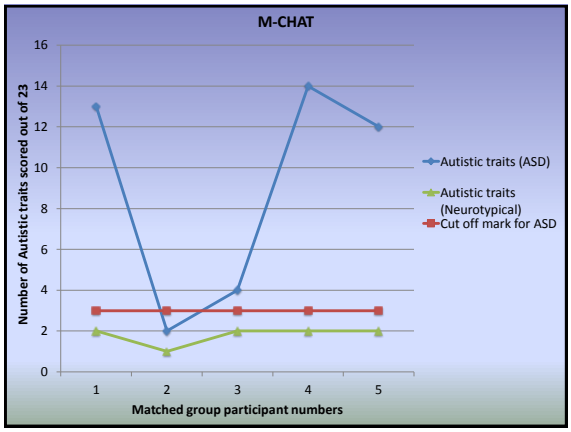
- Age
- Gender
- First language
- Socio-economic status:
  - Type of nursery school - private
  - Same community

Table 1: Participant characteristics (n=10)

Variable	Value	
	5 children with ASD	5 neurotypical children
Age	Range: 48 - 66 months Mean age: 54 months	Range: 47 - 66 months Mean: 53 months
Gender	1: Female 4: Male	1: Female 4: Male
Home language	1: English 1: Xhosa 1: Shona 1: Setswana 1: Afrikaans	1: English 2: IsiZulu 1: Setswana 1: Siswati
Language of instruction at nursery school	5: English	5: English
Diagnosis	4: Diagnosed with ASD's 1: ASD symptoms	5: No diagnosis
Duration in nursery school	Range: 4 - 23 months Mean: 10 months	Range: 1 - 16 months Mean: 11 months
Hearing screen	5: Pass	5: Pass

M-CHAT (Modified checklist for autism in toddlers, Robins, Fein, Barton & Green, 2001)

- Checklist completed by class teachers, scored by researchers
- Total score 23
- 3 or more traits indicate the possible presence of ASD
- One or two traits present in a child is considered normal
- Participant nr 2 with a total of 2/23 traits, was diagnosed with PDD-NOS (DSM-IV-TR, 2000)



Items in M-CHAT referring to listening skills:

- Response to questions
- Response to speech
- Response to own name

Responding to the child's own name, together with five other test items which refer to joint attention and social relatedness, were found to be the best distinguishing features between children with ASDs and neurotypical children (Robins, Fein, Barton & Green, 2001)

Data collection

- 3 video recordings of each child
  - Quiet room
  - Classroom
  - Playground
- Mean time of video recordings:
- 9min 30sec
  (range: 7min 7sec – 10min)

Data processing categories

- 9 different listening components developed in a pilot study
- Checked: present or absent
- Any observable behaviour in response to
  - Speech
  - Own name
  - Noise
- Responses indicating the progression of localization: pause, look up, looks at person, turns head (indicating search for sound source)

No	Component of listening behaviour
1.	Response to questions
2.	Response to speech
3.	Response to name in isolation
4.	Response to name in sentences
5.	Response to environmental noise
6. Localization	
6.1	Pausing of activity in response to name/sounds
6.2	Looks up when name/sound is heard
6.3	Looks at researcher when name/sound is heard
6.4	Turning head in response to sound/name

How good were our measurements?

- Trained during pilot study, tried to avoid random errors
- Defined listening behaviours: what and what not?
- Inter-rater reliability: two raters watched and scored video recordings independently, compared later, discussed differences until agreement was reached
- Intra-rater reliability: watched one video several times, counted the frequency of listening behaviours every time, compared scores, watched again until scores did not differ

Data analysis

- Frequency count of sound stimuli and direct observable responses
- Determined percentages
- Chi Square test to determine the proportions as the number of stimuli differed across the participants
- P-values to indicate if differences between the two groups were significant

Results

- To describe the *nature of differences* between listening behaviours of participants with ASD and those without
  - in a quiet environment with one of the researchers as facilitator
  - in their classroom with peers and one teacher
  - on the playground with peers

Listening responses in three conditions (n=10)

Conditions	Participants and p-value of χ^2 test	Response to questions	Response to descriptions and	Response to own name in isolation	Response to own name in sentences	Response to environmental noise	Pause activity in response to name &	Look up when name/sound is heard	Look at person when name sound is heard	Turn head in response to name
Quiet room	ASD	26%	55%	12%	14%	26%	1%	2%	1%	1%
	Controls	92%	87%	95%	83%	72%	15%	18%	17%	14%
	p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Class-room	ASD	27%	65%	17%	17%	37%	2%	7%	2%	6%
	Controls	54%	81%	100%	100%	71%	5%	7%	7%	4%
	p-value	0.000	0.000	0.000	0.000	0.000	0.207*	0.999*	0.067*	0.516*
Play-ground	ASD	25%	43%	31%	25%	22%	1%	8%	8%	6%
	Controls	79%	85%	94%	81%	51%	11%	23%	18%	16%
	p-value	0.000	0.000	0.000	0.000	0.000	0.003	0.001	0.019	0.015

*Key: Differences not statistically significant

Results

- Highly significant differences between the two groups in all 3 listening conditions, except for localization
- Both groups had limited vocalization responses
- NT responded to almost all social auditory stimuli, ASDs far less
- Poorest responses for participants with ASDs were with researchers: Least familiar condition

Results in quiet room with researcher

Best responses

- ASD: Speech
- TD: Name in isolation and in sentences

Poorest responses

- Both groups: Localization responses
- ASD: Name in isolation and in sentences

Classroom responses: learning environment (10 months in same class already)

Best responses

- ASD: Speech: 65% of the time, not poor
- TD: Name in isolation and in sentences

Poorest responses

- Both groups: Localization responses – no statistically significant differences
- ASD: Name in isolation and in sentences

On playground: Social environment

Best responses

- ASD: Speech
- TD: Name in isolation and in sentences

Poorest responses

- Both groups: Localization responses - statistically significant differences
- ASD: Name in isolation and in sentences

Discussion

Responses to own name

Quiet room	Classroom	Playground
12-14%	17%	25-31%

Could the better responses to their names on the playground be stimulated by a social interest?

Why the poor responses to their own names?

- Own name may be the word most heard by children throughout their life
- A unique social stimulus, as shown in the control group of NT children
- On average 4 month old infants respond to their names (Owens, 2012)

Romeo and Juliet (Act 2, scene 2): "What's in a name? that which we call a rose/ By any other name would smell as sweet".

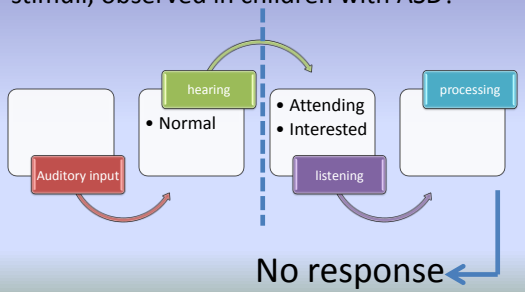
Poor localization responses from both groups

- Head motion is not considered a critical part of the localization process, except when there is enough time to make a detailed assessment of the sound source – localize by turning the head towards the source (Middlebrooks & Green, 1991)
- A skill developed in 3 month old infants

Responses to speech

- Not as poor as expected in participants with ASD
  - ASD symptoms varied in the group with ASD: M-CHAT variability
  - 4½ year old children on average 10 months in nursery school class – familiar environment, benefits of intervention
- Response to speech develops before birth, babies are born with a preference for their mothers' voices

Are poor responses to speech part of the general under-responsivity to any kind of stimuli, observed in children with ASD?

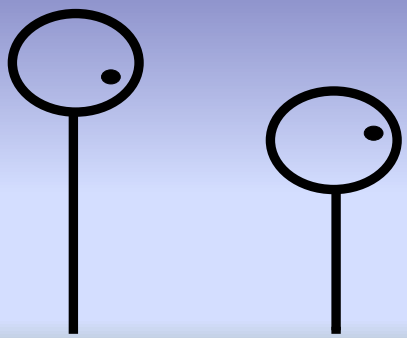


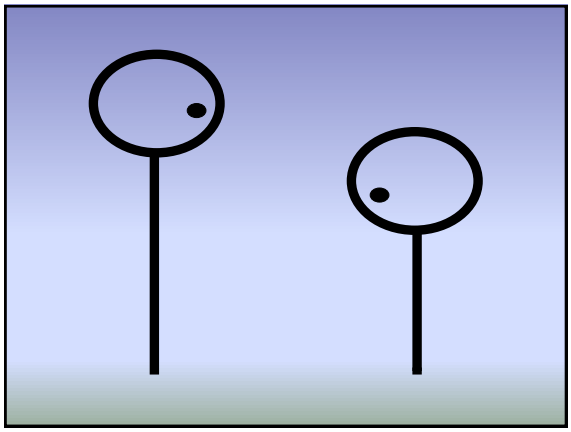
Three elements of listening

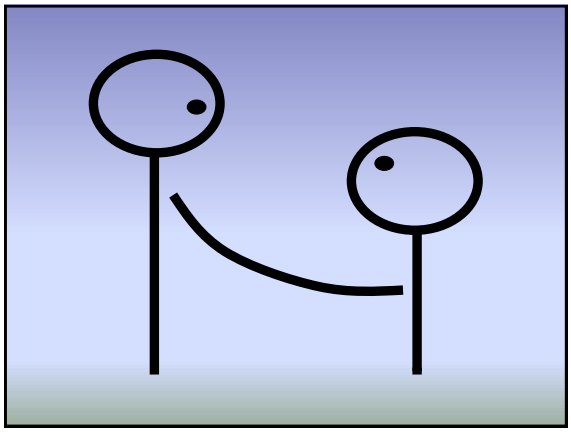
- Participants all had
  - Normal hearing ability
- But one can question their
  - Ability to sustain attention
  - Interest in speech

Conclusion

- The results amplify the unique characteristics of *listening behaviour* that children with ASD may display in natural environments. The apparent *inattention* (or is it processing?) to sound and voices should be further investigated against the background of the severe language and communication difficulties found in children with ASD







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