



University
of Glasgow

Sensory Aspects of Autism and the Importance of Community- & Practice-led Research



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50 years ago ...

- DSM-II (1968)
 - ◆ Schizophrenic Reaction, Childhood Type
- Autism was rare
- Autism was ...
 - ◆ Childhood presentation of schizophrenia?
 - ◆ Caused by the parents ...

Now ...

- DSM-5 (2013)
 - ◆ Autism Spectrum Disorder, ASD
- Autism is common (~1/100)
- Autism is
 - ◆ Neurodiversity in brain structure/function
 - ◆ Caused by an unknown combination of genetic and environmental factors

24 years ago ...

- ICD-10 (1992)/DSM-IV (1994)
 - ◆ No explicit consideration of sensory aspects of autism in diagnostic criteria



Displays indifference



Joins in only if adult insists and assists



One-sided interaction



Indicates needs by using an adult's hand



Lack of creative, pretend play



Handles or spins objects



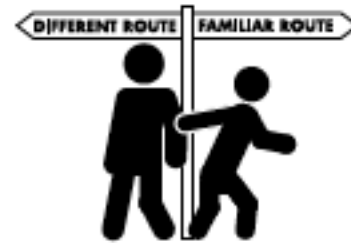
Echolalic – copies words like a parrot



Does not play with other children



Talks incessantly about only one topic



Variety is not the spice of life



No eye contact



Bizarre behaviour



Inappropriate laughing or giggling



But some can do some things very well, very quickly but not tasks involving social understanding

DSM-5: Autism Spectrum Disorder

- B: Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following:
 - ◆ Stereotyped or repetitive speech, motor movements, or use of objects
 - ◆ Excessive adherence to routines, ritualized patterns of verbal or non-verbal behavior, or excessive resistance to change
 - ◆ Highly restricted, fixated interests that are abnormal in intensity or focus
 - ◆ **Hyper- or hypo-reactivity to sensory input, or unusual interest in sensory aspects of the environment**

Sensory Issues in Autism



Hyper-sensitivity



“Defensiveness”

“Enhanced Perceptual Functioning”



Hypo-sensitivity



“Sensory Seeking”

“Unresponsiveness”

Kanner (1943)

- Reports
 - ◆ Food refusal
 - ◆ Aversions to loud noises
 - ◆ Aversions to affective touch
 - ◆ Examples of
 - ✦ Sensory seeking
 - ✦ Auditory hypo-sensitivity
 - ✦ Enhanced perceptual functioning

Kanner (1943)

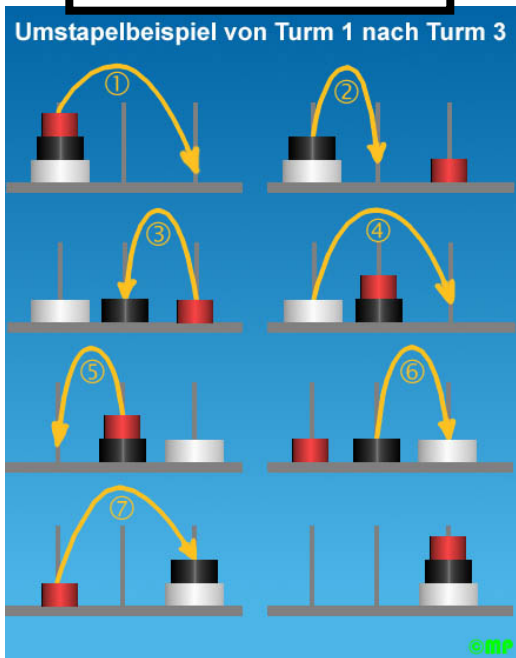
- But ... when discussing sensory hypersensitivity:

“Yet it is not the noise or motion itself that is dreaded. The disturbance comes from the noise or motion that intrudes itself, or threatens to intrude itself, upon the child’s aloneness. The child himself can happily make a noise as great as any that he dreads and move objects about to his heart’s desire”

Psychological Theories

Weak (Central) Coherence

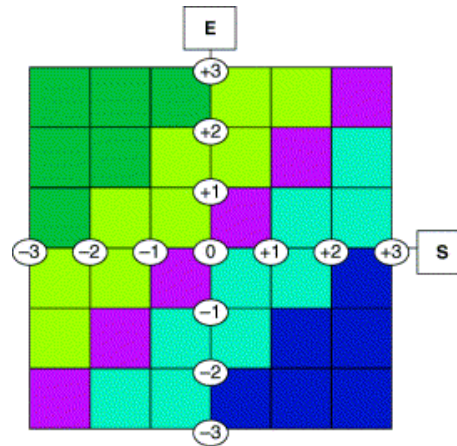
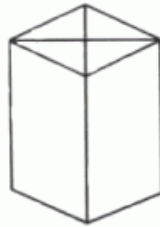
Executive Dysfunction



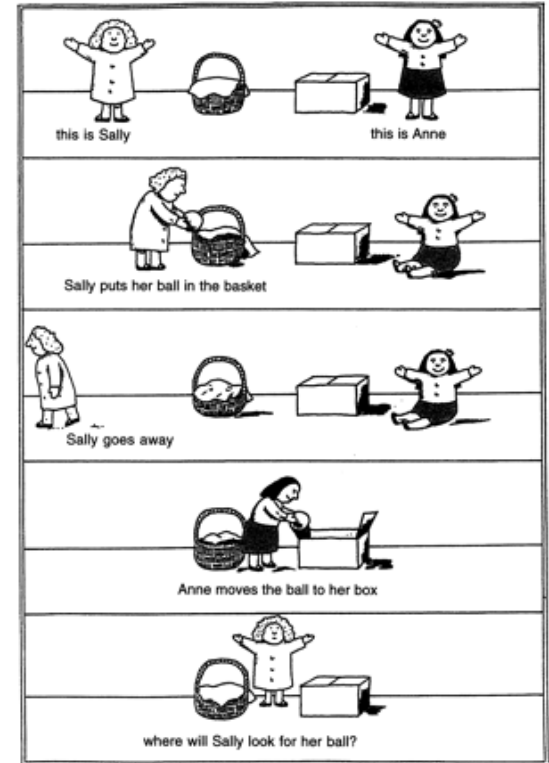
Here is a simple form which we have labeled "X":



This simple form, named "X", is hidden within the more complex figure below:



Extreme Male Brain



Theory of Mind

Annotation: What do we know about sensory dysfunction in autism? A critical review of the empirical evidence

Sally J. Rogers and Sally Ozonoff

M.I.N.D. Institute & Department of Psychiatry and Behavioral Sciences, University of California – Davis, USA

- Rogers & Ozonoff
 - ◆ Acknowledge the large evidence base
- But
 - ◆ Criticize the quality of the research
 - ◆ Argue that these sensory issues are not unique to autism

Sensory Issues in Autism

A typical example

- Hearing
 - ◆ Hyper-sensitive to noise
 - ◆ Fireworks, balloons, dogs, sirens, fire alarms
 - ◆ But failed diagnostic hearing tests
- Vision
 - ◆ Drawn to visual motion and possibly also flicker
 - ◆ Repetitive behaviours
 - ◆ But scared by sudden flashes of light
- Taste/Smell
 - ◆ Picky eater
 - ◆ Problem in “fragrant” shops





Dr. Ashley Robertson (now at Coventry University)

How to investigate Sensory Processing?

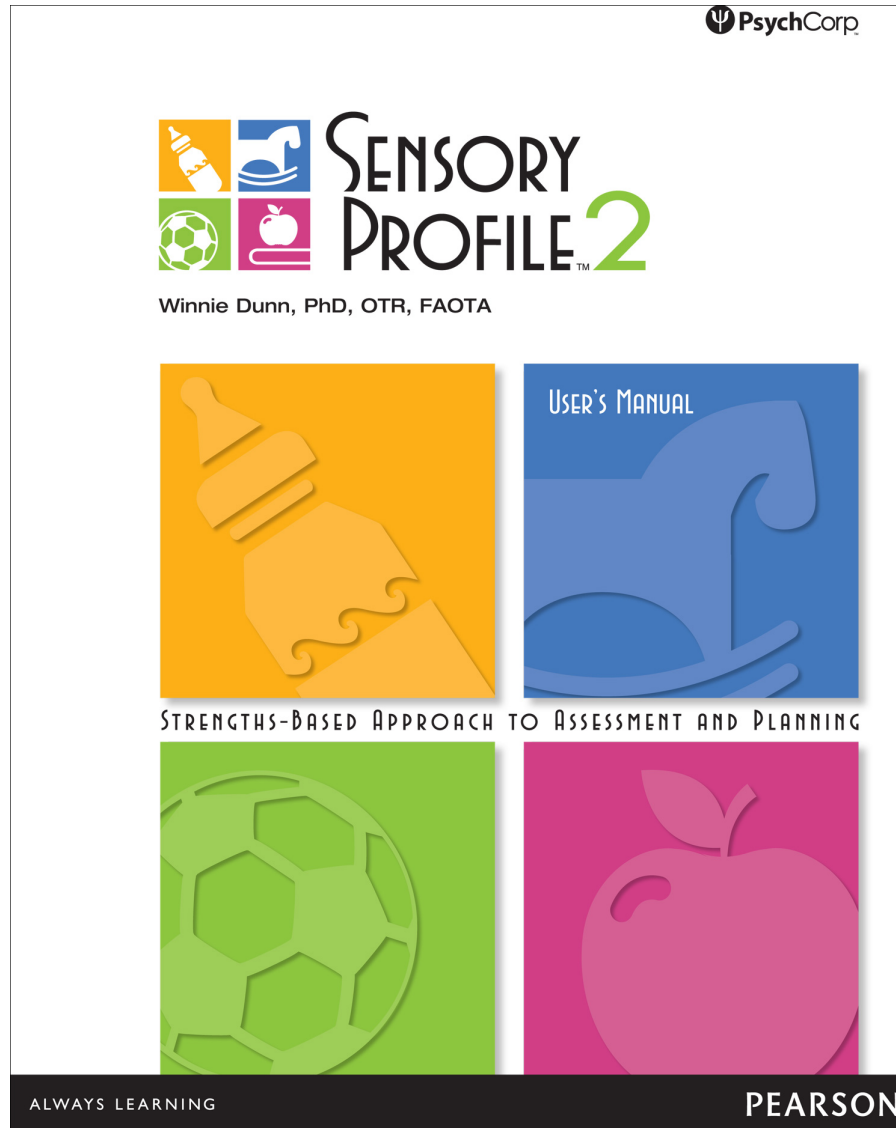
Observer Report

Autobiographical Accounts

Self Report

Direct Measurement

The Sensory Profile



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Glasgow Sensory Questionnaire

1. Do you really like foods that are very strong-tasting (for example chillis and very spicy foods)?

Never Rarely Sometimes Often Always

2. Do you think you have a strong sense of smell -- are you able to smell odours very well?

Never Rarely Sometimes Often Always

3. Do you dislike sudden flashes of light?

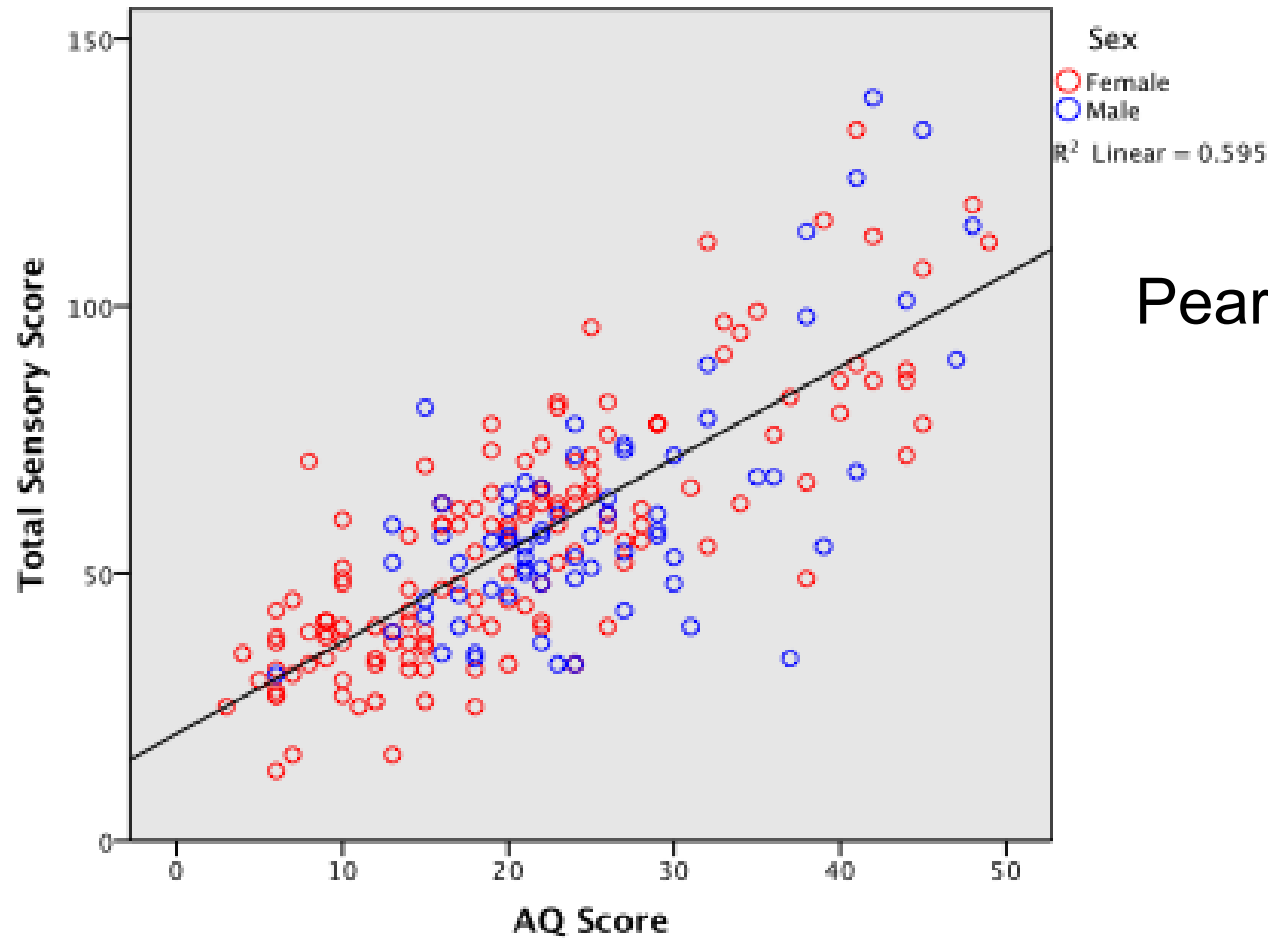
Never Rarely Sometimes Often Always

4. Do you dislike the physical sensation you get when people hug you?

Never Rarely Sometimes Often Always

Figure 1

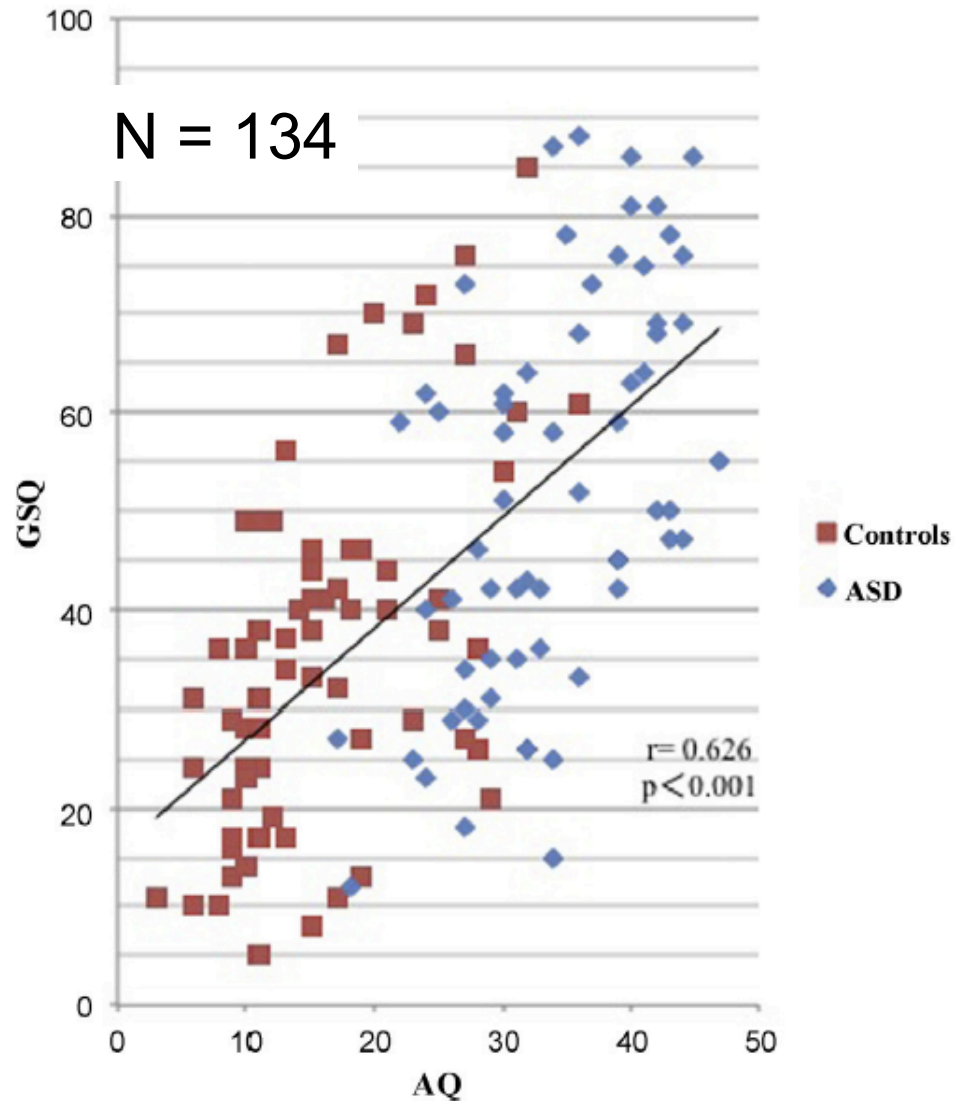
Correlation between total sensory score and AQ score



Pearson correlation:
 $r = 0.775$
 $p < 0.0001$
 $R^2 = 0.595$

**Robertson & Simmons (2013), JADD, 43,
775-783**

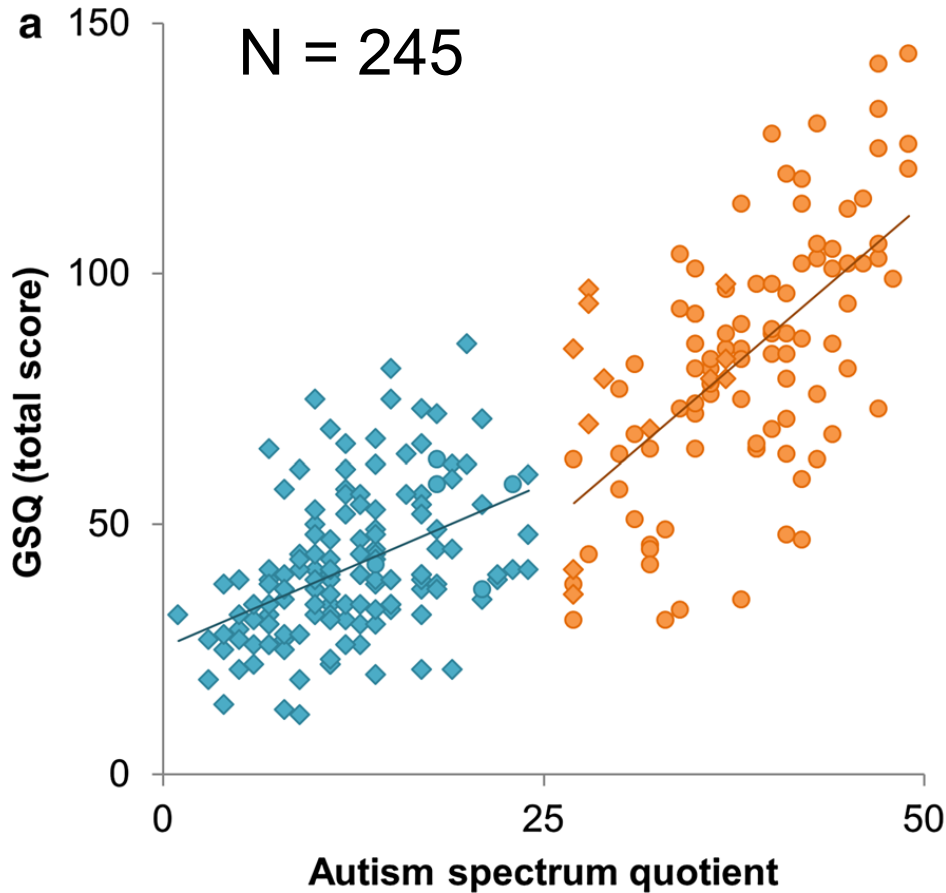
Replication (no. 2)



Using a Japanese translation of the GSQ

**Takayama et al (2014),
Research in ASD, 8,
347-353**

Replication (no. 4)



Using a French translation of the GSQ

Separate correlations for
“low AQ”: $r = 0.45$, $p < 10^{-6}$
“high AQ”: $r = 0.62$, $p < 10^{-6}$

Overall $r = 0.81$, $p < 10^{-6}$

**Sapey-Triomphe et al
(2017), JADD [e-pub]**

Focus Groups

(Robertson & Simmons, 2015, and in prep)

- 3 classes of Focus Group:
 - ◆ One group of 9 caregivers of children with ASD and other complex needs
 - ◆ Two groups of 5 verbal children with ASD (9-14 years old; Mean age, 12 years)
 - ◆ One group of 6 adults with ASD (24-51 years old; Mean age 32)

Overview of Data

Robertson & Simmons (2015 and in prep)

- All participants reported
 - ◆ Negative reactions to sensory stimuli
 - ◆ Positive reactions to sensory stimuli
- Other themes
 - ◆ Strong emotional and physical reactions
 - ◆ Importance of *control* and *predictability*

Negative Sensory Experiences

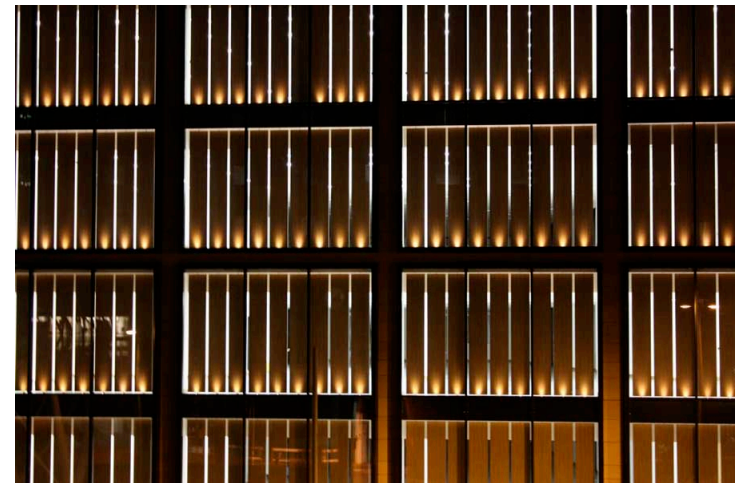
Robertson & Simmons (2015 & in prep)

- Auditory issues paramount
 - ◆ Babies crying, sirens, dogs barking, fireworks
 - ◆ Often associated with pain
 - ◆ **Child:** “I know something that’s even more sore - the emergency bell!”

Negative Experiences (Vision)

Robertson & Simmons (2015 & in prep)

- Grids and Regular Patterns
(**Adults**)
 - ◆ “I have the experience still to this day of standing in a shop staring at things for about five minutes... it’s the kind of structure of the shelves and repeated things, it becomes too much and I just stop being able to process any of it”
 - ◆ “[I have problems with] maybe one of those mats With zillions of these metal strips like the station -- it’s like an optical illusion”



Positive Sensory Experiences

Robertson & Simmons (2015 & in prep)

- Mainly in auditory and tactile domains
 - ◆ Click of a light switch: “I like the sound of lights going on and off ... it’s quite weird, but I like it”
 - ◆ Listening to music
 - ◆ Kneading or squeezing things
 - ◆ Letting water run through the hands
 - ◆ Trampolining
 - ◆ Food textures and temperatures
 - ◆ Cold things (stone floors, metal)

Control Data

O' Leary, Robertson & Simmons (in prep)

- Focus group with 9 typical children (4 male, 5 female)
- All scored very low in autistic traits
- Some surprisingly strong sensory issues reported
 - ◆ Problems in “fragrant” shops
 - ◆ Strong dislike of some auditory stimuli (e.g. fire engine)
 - ◆ Problems with unexpected physical contact
- But different reactions
 - ◆ Less extreme responses
 - ✦ discomfort, and annoyance, but not pain
 - ◆ More successful coping strategies

P-GSQ: Self report for children

8. Do bright lights ever hurt your eyes or cause a headache?



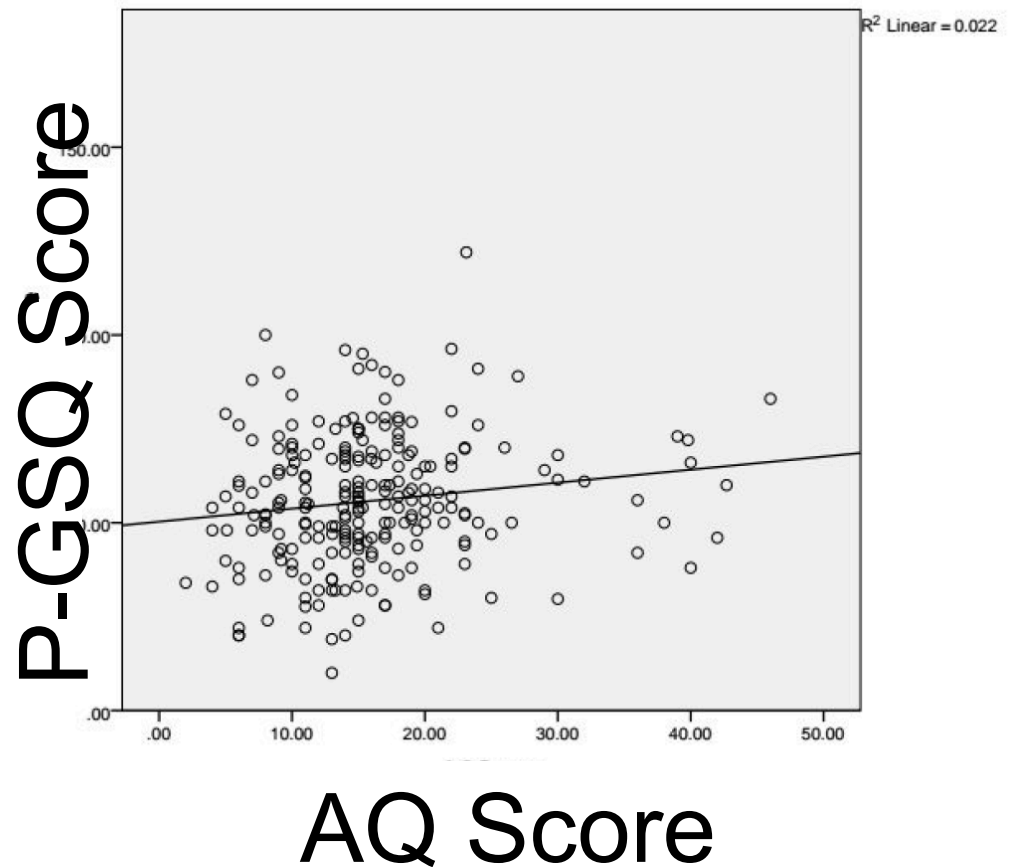
Figure: A sample question and associated illustration from the P-GSQ

Control Data

Glasgow Science Centre

Simmons & Brown (2016)

P-GSQ vs. AQ
($r = 0.147$, $p < 0.05$,
 $R^2 = 0.022$)



Research Question:

Are there differences in the nature and severity of the sensory experiences of autistic adults with higher support needs, as opposed to those with typical IQ levels?

Practitioner Informant Study

(Simmons, Marshall & Harris, 2017)

- 19 practitioner informants
- From two facilities specializing in residential and full-time care for autistics with severe and complex needs
- Semi-structured interviews conducted
- Format based on “critical incident” technique for a more objective description
- Transcripts of interviews analysed using Thematic Analysis

Practitioner Informant Study

(Simmons, Marshall & Harris, 2017)

- Reported **sensory triggers** largely similar to those reported by adults with autism and typical IQ (with a couple of exceptions)
- Differences are in the **extreme reactions** to undesired sensory stimulation and **extreme pursuit** of desired stimulation
- Combination of **experience** and **objectivity** of practitioner informants adds a valuable extra dimension to research on sensory processing in autism

Sensory Profiling in Autism Services

Rachel Forbes

Autism Practitioner – Moray Services

**What causes the
sensory issues
in ASD?**

How to investigate Sensory Processing?

Observer Report

Autobiographical Accounts

Self Report

Direct Measurement



Possibility #1:

Different sensory thresholds?

Visual Acuity



Visual Acuity

ARCHIVAL REPORTS

Eagle-Eyed Visual Acuity: An Experimental Investigation of Enhanced Perception in Autism

Emma Ashwin

Simon Baron-Cohen

(2009) *Bio*

NOT REPLICATED

“Individuals with ASC have significantly better visual acuity (20:7) compared with control subjects (20:13) -- acuity so superior that it lies in the region reported for birds of prey”

Contrast Sensitivity

C H V O S N
D S Z N R K
N D R H V Z
C S O N K H
K N V D S R
Z R D K H O
H Z C V R K
S C Z D V O

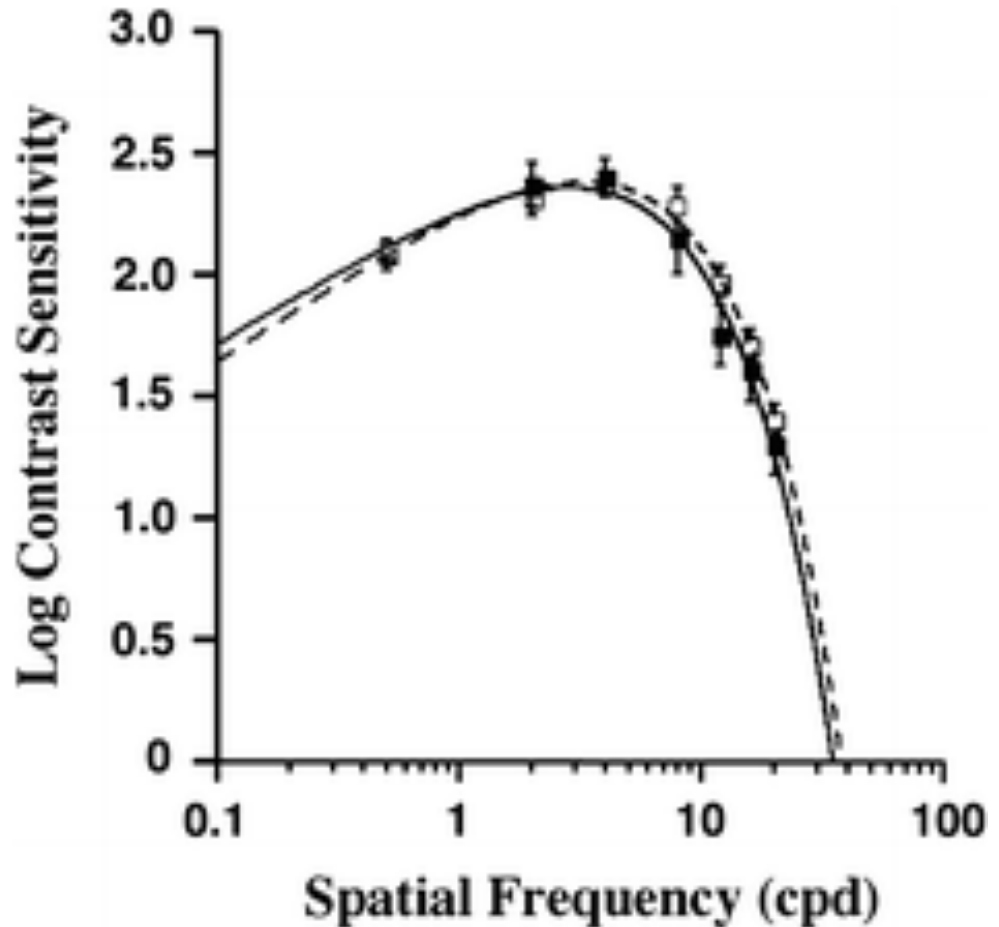
The Mars Letter Contrast Sensitivity Test, Form 1.
© 2003-2004 The Mars Perceptrix Corporation. All rights reserved.

mars perceptrix

Contrast Sensitivity

Koh et al. (2010)
JADD 40, 978-987

No differences
(at least with gratings
or blobs)



Cautionary Note:

**Different sensory thresholds
are not obviously the cause
of sensory issues in ASD**

But beware of

**“diagnostic overshadowing”
(cf. *Autism and Sight Loss Project*)**

Potential Causal Factors

- Different sensory thresholds?
 - Not much reliable evidence so far
- Increased Neural Noise?

(Simmons et al, 2009)

 - Mixed evidence
- Neural hyper-responsiveness?

(Green et al, 2013; 2015)

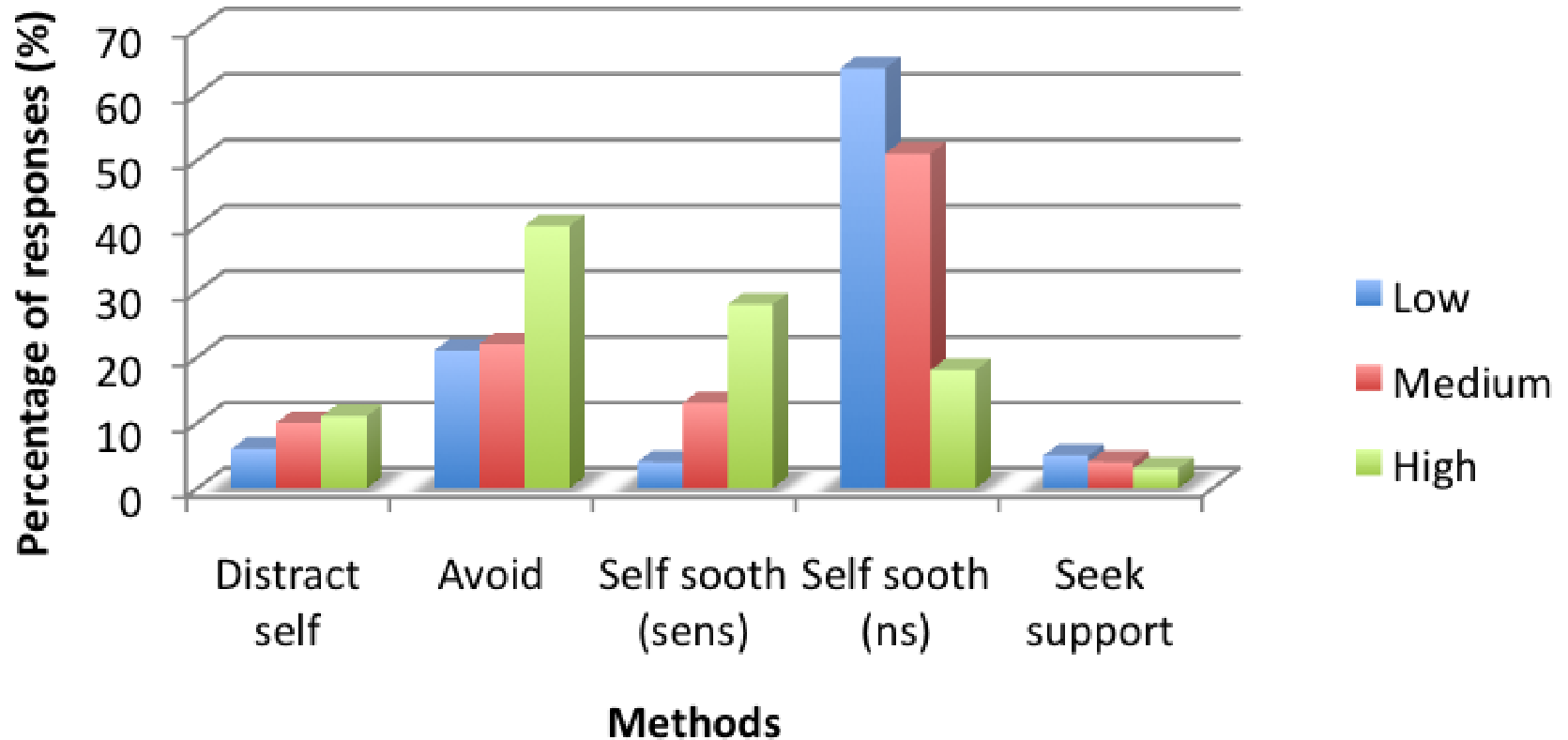
 - evidence base growing
- Too many neural connections?

What can be done?

Managing Sensory Stress

- Adapt the individual
 - ◆ Avoid stressful environments
 - ◆ Use ear defenders/ear plugs/headphones etc.
 - ◆ Explore therapeutic options
- Adapt the Environment
 - ◆ Measure/assess environmental stressors
 - ◆ Eliminate stressors that are controllable
 - ◆ Reduce impact of stressors that are uncontrollable

Methods of coping



Robertson & Simmons (2016)

Coping with Sensory Sensitivities

- Avoidance works!
 - ◆ But this is obviously unsatisfactory
 - ◆ And can be dangerous
- Sensory self-soothing
 - ◆ Use of personal stereos/iPods for auditory noise
 - ◆ Ear defenders/Ear plugs
 - ✦ But this can be problematic too

Sensory Integration Therapy (SIT)

- Individualized assessment
- Personalized treatment programme
- Combination of elements:
 - Weighted vests
 - brushing or rubbing
 - riding on a scooter board
 - sitting on a bouncy ball
 - being squeezed between exercise pads
- BUT Efficacy is controversial (see Schaaf et al, 2013, JADD, e-pub)
- And highly dependent on therapist



Coloured Filters

- Popular treatment for reading difficulties
- Some limited evidence of effectiveness in ASD
- More research is needed (working on this at the moment with colleagues at the Universities of Hertfordshire, Sussex, Essex & Nova South-Eastern)
- Similar story for *yoked prism* glasses



Environmental Adjustments

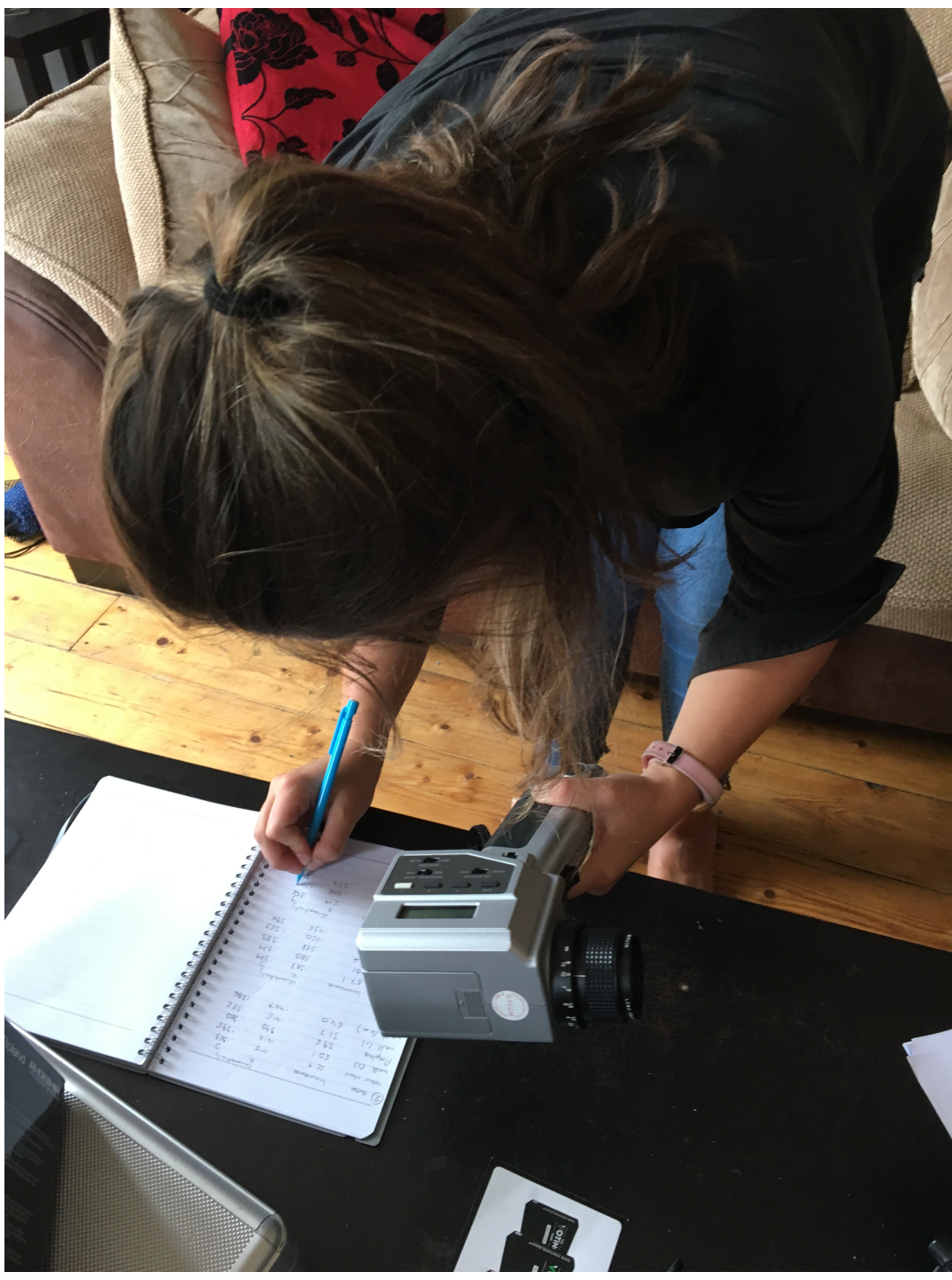
- Sometimes recommended by OTs
- Controversial
 - ◆ Can't always "adjust" the real world!
 - ◆ But can be helpful in educational, domestic and workplace contexts
- Problem
 - ◆ How do you know what to adjust?

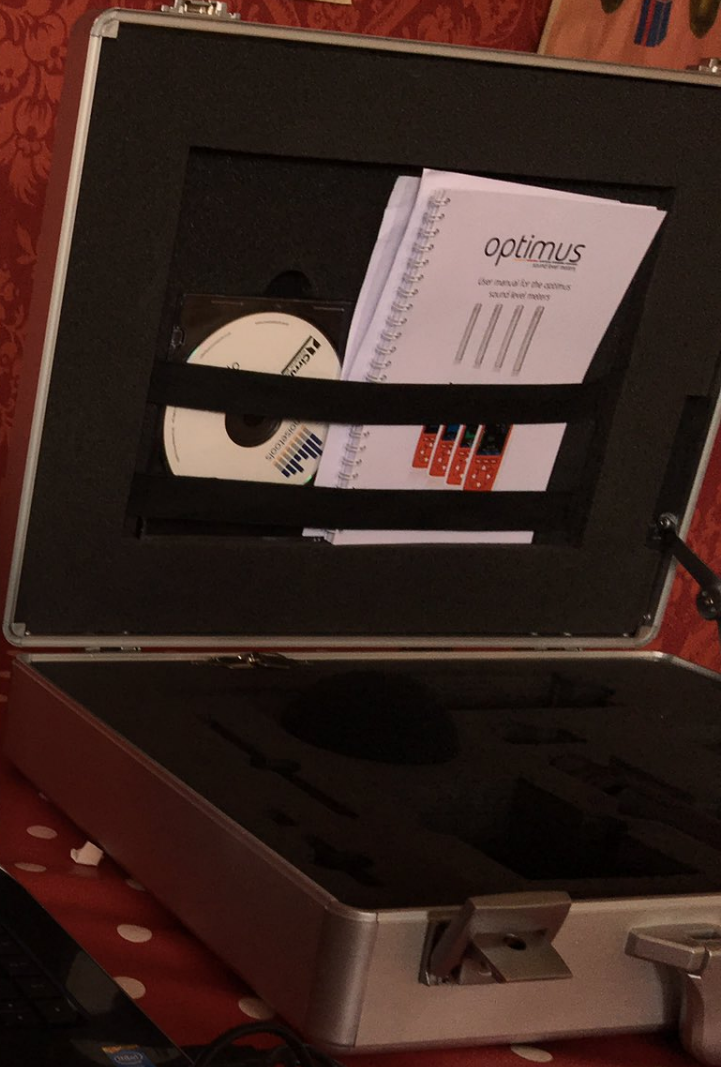
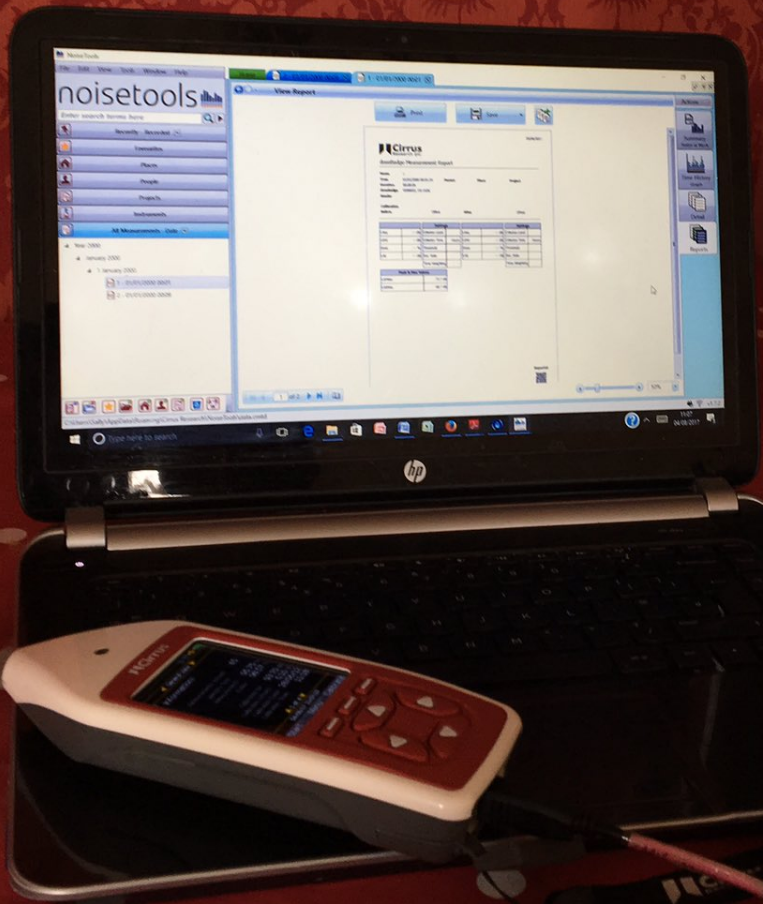
The Sensory Audit

Robertson & Simmons (in prep)

- Technique for measuring sensory stressors
 - ◆ Visual
 - ✦ Light levels, Colour, Décor
 - ◆ Auditory
 - ✦ Sound levels, sound quality, specific sounds
 - ◆ Olfactory
 - ✦ Ambient smells







The Sensory Audit

Robertson & Simmons (in prep)

- Initial preliminary results
 - ◆ Some common domestic noises can be surprisingly loud
 - ✦ E.g. cupboard door banging
 - ◆ Smells are very hard to measure objectively
 - ◆ Enclosed spaces can become very smelly
 - ✦ Lifts, changing rooms

Sensory Audit: Current Developments

Bell, Stack, Robertson & Simmons (in prep)

- Sensory Auditing primary schools
 - ◆ Canteens are a nightmare!
 - ✦ Fridges, food smells, noise from other users
 - ◆ Corridors/transition points
 - ◆ Reflective surfaces near windows
 - ✦ Can be visually disturbing

Government Advice!

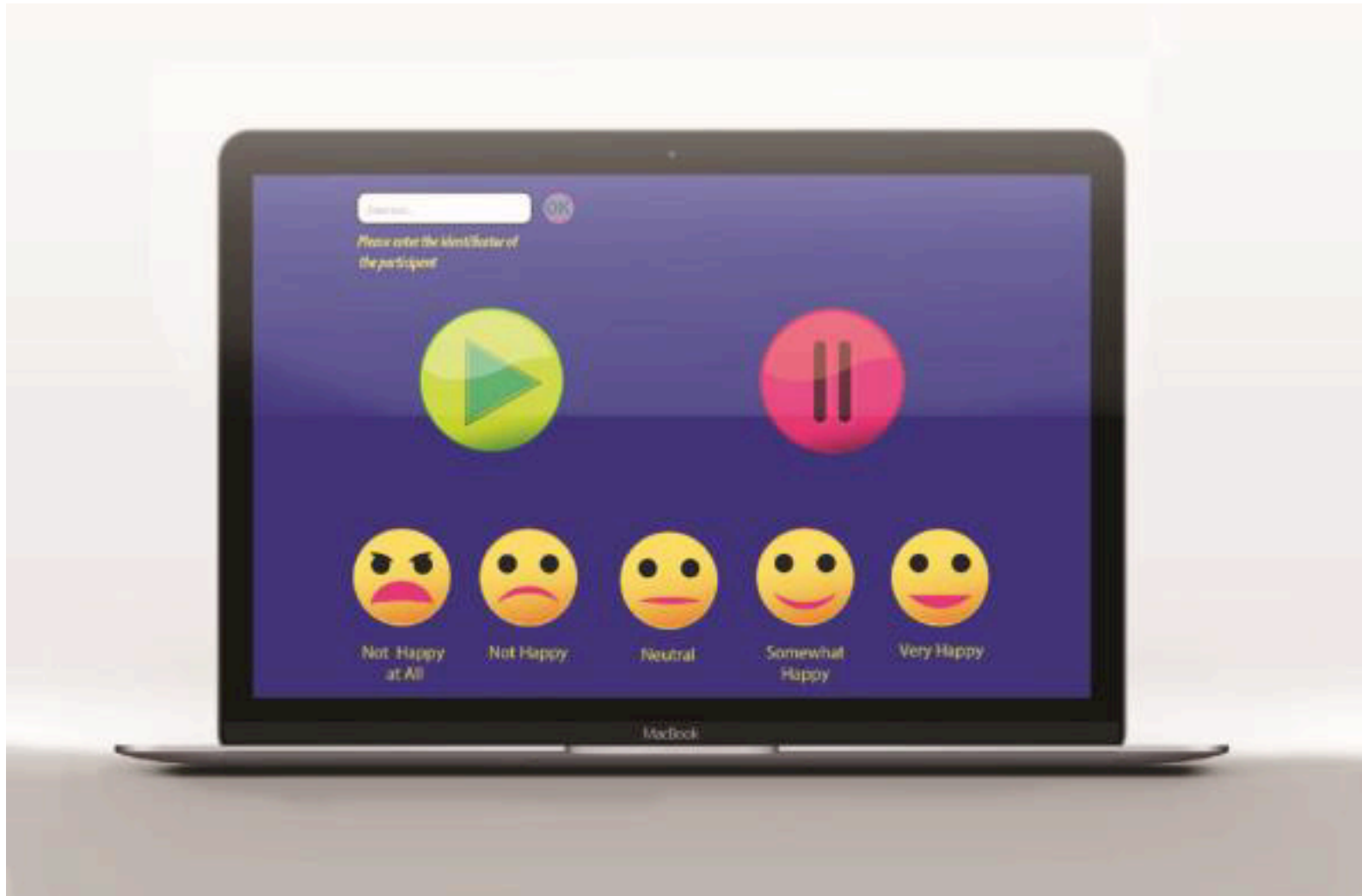
- “Menu of Interventions” developed as part of the *Scottish Strategy for Autism*
- Under “Sensory Issues” the advice is:
- “Assessment of sensory difficulties. Identification and implementation of strategies. Environmental adaptation on an individual basis with individual control working towards reducing the impact of sensory sensitivities”
- What this means in practice will vary between local authorities



Progressive Exposure Therapy

- Works well for phobias
- Progressively expose individual to particular stressors in a controlled way
- Some evidence of success in autism
- Two projects related to this
 - ◆ “Serious game” for auditory hypersensitivity
 - ◆ VR simulation of Aberdeen airport

Serious Games (with Glasgow School of Art)



Sinbad and the Magic Cure





Take- home Messages

- The sensory difficulties faced by autistics have been known about since autism was first described
- Until quite recently it was felt that
 - ◆ these difficulties were not unique to autism
(so not informative for diagnostic purposes)
 - ◆ These difficulties were hard to explain in theoretically
(so largely ignored by the scientific establishment)
- Progress has been due to pressure from
 - ◆ Community-informed scientists
 - ◆ Practitioner- and Community-led initiatives
- We now have
 - ◆ Sensory/Perceptual aspects of autism as a major scientific sub-field
 - ◆ The ability to shop in Morrisons for at least an hour on a Saturday morning!

Two Big Questions

- What is the link between sensory processing and social behaviour?
- How is anxiety linked to sensory sensitivity in autism?

Thank you!



The British
Psychological Society
Promoting excellence in psychology



University
of Glasgow

The Nuffield Foundation

Chancellors' Fund

Thank you!

Dr. Ashley Robertson (now at Coventry University)

Sally Bell

Lauren Brown

Susan Harris

Dr. Joe Long (Scottish Autism)

Heather Marshall

Anna O'Leary

Dr. Matthieu Poyade (Glasgow School of Art)

Dr. Niamh Stack

Hanan Makki Zakari (Glasgow School of Art)