



Autism, prediction errors and well-being

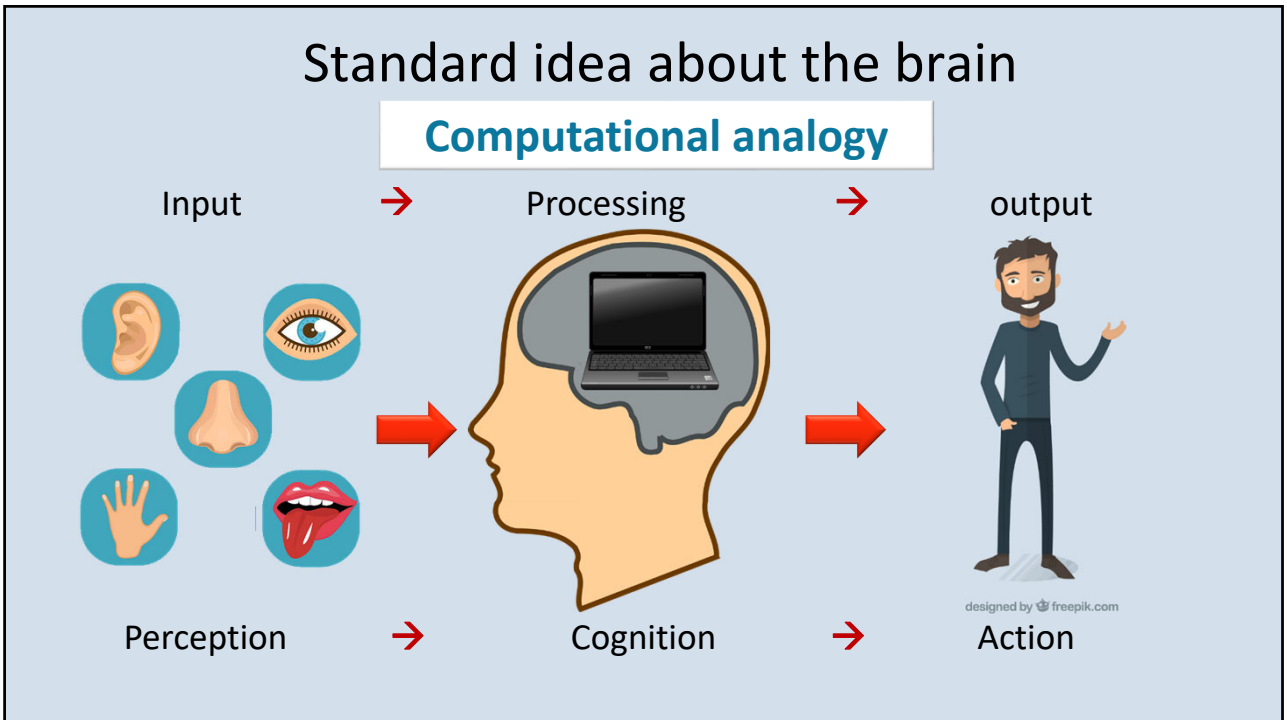
PETER VERMEULEN



AUTISM in CONTEXT

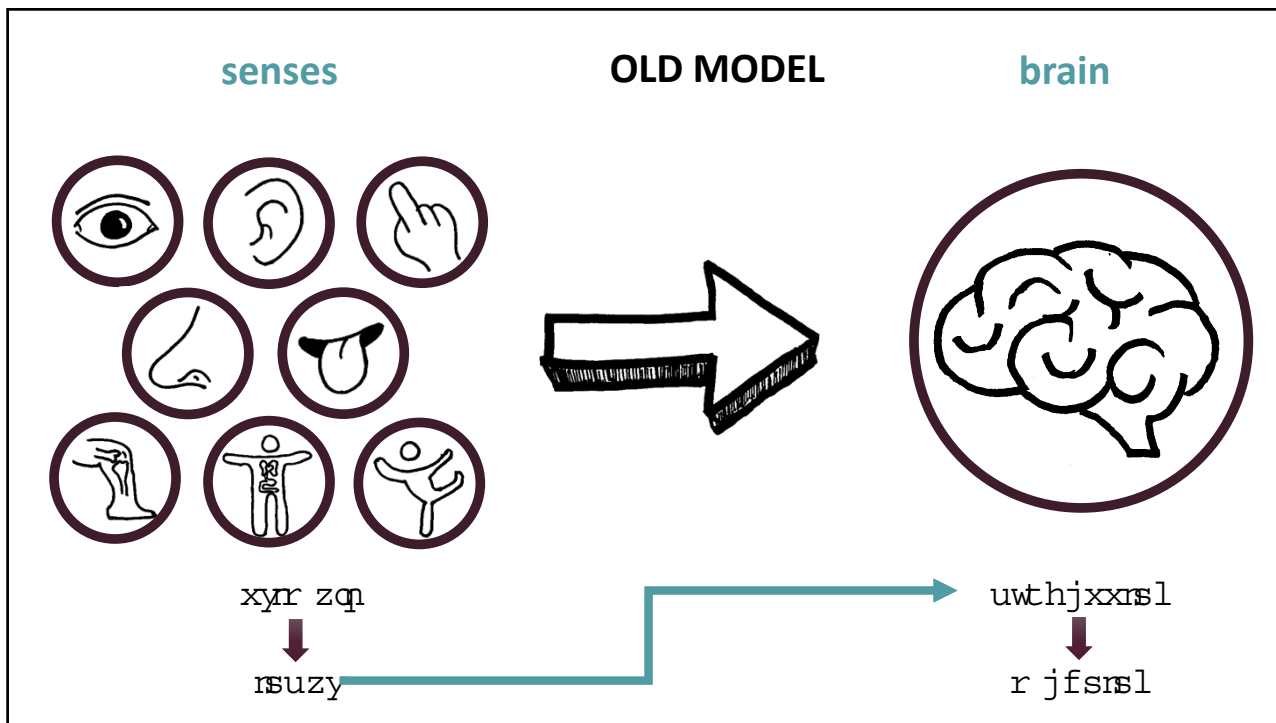
from neurodiversity to neuroharmony

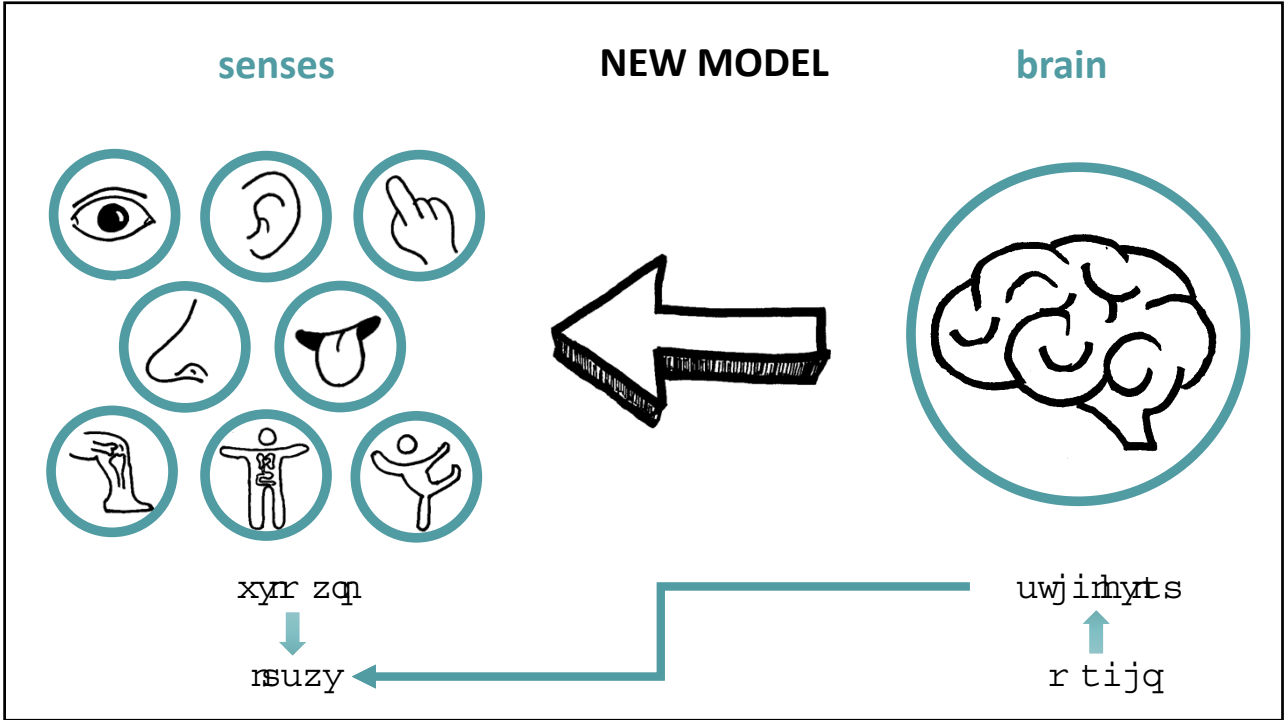
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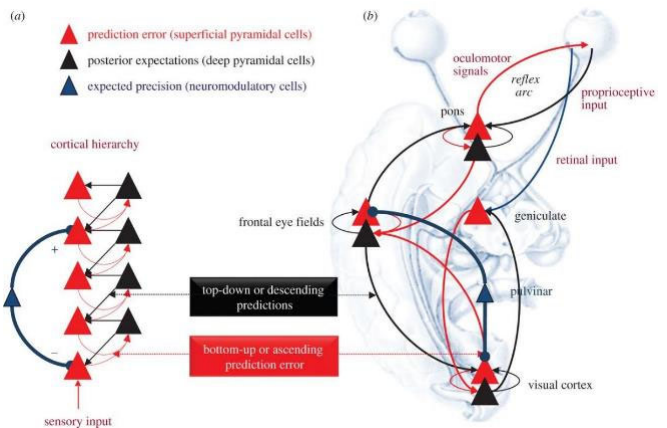
What's wrong with the stimulus-response model of the brain

- Sense making is not just integrating all the details of the sensory input
 - There isn't enough time to calculate and make that puzzle! (Daniel Kahneman)
- So, the brain does not compute, It guesses,
- And it can make smart guesses because it uses context,
- This is known as: **the predictive mind**





The brain does not process stimuli, only what is different from the stimuli it predicted: prediction errors.

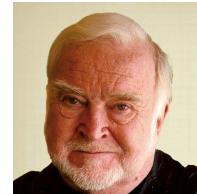


From *The Lancet*

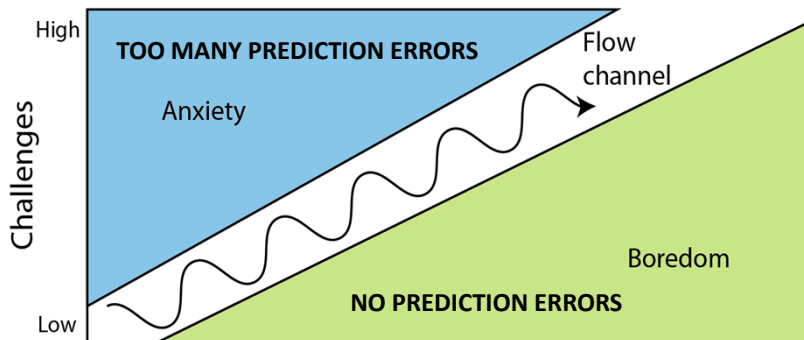
If the brain does not like prediction errors,
why don't we sit in a dark hole with no input at all?

Brain fitness requires...challenges

Flow



Mihaly Csikszentmihalyi



Prediction errors

- The brain has only one goal:
helping us to survive by minimizing prediction errors, either by learning or by changing the world
- The brain doesn't like prediction errors (they cause stress)
- The brain knows it cannot avoid all prediction errors. Therefore, it uses **a variable precision** in handling prediction errors

Depending on the **context** the brain will treat a prediction error as noise (irrelevant) or signal (relevant)

- If relevant, this leads to learning or action

Prediction errors

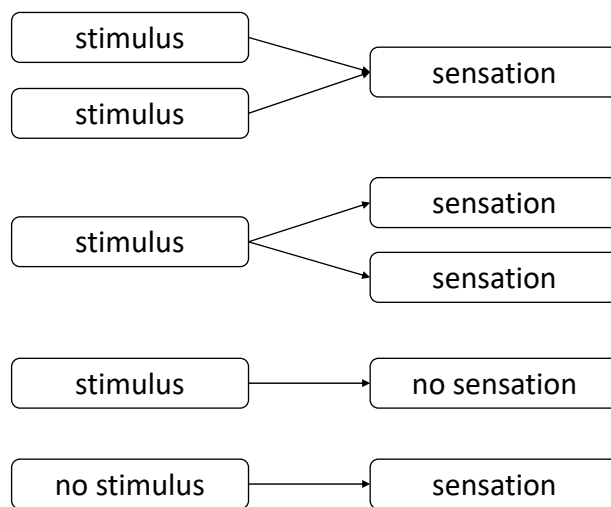
If a prediction error is seen as signal, then the brain has 2 options to minimize the prediction error:

1. Updating the model to match reality (= learning)
2. Updating the world to match the model (= intervening/action)

Predictive mind

Predicts the sensory input. If there is a prediction error, the brain has to decide whether it ignores it or do something with it: learning (updating the model/prediction) or action (updating/changing the world).

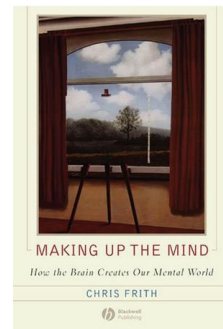
Sensory input is highly unreliable



Perception is controlled hallucinating.

We don't see the world, but our model of the world.

Our perception of the world is an **illusion** that (in most cases, fortunately) coincides with reality.



Chris Frith

Sensory input is not the most important

In terms of neural connections, only 10% of the information our visual brain uses comes from the eyes.

The rest comes from other parts of the brain:
90%.

Information is meaningless (Beau Lotto)

Psychological Review
2014, Vol. 121, No. 4, 649–675

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0033-295X/14/\$12.00 <http://dx.doi.org/10.1037/a0037665>

Precise Minds in Uncertain Worlds: Predictive Coding in Autism

Sander Van de Cruys, Kris Evers, Ruth Van der Hallen, Lien Van Eylen,
Bart Boets, Lee de-Wit, and Johan Wagemans
KU Leuven

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PSYCHOLOGY

GENERAL COMMENTARY
published: 28 January 2013
doi: 10.3389/fpsyg.2013.00019

A predictive coding perspective on autism spectrum disorders

Jeroen J. A. van Boxtel^{1*} and Hongjing Lu^{1,2}

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Journal of Neurophysiology[®]
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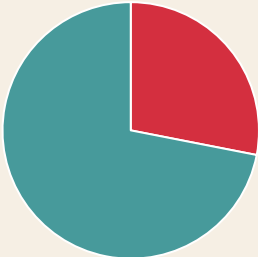
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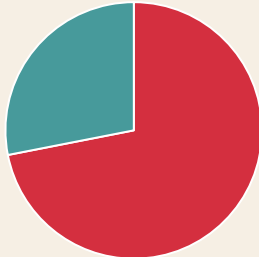
Predictive coding in Autism Spectrum Disorder and Attention Deficit Hyperactivity

The weight given to sensory input or own expectations **depends on the context**

Known environment



Unknown environment



■ Sensory input ■ Own model

■ Sensory input ■ Own model

How much weight you give to a prediction error depends on **how certain** you are about your model of the world and the predictions based on that model (Lawson, Mathys & Rees, 2017)

Autism, the predictive mind and context

- In autism the **flexible adjustment in function of context** of predictions and the weight given to prediction error seems to be affected

- **HIPPEA:**

High, Inflexible Precision of Prediction Errors in Autism

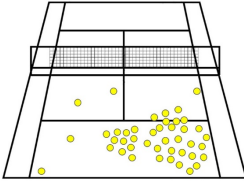
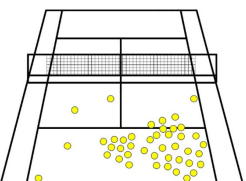
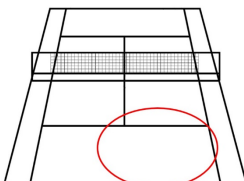
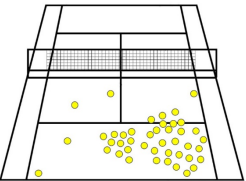
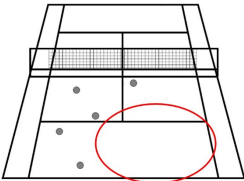
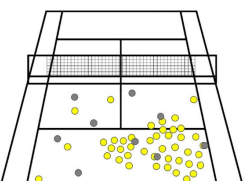
(Van de Cruys a.o., 2013, 2014)

Psychological Review
2014, Vol. 121, No. 4, 649–675

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Precise Minds in Uncertain Worlds: Predictive Coding in Autism

Sander Van de Cruys, Kris Evers, Ruth Van der Hallen, Lien Van Eylen,
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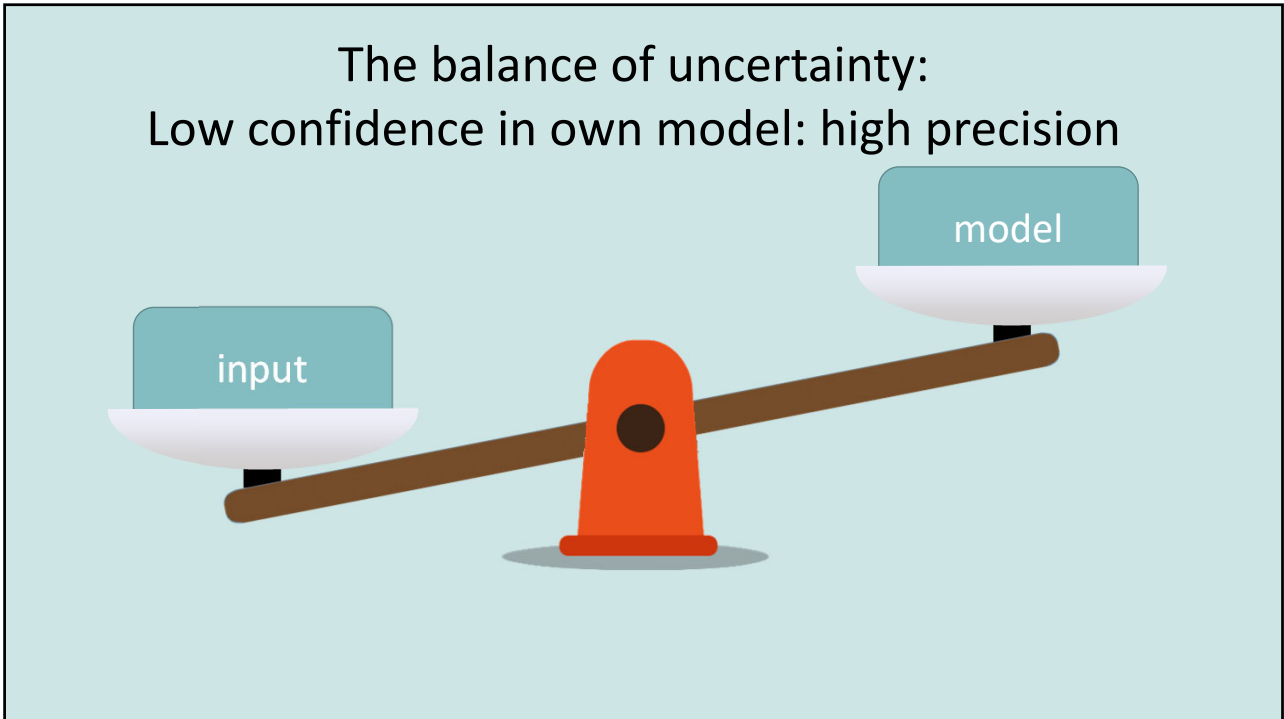
©Peter Vermeulen	Non autistic brain: Relative thinking	Autistic brain: Absolute thinking
Where the balls land		
Prediction		
Prediction errors		

Temple Grandin: My mind is a web browser



The balance of uncertainty:
High confidence in model: low precision





Main source of distress in autism

PETER VERMEULEN
Autism and The Predictive Brain
Absolute Thinking in a Relative World

Psychological Review
2014, Vol. 121, No. 4, 649–675

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Absolute thinking in a highly unpredictable world

↓

confusion – uncertainty - anxiety

Basic problem in autism:
absolute thinking in a relative world

Nothing has an absolute meaning



Review



The relationship between intolerance of uncertainty and anxiety in autism: A systematic literature review and meta-analysis

Richard Jenkinson¹ , Elizabeth Milne¹ and Andrew Thompson² 

Autism
2020, Vol. 24(8) 1933–1944
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Psychological Review
2014, Vol. 121, No. 4, 649–675

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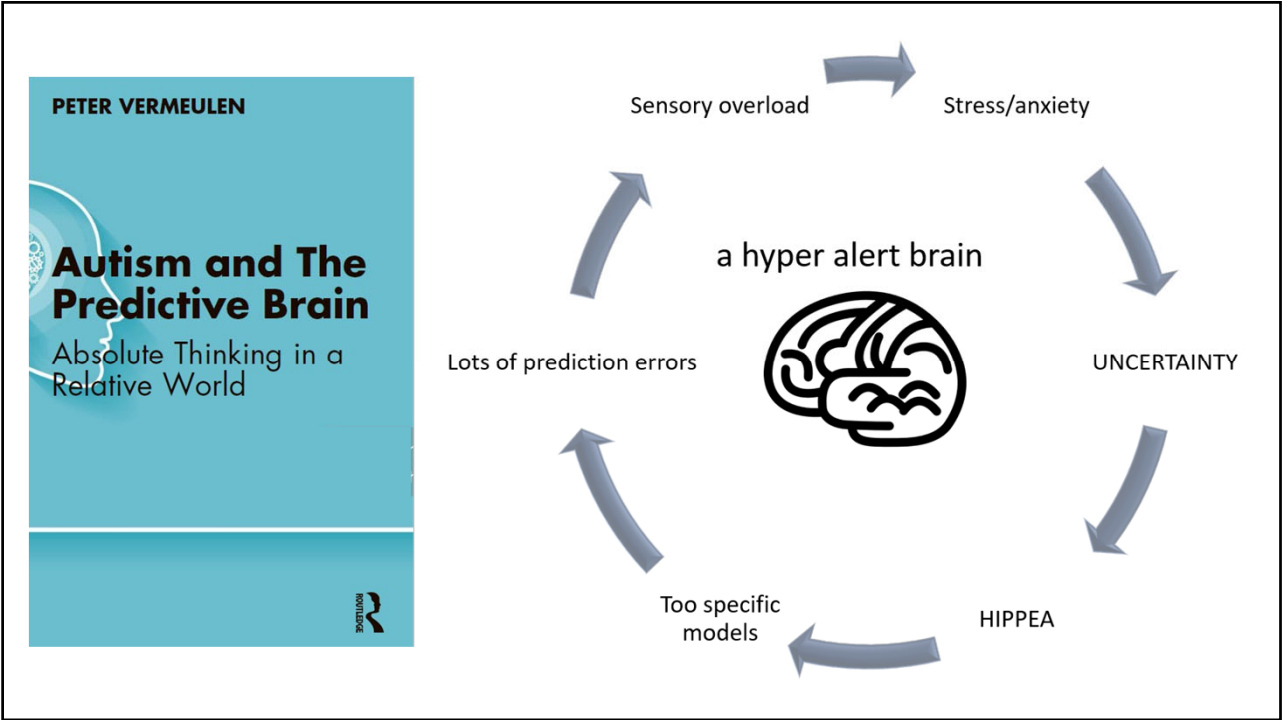
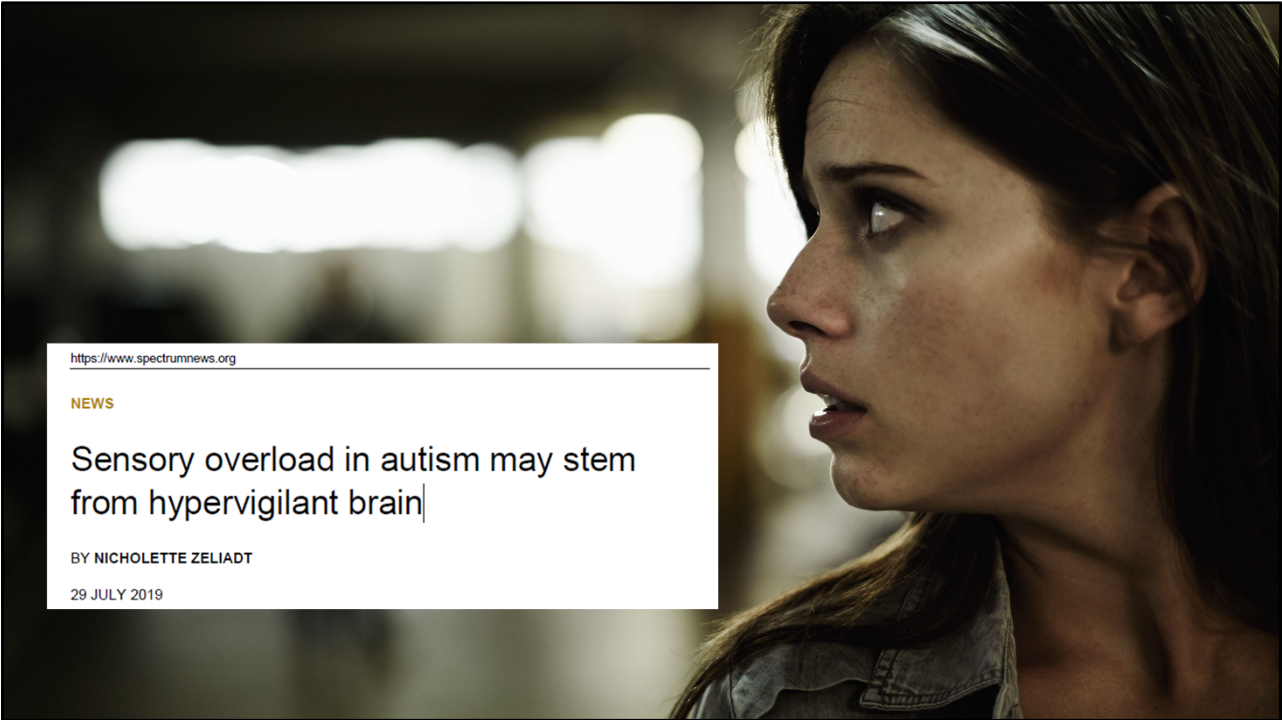
Sander Van de Cruys, Kris Evers, Ruth Van der Hallen, Lien Van Eylen,
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PREDICTIVE CODING IN AUTISM 661

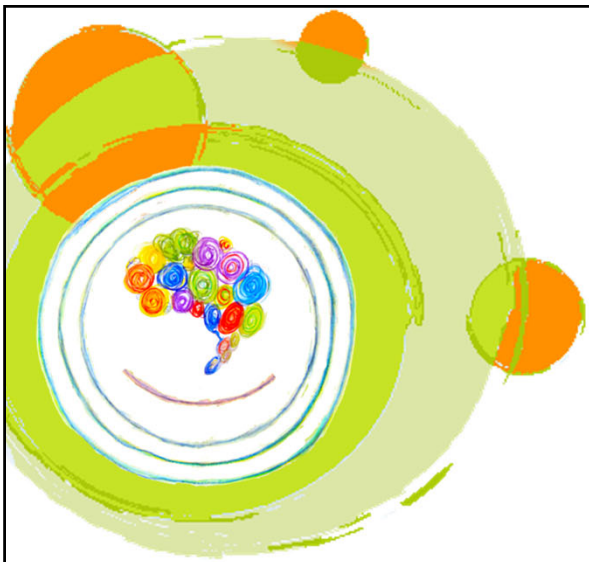
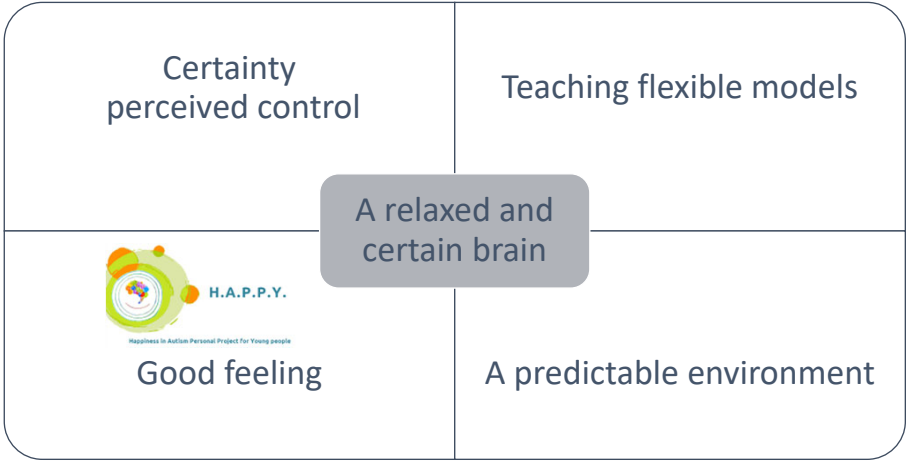
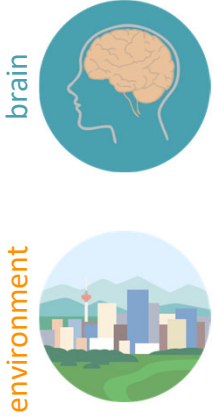
(e.g., under the form of enhanced discomfort to bright light; Kern et al., 2001). When the gain of the neural units representing the prediction errors is fixed at a high level, it is easy to see that hypersensitivity becomes very likely, especially for unexpected input, as is the case in ASD. Overweighting of irrelevant prediction errors causes sensory overload.

Seeing that unpredictability is at the core of the sensory overload, we can also attempt to explain its negative affective impact. Uncertainty has long been identified as a factor that intensifies stress and anxiety (Herry et al., 2007; Miller, 1981). In addition to leading to increased stress and anxiety, persistent significant prediction errors may actually by themselves generate negative affect (Huron, 2006; Van de Cruys & Wagemans, 2011). When prediction theories (Chevallier et al., 2012) that this is an important aggravating factor in the syndrome. Indeed, social interactions are not perceived to be that enjoyable or rewarding in individuals with ASD (Chevallier et al., 2012). Unsurprisingly, a lot of interventions focus on increasing the reward of social interactions. If social situations are avoided from early on in life, the number of social learning experiences decreases, and so, in a vicious circle, even more social impairments ensue.

Taken together, these factors arguably make individuals with ASD more vulnerable to mood and anxiety problems, which are indeed overrepresented in ASD (Kim, Szatmari, Bryson, Streiner, & Wilson, 2000). Hence, mood problems, anxiety, and anxious avoidance should in our view be considered as secondary symp-




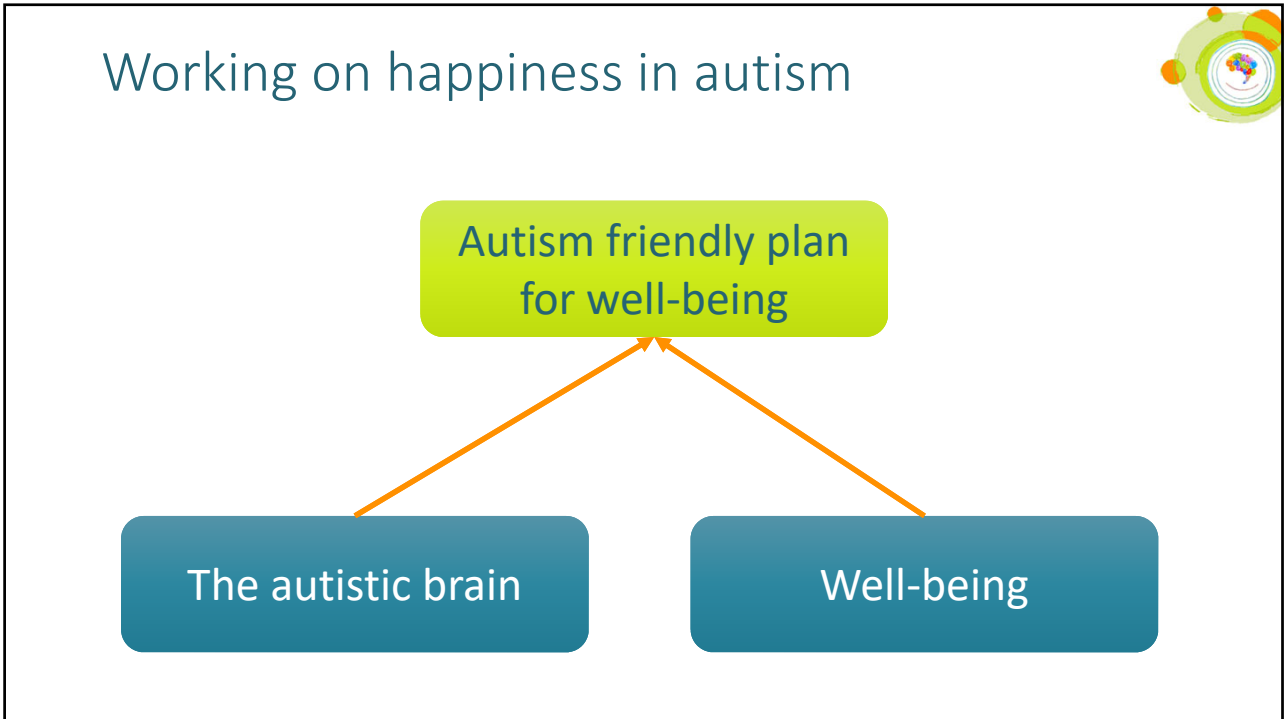
Autism friendly approach: basic ingredients



H.A.P.P.Y.

Happiness in Autism Personal Project for Young people

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Happiness in Autism Personal Project for Young people

10 well-being strategies

1. Accepting and loving yourself
2. Good Feeling toolbox
3. Flow activities
4. Physical exercise
5. Problem focused coping strategies
6. Emotion focused coping strategies
7. Positive thinking
8. Gratitude
9. Kindness
10. Personal projects: learning something new

AUTISM in CONTEXT from neurodiversity to neuroharmony

More similarities than differences

Uncertainty is not new to us.
We have coped with uncertainty
before.
We all experience prediction errors
and uncertainty



H.A.P.P.Y.

Happiness in Autism Personal Project for Young people

Strategies that address uncertainty

- Manage your worry-department
 - Worry box
 - Worry place and time
- Pride diary – positive diary
- But person
- Pointing out the similarities
- Clarify the world / context

“You have power over your mind, not outside events. Realize this and you will find strength.”
Marcus Aurelius



Don not ask about worries / emotions.
Ask what questions the person has about something.

Pushing the context button restores the balance

Will I get my own desk?

What about the breaks?

Who will be my new colleagues?

HR will listen to your concerns

All employees are allowed to take breaks

We can take a look at the website



What do we NOT know?	What DO we know?
Who will be my staff in the supported living	That there will be support for me in my daily activities
How will my room look like	That I will have my iPad and other things I like to have with me
How often and when will my parents visit me	That I will be able to call my parents to ask them when they will come

HIPPEA requires pointing out the similarities

-
- There will be many new things in my new school
 - But many things will also be the same:
 - There will be teachers
 - There will be lockers
 - There will be toilets
 - There will be breaks
 - There will be lunch time
 - School will be closed during holidays
 - There will be sanitizing hand gel

THINK

- True?
- Helpful?
- Inspiring?
- Necessary?
- Kind?



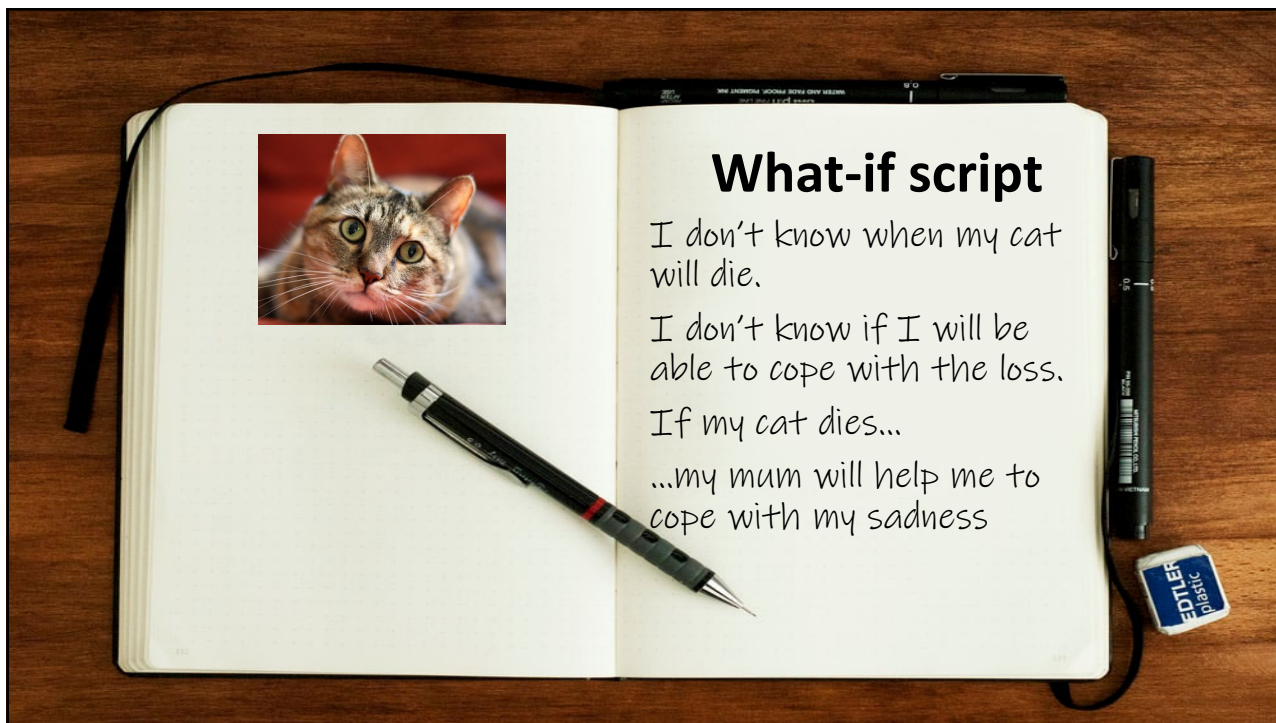
T IS IT TRUE?
Is this fact or is it really an opinion or feeling?
Know & be clear before you speak.

H IS IT HELPFUL?
Does it help you, them or the situation?

I IS IT INSPIRING?
Also, does it IMPROVE on the silence?

N IS IT NECESSARY?
Would this be better left unsaid?

K IS IT KIND?
What is your motivation for communicating?



Uncertainty, stress and control

Martin Seligman

Learned helplessness

THE NEW YORK TIMES BESTSELLER

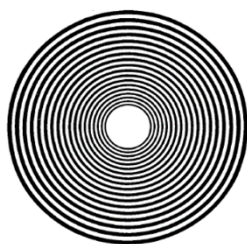
Using the New Positive Psychology to Realize Your Potential for Lasting Fulfillment



MARTIN SELIGMAN

'A revolutionary perspective on psychology. It speaks with a joyful voice about what it means to be fully alive.'
Mihaly Csikszentmihalyi, author of *Flow*

Importance of control in stress



URBAN STRESS

Experiments on Noise and Social Stressors

DAVID C. GLASS / JEROME E. SINGER

New York University
and
Russell Sage Foundation
New York, New York State University of
New York at Stony Brook
Stony Brook, New York

 ACADEMIC PRESS
New York San Francisco London 1972
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David Glass & Jerome Singer

Don't avoid challenges, but give control

Escape scenario

Script that clarifies what to do when it becomes too much

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Autism Good Feeling Questionnaire Finnish

Autism-Good-Feeling Questionnaire Danish

Autism-Good-Feeling Questionnaire English

Routines are good for the mental health

Published in final edited form as:

J Abnorm Child Psychol. 2011 January ; 39(1): 83–94. doi:10.1007/s10802-010-9447-5.

Family Routine Moderates the Relation Between Child Impulsivity and Oppositional Defiant Disorder Symptoms

H. Isabella Lanza and

Department of Psychology, Temple University, Philadelphia, PA, USA; Integrated Substance Abuse Programs, Semel Institute for Neuroscience and Human Behavior, University of California, Los Angeles, 1640 S. Sepulveda Blvd., Ste. 200, Los Angeles, CA 90025, USA

Deborah A. G. Drabick

Department of Psychology, Temple University, Philadelphia, PA, USA

Feature Articles

Why Routines Matter: The Nature and Meaning of Family Routines in the Context of Adolescent Mental Illness

Femke Koome MHSc, Clare Hocking PhD & Daniel Sutton PhD ✉

Pages 312-325 | Published online: 19 Sep 2012

Download citation <https://doi.org/10.1080/14427591.2012.718245>

How to use prediction errors in a positive way



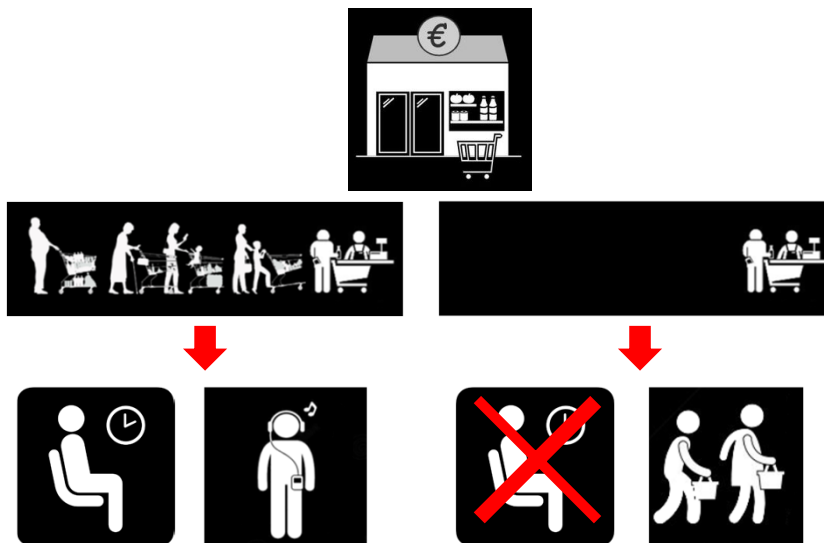
- Controlled and predictable variations in routines
- Teach flexible models by creating contextualized scripts
- Teach the brain to like surprises (eg. 4th movie starting with a certain letter)
- Humour!!! Use it. Laugh together. Safe surprises.

Contextualized scripts

- Mommy is going to pick me up at school at 3.30pm
- I wait for mommy at the school gate.
- If traffic is very busy, mommy could arrive later than 3.30.
- If mommy is not at school at 3.40pm, then I go back in and I go to the group room. I take my Gameboy and play until mommy comes in to pick me up.



Contextualized scripts

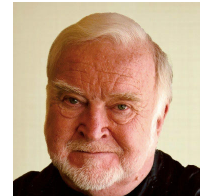


What if you have no access to the brain?

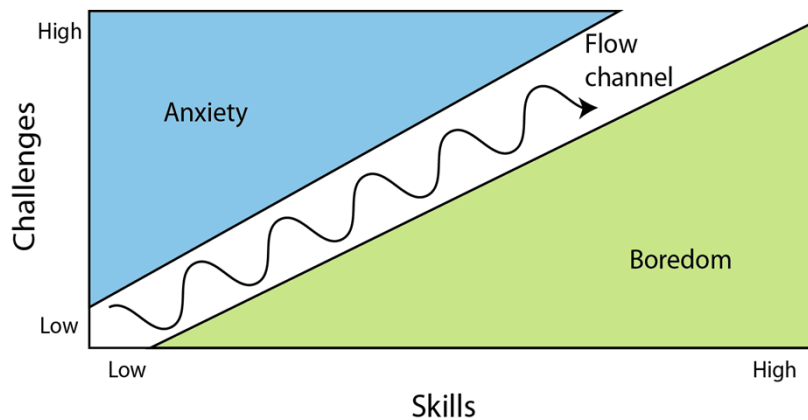


- Flow activities
- Physical exercise

Distraction: flow activities



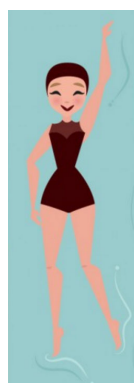
Mihaly Csikszentmihalyi



Distraction: flow activities

- Catch your attention
- Match your interests
- Stretch your skills a bit
- Have a goal that you have chosen
- You enjoy the journey, not the end

Physical exercise



Physical activities lower cortisol level and anxiety in autistic people (Hillier e.a., 2010, Hillier e.a., 2011, Carraro & Gobi, 2012)

Plan everything!

- The positive thinking
- The physical exercise
- The flow activities
- The worry time
- When to check things

- **The surprises**

DAY PLANNER

___/___/___ (M) (T) (W) (Th) (F) (Sa) (Su)


To Do List: _____

today I am grateful for _____

daily goals _____



appointments _____

breakfast _____ lunch _____ dinner _____

water: 

snacks _____

fitness _____ mood _____



AUTISM in CONTEXT

from neurodiversity to neuroharmony

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THANK YOU FOR YOUR ATTENTION

