10 YEARS CPC ♡

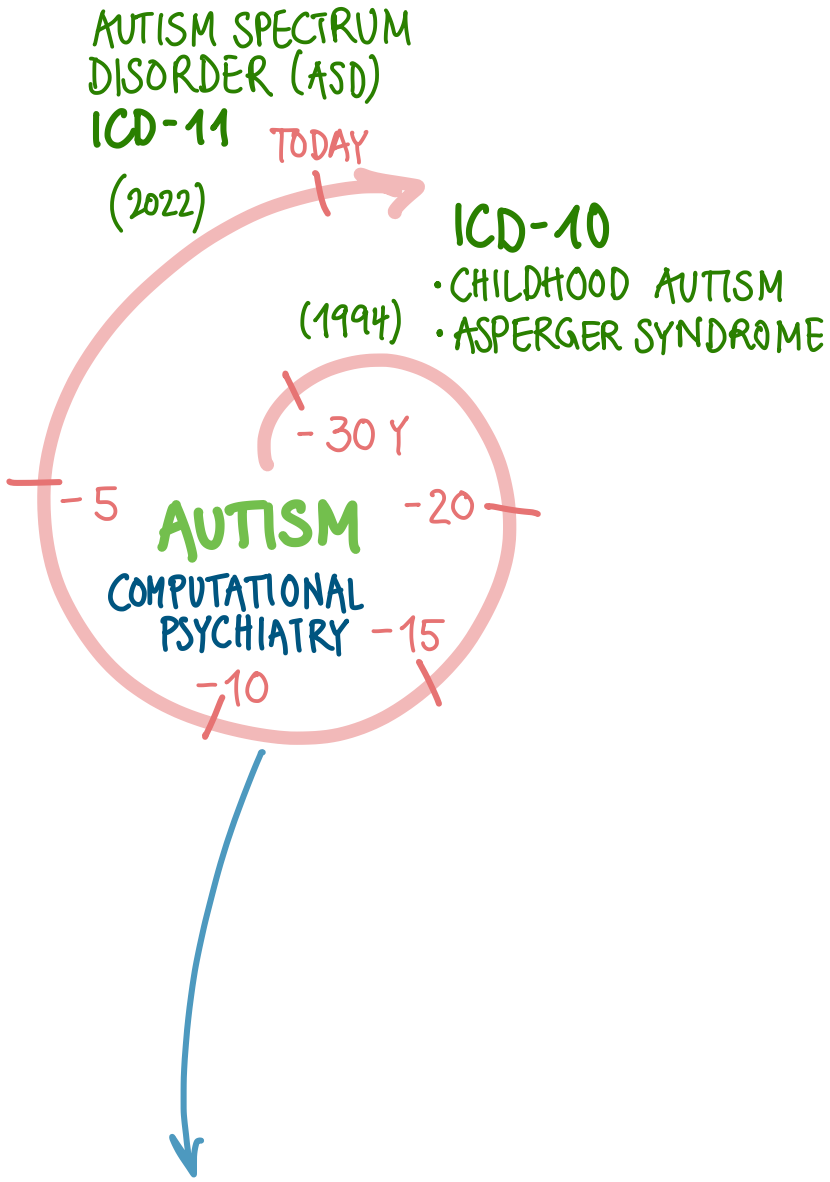
COMPUTATIONAL PSYCHIATRY COURSE 2024

AUTISM

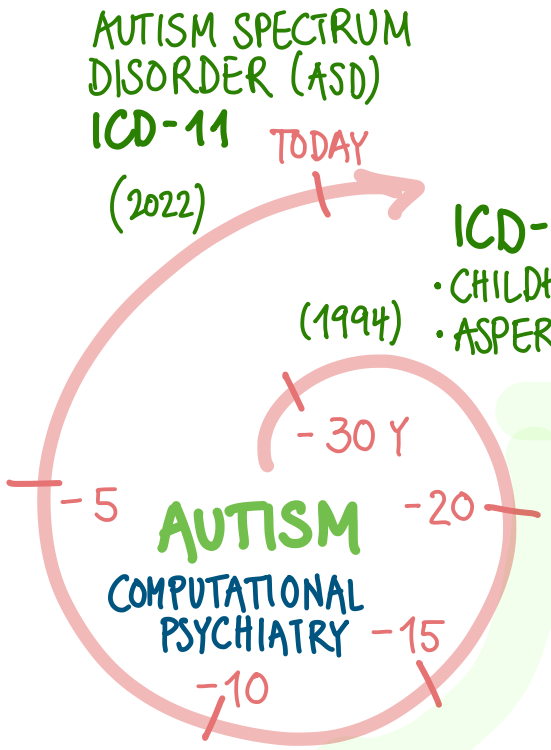
THE ROLE OF COMPUTATIONAL PSYCHIATRY IN THE DEVELOPMENT OF A DEVELOPMENTAL DISORDER

Helene Haker

haker@autismusperspektive.ch



BAYESIAN BRAIN THEORY OF AUTISM (2012) Pellicano & Burr



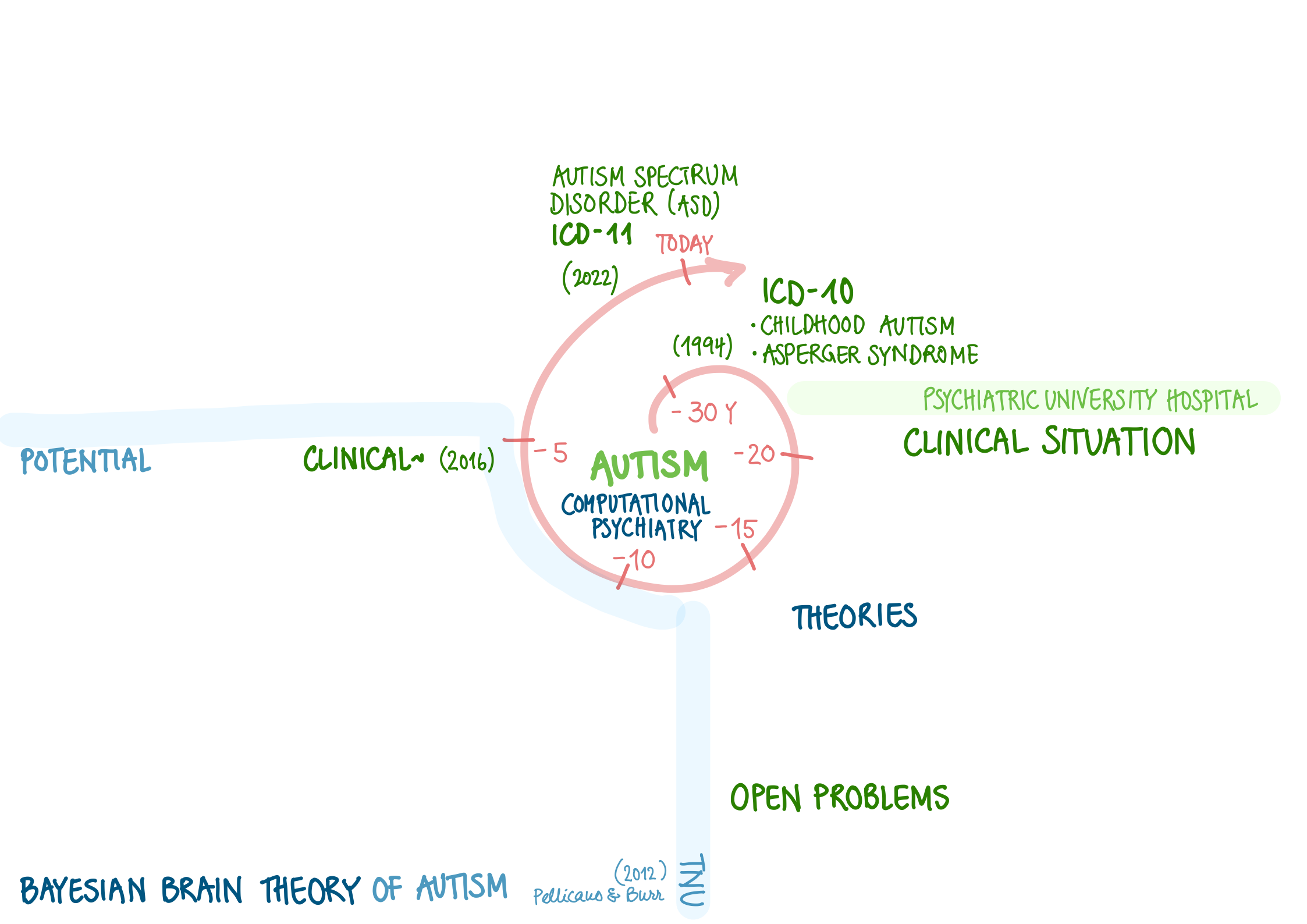
PSYCHIATRIC UNIVERSITY HOSPITAL

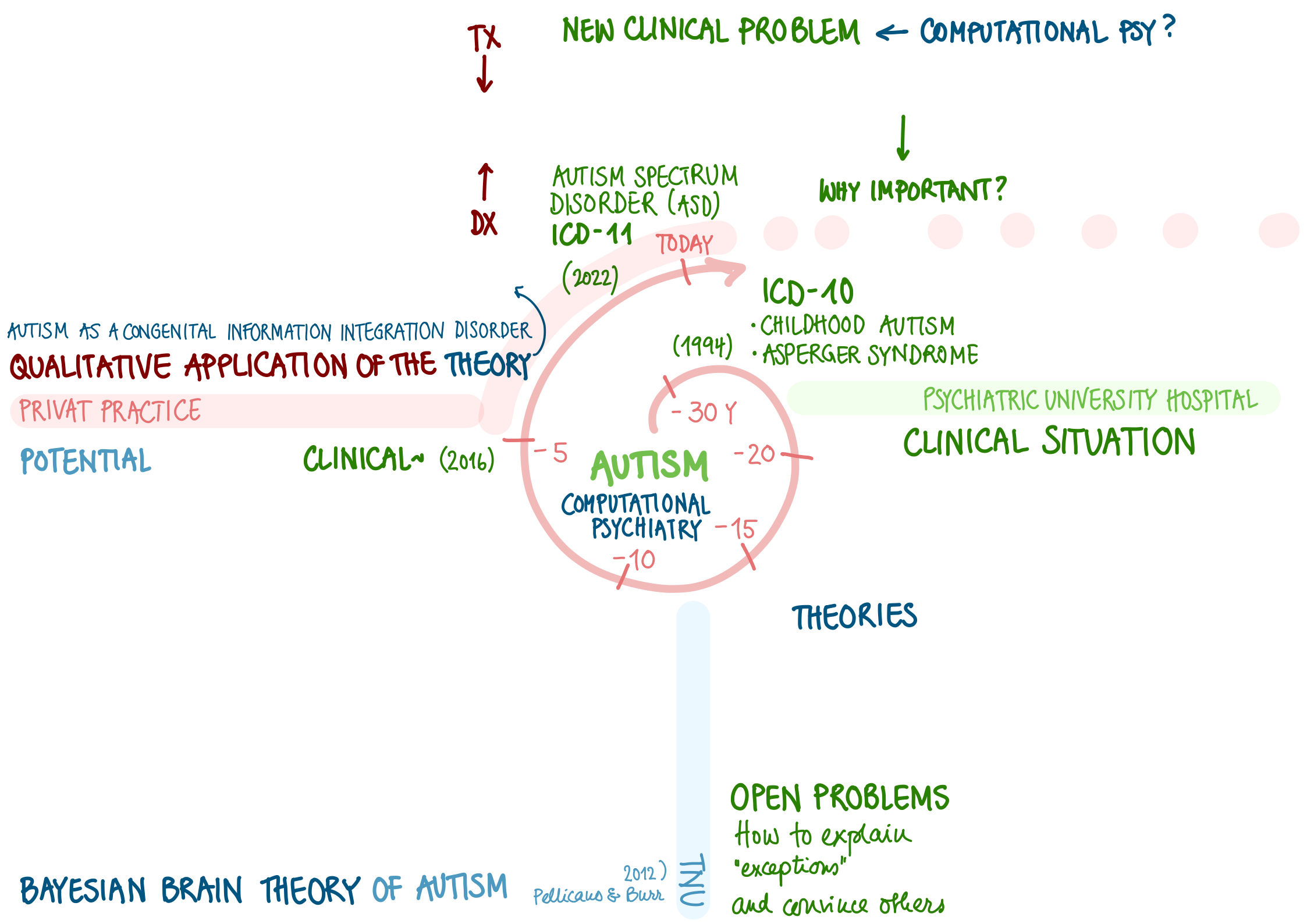
CLINICAL SITUATION

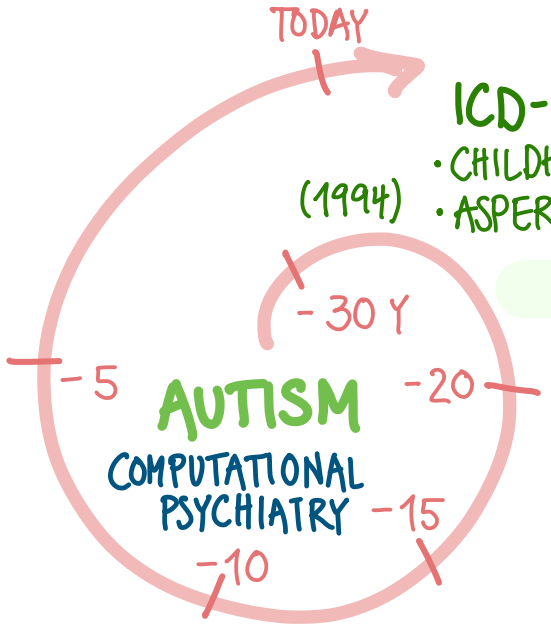
THEORIES

OPEN PROBLEMS

BAYESIAN BRAIN THEORY OF AUTISM (2012) Pellicano & Burr


AUTISM SPECTRUM DISORDER (ASD)
ICD-11
(2022)
TODAY
ICD-10
• CHILDHOOD AUTISM
• ASPERGER SYNDROME
(1994)
PSYCHIATRIC UNIVERSITY HOSPITAL
CLINICAL SITUATION
- 30 Y
- 5
AUTISM
COMPUTATIONAL PSYCHIATRY
- 20
- 15
- 10
POTENTIAL
CLINICAL~ (2016)
THEORIES
OPEN PROBLEMS
BAYESIAN BRAIN THEORY OF AUTISM
(2012)
Pellicano & Burr
TNU


TX
NEW CLINICAL PROBLEM ← COMPUTATIONAL PSY?
DX
AUTISM SPECTRUM DISORDER (ASD)
ICD-11
(2022)
TODAY
WHY IMPORTANT?
ICD-10
• CHILDHOOD AUTISM
• ASPERGER SYNDROME
(1994)
AUTISM AS A CONGENITAL INFORMATION INTEGRATION DISORDER
QUALITATIVE APPLICATION OF THE THEORY
PRIVAT PRACTICE
PSYCHIATRIC UNIVERSITY HOSPITAL
POTENTIAL
CLINICAL~ (2016)
CLINICAL SITUATION
-30 Y
-5
-20
AUTISM
COMPUTATIONAL PSYCHIATRY
-15
-10
THEORIES
OPEN PROBLEMS
How to explain "exceptions" and convince others
BAYESIAN BRAIN THEORY OF AUTISM
Pellicano & Burr (2012)
TNU



ICD-10

- CHILDHOOD AUTISM
- ASPERGER SYNDROME

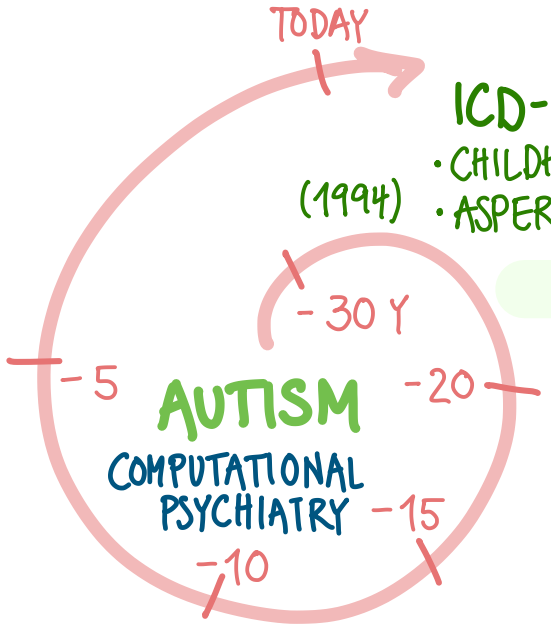
PERVASIVE DEVELOPMENTAL DISORDER
DEFICITS IN

- RECIPROCAL SOCIAL INTERACTIONS
- COMMUNICATION
- RESTRICTED REPETITIVE BEHAVIOR
- GENERAL DELAY IN COGNITIVE DEV.

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry !



ICD-10

- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PERVASIVE DEVELOPMENTAL DISORDER
DEFICITS IN

- RECIPROCAL SOCIAL INTERACTIONS
- COMMUNICATION
- RESTRICTED REPETITIVE BEHAVIOR
- GENERAL DELAY IN COGNITIVE DEV.

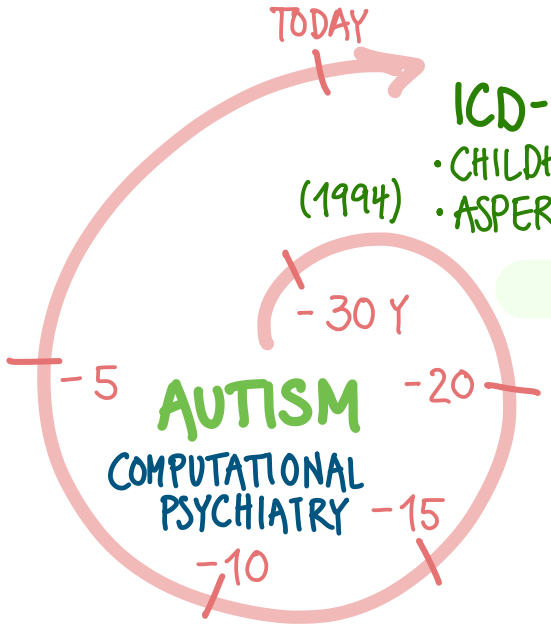
PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH
Social cognition

CASE REPORT
Criteria in adults?



ICD-10

- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PERVASIVE DEVELOPMENTAL DISORDER
DEFICITS IN

- RECIPROCAL SOCIAL INTERACTIONS
- COMMUNICATION
- RESTRICTED REPETITIVE BEHAVIOR
- GENERAL DELAY IN COGNITIVE DEV.

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

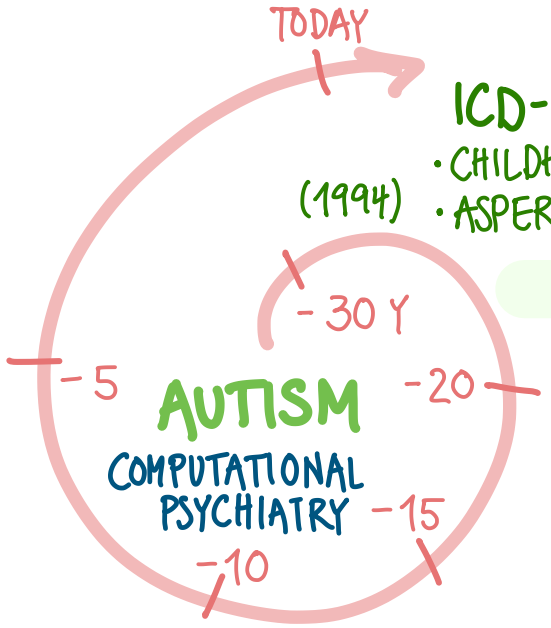
Autism ? → Child Psychiatry

RESEARCH
Social cognition

CASE REPORT
Criteria in adults?

FIRST PATIENT

high social development
sensory irritability
unusual reasoning
depression/exhaustion



ICD-10

- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PERVASIVE DEVELOPMENTAL DISORDER
DEFICITS IN

- RECIPROCAL SOCIAL INTERACTIONS
- COMMUNICATION
- RESTRICTED REPETITIVE BEHAVIOR
- GENERAL DELAY IN COGNITIVE DEV.

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

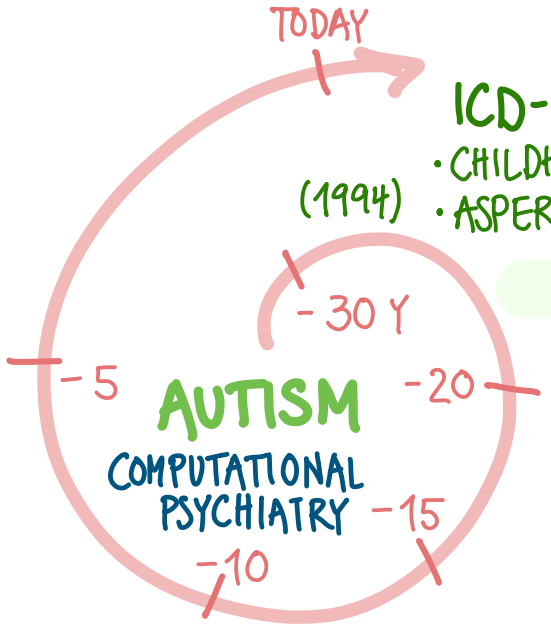
Criteria in adults?

FIRST PATIENT

high social development
sensory irritability
unusual reasoning
depression/exhaustion

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition?



ICD-10

- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PERVASIVE DEVELOPMENTAL DISORDER
DEFICITS IN

- RECIPROCAL SOCIAL INTERACTIONS
- COMMUNICATION
- RESTRICTED REPETITIVE BEHAVIOR
- GENERAL DELAY IN COGNITIVE DEV.

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

Criteria in adults?

THEORIES

- Theory of mind deficit
- Lack of social motivation/ Salience
- Weak central coherence
- ...

FIRST PATIENT

high social development
sensory irritability
unusual reasoning
depression/exhaustion

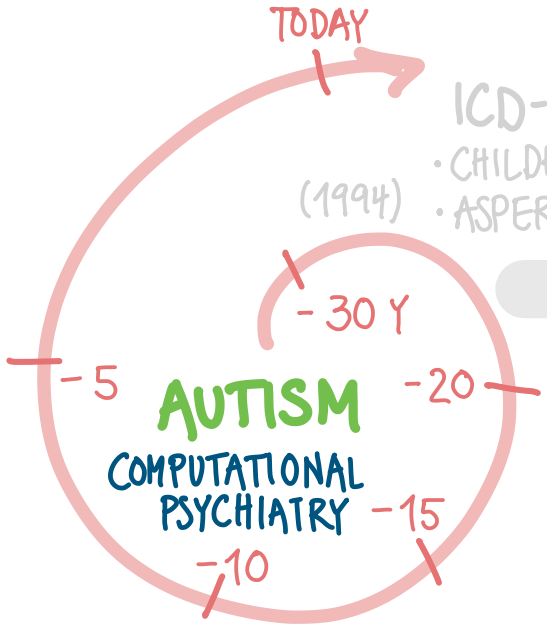
OPEN PROBLEMS

How to explain "exceptions" and convince others

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition?

BAYESIAN BRAIN THEORY OF AUTISM



ICD-10
- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

Criteria in adults ?

THEORIES

- Theory of mind deficit
- Lack of social motivation / Salience
- Weak central coherence
- ...

FIRST PATIENT

high social development
sensory irritability
unusual reasoning
depression/exhaustion

OPEN PROBLEMS

How to explain "exceptions" and convince others

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition ?

(2012) Pellicano & Burr

TNU

Opinion

Cell PRESS

TICS, 2012

When the world becomes 'too real': a Bayesian explanation of autistic perception

Elizabeth Pellicano[1,3] and David Burr[2,3]

[1] Centre for Research in Autism and Education (CRAE), Institute of Education, University of London, London, UK
[2] Department of Psychology, University of Florence, Florence, Italy
[3] School of Psychology, University of Western Australia, Perth, Australia

Perceptual experience is influenced both by incoming sensory information and prior knowledge about the world, a concept recently formalised within Bayesian decision theory. We propose that Bayesian models can be applied to autism – a neurodevelopmental condition with atypicalities in sensation and perception – to pinpoint fundamental differences in perceptual mechanisms. We suggest specifically that attenuated Bayesian priors – 'hypo-priors' – may be responsible for the unique perceptual experience of autistic people, leading to a tendency to perceive the world more accurately rather than modulated by prior experience. In this account, we consider how hypo-priors might explain key features of autism – the broad range of sensory and other non-social atypicalities – in addition to the phenomenological differences in autistic perception.

Introduction

Autism is a heritable, lifelong neurodevelopmental condition that has its most striking effects on social communication – the so-called social symptoms (see Glossary). Yet, the condition is also defined by a less well-researched range of non-social symptoms. These symptoms present throughout development, are prevalent in autistic individuals regardless of intellectual ability, and vary widely from an intense desire for sameness (such as following rigid routines) and sensory atypicalities (such as extreme sensitivity to florescent lighting or to the sound of the school bell) to remarkable talents (such as an excellent eye for detail).

These symptoms feature prominently in the draft changes to the forthcoming diagnostic guidelines for autism in the Diagnostic and Statistical Manual of Mental Disorders 5 (http://www.dsm5.org/proposedrevisions/pages/proposedrevision.aspx?rid=94), but the range and idiosyncrasy of sensory atypicalities, in particular, still represent some of the most puzzling features of autism. They include not only hypersensitivity to incoming stimuli, but also hyposensitivity to stimuli and sensory seeking behaviours, such as attraction to light, intense looking at objects, and fascination with brightly coloured objects [1,2]. Indeed, they often oscillate between these states within the same individual. They can also have catastrophic effects on the lives of autistic people. As Donna Williams reports first hand: 'the sensory overload caused by bright lights, fluorescent lights, colours, and patterns makes the body react as if being attacked or bombarded, resulting in such physical symptoms as headaches, anxiety, panic attacks or aggression' ([3], p. 43).

There has been renewed research interest in these sensory symptoms, prompted in part by the possibility that the non-social symptoms of autism might be attributable to fundamental differences in sensation and perception [4–9]. In this article, we propose a new account of the sensory and other non-social symptoms of autism, which we believe provides a parsimonious explanation for such atypicalities. We argue that people with autism see the world more accurately – as it really is – as a consequence of being less biased by prior experiences.

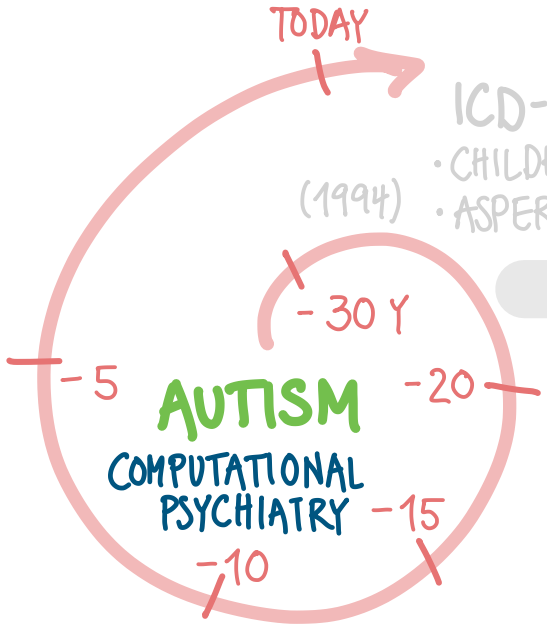
We start with the suggestion that it is not sensory processing itself that is different in autism, but the interpretation of sensory input to yield percepts. We further propose that Bayesian decision theory, a principled description of the processes that enable observers to derive the most probable interpretations of their environment (Box 1), provides a powerful tool to study the mechanisms underlying the diverse range of non-social features in autism. Such computational methods should formalise the process of generating experimentally testable hypotheses about the underlying functional atypicalities in autistic perception. Specifically we suggest that atypicalities

Glossary

Adaptation: a dynamic process in which neural sensitivity is continuously recalibrated to 'match' the characteristics of the current environment.
Aftereffect: the perceptual distortions that arise following lengthy exposure or 'adaptation' to a stimulus.
Autism: autism spectrum disorders are a set of common, lifelong neurodevelopmental conditions defined in terms of the presence of difficulties in social communication and social interaction, and a range of restricted, repetitive patterns of behaviour, interests, or activities, including sensory sensitivities.
Hypo-priors: a term we use to describe attenuated prior knowledge in autism, which would be represented as a broad prior probability distribution.
Likelihood: the function specifying the probability p(x|y) of observing a particular stimulus x for each possible state of the environment y.
Non-social symptoms: the range of autistic symptoms including restricted, repetitive patterns of behaviour, interests, or activities, and sensory sensitivities, which are relatively non-social in nature and content.
Posterior: the probability distribution p(y|x) produced by probabilistic inference according to a particular probabilistic model of the environment.
Prior: the probability distribution p(y) defining the expectation about the environment being in any of its possible states, y, before any observation is available.

Corresponding author: Pellicano, E. (l.pellicano@ioe.ac.uk)

 1364-6613/$ – see front matter http://dx.doi.org/10.1016/j.tics.2012.08.009 Trends in Cognitive Sciences, October 2012, Vol. 16, No. 10



ICD-10
- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

Criteria in adults ?

THEORIES

- Theory of mind deficit
- Lack of social motivation / Salience
- Weak central coherence
- ...

FIRST PATIENT

high social development
sensory irritability
unusual reasoning
depression/exhaustion

OPEN PROBLEMS

How to explain "exceptions" and convince others

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition ?

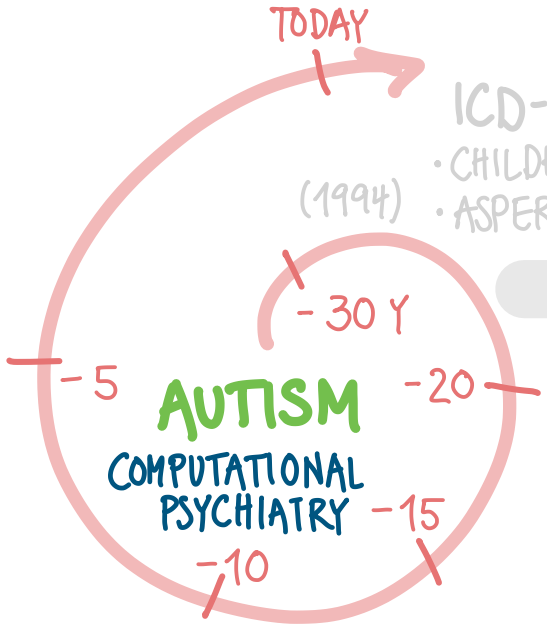
INFERENCE MACHINE

Maintain integrity { MIND
GOAL: HOMEOSTASIS { BODY

BAYESIAN BRAIN THEORY OF AUTISM

(2012) Pellicano & Burr

TNU



ICD-10
- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

Criteria in adults ?

THEORIES

- Theory of mind deficit
- Lack of social motivation / Salience
- Weak central coherence
- ...

FIRST PATIENT

high social development
sensory irritability
unusual reasoning
depression/exhaustion

OPEN PROBLEMS

How to explain "exceptions" and convince others

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition ?

matures through implicit learning

HIERARCHICAL MENTAL MODEL

expectations about sensory inputs

Represents most likely causes behind observations

minimize surprise

INFERENCE MACHINE

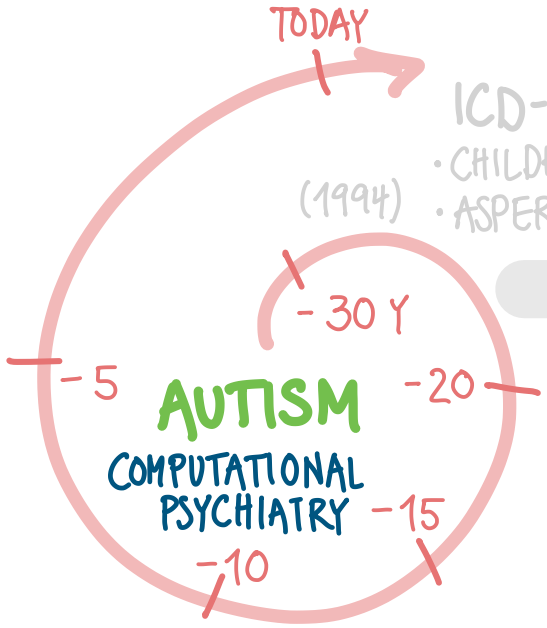
Maintain integrity
GOAL: HOMEOSTASIS

MIND
BODY

BAYESIAN BRAIN THEORY OF AUTISM

(2012) Pellicano & Burr

TNU



ICD-10
- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

Criteria in adults ?

matures through implicit learning

HIERARCHICAL MENTAL MODEL

expectations about sensory inputs

Represents most likely causes behind observations

~~minimize~~ surprise

constant

→ STRESS !

SIGNAL / NOISE

INFERENCE MACHINE

Maintain integrity

~~GOAL~~: HOMEOSTASIS

DYS-

MIND

BODY

SUBOPTIMAL FINE TUNING

overweighting sensory input vs. prior belief

BAYESIAN BRAIN THEORY OF AUTISM

(2012) Pellicano & Burr

TNU

THEORIES

- Theory of mind deficit
- Lack of social motivation / Salience
- Weak central coherence
- ...

FIRST PATIENT

high social development
sensory irritability
unusual reasoning
depression/exhaustion

OPEN PROBLEMS

How to explain "exceptions" and convince others

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition ?

matures through implicit learning

impaired development

HIERARCHICAL MENTAL MODEL

expectations about sensory inputs

Represents most likely causes behind observations

~~minimize~~ surprise

constant → STRESS !

SIGNAL / NOISE

INFERENCE MACHINE

Maintain integrity

~~GOAL~~: HOMEOSTASIS

MIND

BODY

SUBOPTIMAL FINE TUNING

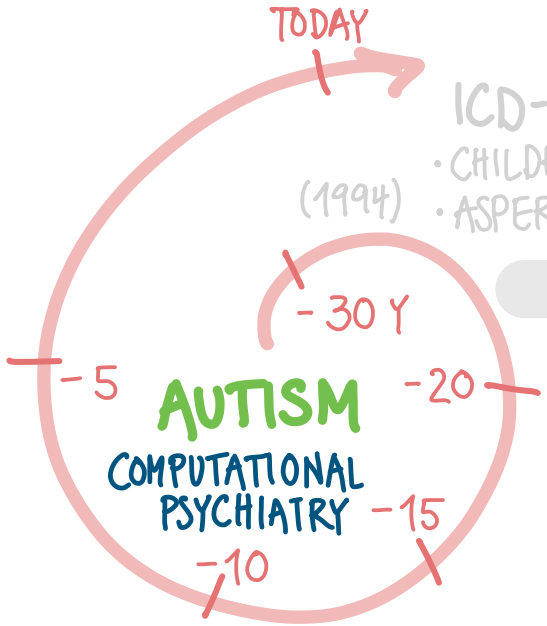
overweighting sensory input vs. prior belief

DYS-

BAYESIAN BRAIN THEORY OF AUTISM

(2012) Pellicano & Burr

TNU



ICD-10

- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

Criteria in adults ?

THEORIES

- Theory of mind deficit
- Lack of social motivation / Salience
- Weak central coherence
- ...

FIRST PATIENT

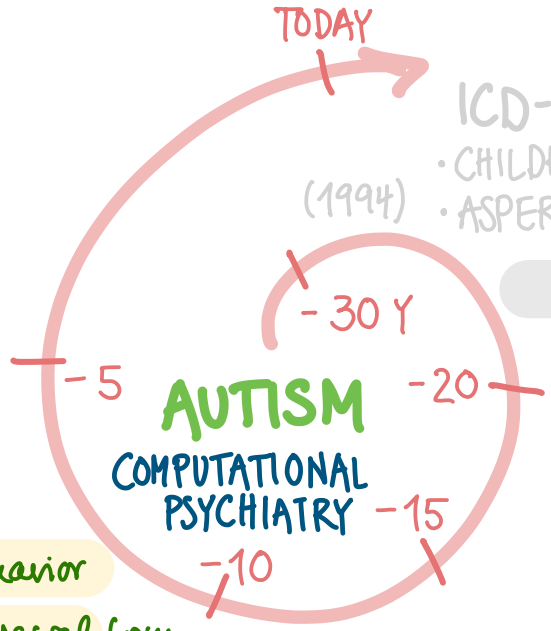
high social development
sensory irritability
unusual reasoning
depression/exhaustion

OPEN PROBLEMS

How to explain "exceptions" and convince others

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition ?



ICD-10
- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

Criteria in adults ?

matures through implicit learning

impaired development

HIERARCHICAL MENTAL MODEL

expectations about sensory inputs

- repetitive behavior
- withdrawal from unpredictable situations

COPING → STRESS !

Represents most likely causes behind observations

~~minimize~~ surprise

constant

SIGNAL / NOISE

INFERENCE MACHINE

Maintain integrity

~~GOAL~~ DYS- HOMEOSTASIS

MIND

BODY

SUBOPTIMAL FINE TUNING

overweighting sensory input vs. prior belief

BAYESIAN BRAIN THEORY OF AUTISM

(2012) Pellicano & Burr

TNU

THEORIES

- Theory of mind deficit
- Lack of social motivation / Salience
- Weak central coherence
- ...

FIRST PATIENT

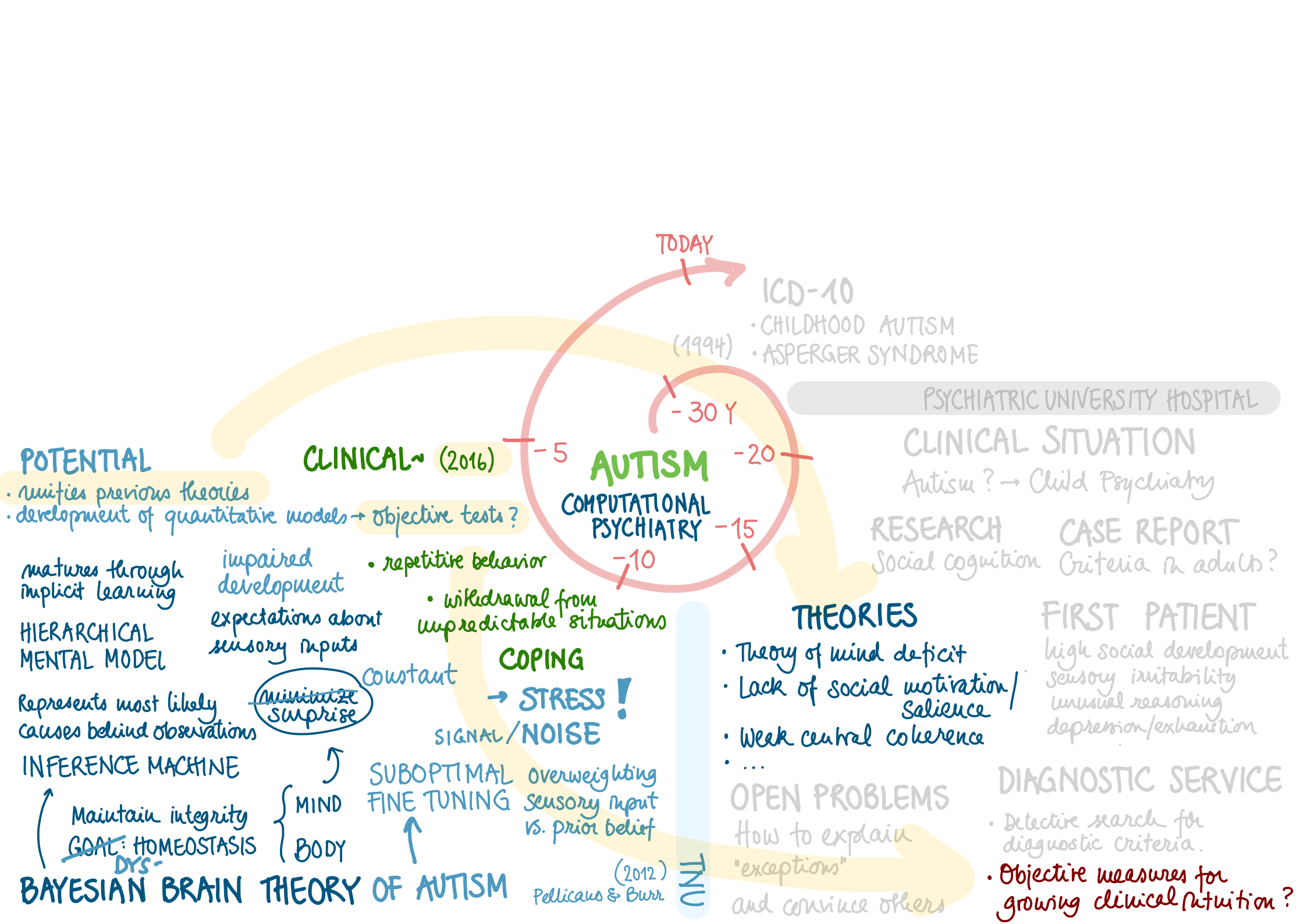
high social development
sensory irritability
unusual reasoning
depression/exhaustion

OPEN PROBLEMS

How to explain "exceptions" and convince others

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition ?


TODAY
ICD-10
• CHILDHOOD AUTISM
• ASPERGER SYNDROME
(1994)
PSYCHIATRIC UNIVERSITY HOSPITAL
CLINICAL SITUATION
Autism ? → Child Psychiatry
RESEARCH
Social cognition
CASE REPORT
Criteria in adults?
FIRST PATIENT
high social development
sensory irritability
unusual reasoning
depression/exhaustion
DIAGNOSTIC SERVICE
• Detective search for diagnostic criteria.
• Objective measures for growing clinical intuition ?
THEORIES
• Theory of mind deficit
• Lack of social motivation/ salience
• Weak central coherence
• ...
OPEN PROBLEMS
How to explain "exceptions" and convince others
TNU
-30 Y
-20
-15
-10
-5
AUTISM
COMPUTATIONAL PSYCHIATRY
CLINICAL~ (2016)
• repetitive behavior
• withdrawal from unpredictable situations
COPING
→ STRESS !
SIGNAL/NOISE
POTENTIAL
• unifies previous theories
• development of quantitative models → objective tests ?
matures through implicit learning
HIERARCHICAL MENTAL MODEL
impaired development
expectations about sensory inputs
constant
minimize surprise
Represents most likely causes behind observations
INFERENCE MACHINE
Maintain integrity
GOAL: HOMEOSTASIS
DYS-
MIND
BODY
SUBOPTIMAL FINE TUNING
overweighting sensory input vs. prior belief
BAYESIAN BRAIN THEORY OF AUTISM
(2012) Pellicano & Burr

frontiers in Psychiatry

HYPOTHESIS AND THEORY
published: 17 June 2016
doi: 10.3389/fpsyt.2016.00107

2016

Can Bayesian Theories of Autism Spectrum Disorder Help Improve Clinical Practice?

Helene Haker[1], Maya Schneebeli[1] and Klaas Enno Stephan[1,2,3]*

[1] Translational Neuromodeling Unit (TNU), Institute for Biomedical Engineering, University of Zurich and ETH Zurich, Zurich, Switzerland, [2] Wellcome Trust Centre for Neuroimaging, University College London, London, UK, [3] Max Planck Institute for Metabolism Research, Cologne, Germany

Diagnosis and individualized treatment of autism spectrum disorder (ASD) represent major problems for contemporary psychiatry. Tackling these problems requires guidance by a pathophysiological theory. In this paper, we consider recent theories that re-conceptualize ASD from a "Bayesian brain" perspective, which posit that the core abnormality of ASD resides in perceptual aberrations due to a disbalance in the precision of prediction errors (sensory noise) relative to the precision of predictions (prior beliefs). This results in percepts that are dominated by sensory inputs and less guided by top-down regularization and shifts the perceptual focus to detailed aspects of the environment with difficulties in extracting meaning. While these Bayesian theories have inspired ongoing empirical studies, their clinical implications have not yet been carved out. Here, we consider how this Bayesian perspective on disease mechanisms in ASD might contribute to improving clinical care for affected individuals. Specifically, we describe a computational strategy, based on generative (e.g., hierarchical Bayesian) models of behavioral and functional neuroimaging data, for establishing diagnostic tests. These tests could provide estimates of specific cognitive processes underlying ASD and delineate pathophysiological mechanisms with concrete treatment targets. Written with a clinical audience in mind, this article outlines how the development of computational diagnostics applicable to behavioral and functional neuroimaging data in routine clinical practice could not only fundamentally alter our concept of ASD but eventually also transform the clinical management of this disorder.

Keywords: autism spectrum disorder, Asperger syndrome, translational research, diagnostic tests, generative modeling, Bayesian inference, Bayesian models, neuroimaging

OPEN ACCESS

Edited by:
Stefan Borgwardt, University of Basel, Switzerland

Reviewed by:
Maria R. Dauvermann, MIT, USA
Nicole Wenderoth, ETH Zurich, Switzerland

****Correspondence:***
Helene Haker
haker@biomed.ee.ethz.ch

Specialty section:
This article was submitted to Neuroimaging and Stimulation, a section of the journal Frontiers in Psychiatry

Received: *22 January 2016*
Accepted: *03 June 2016*
Published: *17 June 2016*

Citation:
Haker H, Schneebeli M and Stephan KE (2016) Can Bayesian Theories of Autism Spectrum Disorder Help Improve Clinical Practice? Front. Psychiatry 7:107. doi: 10.3389/fpsyt.2016.00107

INTRODUCTION

An important precondition for successful translation of basic scientific theories into clinical applications is the knowledge of the most pressing unresolved problems in clinical practice. The care for affected individuals can only be improved effectively if these priority problems are identified and used to guide the design of scientific studies. In heterogeneous disorders, such as autism spectrum disorder (ASD), cross-sectional comparisons of patients vs. controls may provide coarse contours of some characteristics of the spectrum, but are usually not sufficient to inform changes in clinical practice (1).

develop an individual mental model of another (autistic) mind

AUTISM AS A CONGENITAL INFORMATION INTEGRATION DISORDER

QUALITATIVE APPLICATION OF THE THEORY

PRIVAT PRACTICE

POTENTIAL

- unifies previous theories
- development of quantitative models → objective tests

CLINICAL ~ (2016)

matures through implicit learning

impaired development

expectations about sensory inputs

- repetitive behavior
- withdrawal from unpredictable situations

HIERARCHICAL MENTAL MODEL

Represents most likely causes behind observations

~~minimize~~ surprise

constant

COPING → STRESS !

SIGNAL / NOISE

INFERENCE MACHINE

Maintain integrity

~~GOAL~~: HOMEOSTASIS

DYS-

MIND

BODY

SUBOPTIMAL FINE TUNING

overweighting sensory input vs. prior belief

BAYESIAN BRAIN THEORY OF AUTISM

(2012) Pellicano & Burr

TODAY

ICD-10

- CHILDHOOD AUTISM
- ASPERGER SYNDROME

(1994)

-30 Y

-20

-15

-10

-5

AUTISM

COMPUTATIONAL PSYCHIATRY

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

Criteria in adults ?

THEORIES

- Theory of mind deficit
- Lack of social motivation / Salience
- Weak central coherence
- ...

FIRST PATIENT

high social development
sensory irritability
unusual reasoning
depression / exhaustion

OPEN PROBLEMS

How to explain "exceptions" and convince others

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition ?

TNU

LIFE HISTORY ↖ ↗ COPING STRATEGIES TO REDUCE SURPRISE ↑ DX

FOCUS ON DEVELOPMENT

develop an individual mental model of another (autistic) mind

AUTISM AS A CONGENITAL INFORMATION INTEGRATION DISORDER

QUALITATIVE APPLICATION OF THE THEORY

PRIVAT PRACTICE

POTENTIAL

- unifies previous theories
- development of quantitative models → objective tests

CLINICAL~ (2016)

matures through implicit learning

impaired development

expectations about sensory inputs

- repetitive behavior
- withdrawal from unpredictable situations

HIERARCHICAL MENTAL MODEL

Represents most likely causes behind observations

minimize surprise

constant

COPING → STRESS !

SIGNAL/NOISE

INFERENCE MACHINE

Maintain integrity

GOAL: HOMEOSTASIS

MIND

BODY

SUBOPTIMAL FINE TUNING

overweighting sensory input vs. prior belief

DYS-

BAYESIAN BRAIN THEORY OF AUTISM

(2012) Pellicano & Burr

TODAY

ICD-10

- CHILDHOOD AUTISM
- ASPERGER SYNDROME

(1994)

-30 Y

-20

-15

-10

-5

AUTISM

COMPUTATIONAL PSYCHIATRY

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

Criteria in adults ?

THEORIES

- Theory of mind deficit
- Lack of social motivation/ Salience
- Weak central coherence
- ...

FIRST PATIENT

high social development
sensory irritability
unusual reasoning
depression/exhaustion

OPEN PROBLEMS

How to explain "exceptions" and convince others

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition ?

TNU

REPETITION
increase stability in the exterior (behaviorally)

REFLECTION
increase order in the interior (mentally)

TX

LIFE HISTORY ↖ ↗ COPING STRATEGIES TO REDUCE SURPRISE ↑ DX

FOCUS ON DEVELOPMENT

develop an individual mental model of another (autistic) mind

AUTISM AS A CONGENITAL INFORMATION INTEGRATION DISORDER

QUALITATIVE APPLICATION OF THE THEORY

PRIVAT PRACTICE

POTENTIAL

- unifies previous theories
- development of quantitative models → objective tests

CLINICAL ~ (2016)

matures through implicit learning

impaired development

expectations about sensory inputs

- repetitive behavior
- withdrawal from unpredictable situations

HIERARCHICAL MENTAL MODEL

Represents most likely causes behind observations

~~minimize~~ surprise

constant

COPING → STRESS !

SIGNAL / NOISE

INFERENCE MACHINE

Maintain integrity

~~GOAL~~: HOMEOSTASIS

DYS-

MIND

BODY

SUBOPTIMAL FINE TUNING

overweighting sensory input vs. prior belief

BAYESIAN BRAIN THEORY OF AUTISM

(2012) Pellicano & Burr

TODAY

ICD-10

- CHILDHOOD AUTISM
- ASPERGER SYNDROME

(1994)

-30 Y

-20

-15

-10

-5

AUTISM

COMPUTATIONAL PSYCHIATRY

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION

Autism ? → Child Psychiatry

RESEARCH

Social cognition

CASE REPORT

Criteria in adults ?

THEORIES

- Theory of mind deficit
- Lack of social motivation / Salience
- Weak central coherence
- ...

FIRST PATIENT

high social development
sensory irritability
unusual reasoning
depression/exhaustion

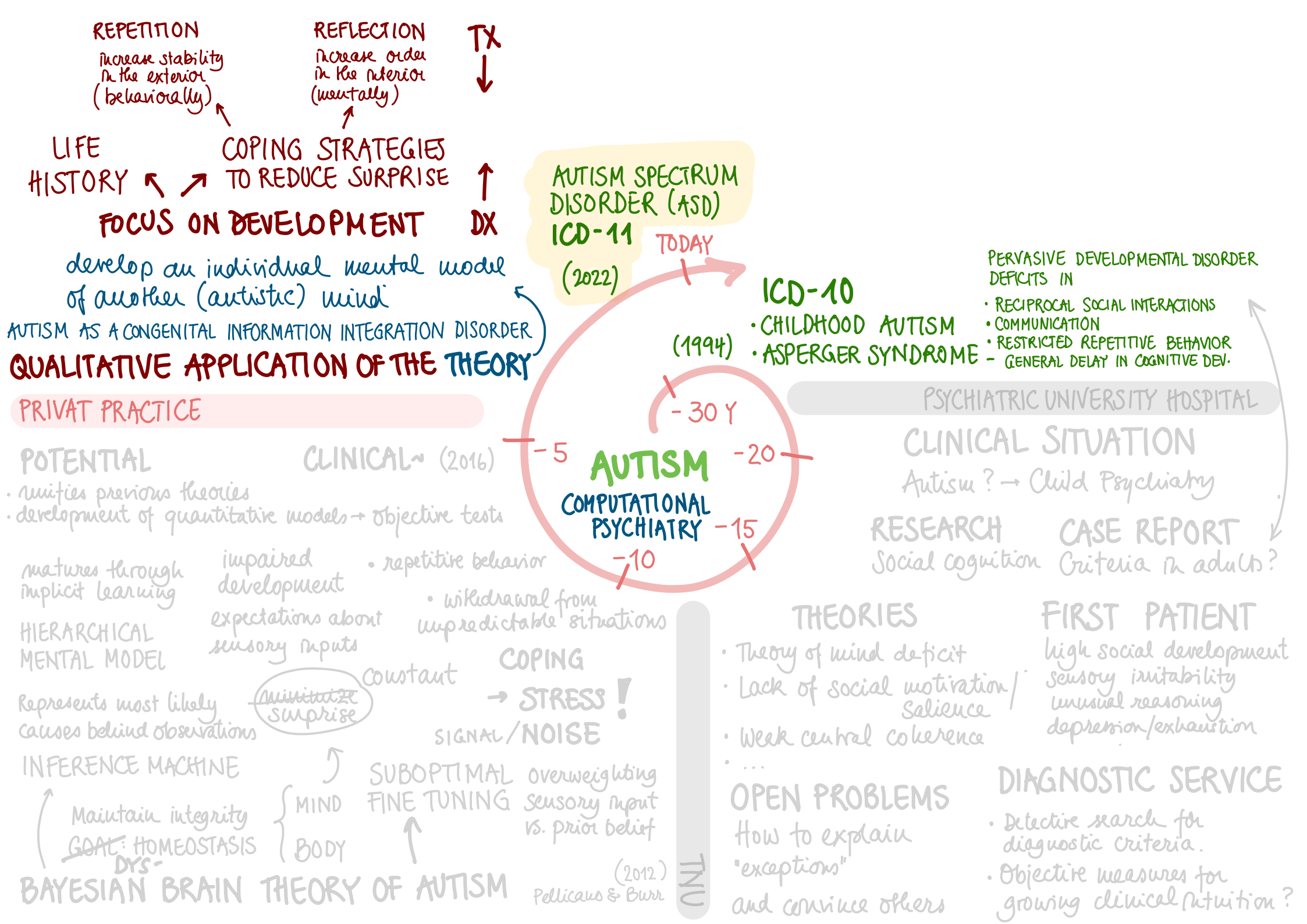
OPEN PROBLEMS

How to explain "exceptions" and convince others

DIAGNOSTIC SERVICE

- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition ?

TNU


REPETITION
increase stability in the exterior (behaviorally)
REFLECTION
increase order in the interior (mentally)
TX
LIFE HISTORY
COPING STRATEGIES TO REDUCE SURPRISE
FOCUS ON DEVELOPMENT
DX
develop an individual mental model of another (autistic) mind
AUTISM AS A CONGENITAL INFORMATION INTEGRATION DISORDER
QUALITATIVE APPLICATION OF THE THEORY
AUTISM SPECTRUM DISORDER (ASD)
ICD-11
(2022)
TODAY
ICD-10
• CHILDHOOD AUTISM
• ASPERGER SYNDROME
(1994)
PERVASIVE DEVELOPMENTAL DISORDER
DEFICITS IN
• RECIPROCAL SOCIAL INTERACTIONS
• COMMUNICATION
• RESTRICTED REPETITIVE BEHAVIOR
– GENERAL DELAY IN COGNITIVE DEV.
-30 Y
-20
-15
-10
-5
AUTISM
COMPUTATIONAL PSYCHIATRY
PRIVAT PRACTICE
POTENTIAL
• unifies previous theories
• development of quantitative models → objective tests
CLINICAL ~ (2016)
matures through implicit learning
impaired development
• repetitive behavior
• withdrawal from unpredictable situations
HIERARCHICAL MENTAL MODEL
expectations about sensory inputs
Represents most likely causes behind observations
minimize surprise
constant
COPING
→ STRESS !
SIGNAL / NOISE
INFERENCE MACHINE
Maintain integrity
GOAL: HOMEOSTASIS
DYS-
MIND
BODY
SUBOPTIMAL FINE TUNING
overweighting sensory input vs. prior belief
BAYESIAN BRAIN THEORY OF AUTISM
(2012)
Pellicano & Burr
TNU
PSYCHIATRIC UNIVERSITY HOSPITAL
CLINICAL SITUATION
Autism ? → Child Psychiatry
RESEARCH
Social cognition
CASE REPORT
Criteria in adults ?
THEORIES
• Theory of mind deficit
• Lack of social motivation / Salience
• Weak central coherence
• ...
FIRST PATIENT
high social development
sensory irritability
unusual reasoning
depression/exhaustion
OPEN PROBLEMS
How to explain "exceptions" and convince others
DIAGNOSTIC SERVICE
• Detective search for diagnostic criteria.
• Objective measures for growing clinical intuition ?

ICD-11 (2022)

6A02 Autism spectrum disorder

Foundation URI: http://id.who.int/icd/entity/437815624

Code: **6A02**

Description

previous characteristics

Autism spectrum disorder is characterised by persistent deficits in the ability to initiate and to sustain reciprocal social interaction and social communication, and by a range of restricted, repetitive, and inflexible patterns of behaviour, interests or activities that are clearly atypical or excessive for the individual's age and sociocultural context. The onset of the disorder occurs during the developmental period, typically in early childhood, but symptoms may not become fully manifest until later, when social demands exceed limited capacities. Deficits are sufficiently severe to cause impairment in personal, family, social, educational, occupational or other important areas of functioning and are usually a pervasive feature of the individual's functioning observable in all settings, although they may vary according to social, educational, or other context. Individuals along the spectrum exhibit a full range of intellectual functioning and language abilities.

ICD-11 (2022)

6A02 Autism spectrum disorder

Foundation URI: http://id.who.int/icd/entity/437815624

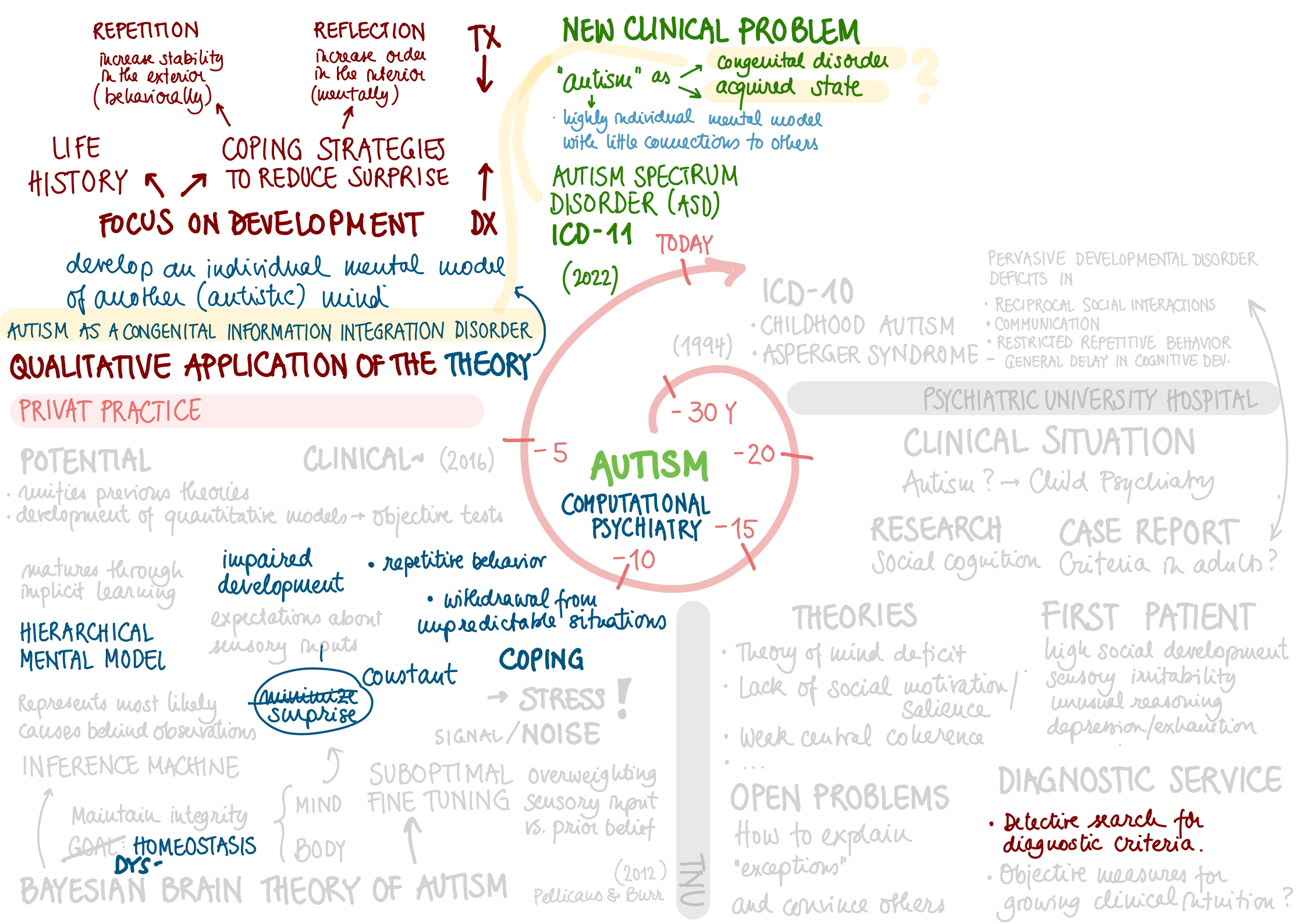
Code: **6A02**

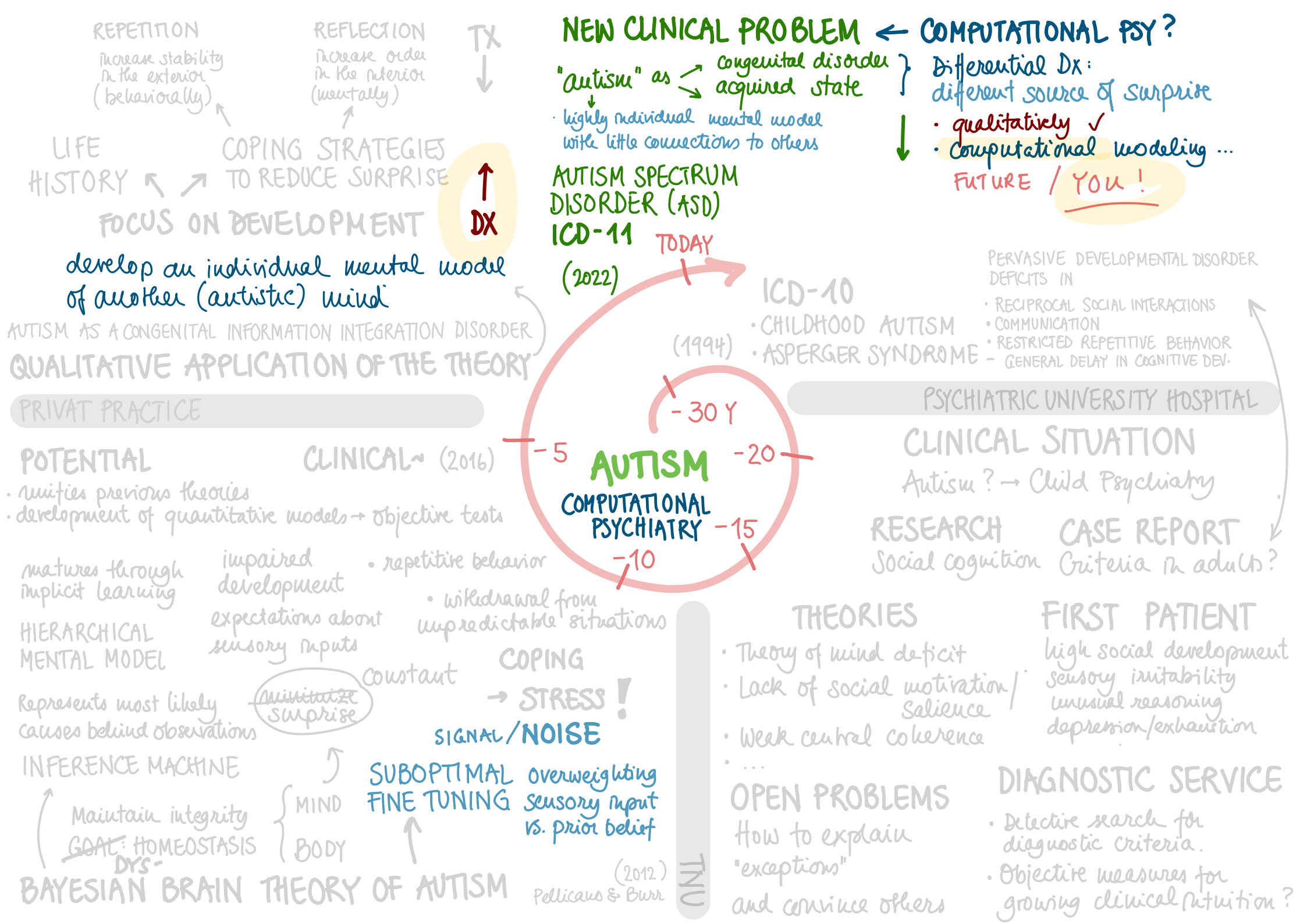
Description

previous characteristics

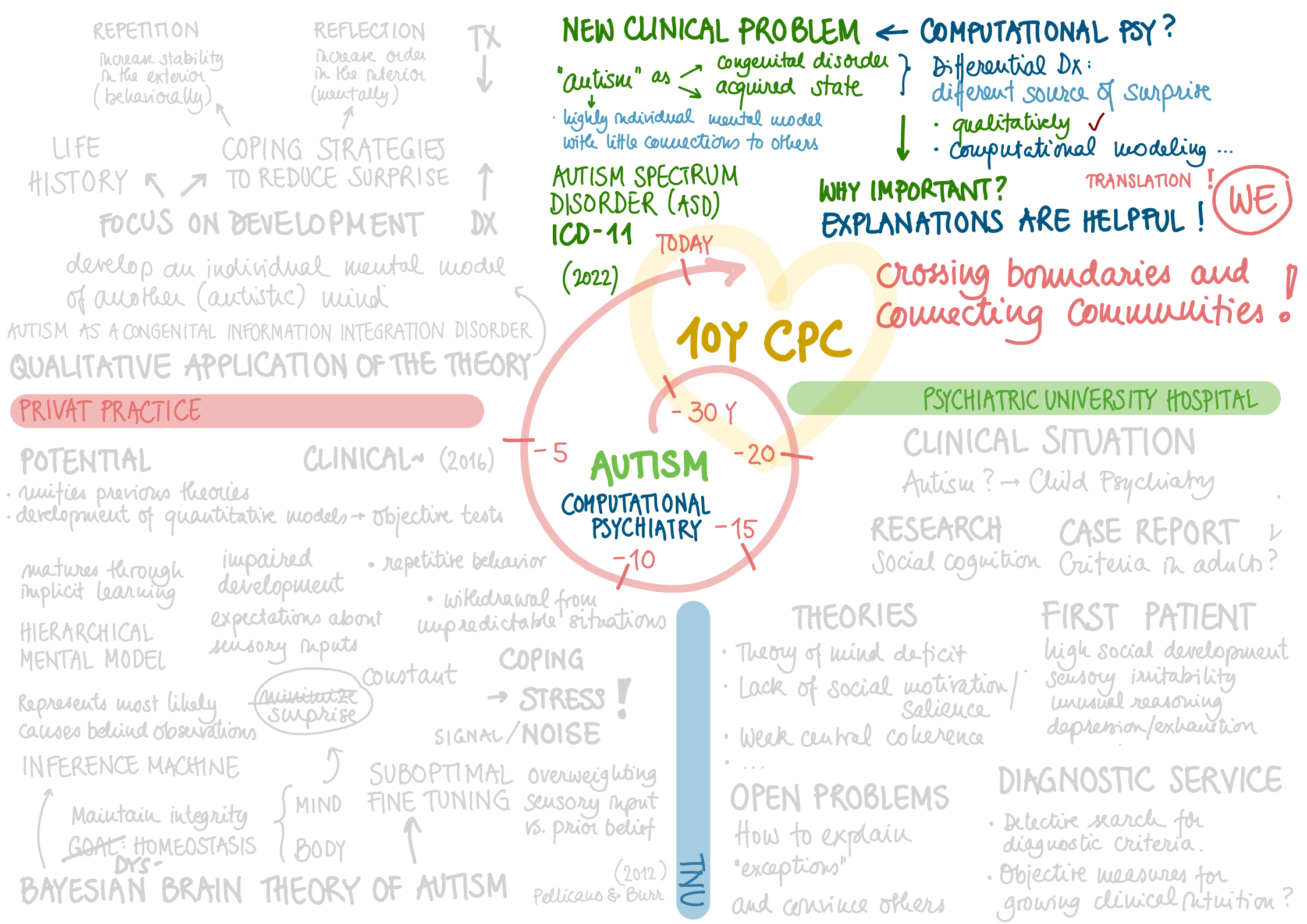
"softening of clinical manifestation"

Autism spectrum disorder is characterised by persistent deficits in the ability to initiate and to sustain reciprocal social interaction and social communication, and by a range of restricted, repetitive, and inflexible patterns of behaviour, interests or activities that are clearly atypical or excessive for the individual's age and sociocultural context. The onset of the disorder occurs during the developmental period, typically in early childhood, but symptoms may not become fully manifest until later, when social demands exceed limited capacities. Deficits are sufficiently severe to cause impairment in personal, family, social, educational, occupational or other important areas of functioning and are usually a pervasive feature of the individual's functioning observable in all settings, although they may vary according to social, educational, or other context. Individuals along the spectrum exhibit a full range of intellectual functioning and language abilities.


REPETITION
increase stability in the exterior (behaviorally)
REFLECTION
increase order in the interior (mentally)
TX
LIFE HISTORY
COPING STRATEGIES TO REDUCE SURPRISE
FOCUS ON DEVELOPMENT
DX
develop an individual mental model of another (autistic) mind
AUTISM AS A CONGENITAL INFORMATION INTEGRATION DISORDER
QUALITATIVE APPLICATION OF THE THEORY
NEW CLINICAL PROBLEM
"autism" as
congenital disorder
acquired state
?
· highly individual mental model with little connections to others
AUTISM SPECTRUM DISORDER (ASD)
ICD-11
(2022)
TODAY
ICD-10
· CHILDHOOD AUTISM
· ASPERGER SYNDROME
(1994)
PERVASIVE DEVELOPMENTAL DISORDER
DEFICITS IN
· RECIPROCAL SOCIAL INTERACTIONS
· COMMUNICATION
· RESTRICTED REPETITIVE BEHAVIOR
– GENERAL DELAY IN COGNITIVE DEV.
PRIVAT PRACTICE
PSYCHIATRIC UNIVERSITY HOSPITAL
POTENTIAL
CLINICAL (2016)
· unifies previous theories
· development of quantitative models → objective tests
matures through implicit learning
impaired development
· repetitive behavior
· withdrawal from unpredictable situations
expectations about sensory inputs
HIERARCHICAL MENTAL MODEL
Represents most likely causes behind observations
INFERENCE MACHINE
minimize surprise
constant
COPING
→ STRESS !
SIGNAL/NOISE
SUBOPTIMAL FINE TUNING
overweighting sensory input vs. prior belief
Maintain integrity
GOAL: HOMEOSTASIS
DYS-
MIND
BODY
BAYESIAN BRAIN THEORY OF AUTISM
(2012)
Pellicano & Burr
-30 Y
-20
-15
-10
-5
AUTISM
COMPUTATIONAL PSYCHIATRY
CLINICAL SITUATION
Autism ? → Child Psychiatry
RESEARCH
Social cognition
CASE REPORT
Criteria in adults?
THEORIES
· Theory of mind deficit
· Lack of social motivation/ Salience
· Weak central coherence
· ...
FIRST PATIENT
high social development
sensory irritability
unusual reasoning
depression/exhaustion
OPEN PROBLEMS
How to explain "exceptions" and convince others
DIAGNOSTIC SERVICE
· Detective search for diagnostic criteria.
· Objective measures for growing clinical intuition ?
TNU


REPETITION
increase stability in the exterior (behaviorally)
REFLECTION
increase order in the interior (mentally)
TX
LIFE HISTORY
COPING STRATEGIES TO REDUCE SURPRISE
FOCUS ON DEVELOPMENT
DX
develop an individual mental model of another (autistic) mind
AUTISM AS A CONGENITAL INFORMATION INTEGRATION DISORDER
QUALITATIVE APPLICATION OF THE THEORY
PRIVAT PRACTICE
POTENTIAL
CLINICAL~ (2016)
• unifies previous theories
• development of quantitative models → objective tests
matures through implicit learning
impaired development
expectations about sensory inputs
• repetitive behavior
• withdrawal from unpredictable situations
HIERARCHICAL MENTAL MODEL
Represents most likely causes behind observations
minimize surprise
constant
COPING
→ STRESS !
SIGNAL/NOISE
INFERENCE MACHINE
Maintain integrity
GOAL: HOMEOSTASIS
DYS-
MIND
BODY
SUBOPTIMAL FINE TUNING
overweighting sensory input vs. prior belief
BAYESIAN BRAIN THEORY OF AUTISM
(2012) Pellicano & Burr
NEW CLINICAL PROBLEM ← COMPUTATIONAL PSY?
"autism" as
congenital disorder
acquired state
• highly individual mental model with little connections to others
Differential Dx: different source of surprise
• qualitatively ✓
• computational modeling ...
FUTURE / YOU!
AUTISM SPECTRUM DISORDER (ASD)
ICD-11
(2022)
TODAY
ICD-10
(1994)
• CHILDHOOD AUTISM
• ASPERGER SYNDROME
PERVASIVE DEVELOPMENTAL DISORDER
DEFICITS IN
• RECIPROCAL SOCIAL INTERACTIONS
• COMMUNICATION
• RESTRICTED REPETITIVE BEHAVIOR
– GENERAL DELAY IN COGNITIVE DEV.
-30 Y
-20
-15
-10
-5
AUTISM
COMPUTATIONAL PSYCHIATRY
PSYCHIATRIC UNIVERSITY HOSPITAL
CLINICAL SITUATION
Autism? → Child Psychiatry
RESEARCH
Social cognition
CASE REPORT
Criteria in adults?
THEORIES
• Theory of mind deficit
• Lack of social motivation/ Salience
• Weak central coherence
• ...
FIRST PATIENT
high social development
sensory irritability
unusual reasoning
depression/exhaustion
OPEN PROBLEMS
How to explain "exceptions" and convince others
DIAGNOSTIC SERVICE
• Detective search for diagnostic criteria.
• Objective measures for growing clinical intuition?
TNU


REPETITION
increase stability in the exterior (behaviorally)
REFLECTION
increase order in the interior (mentally)
TX
LIFE HISTORY
COPING STRATEGIES TO REDUCE SURPRISE
FOCUS ON DEVELOPMENT
DX
develop an individual mental model of another (autistic) mind
AUTISM AS A CONGENITAL INFORMATION INTEGRATION DISORDER
QUALITATIVE APPLICATION OF THE THEORY
NEW CLINICAL PROBLEM ← COMPUTATIONAL PSY?
"autism" as congenital disorder / acquired state
highly individual mental model with little connections to others
Differential Dx: different source of surprise
· qualitatively ✓
· computational modeling ...
AUTISM SPECTRUM DISORDER (ASD)
ICD-11
(2022)
TODAY
WHY IMPORTANT?
EXPLANATIONS ARE HELPFUL!
TRANSLATION
WE
Crossing boundaries and connecting communities!
AUTISM
COMPUTATIONAL PSYCHIATRY
-30 Y
-20
-15
-10
-5
PRIVAT PRACTICE
POTENTIAL
CLINICAL~ (2016)
· unifies previous theories
· development of quantitative models → objective tests
matures through implicit learning
impaired development
expectations about sensory inputs
HIERARCHICAL MENTAL MODEL
Represents most likely causes behind observations
minimize surprise
constant
INFERENCE MACHINE
Maintain integrity
GOAL: HOMEOSTASIS
DYS-
MIND
BODY
BAYESIAN BRAIN THEORY OF AUTISM
SUBOPTIMAL FINE TUNING
overweighting sensory input vs. prior belief
(2012) Pellicano & Burr
· repetitive behavior
· withdrawal from unpredictable situations
COPING → STRESS!
SIGNAL/NOISE
PSYCHIATRIC UNIVERSITY HOSPITAL
CLINICAL SITUATION
Autism? → Child Psychiatry
RESEARCH
Social cognition
CASE REPORT
Criteria in adults?
THEORIES
· Theory of mind deficit
· Lack of social motivation/ Salience
· Weak central coherence
· ...
FIRST PATIENT
high social development
sensory irritability
unusual reasoning
depression/exhaustion
OPEN PROBLEMS
How to explain "exceptions" and convince others
DIAGNOSTIC SERVICE
· Detective search for diagnostic criteria.
· Objective measures for growing clinical intuition?
TNU


REPETITION
increase stability in the exterior (behaviorally)
REFLECTION
increase order in the interior (mentally)
TX
LIFE HISTORY
COPING STRATEGIES TO REDUCE SURPRISE
FOCUS ON DEVELOPMENT
DX
develop an individual mental model of another (autistic) mind
AUTISM AS A CONGENITAL INFORMATION INTEGRATION DISORDER
QUALITATIVE APPLICATION OF THE THEORY
PRIVAT PRACTICE
POTENTIAL
CLINICAL~ (2016)
· unifies previous theories
· development of quantitative models → objective tests
matures through implicit learning
impaired development
expectations about sensory inputs
HIERARCHICAL MENTAL MODEL
Represents most likely causes behind observations
minimize surprise
constant
INFERENCE MACHINE
Maintain integrity
GOAL: HOMEOSTASIS
DYS-
MIND
BODY
BAYESIAN BRAIN THEORY OF AUTISM
SUBOPTIMAL FINE TUNING
overweighting sensory input vs. prior belief
(2012) Pellicano & Burr
· repetitive behavior
· withdrawal from unpredictable situations
COPING → STRESS !
SIGNAL/NOISE
NEW CLINICAL PROBLEM ← COMPUTATIONAL PSY ?
"autism" as congenital disorder / acquired state
· highly individual mental model with little connections to others
Differential Dx: different source of surprise
· qualitatively ✓
· computational modeling ...
AUTISM SPECTRUM DISORDER (ASD)
ICD-11
(2022)
WHY IMPORTANT?
EXPLANATIONS ARE HELPFUL !
TRANSLATION !
WE
Crossing boundaries and connecting communities !
TODAY
10Y CPC
-30 Y
-20
-15
-10
-5
AUTISM
COMPUTATIONAL PSYCHIATRY
PSYCHIATRIC UNIVERSITY HOSPITAL
CLINICAL SITUATION
Autism ? → Child Psychiatry
RESEARCH
Social cognition
CASE REPORT
Criteria in adults ?
THEORIES
· Theory of mind deficit
· Lack of social motivation/ Salience
· Weak central coherence
· ...
FIRST PATIENT
high social development
sensory irritability
unusual reasoning
depression/exhaustion
OPEN PROBLEMS
How to explain "exceptions" and convince others
DIAGNOSTIC SERVICE
· Detective search for diagnostic criteria.
· Objective measures for growing clinical intuition ?
TNU

REPETITION
increase stability in the exterior (behaviorally)

REFLECTION
increase order in the interior (mentally)

TX

LIFE HISTORY ↖ ↗ COPING STRATEGIES TO REDUCE SURPRISE ↑ DX

FOCUS ON DEVELOPMENT

develop an individual mental model of another (autistic) mind

AUTISM AS A CONGENITAL INFORMATION INTEGRATION DISORDER

QUALITATIVE APPLICATION OF THE THEORY

PRIVAT PRACTICE

POTENTIAL

- unifies previous theories
- development of quantitative models → objective tests

CLINICAL~ (2016)

matures through implicit learning

HIERARCHICAL MENTAL MODEL

impaired development

expectations about sensory inputs

Represents most likely causes behind observations

~~minimize~~ surprise (constant)

INFERENCE MACHINE

Maintain integrity
~~GOAL~~ DYS-: HOMEOSTASIS
- MIND
- BODY

SUBOPTIMAL FINE TUNING: overweighting sensory input vs. prior belief

BAYESIAN BRAIN THEORY OF AUTISM

(2012) Pellicano & Burr

- repetitive behavior
- withdrawal from unpredictable situations

COPING → STRESS !

SIGNAL/NOISE

TNU

NEW CLINICAL PROBLEM ← COMPUTATIONAL PSY ?

"autism" as
- congenital disorder
- acquired state

↓
- highly individual mental model with little connections to others

Differential Dx: different source of surprise
- qualitatively ✓
- computational modeling ...

AUTISM SPECTRUM DISORDER (ASD)
ICD-11 (2022)

WHY IMPORTANT?
EXPLANATIONS ARE HELPFUL !

TRANSLATION !

TODAY

ICD-10 (1994)
- CHILDHOOD AUTISM
- ASPERGER SYNDROME

PERVASIVE DEVELOPMENTAL DISORDER
DEFICITS IN
- RECIPROCAL SOCIAL INTERACTIONS
- COMMUNICATION
- RESTRICTED REPETITIVE BEHAVIOR
- GENERAL DELAY IN COGNITIVE DEV.

AUTISM
COMPUTATIONAL PSYCHIATRY
-5 -10 -15 -20 -30 Y

PSYCHIATRIC UNIVERSITY HOSPITAL

CLINICAL SITUATION
Autism ? → Child Psychiatry

RESEARCH
Social cognition

CASE REPORT
Criteria in adults?

THEORIES
- Theory of mind deficit
- Lack of social motivation/ salience
- Weak central coherence
- ...

OPEN PROBLEMS
How to explain "exceptions" and convince others

FIRST PATIENT
high social development
sensory irritability
unusual reasoning
depression/exhaustion

DIAGNOSTIC SERVICE
- Detective search for diagnostic criteria.
- Objective measures for growing clinical intuition ?