

The Ethics of Cybernetic Enhancement: A Somatic-Embodied Perspective

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Aim of Presentation

- *Present framework for reflecting on ethics of Cybernetic Enhancement in relation to Cognitive Enhancement*
- Integrate Fundamental Neuroethics and Somatic-Embodied Perspectives
- **Fundamental Neuroethics:** Investigates how knowledge of the functional architecture of the brain and its evolution can increase our understanding of personal identity, consciousness and intentionality, including the development of moral thought and judgement (Evers, 2007)
- **Somatics:** Practices working with the body as perceived by the self, or the experience of body

Ethics of Cognitive Enhancement

- Elicits both attraction and repulsion
- *Supporters* – Enlightenment Rationality – Ability to have unlimited powers on our cognitive evolution – “Reasoned Argument” (Harris 2007, Savulescu)
- *Against* – Romantic Sensibility – Radical danger against our authentic humanness – “Moral Intuitions”; “Giftedness” (Sandel 2009)
- *Justified Ambivalence* – we typically will feel strong but conflicting attitudes towards new technologies (Parens 2005).

Banal Neuroethics

- “If we are to come to well-justified assessments of the values of particular uses of particular enhancements, we must take steps to avoid triggering ambivalence.” (Levy 2016)
- Sets the stage for mechanisms that reduce cognitive dissonance
- **E.g. Confabulation:** Subjects can be induced to confabulate reasons for judgements due to situational pressures
- The profound ambivalence to which Parens points is a reflexive response to the new and the unfamiliar. Once a technology comes to be widely used, in fact, both reflexively generated attitudes fade.
[Reflexive Rule]

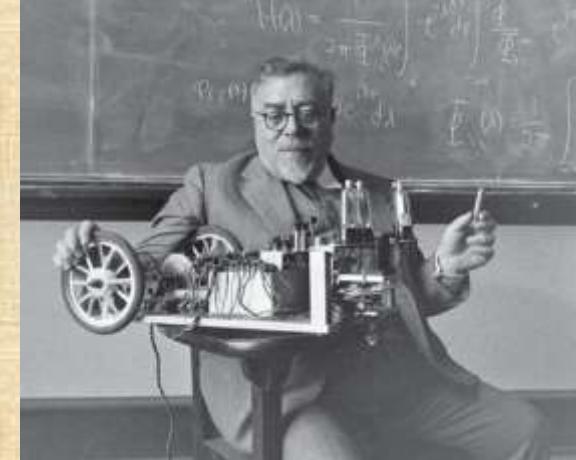
Critique

- Illusion of absolute rationality free from affective bias.
- Considers that laboratory experiments can sufficiently analyze the human condition.
- The ambivalence position emphasizes the dichotomy in our conceptual apparatus: Either we jump to non-embodied rationality, or else to transcendental notions of giftedness.
- Levy attempts to collapse this dichotomy into the single pole of enlightened rationality.
- Ignores the body as the zero point of orientation (Merleau Ponty)
- *Reflexive Rule is Wrong!*

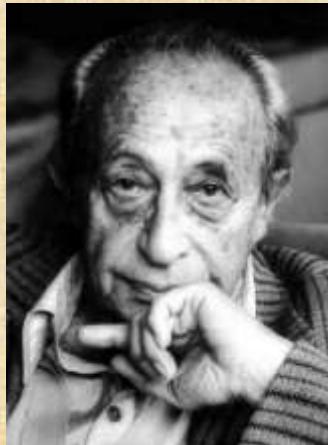
Example of naturalistic fallacy. Just because we are used to something, does not make it morally right!

Cybernetics

- Self-correcting systems –
 - e.g. Flyball governor for steam engine (James Watts)
 - **Feedback mechanism** – a part of the output energy is redirected to the controlling apparatus further back in the causal order of the system.
 - **Negative feedback** – counteracts the action of the machine
- **Norbert Weiner (1894-1964)** – The attempt to find the common elements in the functioning of automatic machines and the human nervous system.
- Yet, this schema reduces the biological to forms of information.



Hans Jonas: The Phenomenon of Life



Cybernetics and Purpose: A Critique

“The cybernetic model reduces animal nature to the two terms of sentience and motility, while in fact it is constituted by the triad of perception, motility, and emotion.” (1966)

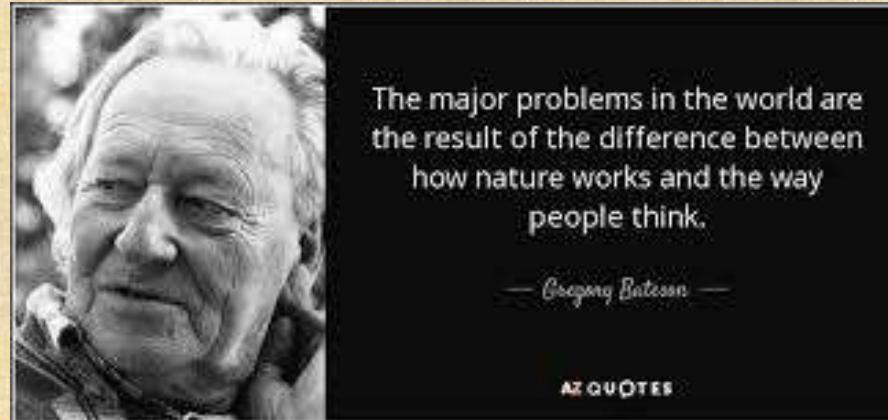
Brain-Machine Interface (BMI)

- BMI's allow manipulation of external devices and computers directly with brain activity without involvement of overt motor actions
- E.g. *BrainQ*: BMI based device that uses AI to translate large-scale data into treatment. It observes the characteristics of movement in the brain and applies those same characteristics directly to a patient's central nervous system (CNS)
- Apparent Cybernetics Paradox: BMI platform grants great technological control over the body, through bypassing cortical control of motoric action

Bio-Algorithms

- **For** – “What the future is also likely to hold is an expansion and improvement of our own internal algorithms... Our spheres of empathy are expanding. We are assigning more computing power to our frontal lobes and drowning out baser impulses from our reptilian modules.” (Hugh Howey, “How to Build Self-Conscious Artificial Intelligence, *Wired Magazine*, 2017)
- **Against** – “When the biotech revolution merges with the infotech revolution, it will produce Big Data algorithms that can monitor and understand my feelings much better than I can, and then authority will probably shift from humans to computers. My illusion of free will is likely to disintegrate...” (Yuval Harari, *21 Lessons for the 21st Century*, 2019)

Gregory Bateson (1904-1980)



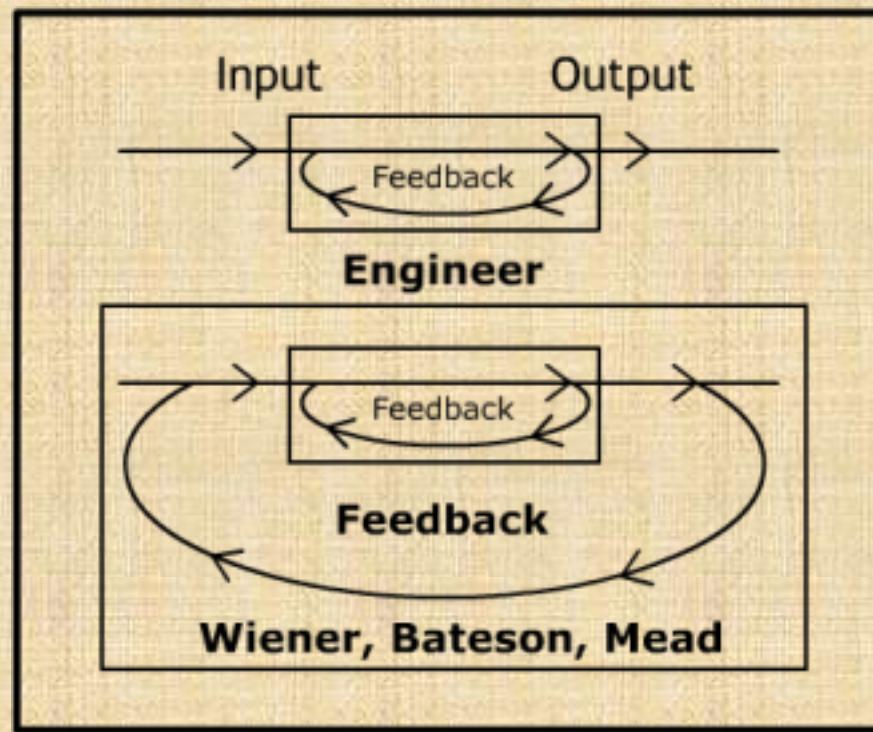
The major problems in the world are
the result of the difference between
how nature works and the way
people think.

— Gregory Bateson —

AZ QUOTES

- Anthropologist and Cyberneticist
- One of the members of the core group of the 10 Macy Conferences on Cybernetics (1946-1953)
- Extended systems theory and cybernetics to the social and behavioral sciences

Second-Order Cybernetics



Steps to an Ecology of Mind

- Bateson combines the insights of the experimental psychologists with those of the anthropologists
- Procedure:
 - Takes the contexts of experimental learning in the laboratory
 - Asks what sort of apperceptive habit we should expect to find associated with it
 - Then looks around the world for human cultures in which this habit has been developed.
 - Inversely, we may be able to get a more definite – more operational – definition of such habits as “free will” if we ask about each, “What sort of experimental learning context would we devise in order to inculcate this habit?” How would we rig the maze or problem-box so that the anthropomorphic rat shall obtain a repeated and reinforced impression of his own free will?” (Bateson 1972)

Bateson's Conception of Cybernetics

- Cybernetics is the science of constraints, rather than causal relationships.
- Defines Cybernetics as the “difference that makes a difference.”
- “This is a double-sided, double faced process in which the ordering of language and the flux of reality constrain each other.” (Fleckenstein 2005)
- Physical reality-blood, bone, and earth-can be separated from the constitution of difference only at the level of description. (Mary Catherine Bateson, in Fleckenstein 2005)

Individual Environment

- When we view the individual as a servosystem coupled with its environment ... the whole appearance of adaptation and purpose changes
- We believe that consciousness has feedback into the remainder of the mind and so an effect upon action
- If consciousness has feedback upon the remainder of mind, and if consciousness deals only with a skewed sample of events of the total mind, then there must exist a *systematic (i.e., nonrandom)* difference between the conscious views of self and the world, and the true nature of self and the world. Such a difference must distort the processes of adaptation

Framing the Bio-Ethics of Cybernetics

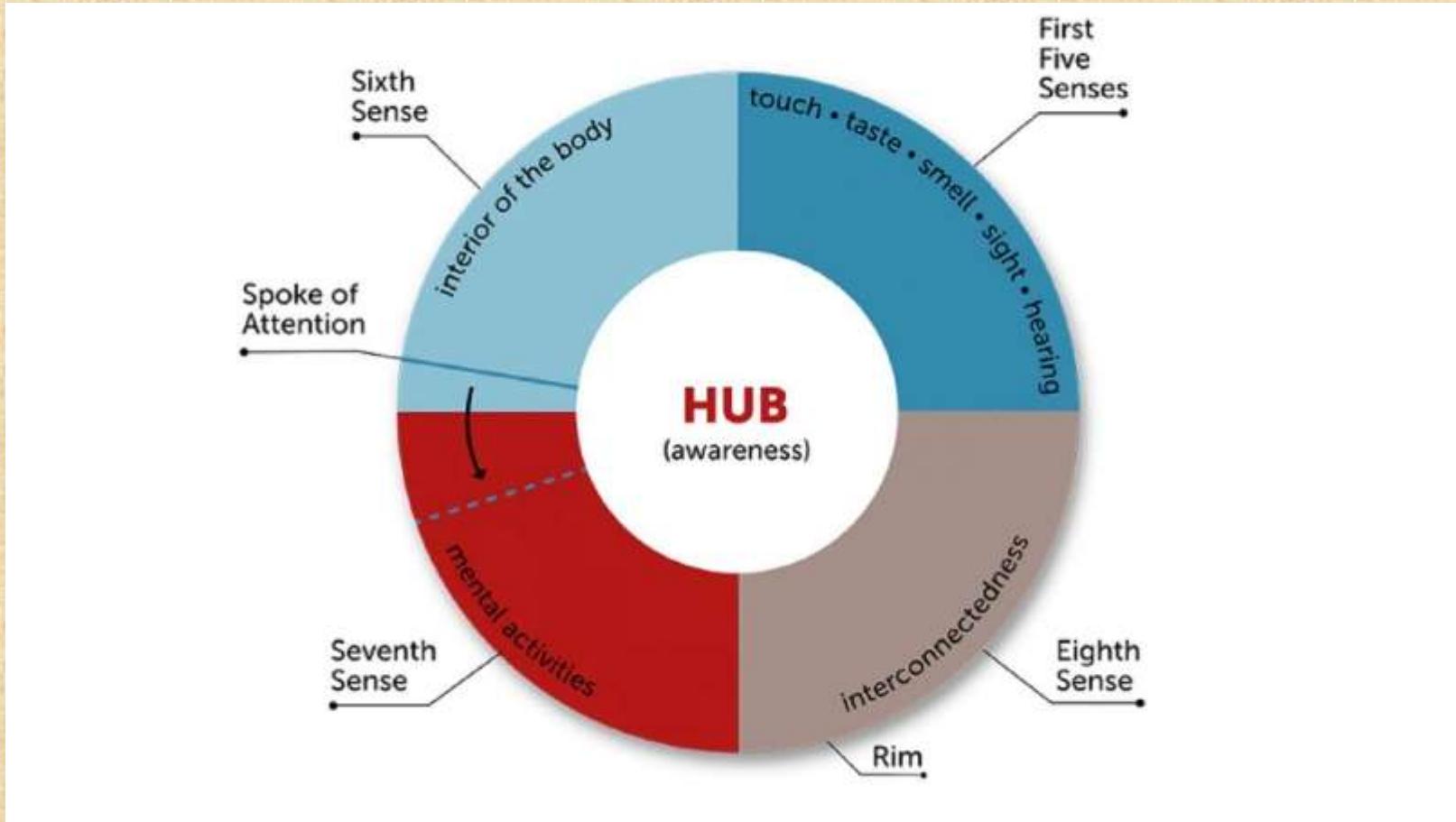
- How to use human-machine interface to maximize benefits (e.g., volition) and minimize harms (e.g., erosion of human values) while recognizing the material constraints on human cognition?

Informed Materialism

- Acknowledge both the embodiment of consciousness and the irreducible subjective perspective. (Evers 2007)
- The brain is an autonomously active, projective and variable system, in which emotions and values are incorporated as necessary constraints.
- Adequate understanding of our subjective experience must take into account self-reflective information, physiological observations and physical measurements (Dehaene et al, 2003; Changeux, 2004).
- An act of will can be ‘free’ in the sense of being ‘voluntary’, even if it is a brain construct that is causally determined or influenced by non-conscious neuronal processes.

Science of Meditation

Daniel Siegel's Wheel of Awareness



Functional Components of Intentional Action

- The **image of action** (encoded now somewhere in the planning part of the brain)
- The **decision to start the action proper**, with the activation of the executive parts of the self: the motor cortex, etc., and the outgoing (efferent) nervous impulses reaching the muscles
- Any **emotional state linked with the action**, whether anticipated or emerging while the action is carried out
- The corollary **discharge (efference copy)**, informing (presetting) the sensory centers about the feedback that is going to come with the realization of the action
- **Movement**, produced by the relevant muscles, while they obey the efferent impulses that have reached them
- The **sensory feedback** that informs the sensory centers, as well as the planning center, about the state of affairs while the action is going on, and eventually, the perception of the environment as invariant
- The **decision of the planning (monitoring) center** to compare this upcoming image with the original image of the action
- If needed, the planning center changes something in the efferent impulses, in order to diminish a possible deviation between the two images (**negative feedback**); that last component might relate to any object connected with the action, as well as the orientation of the self within the environment, while coming nearer, for example, to such an object or to a certain part of the environment, or avoiding it, as the case might be
- The **feed forward**, which is the beforehand information that leads to control of action, one kind being the above-mentioned image of action that precedes it, and the other kind being the information that stems from the immediate environment and/or from the self's bodily parts relevant to the activity
- The parts of **the environment** that are connected to the self by action (energy exchange) or by information-flow should also be considered as components of the image of intentional action (Rywerant 2008)

Efference Copy

- Neural processes result in the generation of a “motor command” to muscles
- A copy of the command (efferent copy; EC) is used to estimate an expected change in sensory signals and sent to a neural structure that computes the difference between EC and the change of the sensory feedback produced by the action (reafference; RA)
- This difference ($D\ RA$) produces a correction signal sent to the motorneurons and participates in perception (Latash 2015)

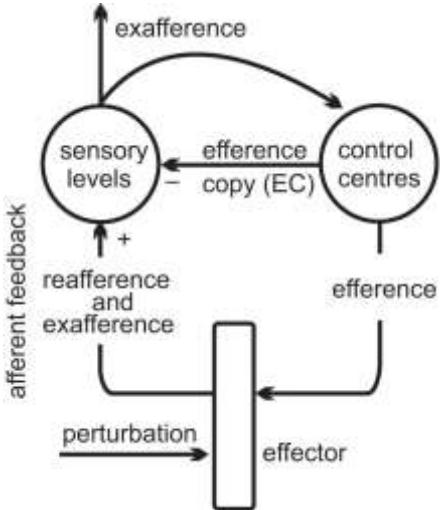


Fig. 1. Von Holst's reference principle for control of action and perception. It suggests that each self-initiated action results from preprogrammed motor commands (effence). The influence of afferent signals (reafference) on the central program is prevented by a copy of these commands (EC). If present, the residual afferent signal (exafference) is perceived as elicited by external forces (perturbation).

DOI: (10.1152/jn.00016.2016)

A.G. Feldman. (2016) Active Sensing without Efference Copy. Referent Control of Perception. *J. Neurophysiol.*, 116:960-976.

Sensory Inhibition

- The sensory outcome of the action might sometimes have an inhibiting character, as when it provides a sense of inability or inadequacy, an unusual effort, danger (real or imagined), or even pain.
- After some repetitions of that action, an anticipation of that kind will become part of the image that precedes the action, and, hence, be a hindrance to that action, sometimes stopping it altogether. (Rywerant 2008)

The Feldenkrais Method: Functional Integration



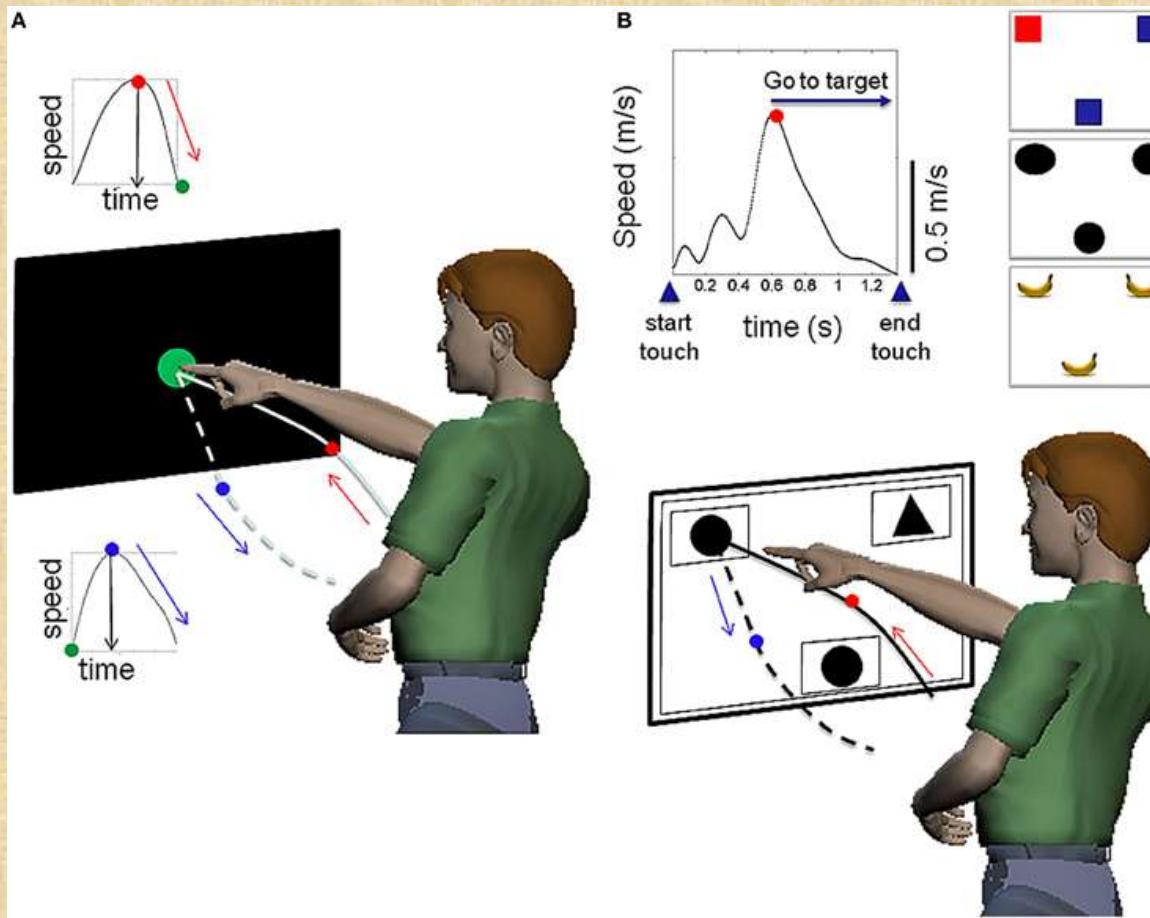
Relative Conjugative Movement

- Moving a proximal part of the body relative to a motionless distal part (movement B), instead of moving that distal part relative to the said proximal part, which is motionless (movement A)
- The two movements (A and B) use the same joint, but are part of different images of action, the latter (A) attempted habitually and possibly being connected with restricted anticipations, whereas the former (B) is done in a nonhabitual way and is devoid of such restrictions
- When the B movement is perceived by the teacher as having been allowed, and accepted (in other words, cortically controlled), the teacher can propose the original A movement (Rywerant 2008)

Concluding Thoughts

- Propose that in thinking of ethics of cybernetics, and cognitive enhancement more generally, need to take account of the somatic-embodied perspective
- Need to develop a methodology of conceptual reflection that incorporates lived experience
- Be able to move through different levels of relations
- To relate inner processes to external environment
- To be able to play with conceptual terms

PostScript: Autism

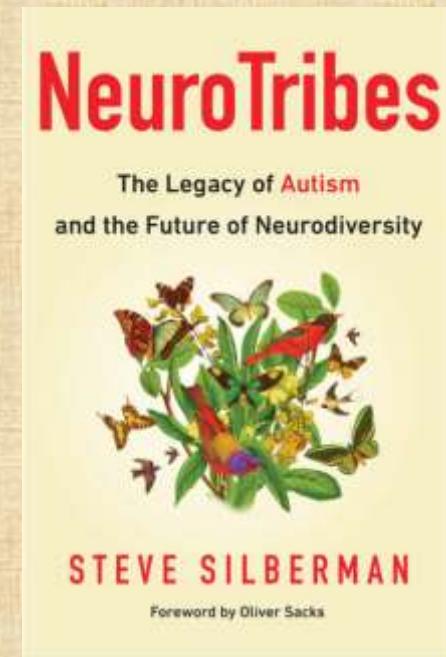


E.g. Rihyu, J, Torres, E. (2018) Characterization of Sensory Motor Behavior under Cognitive Load Using a New Statistical Paradigm for Studies of Embodied Cognition. *Frontiers in Human Neuroscience*.

Virtual Deafferentiation

- The persistently corrupted motor output that would re-enter the system as noisy and random sensory-motor input, thus providing faulty updating sensory feedback and likely obfuscating the development of a predictive code (Torres 2018)

Virtual Autism



- Virtual Autism – Consumption of virtual environment more than 4 hours/day in children between 0-3 years old can cause a syndrome similar with Autism Spectrum Disorder (ASD) (Zamfir 2018)

Historical Prevalence of Autism in the USA

In 1990 the NIH reported of
1:500 children



In 2003
1:160 children



In 2013
1:88 children



In 2018
1:47 children



“Different Biometrics for Clinical Trials that Measure Volitional Control”

“The combination of empirically determined parametric multilayered approach and closed loop methods has helped us in the lab optimize ways to help the system regain **volition** on its own, by augmenting and/or compensating the missing or corrupted feed-back information with other controllable means. The essence of the success of our approach has been the design of a new way to parameterize the output activities of the nervous systems and influence it (or altogether change it) in real time” (Torres 2018)

תודה רבה

Thank You

