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Does television cause autism? A theoretical account.

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Abstract
The incidence of autism spectrum disorders may have increased in the past few decades. If so, it is important to identify possible causes. Here we consider whether exposure to artificial displays such as television in the first year or two of life is a contributing factor for infants already at risk of autism. Correlational studies and anecdotal evidence from clinical practice are consistent with this hypothesis. Are there also theoretical reasons for concern?

Keywords
autism, perceptual learning, television

Comments
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The incidence of autism spectrum disorders may have increased in the past few decades. If so, it is important to identify possible causes. Here we consider whether exposure to artificial displays such as television in the first year or two of life is a contributing factor for infants already at risk of autism. Correlational studies and anecdotal evidence from clinical practice are consistent with this hypothesis, as Anna Baumgaertel will discuss in the next talk. Are there also theoretical reasons for concern?

During perception, visual and other sensory systems collect sense data. From these data they construct representations of the local environment. The "way things look" is a result of this automatic process. But how is this mapping from sense data onto perceptual representations established in an individual? Many questions remain unanswered, but we do know that the mapping depends both on innate predispositions (pre-programmed neural circuits and activity) and on experience (changes in circuits and learned patterns of neural activity). Some examples include that it takes many months for a person with congenital cataracts to make functional use of vision after the cataracts are removed, that infants whose eyes are not properly aligned fail to develop good stereoscopic depth perception, that poor vision in one eye leads to amblyopia (a neural processing deficit that persists even after vision is corrected), and that playing video games can improve a person's ability to attend to multiple locations or objects. Results from various labs, including my own, show that the visual system adjusts itself in myriad ways to improve perception after birth.

Thus, to the extent that the sense data from television are unique and different from other sense data provided by the world, it is probable that watching television changes perception. The question is whether such changes can contribute to autism. Television might have such an effect in any or all of several ways.

First, television differs from natural stimuli in its intensity: the rate and salience with which visual and auditory information are delivered are higher for TV. In particular, variation in television stimuli may be much more salient than variation in the facial expressions that signal different emotions. A perceptual learning system with limited capacity would be expected to learn salient differences at the expense of subtle ones. Thus perceptual learning mechanisms in at-risk individuals may be less able than the mechanisms in normals to discover perceptual interpretations for human stimuli, and the presence of television in the infant's environment could exaggerate this difference.

Second, television differs from human stimulation in that the sense data are not contingent in any important way on what the infant does. Television therefore affords no opportunities to practice using emotional states, nor to practice representing other people's emotional states, in situations where these states would normally mediate goal-directed behaviors aimed at people. If feedback is important for learning to perceive emotion, then television would frustrate learning to perceive

emotion, certainly during viewing and possibly also afterwards: television might actively teach at-risk infants not to construct internal representations of emotion, or teach them to associate emotions arbitrarily with stimuli. Learning to represent physical properties of the stimulus itself, such as image details and temporal sequences, probably does not require external feedback.

Third, it is possible that children's television in particular is bad for children. Programming for children is "successful" when it holds a child's attention. Part of what makes any visual stimulus fascinating may be the novelty of its visual statistics. Mobiles and trees blowing in the wind are "natural" stimuli that differ from the rest of the world and are highly engaging. Even adults—perhaps especially those who watch very little television—occasionally find themselves transfixed by these stimuli—or by television. Thus, it is plausible that unusual stimuli are fascinating *because* the visual system is engaged by learning how to represent them. In that case, a good way to make a stimulus engaging is to give it visual statistics that are just at the limit of what the infant is able to encode perceptually. The hypothesis here is that learning to perceive statistically unusual visual stimuli could occur at the expense of other perceptual learning, such as learning how to map visual cues (such as facial expressions) onto the corresponding emotional states that they typically represent.

It is significant that individuals with a family history of synesthesia or autism are more likely than normal to develop anomalous perceptual responses. Anecdotal reports indicate that these responses depend on the individual's early visual history. For example, the illusory colors seen by some graphemic synesthetes are the same as the colors of the lettered blocks or refrigerator magnets they saw as infants. In that case, the letter became a cue that mapped onto perceived color. It is not hard to imagine, by analogy, that learning is also essential to the proper and automatic construction of the mental representations that encode other peoples' emotional states in response to facial and auditory cues. If the meanings of these cues must be learned, then individuals at the autistic end of the spectrum may differ from their more normal counterparts by virtue of having learned different mappings during development.

We propose therefore that television is primarily a risk factor not because it displaces time spent interacting with other humans during infancy, but because the presence of compelling dynamic stimuli causes elaboration of the mental states available for rep-resenting the physical properties of objects, at the expense of representing the emotional states of people. Eliminating early television could not prevent all cases of autism, and the presence of television does not cause all children to become autistic, but some fraction of at-risk children may develop autistic tendencies as a consequence of viewing television. Together with epidemiological and anecdotal evidence, these theoretical considerations imply a need for controlled clinical studies in which the intervention for the treatment group is deprivation of television in the first 24 months of life.

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