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Psychopathology as a Result of Selection by Consequences Exemplified by Autism Spectrum Disorders (ASD)

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B. F. Skinner is one of the most important 20th century psychologists, and the 1981 paper *Selection by Consequences* is among his most important contributions. In this paper, Skinner integrates evolutionary biology with psychology, sociology and anthropology. More specifically, Skinner shows how selection by consequences operates on the shaping and maintenance of the behavior of the individual (i.e., psychology) as well as on the evolution of cultures (sociology and anthropology). Selection by consequences on the individual and cultural levels makes the foundation for *behavior analysis*, which is a broad interdisciplinary natural science.

In this paper, I will focus on selection of the behavior of the individual. Specifically, I will focus on how consequences may select abnormal behavior, as exemplified by a hypothesis of how the behaviors defining Autism Spectrum Disorders (ASD) may be shaped and maintained through selection by consequences. Skinner asserted that selection has been neglected and that causal force has been assigned to structures instead. He exemplified this using cognitive psychology, Freudian psychology, Gestalt psychology and anthropology, but he did not address specifically how abnormal behavior may be understood based on the principle of selection by consequences.

In the case of ASD, Lovaas and Smith (1989) touched on selection when they suggested that the environment selects autistic behaviors because children with ASD are different along some biological variables when compared to children exhibiting typical behaviors. Long before that, Ferster (1961) suggested that children with ASD failed to acquire social stimuli such as praise and attention as conditioned reinforcers. If there is a variation in which type of stimuli functions as reinforcers for the behavior of an infant, this variation may change the course of development through the process of selection by consequences.

Over the past decade, there has been a great deal of research on infants at risk of developing ASD. The aim of this research is to identify biological and/or behavioral markers that reliably predicts later onset of ASD, and this research is highly relevant for the issue of selection by consequences. Using eye tracking technology, Jones and Klin (2013) assessed eye fixation in infants later diagnosed with ASD and compared the results to that of typically developing infants. The participants viewed scenes of a caregiver's interaction with another infant (e.g., the participant watched an adult playing peek-a-boo with another infant). Results showed that, on average, the infants who later were diagnosed with ASD exhibited a change in

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eye fixation over time: Between two-to-six-months of age, the infants begun fixating less on the eye regions of the adult and more on other regions such as the mouth, body, and objects in the environment, when compared to the typically developing infants.

From two-to-six months of age and onwards, variation change in preferred stimuli occurred and this predicted, on a group level, which children would later receive a diagnosis of ASD. This finding can be better understood when considering another landmark eye-tracking study by Pierce, Conant, Hazin, Stoner, and Desmond (2011). The researchers noted that since children with autism often engage in repetitive behaviors and prefer to visually examine geometric repetition (such as the moving blade of a fan or the spinning of a front-fed laundry machine), this preference for fixating on non-social images may somehow be related to ASD. Toddlers between 14 and 42 months-of-age were presented with a brief movie depicting moving geometric patterns on one side of a video monitor, and children dancing or doing yoga on the other. Results showed that 40 % of the participants with autism preferred looking at geometric patterns rather than the social stimuli, compared to only 2 % of typically developing peers. If a toddler spent more than 69% of his or her time fixating on geometric patterns, then the positive predictive value for accurately classifying that toddler as having an ASD was 100%. This suggests that many toddlers who later receive a diagnosis of ASD, *non-social stimuli are preferred stimuli as compared to social* stimuli.

In another recent eye-tracking study, Klin, Shultz, and Jones (2015) presented two-year-olds with ASD, typically developing, and non-autistic but developmentally delayed controls with a series of point-light animations representing adults playing children's games, such as "peek-a-boo" or "pat-a-cake." The animations included simultaneous audio recording. The participants with ASD showed on average no preferential fixation for these animations; instead, their levels of looking at the animations were equivalent to what is expected by chance. Participants in both control groups, in contrast, tended to fixate on the animations showing adults playing children games.

Interestingly, the animation "pat-a-cake" included a sound in addition to the human voice (all other animations contained human voices only). This was the sound of clapping, which was heard at the same time that the animation's hands clapped. This clapping and the resulting clapping sound created a causal physical contingency: rather than merely co-occurring (as with speech sounds and movements in the other animations), the movements of the hands "caused" the noise to occur. In contrast to the chance levels of preferential looking exhibited with all of the other animations, the toddlers with ASD displayed a strong and significant preference for the "pat-a-cake" animation. These results suggested that the toddlers with ASD had failed to preferentially orient toward animations of social action but were acutely sensitive to the presence of physical contingencies in the same stimuli (Klin, Shultz, & Jones, 2015).

A Nonsocial Reinforcement Hypothesis of Autism Spectrum Disorders

In the studies just described, non-social stimuli selected looking from the participants with ASD, whereas the social images selected looking for the typically developing toddlers and the toddlers with developmental delays. These studies differ from previous studies in that they do not only show that participants with autism show less preference for social stimuli (as suggested by Ferster and others), but they also demonstrate that participants with ASD show an increased preference for *non*social stimuli. This occurs most likely because the different types of stimuli have different reinforcement valence for the behavior of infants with a subsequent ASD

diagnosis, as compared to typically developing infants and infants with developmental delays. Note that others (most notably Lovaas, Newson & Hickman, 1987) have used the term sensory/perceptual reinforcers to denote the type of stimuli that we refer to as nonsocial reinforcers.

The Nonsocial Reinforcement Hypothesis of ASD asserts that infants later develop ASD because they have an affinity for nonsocial reinforcers, in contrast to typically developing children who have an affinity for social reinforcers. Nonsocial stimuli will select looking at, for example, geometrical patterns in the environment, moving objects, and listening to nonverbal sounds and sounds that are synchronized with movements, rather than attending to the eyes and voice of caregivers. As the infants acquire more advanced motor skills, nonsocial reinforcers will not only select looking, they will also select a more advanced repertoire of repetitive and stereotyped behaviors such as hand flapping, object twirling, lining of objects, ear cupping, rocking, spinning of body, pacing, toe walking, repeatedly switching lights on and off, etc., all of which are defining characteristics of ASD. Hence, the increased operant control of fingers, hands, arms and feet makes additional contingencies possible and these contingencies may lead to stereotyped and repetitive behaviors (e.g., toe walking and spinning of body is possible after learning to walk).

If nonsocial stimuli are more rereinforcing than social stimuli, the environment will select stereotyped and repetitive behaviors over social behavior. Verbal operants such as tacts and intraverbals are shaped and maintained by social reinforcement, and are often missing or delayed in children with ASD. Echoic behavior, which is more often seen in children with autism, do not require the same type of social reinforcement since copying a stimulus may be reinforcing in itself. In this way, the environment selects "autistic" behaviors through the process of operant conditioning, the second kind of selection by consequences described by Skinner (1981). The difference in reinforcement valence (social versus nonsocial) is also a result of selection, on a biological level, involving genetic, epigenetic and other biological factors (Kim & Leventhal, 2015; Reiss & Havercamp, 1996; Skinner, 1953). This is an example of what Skinner described as selection at the first level.

For typically developing infants, in contrast, the highly preferred social stimuli will select fixation to the eye regions of adults and attentive listening to human voices. The preferred social stimuli will subsequently shape additional social skills such as social smiling, imitation and babbling, which in turn are behavioral cusps that bring the infant into additional social contingencies that increase the complexity of the social interaction between the infant and the caregivers. This in turn provides the infant with additional social consequences. This type of early social dyad between the parent and the infant is highly reinforcing also for the caregivers,. These social contingencies will select increasingly advanced types of social skills; such as joint attention and more advanced social communication behaviors that, in turn, produce a wider range of social reinforcers. The change in child behavior leading to a change in parent behavior in turn leading to change in child behavior and so on, is often referred to as transactional model of development (Novak & Pelaez, 2004). The behavior of the infant changes, and so do the behavior of the parent and this transaction conditions previously neutral social stimuli such as body language and various facial expressions as reinforcers.

In children with a slightly different nervous system (such as children with ASD) the affinity for non-social stimuli at the expense of the affinity for social stimuli may result in a subsequent negative spiral in acquiring social interests, language skills, and social behaviors. Slight differences early in life in affinity for non-social stimuli can also have negative effects on the establishment

previously neutral stimuli as conditioned reinforcers, which in turn will hamper the development of language, social skills and social interests.

In this paper, I have attempted to show that Skinner's selection by consequences can be useful for understanding how some psychopathologies occur. A psychiatric condition can occur because of a variation in reinforcer affinity, with the result that the "same ecological environment" that most often selects adaptive behaviors selects maladaptive behaviors instead. In the case of ASD, this variation in reinforcers is to some extent genetic, and almost certainly biological in origin (Kim & Leventhal, 2015). Overeating leading to obesity might be an example of the mechanism from genes, through reinforcers, to a disorder through selection by consequences (Epstein et al., 2007). ADHD is an example of another disorder that can be understood based on the principles underlying selection by consequences (Sagvolden, Johansen, Aase, & Russell, 2005).

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