Board gaming on the spectrum
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Autism Spectrum Condition (ASC) is a neurodevelopmental condition that affects approximately 2% of the population (Kogan et al., 2018). It is a heterogeneous condition, meaning that autistic people can present with any number of different symptoms in combination with one another. People with autism possess social and communicative differences and restricted interests and repetitive behaviours (American Psychiatric Association, 2013). Additionally, many autistic people have conditions in addition to autism, such as anxiety or ADHD, and an estimated 50% of the autistic population has a co-occurring intellectual disability, meaning they have an IQ below 70 (Matson & Shoemaker, 2009).

Many interventions that target improvements in social communication, as well as other cognitive, learning and physical issues, have been developed to help autistic people. Numerous interventions focus on a training approach which involves teaching autistic people how to adopt neurotypical behaviours. Traditionally, assessments of these behaviours and skills involve determining how autistic individuals perform before and after the treatment in comparison to neurotypicals. Such interventions are often criticised by the autism community as they may increase stigma and inhibit authenticity (Bottema-Beutel et al., 2018). Gamification offers an alternative approach to both foster and assesses desired behaviours and cognitions in a more naturalistic and emergent setting. Through this review, the use of games in intervention and assessment in relation to ASC will be explored.

Autism & Play
Autism was first formally identified by Kanner (1943) and Asperger (1944) in the mid 20th century through a series of case studies, which described children who showed little interest in social interactions, but high interest in restricted topics. Notably, the children showed atypical interactions during periods of play. For example, rather than build with blocks, a child would use a repetitive motion to move the blocks systematically. When a parent would try and move the block, the child would brush their hand away as if the hand was an object rather than belonging to a social agent (Kanner, 1943).

The above example is notable in that the development of early play behaviors are considered pivotal for several reasons. As discussed at length by seminal child psychologist Piaget (1955), play behaviours allow for a child to engage with emerging cognitive skills. Pretend play, for instance, will enable children to learn concepts such as false belief, and more structured turn-taking board games teach reciprocity and strategy. Crucially, when one is playing with another in a competitive or cooperative game, the experience allows them to practice and develop a range of skills including communication, perspective-taking, emotional regulation, emotional recognition and sportsmanship. Also, they are engaging in shared attention and joint action with other social agents, as all players are focused on the same activity and must mutually contribute to the completion of the game.

In this way, while a game is ostensibly an enjoyable, entertaining leisure activity, any game, no matter how 'serious,' is simultaneously teaching players how to behave in a group context. Due to in-built rewards systems that track advancement, games may be motivating over and above other types of educational interventions (Filsecker & Hickey, 2014). For this reason, it is unsurprising that researchers hoping to improve the lives of autistic people have turned to games when designing interventions.

Autistic people have been observed to have differences with regards to experiencing social stimulation (Chevallier et al., 2012). While typically developed children may automatically imitate the

behaviors of a teacher or peer, autistic children do not as readily imitate other social actors (Gowen, 2012). They may also be less interested in joining in with a shared activity or remaining focused on a joint social goal (Wong & Kasari, 2012). For this reason, the built-in reward system involved in games may provide positive reinforcement that motivates an autistic person to continue playing a game, allowing them to either complete an intervention or remain socially engaged with other players.

Furthermore, games are in and of themselves teaching cognitive as well as social skills. A multi-player game, for instance, teaches joint attention, turn-taking, strategy and appropriate social behaviours in response to other players (Rogerson et al., 2018). Autistic people struggle with these skills and are often late to develop them. Thus, using games, which encourage the development of these skills and behaviours in a naturalistic way, could offer a highly effective way to enable autistic people to practice these concepts.

Learning and playing games are a cornerstone in child development, allowing children to form independent relationships with one another (Piaget, 1997). Autistic children often have difficulty forming peer relationships and can be excluded from social settings (Chamberlain et al., 2007). Developing gameplay skills may serve as an essential tool for autistic children to build social capital they can use to engage peers. Creating opportunities for autistic and neurotypical children to connect in naturally motivating activities like shared enjoyment of a game could be an advantageous way for peers to model socially desirable behaviours for autistic children, and for autistic and neurotypical children to form reciprocal relationships based on shared interests.

Games are particularly well-suited for customization and need not be overly reliant on outside support. Once children learn the rules to a game, they can interact with one another independently through the game without adult oversight (Lancy & Grove, 2017). This may be particularly helpful for autistic children who have been shown to be overly reliant on adult assistance, which may interfere with their ability to interact with peers (Milley & Machalicek, 2012). Additionally, games build upon fundamental mechanics (i.e. turn-taking, point collection, random dice throws, card matching, bluffing) that can then be modified to fit a specific theme (i.e. fantasy, space, trains, action-adventure). As most autistic people have restricted interests within a particular domain, they may be particularly interested in games that fit a specific theme. The customization of games also makes it possible to design interventions that mainly target specific skills while still providing an enjoyable experience that feels like fun rather than work. As will be discussed, several interventions using games as interventions with autistic children expressly incorporate restricted interests to engage autistic players and include neurotypical children in the autistic child's world.

Theory of Mind

Theory of mind (ToM) is a socio-cognitive skill that develops at the age of four in neurotypical children (Wellman & Liu, 2004). First coined by Premack and Woodruff (1978), it refers to the ability to understand what another person is thinking. ToM has several components, as it is an umbrella term for the broad process of perspective-taking. People also develop more complex ToM abilities as they age. As outlined in Wellman and Liu (2004), children first begin to understand that there are other minds and that these other minds may have thoughts or beliefs different from their mind, as they reach the age of four. This understanding marks the end of a period of 'egocentrism,' a term coined by Piaget and Cook (1954), which describes how children are unable to comprehend that what they believe or understand is not necessarily shared by others. By the age of four children have learned many of the words used to describe mental states, and can conceptualize propositions such as 'he

believes that the sky is green' or 'she **thinks** that the box contains a puppy' which allows them to understand that people can think or believe things that are not necessarily true.

Understanding false beliefs is the first stage of ToM development, and involves understanding lower-order or first-order ToM. First-order ToM allows one to represent other people's thoughts, allowing them to understand that someone may think something that may or may not be correct. As children age, they begin to understand higher-order or second-order ToM constructs. These are more complex than first-order ToM in that they involve an additional layer of thinking about 'thinking' (Mancuso et al., 2011). For instance, a double-bluff or a white-lie is a second-order ToM construct (White et al., 2009). To double-bluff someone, a person must a) consider another person's thought processes about their own thought processes (i.e. 'he thinks that I think') and then b) use that information to influence a person's actions (i.e. I will tell the truth because he thinks I will tell a lie). A person may double bluff when, for instance, they are confronted with telling a lie, and are asked to tell the truth. In double-bluffing, they may tell the truth knowing that the confronter will assume that they will lie, and consequently will not follow that lead.

These skills are heavily studied in autism research, as historically research has shown that autistic people struggle to develop ToM skills independent of other cognitive abilities. For instance, Baron-Cohen et al. (1985) tested autistic children, children with Down's Syndrome, and typically developed (TD) children on ToM ability. They found that, though they were matched on IQ, autistic children performed significantly worse than neurotypical children on ToM, and worse than children with Down's Syndrome despite their higher IQ. This sparked the ToM theory of autism, which suggests that the socio-communicative differences observed in the population are explained by developmental differences in ToM acquisition (Brunsdon & Happé, 2014). While ToM differences are among the most heavily researched cognitive skills in autism, and many interventions have been developed to support its development, few have successfully shown efficacy. Marraffa and Araba (2016) found that while many ToM interventions show gains within the program, soon after program completion participants fail to generalize to learned skills to novel settings, and do not continue to show improvements at further time points. These limitations underscore the need for ToM interventions that can improve skills beyond the 'lab' and improve functioning in real life settings.

As discussed above, games may be a promising avenue to develop interventions for autistic people, as they have built-in reward mechanisms. Furthermore, most games rely on ToM within their mechanics. Bluffing is, for instance, a ToM mechanism that is involved in many social deduction board games, including Werewolf and Coup. Players must understand what another player thinks, and use this knowledge to influence the player's actions. Games like Dixit and Codenames rely on more straightforward ToM mechanics. A player must consider what they know about a person and use this knowledge to understand what words or phrases would cause a player to choose a specific card. Even cooperative and competitive games involve strategizing about what a player will do next, or how to work well with other players to achieve the same goals. These types of ToM skills are more diffuse but are still at their core tapping into perspective-taking. Of course, while board games are themselves indicative of ToM, there is also the possibility of teaching ToM explicitly by adapting boardgames. In the next sections, we will discuss some of the use of board games in interventions.

Skill Building Within Games: Social Communicative

The social aspects of autism are among the most widely researched, and some of the most commonly targeted in interventions. This is also the case with regards to gaming interventions, though the approaches to using games improve social skills are varied.

Several interventions, particularly with younger children, use behavioral approaches embedded within gameplay to increase social responsiveness and improve social behaviors. For instance, Daubert et al. (2015) used Power Cards, small cards printed on one side with an autistic child's favourite character and on the other side with how that character would optimally behave, to teach sportsmanship to two autistic children during gameplay with peers. The three specific behaviors of focus were initiating a turn, relinquishing a turn and appropriate commenting. For instance, a child who had an interest in the Ninja Turtles, had Power Cards written from the perspective of one of the turtles behaving appropriately during the game (i.e. Donatello tells his friends 'You did it!' and 'You won!'). Participants reviewed these cards at the beginning of the gameplay session, and when needed, were prompted to view the cards when they forgot to use the appropriate behavior. Results showed that the participants significantly improved in their ability to initiate and relinquish a turn following the intervention.

Jung and Sainato (2015) also used modelling in their intervention with slightly younger children. Borrowing from the Power Card method, they used children's special interest characters (i.e. a princess) by including them in video recordings of adults modelling appropriate gameplay behaviors, which the children watched before playing board games like Candyland. The facilitator prompted them to use the appropriate behaviors throughout (i.e. 'play the game with your friend'), and when the children engaged in appropriate behaviors during the game they were rewarded with tokens. This study found that the use of behavioural reinforcement and modelling led to increases in appropriate behavior, increased engagement with peers, children were able to generalize the learned skills to a novel game.

Rather than explicitly teach socio-communicative skills, some games embedded them within the mechanics of the game. Dell'Angela et al. (2020) modified three existing board games already popular with children in an effort to target certain emotional competence skills. For instance, the researchers changed the game CodeNames so that rather than pick any word as a clue to help their team guess the right cards, players instead had to pick an emotion word as their clue. Results showed that children who played the emotion versions of the games rated them as highly as those who played the off-the-shelf versions, suggesting that the adapted games retained the gaming elements already popular with children. They also found that children with higher emotional competencies were more successful at the new games, indicating that the new games are indeed tapping into social domains.

While most of the games reviewed were mainly geared towards children, there are several games that have been shown to be beneficial to adolescents and adults for socio-communication skill development. In an ethnographic study, Fein (2015) spent time at a summer camp for autsitic adolescents where they spend time engaging in Live Action Role Playing and play tabletop role-playing games like Dungeons and Dragons. Fein (2015) found that the games were particularly engaging for campers as it allowed for structured social interactions between players that were specific to the game, and promoted a narrative of inclusion and acceptance within the stories of the games. Katō (2019) tested the effect of tabletop role-playing games on improvements in social speech and changes in quality of life in adolescents with autism following either four or fourteen sessions of tabletop role-playing games. For the four participants who played fourteen sessions, socio-communicative skills improved following the intervention. For the fifty-one children who played four sessions, total scores on a quality of life measure significantly increased.

Autistic individuals often experience challenges in other areas of life outside of socio-communicative domains including academic and physical difficulties. Several studies target improvements in these specific domains through the use of games. Satsangi and Bofferding (2017)

designed a simple board game to improve numerical knowledge of autistic children by teaching them to roll dice and move tokens along a coloured number line. Results showed that across the ten participants the ability to make numerical estimates significantly improved amongst those for whom the game centred on the numbers not the colours.

Application: From Research To practice

While many studies offer promising results with regards to improving the lives of autistic children, adolescents and adults, it is clear from this review that more needs to be done. Specifically, more research should be undertaken to determine how effective these gamified interventions are in naturalistic settings, how they affect skill development over time, and how easily they can be implemented by educators, professionals and families.

Specifically, there appears to be a disconnect between game designers and the researchers who test pre-existing games. Designers who create complex games benefit from their ability to provide in-depth descriptions of the game development process and the technological innovations that may improve the novelty of the game. Very few, however, have tested the effects of the game formally and in-depth on special populations. More work needs to be done with regards to testing the behavioural outcomes of those who participate in gaming interventions. Specifically, it is important to understand how certain gaming mechanisms (i.e. role-playing, bluffing, cooperation) tap particular cognitive skills, and whether this leads to cognitive gains in players. It is also important to understand the individual differences in game play, specifically player preferences when it comes to specific game mechanics, to understand why players may be motivated to engage in certain types of game play over others.

On the other side, there are many interventions in which autism researchers have adapted existing games (Wii, Candy Land, Bingo) to study the effects of behavioral modification programs. These studies tend to rely on small samples and use single-case designs. Unlike the papers written about the development of complex programs, these programs are relatively simple in their development and instead have quite involved testing procedures (i.e. video coding of behaviors and complex behavioral reinforcement schedules). While game development and modification may be more straightforward, these studies, in contrast, involve lengthy implementation and testing. The time required to manually code behaviors and individualize existing games for each participant places a heavier burden on professionals wishing to implement these interventions to larger groups.

In order to move from research to practice it is necessary that these two groups of researchers, i.e. those who specialize in game design and those specialize in behavioral testing, collaborate. To invest in a particular gaming intervention these prototypes should be more thoroughly tested. Likewise, in order to understand the effects of the behavioral interventions larger sample sizes and a way to more efficiently customize the program and track progress, is necessary.

Some of the more achievable gaming interventions discussed thus far maybe those that build upon existing games and existing interests and those that encourage collaboration between multiple players. Though it requires further formal testing, the studies focused on role-playing games used pre-existing games and self-reported interests in autistic adolescents to promote social interaction and provide opportunities to build friendships (Fein, 2015; Katō, 2019). These may be particularly attractive to professionals as they build on existing interests are low cost and encourage social interaction with peers.

Likewise, several researchers used simple well-known boardgames and modified them to reflect a child's restricted interests (Baker, 2000; Jung & Sainato, 2015), or combined them with video modelling (Ferguson et al., 2013), or modified them to teach a specific social skill (Dell'Angela et al.,

2020). This approach may also be attractive to professionals as these games are easily accessible (i.e. off-the-shelf board games) and with only minor modification the aspects of game play that are already engaging and enjoyable are preserved.

References

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders (dsm-5®)*, American Psychiatric Pub.

Asperger, H. (1944). Die „autistischen psychopathen" im kindesalter. *Archiv für psychiatrie und nervenkrankheiten, 117*(1), 76-136.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition, 21*(1), 37-46.

Bottema-Beutel, K., Park, H., & Kim, S. Y. (2018). Commentary on social skills training curricula for individuals with asd: Social interaction, authenticity, and stigma. *Journal of autism and developmental disorders, 48*(3), 953-964.

Brunsdon, V. E., & Happé, F. (2014). Exploring the 'fractionation'of autism at the cognitive level. *Autism, 18*(1), 17-30.

Chamberlain, B., Kasari, C., & Rotheram-Fuller, E. (2007). Involvement or isolation? The social networks of children with autism in regular classrooms. *Journal of autism and developmental disorders, 37*(2), 230-242.

Chevallier, C., Kohls, G., Troiani, V., Brodkin, E. S., & Schultz, R. T. (2012). The social motivation theory of autism. *Trends in Cognitive Sciences, 16*(4), 231-239.

Filsecker, M., & Hickey, D. T. (2014). A multilevel analysis of the effects of external rewards on elementary students' motivation, engagement and learning in an educational game. *Computers & Education, 75*, 136-148.

Gowen, E. (2012). Imitation in autism: Why action kinematics matter. Frontiers in Integrative *Neuroscience, 6,* 117.

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous child, 2*(3), 217-250.

Kenny, L., Hattersley, C., Molins, B., Buckley, C., Povey, C., & Pellicano, E. (2016). Which terms should be used to describe autism? Perspectives from the uk autism community. *Autism, 20*(4), 442-462.

Kogan, M. D., Vladutiu, C. J., Schieve, L. A., Ghandour, R. M., Blumberg, S. J., Zablotsky, B., Perrin, J. M., Shattuck, P., Kuhlthau, K. A., & Harwood, R. L. (2018). The prevalence of parent-reported autism spectrum disorder among us children. *Pediatrics, 142*(6), e20174161.

Lancy, D. F., & Grove, M. A. (2017). Marbles and machiavelli: The role of game play in children's social development. *American Journal of Play, 3*(4).

Mancuso, F., Horan, W. P., Kern, R. S., & Green, M. F. (2011). Social cognition in psychosis: Multidimensional structure, clinical correlates, and relationship with functional outcome. *Schizophrenia Research, 125*(2), 143-151.

Marraffa, C., & Araba, B. (2016). Social communication in autism spectrum disorder not improved by theory of mind interventions. *Journal of Paediatrics and Child Health, 52*(4), 461-463.

Matson, J. L., & Shoemaker, M. (2009). Intellectual disability and its relationship to autism spectrum disorders. *Research in Developmental Disabilities, 30*(6), 1107-1114.

Milley, A., & Machalicek, W. (2012). Decreasing students' reliance on adults: A strategic guide for teachers of students with autism spectrum disorders. *Intervention in school and clinic, 48*(2), 67-75.

Piaget, J. (1955). *The construction of reality in the child*, Routledge.

Piaget, J. (1997). *The moral judgement of the child*, Simon and Schuster.

Piaget, J., & Cook, M. (1954). The construction of reality in the child, *Basic Books.*

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences, 1*(04), 515-526.

Rogerson, M. J., Gibbs, M. R., & Smith, W. (2018). Cooperating to compete: The mutuality of cooperation and competition in boardgame play. *Proceedings of the 2018 CHI conference on human factors in computing systems.*

Wellman, H. M., & Liu, D. (2004). Scaling of theory-of-mind tasks. *Child Development, 75*(2), 523-541.

White, S., Happé, F., Hill, E., & Frith, U. (2009). Revisiting the strange stories: Revealing mentalizing impairments in autism. *Child Development, 80*(4), 1097-1117.

Wong, C., & Kasari, C. (2012). Play and joint attention of children with autism in the preschool special education