Title: Delay of Gratification in 6- to 8-year-olds with Williams Syndrome: Relations with Emotion Regulation and IQ

Authors: C. Holley Pitts[1], Gopika Gopan[1], & Carolyn Mervis[1]

Introduction: Individuals with Williams syndrome (WS) often evidence deficits in executive functioning, including difficulties with inhibitory control (Carney, Brown, & Henry, 2013) and emotion regulation (Phillips, 2008). In typically-developing children, delay of gratification, or the ability to wait for a reward when faced with a temptation, is facilitated by emotional aspects of executive functioning (Holodynski et al., 2013). Shifting and emotional control have been shown to be independently associated with practical problem-solving in novel situations for children and young adults with WS (Camp et al., 2016). In this study, we directly measured inhibition using a gift delay of gratification task in 6 – 8-year-olds with WS. The goals were (1) to examine the concurrent effects of intellectual abilities and parent ratings of behavior and emotion regulation on children's ability to delay gratification and (2) to further explore the relation of emotion regulation by evaluating the concurrent effects of shifting, emotional control, and intellectual abilities on delay of gratification.

Method: Participants were 33 children (17 girls) aged 6.01 – 8.05 years (*M* = 6.87 years, *SD* = 0.69) with genetically-confirmed, classic-length WS deletions. Children completed a gift-delay task (adapted from Kochanska et al., 1996) in which they were told the examiner had a present for them. Participants were seated across the room and were faced away from where the gift was to be wrapped. After the child was instructed to sit, wait, and not peek so the gift could be a "big surprise," the examiner noisily wrapped the present for 60s. An overall pass (never looked)/fail (looked or peeked) score and the total duration a child looked/peeked while the gift was being wrapped was coded. Intellectual ability was assessed using the Differential Ability Scales-II (DAS-II; Elliott, 2007) General Conceptual Ability (GCA; similar to IQ) standard score (SS; general population *M* = 100, *SD* = 15). Parent rating of executive function was measured by the Behavior Rating Inventory of Executive Functioning-2 (BRIEF-2; Gioia et al., 2015) Behavior Regulation Index (BRI) and Emotion Regulation Index (ERI) T-scores. The ERI includes two scales: Shift and Emotional Control. Higher T-scores indicate greater difficulty (general population *M* = 50, *SD* = 10).

Results: Overall, 33.33% of children passed the gift-delay task by successfully inhibiting the urge to peek. The proportion of children who passed did not differ as a function of sex ($\chi^2(1) = 0.97$, *p* = .325). On average, children looked for 19.61s (*SD* = 20.50, *Mdn:* 12.83, range: 0 – 57.15s). Mean GCA SS was 64.94 (*SD* = 11.85, range: 43 – 84). For the BRIEF-2 Indices, mean T-scores were 65.45 (*SD* = 9.69, range: 41 – 82) for BRI and 62.58 (*SD* = 9.07, range: 47 – 79) for ERI. A multiple regression model predicting the amount of time spent looking at the gift from GCA, ERI, and BRI was significant [R^2 = .393, adjusted R^2 = .330, $F(3, 29)$ = 6.26, *p* = .002]. GCA (*p* = .006, semi-partial *r* = -.431) and ERI (*p* = .006, semi-partial *r* = .430) were significant predictors, after controlling for BRI (*p* = .815, semi-partial *r* = -.034). To further explore the relation between emotion regulation and delay of gratification, the ERI scales were evaluated. Mean T-scores were 61.79 (*SD* = 9.26, range: 42 – 77) for Shift and 61.55 (*SD* = 9.99, range: 40 – 82) for Emotional Control. A multiple regression model predicting the time spent looking at the gift from GCA, Shift, and Emotional Control was significant [R^2 = .435, adjusted R^2 = .377, $F(3, 29)$ = 7.45, *p* = .001]. GCA (*p* = .003, semi-partial *r* = -.460) and Shift (*p* = .012, semi-partial *r* = .376) were significant predictors, after controlling for Emotional Control (*p* = .367, semi-partial *r* = .128).

Discussion: Deficits in inhibitory control for children with WS were evident. Two-thirds of the participants were unable to inhibit the desire to peek or look at the gift while it was being wrapped. Higher intellectual abilities and better emotion regulation was related to better impulse control, after controlling for behavioral regulation. Specifically, the ability to shift between mental sets or tasks and intellectual abilities were predictive of children's ability to delay gratification, after controlling for emotional control. Consistent with research on typically-developing children (Holodynski et al., 2013), impairments in emotion regulation make it difficult for children with WS to overcome the urge to act on impulses and exercise self-control to wait when presented with an enticing temptation (i.e., gift). These findings suggest that children who have difficulty shifting their focus and attention are likely to become stuck and mentally fixate, making it harder to implement effective regulation and problem-solving strategies. Theoretical and practical implications will be discussed.

References: Camp, J., Karmiloff-Smith, A., Thomas, M. & Farran, E. (2016). Cross-syndrome comparison of real-world executive functioning and problem solving using a new problem-solving questionnaire. *Research in Developmental Disabilities*, *59*, 80-92

Carney, D., & Brown, J. & Henry, L. (2013). Executive function in Williams and Down syndromes. *Research in Developmental Disabilities*, *34*, 46-55

Elliott, C.D. (2007). *Differential Ability Scales-II*. San Antonio, TX: PsychCorp

Gioia, G., Isquith, P., Guy, S. & Kenworthy, L. (2015). *BRIEF-2: Behavior Rating Inventory of Executive Function*. Lutz, FL: Psychological Assessment Resources

Holodynski, M., Seeger, D., Kortas-Hartmann P. & Wörmann, V. (2013). Placing emotion regulation in a developmental framework of self-regulation. In K. Barrett, N. Fox, G. Morgan, D. Fidler, & L. Daunhauer (Eds.)*, Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 27-60). New York: Psychology Press

Kochanska, G., Murray, K., Jacques, T., Koenig, A. & Vandegeest, K. (1996). Inhibitory control in young children and its role in emerging internalization. *Child Development*, *67*, 490-507

Phillips, K.D. (2008). *Emotion regulation and dysregulation in children and adolescents with Williams syndrome (Doctoral dissertation).* Retrieved from ProQuest database (304453044)

[1]University of Louisville