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## Duration discrimination predicts delay of gratification in children with and without ADHD

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### Abstract

The ability to delay gratification, to wait for a larger but delayed reward in the presence of a smaller but constantly available reward, has been shown to be predictive for various aspects of everyday life. For instance, preschool children who were better able to delay gratification achieved better school grades, a higher education, a better ability to cope with stress, as well as a reduced risk for being overweight or consume drugs up to 30 years later (Mischel et al., 2011). However, despite the importance of delay of gratification cognitive factors underlying individual differences are only poorly understood. Wittmann and Paulus (2008) suggested that individuals who overestimate the duration of time intervals experience waiting times as more costly and are, therefore, less likely to delay gratification. Furthermore, a recent study revealed an association between less accurate internal clock speed and a behavioral choice delay task (Corvi, Juergensen, Weaver, & Demaree, 2012). Further evidence for an association between temporal processing and delay of gratification can be derived from studies using clinical samples. For instance, children with attention-deficit/hyperactivity disorder (ADHD) consistently prefer smaller, immediate rewards over larger, delayed rewards and show impaired temporal processing (Sonuga-Barke, Bitsakou, & Thompson, 2010). However, no study has directly tested an association between a measure of temporal processing and a classical delay of gratification task in children with and without ADHD so far.

As part of a larger study, 64 children (29 with ADHD) aged between 8 to 12 years performed a version of an auditory duration discrimination task and a delay of gratification task. In the duration discrimination task, the children were presented with two unfilled intervals indicated by two brief tones each. The baseline interval lasted for 400 ms, while the comparison interval was always longer and adjusted up or down in 10 ms steps securing an accuracy of 80%. In the delay of gratification task, the children

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were instructed that they could either opt for one chocolate bar immediately or that they could wait to receive two chocolate bars. Unbeknownst to the children, the waiting time lasted 25 minutes but children were told that they could decide for the immediate chocolate bar at any time by ringing a bell.

Children with ADHD did not differ in their performance from children without ADHD in the duration discrimination task or the delay of gratification task. However, in the whole sample of children with and without ADHD, children who waited for the additional chocolate bar showed a better duration discrimination than children who failed to wait for the additional chocolate bar [ $t(62) = -2.52, p = .01$ ].

We demonstrated an association between temporal processing ability and the ability to delay gratification. These results need to be replicated in further studies with larger sample sizes. Moreover, different tasks measuring temporal processing and delay of gratification should be used to further clarify the relationship of temporal processing, delay of gratification, and ADHD.

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## References

- Corvi, A. P., Juergensen, J., Weaver, J. S., & Demaree, H. A. (2012). Subjective time perception and behavioral activation system strength predict delay of gratification ability. *Motivation and Emotion, 36*, 483-490.
- Mischel, W., Ayduk, O., Berman, M. G., Casey, B. J., Gotlib, I. H., Jonides, J., Kross, E., Teslovich, T., Wilson, N. L., Zayas, V., & Shoda, Y. (2011). 'Willpower' over the life span: Decomposing self-regulation. *Social Cognitive and Affective Neuroscience, 6*, 252-256.
- Sonuga-Barke, E. J. S., Bitsakou, P., & Thopmson, M. (2010). Beyond the dual pathway model: Evidence for the dissociation of timing, inhibitory, and delay-related impairments in Attention-Deficit/Hyperactivity Disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 49*, 345-355.
- Wittmann, M., & Paulus, M. P. (2008). Decision making, impulsivity and time perception. *Trends in Cognitive Sciences, 12*, 7-12.