**INTRODUCTION**

The Stop-Signal Task (SST) task has been used to assess inhibitory control, and recently the task has been adapted to examine the impact of incentives on inhibition. Given the importance of inhibitory control and sensitivity to incentives in models of disinhibitory psychopathology (e.g., ADHD and Conduct Disorder), it is important to have multiple methods of assessing these differences. This study examined the association of parent reports of child temperament with inhibitory control and sensitivity to incentives (e.g., money incentives) and then the effects of motivational incentives on inhibitory control. We hypothesized that parent reports of effortful control were associated with SST inhibitory control. Also, SST inhibitory control improved with the introduction of reward, and this was particularly true for children characterized by high levels of parent reported sensitivity to punishment. Findings supported convergence of measures of inhibitory control, and some unexpected associations with respect to sensitivity to incentives.

**METHODS**

Participants & Procedures. The sample included 118 11- to 12-year-old children taken from a larger longitudinal study of children selected from the community in Erie County, New York using random-digit dialing procedures. Adolescents with any disabilities precluding them from understanding or completing the interviews were excluded from the study. The majority of the sample was female (62.7%) and Caucasian (74.6%). The entire session lasted for two and a half hours and families were compensated $75 upon completion of the session.

Measures. Parents reported on their child’s temperament using the Revised Sensitivity to Punishment and Sensitivity to Reward Questionnaire for Children (SPRSR-CR) and the Revised Early Adolescent Temperament Questionnaire (EATQ-R). The SPRSR-CR is composed of two scales, including sensitivity to punishment (SP), which measures behavioral inhibition and reaction to the threat of punishment or failure, and sensitivity to reward (SR), which primarily measures impulsivity, sensation-seeking, and reward responsiveness. The EATQ-R was included in this study as a step to examine the child’s response to situations related to self-regulation. For our purposes, we used the activation control (the capacity to perform an action), inhibition (the ability to sustain attention on a task), and inhibitory control (the competence at suppressing actions or responses) subscales from the EATQ-R. Additionally, we considered the broader, second-order factor of effortful control, which combines activation control, attention, and inhibitory control into one dimension. Children completed the SST, which was adapted to include a reward incentive condition (Logan, 1997). The two conditions were administered in a fixed order: 1), children received no feedback/no incentive (NI), and 2), incentives/feedback (INC) were provided and children were instructed to press a button when they saw the go signal. Children completed the SST, which was adapted to include a reward incentive condition (Logan, 1997). The two conditions were administered in a fixed order: 1), children received no feedback/no incentive (NI), and 2), incentives/feedback (INC) were provided and response speed was rewarded with more points. Points accumulated during the task were later redeemed for a prize.

Data reduction and analysis. The variable of interest used to measure inhibitory control from the SST was Stop Signal Reaction Time (SSRT). The SSRT is an estimate of the latency of inhibiting a prepotent response that is calculated by subtracting mean stop delay (the delay between the stop signal and the go signal) from the mean reaction time (the average time it took to respond to the go signal) and was calculated in the No Incentive (NI) and Incentive (INC) conditions. Difficulty in inhibiting a response when a stop signal is presented (i.e., poor inhibitory control) results in a longer SSRT, where a shorter SSRT indicates good inhibitory control. We also calculated a change score (no incentive minus incentive) to represent changes in inhibitory control across conditions. For the temperament measures, the items within each scale were averaged to form scaled scores.

**RESULTS**

- Short SSRT (good inhibitory control) during both the NI and INC conditions was associated with high levels of parent reported activation control, attention, and effortful control.
- Short SSRT (good inhibitory control) in the NI condition was associated with high levels of parent reported inhibitory control.
- Decreases in SSRT (improved inhibitory control) from the NI to INC condition were associated with high levels of parent reported SR.
- SSRT variables were not associated with parent reported SR.

**DISCUSSION**

Our findings suggest some convergence between SST performance and parent reports of temperament, and some unexpected findings. We found a general pattern suggesting that all three components of effortful control were associated with high levels of SST assessed inhibitory control. Children characterized by good effortful control were viewed by parents as having the capacity to focus attention and inhibit responses. However, these data suggest that these are all important aspects of successful inhibition during the SST. In support of one of our main hypotheses, children characterized by high levels of inhibitory control on the SST regardless of whether incentives were present or not. This suggests that rewards are not necessary for children characterized by high effortful control to perform well on the task.

Contrary to our hypothesis, we found that children characterized by high levels of parent reported SP improved their inhibitory control when reward was available. It is possible that our incentive condition generated strong expectations of reward, and that poor performance indicated by a low percent total was experienced as frustrating non-reward. This may have motivated high SP children to improve inhibition. This would be consistent with Gray (1987), who suggested that frustrating non-reward can activate the behavioral inhibition system (BIS).

Our findings did not support an association between high levels of parent reported SR and improved inhibitory control during the reward condition. SR is thought to measure behavior reflecting activation of a behavioral approach system (BAS), which is engaged by signals of reward. Accordingly, we expected children characterized by high levels of SR to be particularly responsive to the incentive manipulation. However, the behavioral response measured in the SST is inhibition, which is BIS, not BAS mediated. Thus, despite rewards being present, our findings suggest that the SST is more likely to engage the BIS than the BAS.

There may be some clinical implications of our findings. Effortful control (and its components) provided good convergence with performance on the SST, and like Self Regulation, is an aspect of inhibitory control, it is an important individual difference to consider when planning interventions aimed at children who are at-risk for externalizing problems. Children who are low in effortful control tend to use Caution, whereas high responding and high risk for negative individual differences, in particular, interpersonal outcomes, are more aggressive, and experience more peer problems (Loukas, 2004). The SST may provide a useful laboratory analogue method for teaching children good effortful control. Therefore, it would be beneficial for additional longitudinal research to examine whether change in effortful control is associated with change in SST performance and the role that incentives may play in the development of improved self-regulation.

**REFERENCES**