



# Selective and nonselective attention effects on prepulse inhibition of startle: a comparison of task and no-task protocols

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## Abstract

The effects of selective and nonselective attentional processes on prepulse inhibition (PPI) of the acoustic startle response were examined by assessing PPI under intermixed task and no-task conditions. Results for the task condition revealed that greater PPI was produced by an attended than an ignored prepulse at a lead interval of 120 ms (marginally significant in the early trial block and significant in the late trial block), indicating an effect of selective attention at this lead interval. Comparisons between the task and no-task conditions revealed significantly greater PPI in the task than no-task condition at a 60-ms lead interval, during early and late trial blocks, indicating a nonselective attention effect at this lead interval. Overall, these results suggest that PPI is sensitive to selective and nonselective attentional influences and indicate that task and no-task PPI protocols reveal unique aspects of sensorimotor gating ability.

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## 1. Introduction

Prepulse inhibition of startle (PPI) refers to the reduction in startle reflex amplitude that occurs when a startle-eliciting stimulus is preceded by a non-startling stimulus (prepulse) at a lead interval of approximately 50–500 ms (see review by [Blumenthal, 1999](#)). As first proposed by [Graham \(1975\)](#), PPI is widely viewed as an operational measure of sensorimotor

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gating, a process that protects early stimulus processing and prevents sensory overload (see review by Fillion et al., 1998). As an index of sensorimotor gating, PPI has become an important measure in studies investigating patterns and potential causes of cognitive impairment, particularly in the area of the schizophrenia spectrum disorders.

Studies assessing PPI as an index of sensorimotor gating in schizophrenia have generally employed one of two test protocols: a passive, no-task protocol in which participants are given no explicit instructions regarding the prepulse or startle stimuli (e.g. Braff et al., 1992), or a task-based protocol in which participants are presented with two prepulse types (e.g. high and low tones), with the instruction to attend to one prepulse type and ignore the other (e.g. Dawson et al., 1993). The passive PPI protocol is hypothesized to assess a sensorimotor gating ability that is relatively automatic and insensitive to attentional influence, whereas the task-based protocol is hypothesized to index the automatic component of sensorimotor gating as well as the ability to modulate sensorimotor gating through controlled/effortful attentional processing (Dawson et al., 1997; Fillion et al., 1998). Although these hypotheses are not necessarily inconsistent, a better understanding of the similarities and differences of the sensorimotor gating indices obtained with these protocols is needed before results from these protocols can be reconciled, synthesized, and used to provide a more comprehensive description of schizophrenia-linked sensorimotor gating deficits. Specifically, research is needed to determine whether these protocols provide indices of the same, different, or overlapping, aspects of sensorimotor gating.

The hypothesis that the no-task protocol provides an assessment of automatic sensorimotor gating is based on a large body of evidence documenting that PPI is not dependent on conscious or voluntary attentional processes (reviewed by Graham, 1975), and that it occurs as the result of activity in a well-delineated subcortical neural circuitry (Swerdlow and Geyer, 1999). Using no-task PPI protocols, the general finding in schizophrenia has been reduced PPI across lead intervals ranging from 30 to 120 ms, a finding interpreted as indicating a schizophrenia-linked deficit in automatic sensorimotor gating (see Braff et al., 2001, for a review).

The hypothesis that the task-based protocol provides an assessment of automatic sensorimotor gating in addition to the modulation of sensorimotor gating by selective attentional processes is based on a consistent pattern of results obtained with the task-based protocol (e.g. Fillion et al., 1993, 1994; Hazlett et al., 1998; Jennings et al., 1996; Schell et al., 1995, 2000). Across studies, the attentional instruction is found to produce enhanced PPI at a 120-ms lead interval (PPI-120) during the attended prepulse, suggesting that this lead interval indexes the modulation of sensorimotor gating by controlled selective attentional processes. In contrast, these studies report no difference in PPI produced by attended and ignored prepulses at a lead interval of 60 ms (PPI-60). This latter pattern, together with the observation of equivalent PPI during an ignored prepulse and a no-task prepulse (Jennings et al., 1996; Seljos et al., 1994, discussed below), has led to the hypothesis that PPI-60 and PPI-120 during the ignored prepulse reflect 'predominately automatic' sensorimotor gating (Dawson et al., 1997, p. 262).

Using the task-based protocol, the general finding in schizophrenia has been reduced PPI-120 during the attended prepulse compared to controls, but normal PPI-120 during the ignored prepulse and normal PPI-60 during the attended and the ignored prepulse (e.g. Dawson et al., 1993, 2000; Hazlett et al., 1998). This pattern of results has been interpreted

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