

## Self-reported and P3 event-related potential evaluations of condoms: Does what we say match how we feel?

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### Abstract

Research consistently reveals positive self-reported condom evaluations, yet such evaluations often do not predict condom use. Whereas positive self-reports likely reflect social norms regarding prevention of diseases and pregnancy, psychophysiological measures might better assess spontaneous condom evaluations. Here, participants completed a visual oddball task in which condoms and alcoholic beverages were infrequent targets among neutral, positive, and negative context images. Although self-reported condom evaluations were very positive, condom images presented in a negative context produced a smaller P3 than condom images presented in a neutral or positive context, suggesting that spontaneous condom evaluations were more negative than positive. The P3 elicited by alcohol images indicated positive evaluations. The findings underscore the multifaceted nature of evaluations and point to the utility of ERPs for assessing health-related attitudes.

**Descriptors:** ERPs, P3, Condom, Alcohol, Evaluations, Self-report

Human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS) is an international epidemic with no known cure (approximately 40 million people worldwide currently are living with AIDS), making prevention efforts vitally important. Considering the danger of contracting sexually transmitted diseases (STDs) such as HIV through unprotected sex, understanding factors related to decision making about sexual opportunities is critical. Aside from abstinence, the recommended method of STD prevention is correct and consistent use of condoms (Pinkerton & Abramson, 1997; World Health Organization, 2003). Thus, understanding attitudes toward condoms and condom use is important in HIV prevention efforts.

Condom attitudes typically are assessed using questionnaire measures, but such measures do not always predict condom use (Albarracín, Johnson, Fishbein, & Muellerleile, 2001; Keller, 1993). Self-report measures can be fraught with validity problems, such as participants' self-presentational concerns and difficulty accurately recalling past behavior (Nisbett & Wilson, 1977). Moreover, attitudes are multifaceted and complex (see Eagly & Chaiken, 1998), sometimes involving affective components (e.g., condoms decrease hedonic pleasure) and cognitive components (e.g., condoms prevent STDs) with opposing evaluative connotations. Such complexity often is not reflected in self-report measures aimed at assessing overall, general evaluations of condoms. Thus, some researchers have called for more multidimensional assessments of condom attitudes (Helweg-Larsen & Collins, 1994).

Recently, researchers have attempted to tap into different aspects of condom attitudes using reaction-time based measures such as the Implicit Association Test (IAT; see Czopp, Monteith, Zimmerman, & Lynam, 2004; Marsh, Johnson, & Scott-Sheldon, 2001). Such measures have advantages over self-reports in that they arguably reveal less controlled aspects of attitudes that unfold relatively quickly (see Nosek, 2007). However, even these measures can confound relevant cognitive and affective/motivational processes with largely irrelevant motor-related response output processes (see Ito & Cacioppo, 2007).

Fortunately, event-related brain potentials (ERPs) can provide insight into spontaneous evaluations in ways that overcome such difficulties. Numerous studies have shown that the amplitude of the P3 component is associated with evaluative categorization. Cacioppo, Crites, Berntson, and Coles (1993) were the first to show that P3 amplitude increases as a function of the evaluative distinction between an attitude object and a preceding category (see also Cacioppo, Crites, & Gardner, 1996; Cacioppo, Crites, Gardner, & Berntson, 1994). Importantly for our purposes here, P3 amplitude has been shown to vary as a function of attitude registration rather than attitude report (Crites, Cacioppo, Gardner, & Berntson, 1995), a finding consistent with other data indicating that the P3 is a relatively pure measure of evaluative categorization, independent of response-related processes (see Magliero, Bashore, Coles, & Donchin, 1984). Previous work also indicates that the P3 can be useful as a tool to investigate both attitudes and knowledge that participants are unwilling to report (e.g., Allen, Iacono, & Danielson, 1992; Johnson, Barnhardt, & Zhu, 2003). Such findings suggest that the P3 can be particularly useful when assessing attitudes related to socially sensitive topics. Despite these advantages, to our

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knowledge ERPs previously have not been used to assess condom evaluations.

The purpose of the present research was to compare explicit, self-reported condom evaluations with P3-based, spontaneous evaluative responses to condoms. Evaluations reflected in P3 amplitude are affected both by internal, individual difference processes (e.g., Ito, Thompson, & Cacioppo, 2004) and also by experimental manipulations such as the dimension on which participants are asked to categorize targets (e.g., Crites & Cacioppo, 1996; Ito & Cacioppo, 2000). Here we use the term “spontaneous” evaluations to differentiate the process reflected in the P3 from the relatively slower and more deliberative process reflected in explicit categorizations. We used a visual oddball task in which condom images (and images of alcoholic beverages) were used as infrequent targets amid more frequent negative, neutral, and positive context images. In this paradigm, the extent to which the target P3 is enhanced relative to the valenced context in which it appears reflects the degree of evaluative difference between the target and the context (e.g., Cacioppo et al., 1993, 1994). We hypothesized that participants would report generally positive explicit attitudes toward condoms, given current cultural endorsement of condom use for health protection (Pinkerton & Abramson, 1997), but that spontaneous condom evaluations reflected in P3 amplitude would be less favorable given that condom use is infrequent (Keller, 1993). Alcohol targets were included for comparison purposes, as alcohol is another health-related attitude object associated with risky behavior that recently has been studied using implicit measures (e.g., Wiers, van Woerden, Smulders, & de Jong, 2002).

## Method

### Participants

Twenty-nine healthy undergraduates (19 men) enrolled in introductory psychology courses participated in partial fulfillment of course requirements. All participants had no history of neurological disorder and had normal or corrected-to-normal vision.

### Pretest measures

Early in the semester participants completed measures of lifetime number of sexual intercourse partners and their current relationship status. Self-reported condom evaluations were measured using an item asking participants to rate condoms on a scale anchored at 1 (*very bad*) to 6 (*very good*). Participants also rated their likelihood of using a condom with someone they did not know well, using a scale ranging from 1 (*definitely*) to 6 (*definitely not*). Participants also reported their typical quantity and frequency of alcohol use (per week, based on past 3 months).

### Picture Viewing Task

Participants completed a visual oddball task in which images of condoms and alcoholic beverages were infrequent targets (10% each) presented among more frequent negative ( $M_{\text{valence}} = 3.03$ ;  $M_{\text{arousal}} = 4.87$ ), neutral ( $M_{\text{valence}} = 5.07$ ;  $M_{\text{arousal}} = 2.75$ ), and positive ( $M_{\text{valence}} = 7.60$ ;  $M_{\text{arousal}} = 4.74$ ) context images. All context images were taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2001).<sup>1</sup> Target

images that did not come from the IAPS were pre-rated by 11 undergraduates (none of whom participated in the current study) using the same social affective manikin used in the IAPS. Alcohol and condom images were rated similarly in terms of both valence ( $M_s = 5.94$  and  $5.6$  for alcohol and condoms, respectively) and arousal ( $M_s = 5.84$  and  $6.08$ , respectively).

Images were presented in the center of a monitor in sequences of five, four of which were always context images. Target images (alcohol or condoms) were shown in the fourth or fifth position within each trial sequence. Valence of context (neutral, positive, or negative) was consistent within sequences but varied randomly across sequences. Each image was presented for 250 ms, followed by a 1000-ms interstimulus interval. There were a total of 162 trial sequences (54 each of negative, neutral, and positive context), half of which included condom targets and half alcohol targets. Participants were instructed to categorize each image as positive/pleasant or negative/unpleasant by pressing one of two buttons on a response box (counterbalanced across participants). They were told that some images might not be easily categorized, but to go with their “gut instinct.” At a viewing distance of 120 cm, the images subtended a visual angle of  $4.75^\circ$ .

### ERP Measures

Electroencephalographic (EEG) data were recorded from 28 standard scalp locations (American Encephalographic Society, 1994) using tin electrodes fixed in a stretch-lycra cap (Electro-cap International, Eaton, OH). EEG was sampled continuously at 1000 Hz and filtered online at 0.05–40 Hz. Scalp electrodes were referenced online to the right mastoid; an average mastoid reference was derived off-line. EOG was monitored from electrodes placed above and below the left eye and 2 cm lateral to the outer canthus of each eye. Impedance was kept below 5 k $\Omega$ . Ocular artifacts were corrected from the EEG signal off-line using a regression-based procedure (Semlitsch, Anderer, Schuster, & Presslich, 1986).

## Results

### Demographics

Fourteen participants indicated they were not in a serious relationship, 8 participants indicated they had a boyfriend or girlfriend, 3 said they were casually dating, and 5 did not indicate their relationship status. Participants indicated having from 0 to 50 lifetime sex partners (median = 3). Most participants (63%) described themselves as social drinkers; the remainder reported less frequent drinking.

### Self-reported Condom Attitudes

Overt condom evaluations were uniformly quite positive. The majority of participants (77%) evaluated condoms as “good” or “very good” ( $M = 5.52$ ,  $SD = 0.77$ ). All participants indicated they would use condoms with casual partners.

### Explicit Categorizations

Analyses of behavioral data focused on the proportion of “positive” and “negative” categorizations of each target type. An initial analysis showed that, across all target types and contexts, participants were more likely to respond “pleasant” ( $M = .68$ ) than “unpleasant” ( $M = .28$ ),  $F(1,27) = 24.67$ ,  $p < .001$ . Thus, main analyses focused on the effects of our manipulations on the proportion of positive categorizations using a 2 (Sex of Participants)  $\times$  3 (Valence of Context; negative, neutral,

<sup>1</sup>IAPS picture numbers used in this study were: Neutral = 7002, 7004, 7090, 7233, and 6150; Negative = 9320, 9912, 9630, 9001, and 9180; Positive = 7260, 7330, 8501, 5760, and 5001.

positive)  $\times$  2 (Target Type; condoms, alcohol) mixed factorial analysis of variance (ANOVA) with repeated measures on all but the first factor. This analysis showed a significant main effect of Target,  $F(1,27) = 12.91$ ,  $p < .01$ ,  $\eta^2 = .32$ ; participants more often categorized alcohol targets as positive ( $M = .71$ ) than condoms as positive ( $M = .64$ ). A significant Context effect,  $F(2,54) = 89.9$ ,  $p < .001$  (G-G adjusted),  $\epsilon = .70$ ,  $\eta^2 = .77$ , indicated that participants were more likely to categorize targets as positive when presented in a positive ( $M = .83$ ) or neutral context ( $M = .80$ ) compared to a negative context ( $M = .42$ ). No other effects were significant.

### ERP Data

**P3 amplitude.** Preliminary analyses revealed a significant Coronal Location (anterior to posterior)  $\times$  Lateral Location (left, midline, right) interaction,  $F(8,216) = 21.9$ ,  $p < .001$ , indicating that P3 amplitude was largest at centro-parietal and parietal locations at or near the midline (see Figure 1). Thus, primary analyses were restricted to data recorded at those locations.<sup>2</sup>

A 2 (Sex)  $\times$  2 (Target Type)  $\times$  3 (Context)  $\times$  2 (Location; CP sites, P sites)  $\times$  3 (Lateral; left, midline, right) mixed factorial ANOVA with repeated measures on all but the first factor showed a main effect of Target type,  $F(1,27) = 23.43$ ,  $p < .001$ , indicating that condoms elicited larger P3s ( $M = 14.03 \mu\text{V}$ ) than alcohol ( $M = 10.96 \mu\text{V}$ ). This effect was qualified by a Target Type  $\times$  Context interaction,  $F(2,54) = 5.62$ ,  $p < .01$  (G-G adjusted),  $\epsilon = .95$ ,  $\eta^2 = .172$ . We probed this interaction using separate linear contrasts comparing P3s elicited by condoms and alcohol across the three levels of context. For condom targets, the P3 increased linearly from negative ( $M = 12.86 \mu\text{V}$ ) to neutral ( $M = 14.23 \mu\text{V}$ ) to positive contexts ( $M = 15.0 \mu\text{V}$ ),  $F(1,27) = 5.24$ ,  $p < .05$ . This pattern indicates a smaller evaluative distinction between condoms and negative than between condoms and positive.<sup>3</sup> In contrast, the P3 elicited by alcohol targets showed the opposite pattern, decreasing in a largely linear fashion from negative ( $M = 12.05 \mu\text{V}$ ) to neutral ( $M = 10.58 \mu\text{V}$ ) to positive ( $M = 10.23 \mu\text{V}$ ) contexts,  $F(1,27) = 3.54$ ,  $p = .07$ .

The analysis also showed a Target  $\times$  Sex interaction,  $F(1,27) = 6.92$ ,  $p < .01$ ,  $\eta^2 = .20$ . Whereas alcohol targets elicited similar P3s in men ( $M = 10.48 \mu\text{V}$ ) and women ( $M = 11.43 \mu\text{V}$ ),  $t(27) = 0.54$ ,  $p > .50$ , condoms elicited marginally larger P3s in women ( $M = 16.18 \mu\text{V}$ ) than in men ( $M = 11.89 \mu\text{V}$ ),  $t(27) = 1.94$ ,  $p = .06$ . The three-way Target  $\times$  Context  $\times$  Sex interaction was not significant ( $F < 1$ ), nor were any other effects.<sup>4</sup>

<sup>2</sup>Including data from all electrodes produces essentially the same pattern of findings but also reveals a number of higher-order interaction effects involving electrode location that are not of interest here.

<sup>3</sup>Note that this same pattern emerges when participants whose self-reported evaluations were less than very positive ( $n = 10$ ) are excluded from the analysis, which suggests that P3 results were not driven by "outliers" whose self-reported evaluations were relatively negative.

<sup>4</sup>Inspection of Figure 1 suggests that condoms presented in negative contexts elicited slower P3 latency than did condoms presented in other contexts. Although we had no hypotheses concerning latency effects, we conducted an exploratory analysis of P3 latency using a 2 (Target)  $\times$  3 (Context)  $\times$  2 (Sex) mixed ANOVA. The Target  $\times$  Context interaction was not significant,  $F(1,54) = 0.78$ ,  $p = .46$ . However, a follow-up contrast showed that the P3 for condoms in a negative context ( $M = 591$  ms) peaked more slowly than for condoms in a positive ( $M = 545$  ms) or neutral context ( $M = 543$  ms),  $F(1,27) = 6.54$ ,  $p < .05$ .

### Discussion

Numerous previous reports have established the P3 as a reliable marker of spontaneous evaluative categorization (see Ito & Cacioppo, 2007). The results of this study suggest that, whereas self-reported evaluations were quite positive, spontaneous aspects of condom evaluation reflected in P3 amplitude were more negative than positive. Specifically, the size of the P3 elicited by condom targets increased linearly along with context valence. In contrast, evaluative categorization of alcohol cues appeared to be more positive than negative; P3 amplitude elicited by alcohol cues was larger in a negative than a positive context. Behaviorally, participants categorized condoms positively only 64% of the time, also suggesting less positive evaluations than indicated in the self-report data.

Given the limited sampling frame (college undergraduates), relatively small sample size, and preliminary nature of the current data, conclusions concerning the differences between self-reported and electrocortical responses to condoms seen here should be made with caution. For example, the causal mechanism(s) responsible for potential differences between spontaneous and self-report evaluations are unclear. One possibility is that positive self-reported evaluations of condoms do not reveal respondents' true attitudes but rather reflect awareness of social norms and expectations concerning the benefits of condom use, whereas P3 amplitude provides a more "direct" measure of a person's "true" attitude (see Crites et al., 1995).

Another plausible explanation is that attitudes toward condoms are complex, likely involving multiple components that are differentially revealed by measures at different levels of analysis. The P3 likely reflects an early, largely automatic, affect-driven component that appears to be mostly negative, perhaps based on personal experiences of decreased hedonic pleasure when using condoms (Weinstock, Lindan, Bolan, Kegeles, & Hearst, 1993), embarrassment about condom purchase or possession (Czopp et al., 2004), or other related issues that influence motivation to use condoms. Somewhat later in the processing stream, overt categorization responses likely incorporate this initial affective response with some additional information concerning the benefits of condom use that tempers the evaluative response somewhat. Finally, self-reported evaluations probably reflect both knowledge about health-protective reasons for condom use as well as prevailing social norms and concerns about self-presentation that lead to generally positive responses. To the extent that the evaluative processes reflected in the P3 can be considered similar to so-called implicit measures (see Ito & Cacioppo, 2007) and that such measures predict condom use in sexually risky situations more effectively than explicit measures do (Czopp et al., 2004; Marsh et al., 2001), the current data suggest that decisions to use condoms in risky situations are more likely based on initial (negative) affective reactions than on more reasoned cognitive responses (see Norton, Bogart, Cecil, & Pinkerton, 2005). This pattern could help to explain why, despite generally positive self-reported evaluations (e.g., Fisher, Fisher, & Rye, 1995; Gibbons, Gerrard, Blanton, & Russell, 1998), people often fail to use condoms for health protection. However, the current data do not definitively support this conclusion, nor can they differentiate between the two potential mechanisms proposed here. Future research should test these ideas directly.

In conclusion, these preliminary data highlight the potential for ERPs to measure evaluations of often complex attitude

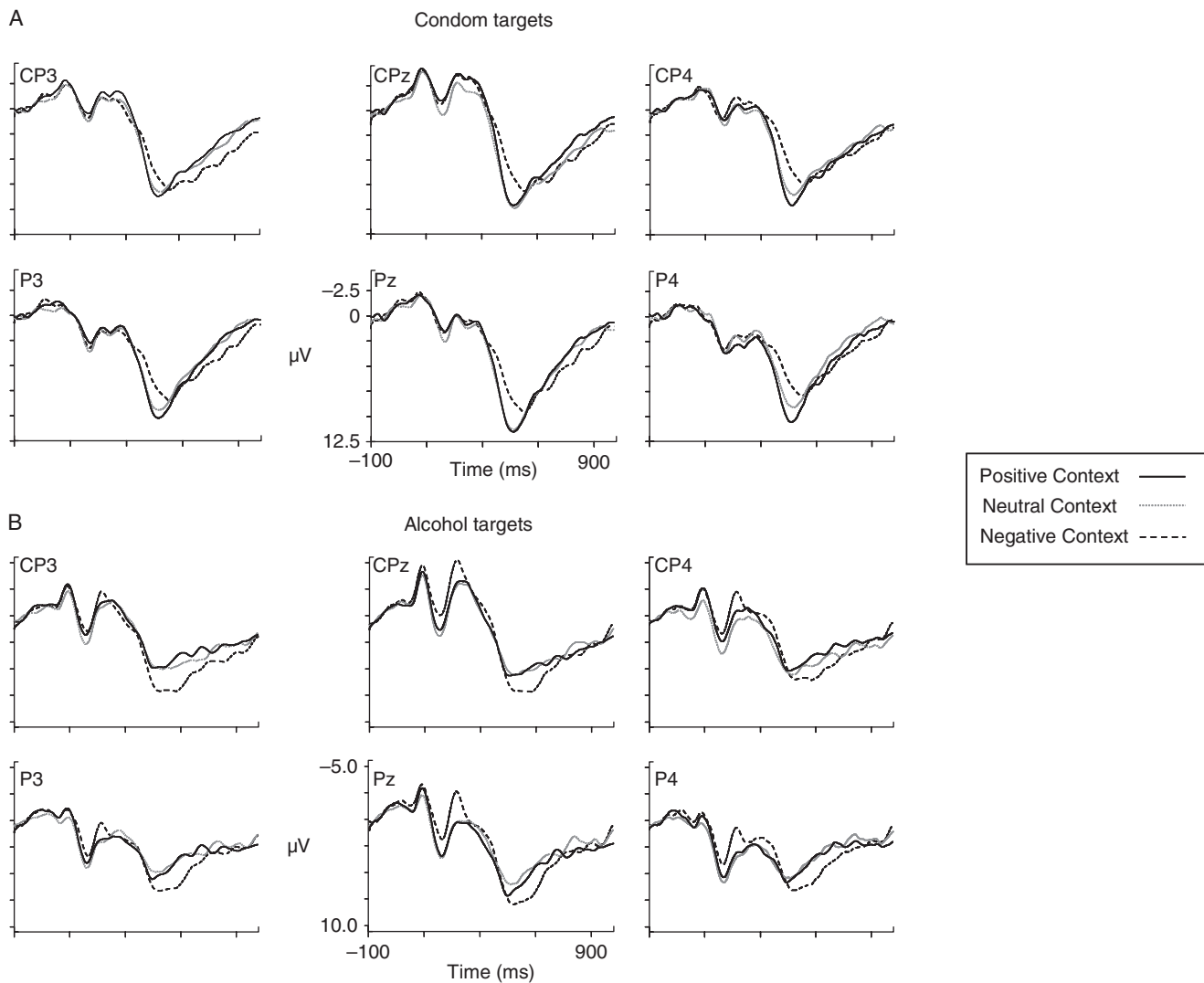


Figure 1. ERP waveforms elicited by condoms (A) and alcohol (B) as a function of context valence.

stimuli that can inform and augment other “implicit” (e.g., IAT) and explicit (self-report) attitude measures. The current data suggest that condom evaluations might differ considerably

depending on levels of analysis and that a fuller understanding of attitudes toward health-related behaviors requires use of measures that tap these different levels.

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