5-1-2023

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Received: 1 August 2022 | Revised: 24 February 2023 | Accepted: 2 April 2023

DOI: 10.1002/cb.2166

SPECIAL ISSUE ARTICLE

WILEY

Neuromarketing as a scale validation tool: Understanding individual differences based on the style of processing scale in affective judgements

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Abstract

This paper revisits a well-cited and widely applied consumer scale, Style of Processing (SOP) (Childers et al., *Journal of Consumer Research*, 1985, **12**, 125), that has been used to investigate individual differences in processing visual versus verbal information in marketing. The scale has advanced knowledge in fields related to marketing communications, product development, psychology, advertising, education and learning theories, shedding light on our understanding of consumer psychology related to persuasion, comprehension, memory, and other consumer cognitive processes involving information. In a research dialog that took place in 2008, a need for further SOP validation was suggested using a neuromarketing approach. We took this call forward and conducted an event-related-potential (ERP) experimental research study using electroencephalogram (EEG) to validate the SOP scale, focusing on differential affective processing between verbalizers and visualizers. We not only demonstrate how neuromarketing tools can be utilized to provide evidence for scale validity, providing advantages over self-reported measures; but more importantly, address issues related to understanding differential fluency effects that exist between visualizers and verbalizers. Behavioral data revealed varying reaction times to emotional stimuli of a pictorial nature. We further identify two ERP components in our data, early left anterior negativity (ELAN) and late negative slow wave (LNSW), that differentiate individual processing fluency in affective versus evaluative-based judgements. Findings confirmed the construct validity of the SOP scale and enhance our understanding of individual differences in emotional processing of pictorial information.

1 | INTRODUCTION

Originally developed for consumer behavior research, Childers et al.'s now seminal Style of Processing (SOP) scale has been widely employed in marketing and many other contexts since its development three decades prior. Cited by over 700 papers (many in elite journals) in fields ranging from marketing, advertising, psychology, education, computer science, and many others, SOP was constructed to assess consumers' preferences and propensities to invoke visual versus verbal processing styles as applied to exchange-related scenarios. For example, a "visual" item from the SOP scale asks respondents their agreement with the following: "*I like to picture how I*

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could fix up my apartment or a room if I could buy anything I wanted." Indeed, wide adoption of SOP has been utilized to understand individual differences in learning, forming attitudes, decision making and contributing to the advancement of other cognitive and behavioral implications for relevant consumer research (Childers & Jiang, 2008; Wyer, Hung, & Jiang, 2008). With extensive application of SOP, several scholars have explored the validity of the scale and its ability to accurately predict and support differential outcome behaviors vis-à-vis processing style (Ong & Milech, 2001, 2004). Writing in a *Journal of Consumer Psychology* (JCP) Research Dialogue, Bagozzi (2008, p. 261) questioned whether scale items that involve affective-based questions should be included along with preference and propensity (as SOP does).[1] This viewpoint is difficult to discern and rule out with the current mainstream approach of behavioral and survey methods, which often relies on subjective responses based on reflection of one's attitudes and preferences (Plassmann et al., 2015). Instead of counterarguing this view, Childers and Jiang (2008) rebutted with an alternative approach to study SOP grounded in neuroscience. As cognitive processes such as memory, attention and emotions are often suggested to vary based on one's orientation towards information processing, Childers and Jiang (2008) proposed that using the framework of differences in neural response times in tasks undergoing automatic or controlled processing could serve to validate processing style as articulated by SOP.

A decade later, we took these propositions and conducted an event-related potential (ERP) study, using electroencephalographic (EEG) methods, that aims to (a) dissect these processes in the context of processing pictures by examining individual differences in SOP and their corresponding relation to cognitive processes including attention, memory, and emotions, and (b) provide further validation support for the SOP scale by taking an unconventional psychometric approach—neuroscience validation, which provides initial evidence for future researchers to consider as a tool for scale development and scale validation. We test the original propositions outlined in Childers and Jiang (2008), which are based on the notion that the brain is wired and trained to process information in a certain sequence and route from repeated learning, which is reflected in the preferences that verbally versus visually oriented individuals display. Furthermore, we utilize ERP data to analyze cognitive processes, pinpointing specific individual differences in information processing (cf. Kok, 1997).

2 | LITERATURE REVIEW

2.1 | Application of the SOP scale in consumer research

The SOP scale is a 22-item, 4-point true–false scale, with 11 items for measuring verbal and 11 items for measuring visual dispositions to process information semantically or to construct visual images, respectively, when people are engaged in different mental tasks (see Childers et al., 1985). The authors defined processing style to be "a preference and propensity to engage in a verbal and/or visual modality of processing" (Childers et al., 1985, p. 130) and its attentional orientation (Heckler et al., 1993).

A shorter version of the SOP scale with 10 items has been developed (Ramsey & Deeter-Schmelz, 2008) and widely adopted in many subfields of consumer research relevant to marketing, including new product development (Hoffman et al., 2010; Oliver et al., 1993; Petrova & Cialdini, 2005), product aesthetics (Bloch et al., 2003), advertising effectiveness (Burns et al., 1993), incidental ad exposure (Shapiro et al., 1997), sports sponsorships (Close et al., 2015), media perception (Darley, 1999), preferences in assortment choice (Townsend & Kahn, 2014), healthy food choices (Cao et al., 2020), ecommerce website design (Lightner & Eastman, 2002), sense of telepresence (Orth et al., 2019), food pictures for menu design (Hou et al., 2017), consumption vision and brand perception (Chang, 2012), persuasive messaging (Myers & Jung, 2019) and many others. Other fields of study that also involve processing information, such as education and learning theories, have applied the SOP scale to understand multimedia learning (Chen & Sun, 2012; Smith & Woody, 2000), effective use of simulation programs in learning (Liu et al., 2012), intuition learning style (Sadler-Smith, 2011), learning effectiveness on MOOCs (Chang et al., 2019) and others.

Specific mental processes, emotional and cognitive, and their impact on other behaviors and decisions have been investigated in the field of consumer psychology by considering individual differences in SOP among consumers. Some examples include differentiating SOP to better understand the emotions triggered and its role in decision making (Pham, 1998); the relationship between cognitive style and SOP (Ong & Milech, 2004); the role of SOP in comprehension (Wyer, Hung, & Jiang, 2008); the influence of SOP on memory source and memory distortion (Kiat & Belli, 2018); and the role of SOP on the memory of scent and its associated images (Lwin et al., 2010).

Others have studied the connection between SOP characteristics and other traits such as personality (Sojka & Giese, 2001), and SOP's relationship with other constructs, such as need for affect and need for cognition (Powell et al., 2019). Others consider the measure of SOP as covariates in their analysis to focus on the key effects of imagery appeals on product choice (Petrova & Cialdini, 2005), and message modality and appeal (Liu & Stout, 1987), pointing to the relevance of SOP in influencing one's judgment and perception of information.

SOP has also inspired the development of other information processing scales, such as the Object-Spatial Imagery and Verbal Questionnaire (Blazhenkova & Kozhevnikov, 2009), which is based on the original SOP scale. The SOP scale has also been discussed as part of a proposed scale development process—C-OAR-SE (Rossiter, 2002) and has been validated in cross cultural samples using this new scale development process (Wong et al., 2003), and has served to perform confirmatory factor analysis for the development of the consumer alit-eracy scale (DelVecchio et al., 2019), influencing consumer's preference for how marketing materials are presented.

[1]Bagozzi (2008) delineated the items in SOP into three broad categories: statements of facts, affect or ongoing desires, and evaluations or preferences. Of these, Bagozzi seems most concerned with affect or ongoing desires, which largely revolve around two SOP items that feature the word "enjoy."

2.2 | Validity assessment of the SOP scale

While the SOP scale has been widely adopted by researchers to gain enhanced understanding of consumer cognitive and affective processes, the validity of the scale has also been questioned by some (Ong & Milech, 2001, 2004). In their paper, Ong and Milech (2001) tested the SOP scale and reported good internal reliability and test–retest scores. They used the SOP scale to predict the individual learning outcomes between text and diagram format of computer-based learning materials, but results were not supported (Ong & Milech, 2001). To improve the validity of the scale, Ramsey and Deeter-Schmelz (2008) assessed the original 22-item SOP scale and tested a reduced 10-item version, which performed better on discriminant validity. Nomological validity was tested by examining the relationship between the openness of information processing, risk preference and creativity/curiosity. Results were mixed and the authors concluded that the SOP scale had inconclusive nomological validity (Ramsey & Deeter-Schmelz, 2008). Although Childers (1986, p. 185) has previously implicated risk preference and creativity in relation to opinion leadership, the latter of which may be mediated by mental imagery of an unspecified kind, a solid underpinning of the relationships between the constructs in the SOP nomological network purported by Ramsey and Deeter-Schmelz was lacking.

At the same time, Wyer, Hung, and Jiang (2008), in discussing their work on comprehension and judgment, took into consideration the role of individual differences in verbal versus visual coding of information. They found that comprehension was faster when verbal instructions were interpreted by verbalizers than it was by visualizers. In another study, the authors found that verbalizers accessed verbal (vs. visual) information faster than visualizers (Jiang et al., 2008), especially in cases where there was no prior memory or experience of the information. They suggested automatic processing of information based on a propensity towards information is unrelated with affective processing, which is going against the premise of what SOP scale is built on.

In the dialog between Wyer, Hung, and Jiang (2008) and Bagozzi (2008), a criticism was aimed at taking a categorical view of individual differences in information processing with the SOP scale may contribute to its observed low validity. However, Wyer, Jiang, and Hung (2008) further distinguish between ability and disposition, suggesting that SOP is more likely to capture the latter. They further demonstrate that SOP is situational and can be primed by the external continuants, while realistically, consumers apply both strategies in decision making and judgment (Wyer, Jiang, & Hung, 2008).

More recently, DeRosia and McQuarrie (2019) reanalyzed past studies focused on investigating style of processing and had concluded a null effect of individual differences in SOP. However, in their paper they proposed a slightly different approach to conceptualizing SOP. Instead of taking a "relative propensity" view of visual or verbal preference, the authors propose that taking an "absolute" approach to conceptualizing SOP, that is, considering visual and verbal measures separately, overcomes the original assumptions to unbound preference, dominance, and comparison (DeRosia & McQuarrie, 2019).

2.3 | Taking a neuroscience approach to re-examine the SOP scale

Childers and Jiang (2008), in the same research dialog in the JCP issue, responded to the critiques by proposing a neurophysiological approach to understanding information processing with a focus on input—picture versus words, and the onset of visual versus verbal processing that follows. The authors point to the differentiation between automatic processing and controlled processes as the paradigm to understand "fluency," which is the process coined for faster response time and higher accuracy when input "matches" one's preferred style of processing information. Processing fluency has marketing implications for predicting higher rating of products, attitudes to advertising (Petrova & Cialdini, 2005) and other key constructs to understand consumer decisions (Labroo & Lee, 2006). Because SOP refers to chronic accessibility of preferred modality, placing an emphasis on the automatic processing of this preferred modality (Childers & Jiang, 2008), the authors posit that SOP is best understood by focusing on activation readiness, to include automatic (unconscious) versus controlled (conscious), and situational- versus individual-based visual and verbal processing. The answers to these questions are often restricted by self-reported approach, often arriving at what may seem to be the same behavioral outcome (concluding a null effect), hence pointing to the advantageous use of a neuroscience approach. In contrast, data captured through neuroscience methods can provide a clearer understanding of "processing fluency" (Jones et al., 2012).

Childers and Jiang (2008) proposed a conceptual model to study the effects of stimuli input (word vs. picture) and its activity in corresponding brain regions. The temporal region, which is more closely related to the emotion-governing amygdala, is activated in visualizers, hence predicting higher "fluency" in processing picture stimuli. In contrast, verbal processing in the brain is located in the occipital and frontal regions, hence predicting slower response in both evaluative and automatic tasks, in other words, low fluency. Implied in their paper, the automatic affective responses triggered by pictures can be differentiated between the verbalizers and visualizers based on the different routes in the brain taken (Childers & Jiang, 2008, fig. 1). In this paper, we aim to test these predicted routes focused on individual differences in cognitive processes based on SOP orientations.

2.4 | Neuroscience-informed scale validity test

The use of neuroscience methods for scale validation has been successfully demonstrated in the development of the sales force-specific theory of mind scale (Dietvorst et al., 2009), a scale designed to assess interpersonal mentalization capabilities in the context of personal selling. The paper followed a typical psychometric method for scale development to assess convergent, discriminant and criterion-related validity and nomological validity. The authors used the fMRI technique to identify brain regions such as medial prefrontal cortex (MPFC), temporo-parietal junction (TPJ), and temporal poles (TP) involved in interpersonal mentalizing to pinpoint specific neural processes between salespeople low versus high in interpersonal mentalizing skills. They found differences in the activation in MPFC and TPJ (Dietvorst et al., 2009).

Clinical medical fields have also used neuroscience methods to validate scales used in quick diagnosis or detection of diseases or trauma. Examples include the post concussive symptoms (PCS) scale which was validated using fMRI (Chen et al., 2007); convergent validity was conducted for a screening instrument (TE4D), a test for early detection of dementia with discrimination from depression, using EEG (Brinkmeyer et al., 2004); a translational cross-validation of a clinical self-evaluation scale, the von Zerssen's depression scale, used fMRI to evaluate the sensitivity of the self-reported scale in differentiating healthy from depressed patients (Stoyanov et al., 2018). Aside from this clinical self-reported battery scale validation, there has not been other psychometric scale development or validation studies in consumer research that incorporate the use of neuroscientific methods, with the exception of the sales force-specific theory of mind scale (Dietvorst et al., 2009).

In consumer neuroscience, Plassmann et al. (2015) have identified five ways neuroscience can inform and provide further understanding of marketing theories and consumer behavior: (1) identifying mechanisms; (2) measuring implicit processes; (3) dissociating between psychological processes; (4) understanding individual differences; and (5) improving predictions of behaviors. Here in this paper, we follow prior studies using EEG to examine individual differences in response to sensory stimuli (Lin, Cross, & Childers, 2018); additionally, we add a sixth purpose of the use of neuroscience methods for marketing research—scale development and scale validation, by demonstrating how EEG approaches can be used to assist in the validation of the SOP scale.

3 | RESEARCH OBJECTIVE AND ERP COMPONENTS

3.1 | Affective processing fluency in visualizers versus verbalizers

As noted earlier, while much highly impactful consumer research has utilized the SOP scale to provide researchers insights into consumer decisions and perceptions in the marketplace and beyond, a shortcoming of the scale has also been pointed out—questionable validity (Bagozzi, 2008; Ong & Milech, 2001; Ramsey & Deeter-Schmelz, 2008). One example is its failure to predict learning performance from text inputs based on individual differences in SOP (Ong & Milech, 2001). The original scale was founded on the basis that preferences, propensity and affect are what shapes individual differences in SOP (Childers et al., 1985), which are driven by the accumulation of experiences and memory stored in the brain. It is suggested that these learned experiences, together, will form the circuits and network to process word versus picture inputs differently (Childers & Jiang, 2008). A critical factor that is predicted to trigger different pathways related to the word or picture stimuli is "how" the information is processed. An evaluative (cognitive-based) versus automatic (affect-based) task is predicted to involve different brain networks in the verbal processors and visual processors.

In the marketing literature, consumer processing fluency has been linked to positive attitudes towards brands and especially pointing the relevance of valence and fluency (Lee & Labroo, 2004). Others have demonstrated processing fluency is related to the choice and information related to their purchase decisions (Novemsky et al., 2007). Fluency is conceptualized as information processing ease, which is a metacognitive sense of ease, reflecting cognitive processes such as memory and perception, etc. (Nunes et al., 2015), and which is reflected in the effort and speed of processing that information (Schwarz & Clore, 1996). In a study on experiential attributes, judgments based on hedonic product attributes such as sensory and affective factors are processed more fluently than functional product attributes, which are more deliberate (Brakus et al., 2014). Considering these applications of fluency theory in understanding consumer information processing, we explore how processing fluency may play a role based on tasks (affective vs. evaluative) in addition to how individual differences (i.e., SOP) influence their propensity to process visual information.

In this paper, we consider (1) the conceptual predictions of and (2) test the hypotheses proposed by the original authors (Childers & Jiang, 2008). While Bagozzi (2008) argued for the removal of affect considerations from the original SOP scale, we contend that affect *is* relevant in processing most forms of information and materials, especially as relates to hedonically marked fluency processes (Winkielman et al., 2003), unless the information is neutrally presented in either text or picture form. Hence, in addition to validating the SOP scale on individual differences in information processing, we also examine emotional processing by the brain during different tasks, affective versus evaluative, by taking an ERP methodological approach using EEG data collection.

As a more automatic process, Childers and Jiang (2008) had predicted speedier responses via the visual cortex to the emotional processing structure amygdale for visual processors. They proposed this process would be similar for both evaluative and non-evaluative judgments. This is because affect portrayed in images are better (and faster) extracted by visualizers as predicted by the brain structure setup where occipital and temporal regions are more sensitized in visualizers, hence triggering processes in these brain regions more automatically. Childers and Jiang (2008) predicted that for verbal processors, more resource-demanding judgments of pictures would lead to slower responses in the amygdale, detouring via the frontal cortex brain region as the default route for verbalizers, which is better for word processing and evaluative judgments.

As an alternative prediction to how brain processes may occur in response to picture stimuli, we consider the literature on emotional regulation (Dunn et al., 2009) and the two main forms of strategies used in regulating emotions proposed by Gross (2002)—suppression and cognitive reappraisal. While the assumption that picture-triggered emotions are automatically processed by visualizers, we also predict that cognitive judgment of pictures is more effortful for visualizers since rerouting of the process to prefrontal cortex, through the common route of occipital and temporal regions, for evaluative processing will take longer. In contrast, for verbalizers, picture-triggered emotions are more easily suppressed (ignored), and hence evaluative processing of picture-based information is more automatic (faster).

Based on the above premise, our first research question is:

> **RQ1.** How do motivation or purpose of tasks (evaluative vs. automatic affective) result in varying affective processing fluency between visualizers and verbalizers?

3.2 | Neurological ERP markers differentiating visualizers and verbalizers

Electroencephalographic (EEG) approaches have the advantage of high temporal resolution that other methods such as fMRI do not have, hence the study of images and text in the context of advertising is relevant (Harris et al., 2018). We proposed two affect-relevant ERP components that are expected to vary in activation latency, hemispheric topographical distribution and amplitudes based on the orientation and motivational task in verbalizers and visualizer. Specifically, the early left anterior negativity (ELAN) and the late negative slow wave (LNSW) are predicted to characterize individual differences in affective processing of picture stimuli based on the SOP scale.

3.2.1 | Early left anterior negativity (ELAN)

Early components of the event-related potential (ERP) are thought to underpin individual differences (for a review see Lin, Cross, & Childers, 2018; Lin, Cross, Jones, & Childers, 2018).[2] Handy et al. (2010), for example, showed rapid hedonic evaluation of brands over visual attention areas within 200 ms that were "individual bound" as compared to "stimulus bound" characteristics—that is, those pertaining to the stimuli themselves. Comparably, we expect anterior cortical sites, and in particular those centering over the frontal region, to demonstrate early ERP differences that differentiate visual *and* verbal processes (Childers & Jiang, 2008). As Childers and Jiang (2008) note, anterior scalp locations sensitive to neural activity subtended by the frontal and temporal cortices (see Figure 1 in blue) may serve as putative locations for differences in sensory processing style, which is expressed in their prediction that: "For verbal processors, we would predict the more resource demanding judgments of pictures would only lead to slower responses in the amygdale via this frontal word processing brain region for evaluative judgments" (p. 267). Even nonconscious emotional processes have been shown to elicit effects on affective word and picture categorization (Rohr & Wentura, 2021). Studies focusing on syntactical violations (i.e., those of the rules of language), for example, have shown nonconscious emotional processes exert their effects early, which may be indexed by an early left anterior negativity or ELAN whose time course to verbal information could precede visual information (Hahne & Friederici, 1999). ELAN is a left lateralized, anterior ERP component that embodies the long-held understanding that language is situated in the left hemisphere (Rossion & Lochy, 2021). We speculate that verbalizers may, by virtue of their preferred processing style, be especially adept at categorizing affective processes as a verbal kind, and thereby elicit rapid and pronounced ELAN as compared to visualizers when making such judgments. In studies with marketing stimuli, negative frontal ERP components like ELAN have been linked to inhibition of aroused prepotent responses such as consumer impulsivity (Mei et al., 2021) or conflict as when a consumer is making a choice based on differing expert and consumer reviews (Guo et al., 2022). Theoretical accounts suggest that emotion, in particular negative affect, affects the brain as a regulator of the right anterior hemisphere (Kuhl et al., 2021), in concert with a wide body of literature demonstrating hemispheric specialization as shown by ERPs (cf. Prete et al., 2018). We speculate that verbalizers may, by virtue of their preferred processing style, be especially adept at categorization of affective processes as verbal activities, and thereby elicit rapid and pronounced ELAN as compared to visualizers when making such judgments.

3.2.2 | Late negative slow wave (LNSW)

In addition to early sensory ERPs, late slow waves such as the late negative slow wave (LNSW) could serve as putative neural indicators of *activation* differences among visualizers and verbalizers. Whereas Childers and Jiang (2008) explicitly describe style of processing (SOP) as a chronically accessible long-term "activation readiness potential" that is "more consciously monitored and regulated" (p. 267), this term seems to confuse activation with arousal. In their seminal paper relating activation and arousal to ERPs, Pribram and McGuinness (1992) argue that slow wave negativities index activation. Late ERPs within the time window of the P3b (cf. N400, LPP, and ELAN abuts this) index arousal, which result from familiarization processes like the model outlined by Childers and Jiang. Schupp et al. (2006) describe how LNSW activity, a subclass of readiness potentials, has been shown to index attention and elaborative emotional processes. As noted in their review, broad activation patterns for slow waves were found for a host of different tasks. In particular, slow wave activity may have task specific topographic patterns (Rösler & Heil, 1991). LNSWs especially have been invoked in tasks involving affect and anticipation (Brunia et al., 2011). Taken together, direct comparisons of ELAN to LNSW allow for further refinement of the neural mechanism put forth by Childers and Jiang with respect to both neurobiology and process (i.e., arousal vs. activation).

[2]Childers and Jiang (2008) originally proposed an "early" P1/N1 posterior effect and a "late" N400 effect, which correspond to their subsequent work relating these components to perceptual and conceptual fluency, respectively (Jones et al., 2012). Analysis of these components failed to meaningfully differentiate style although differences were noted for pleasant versus unpleasant stimuli. As such, and for conciseness, we omitted these components from our discussion.

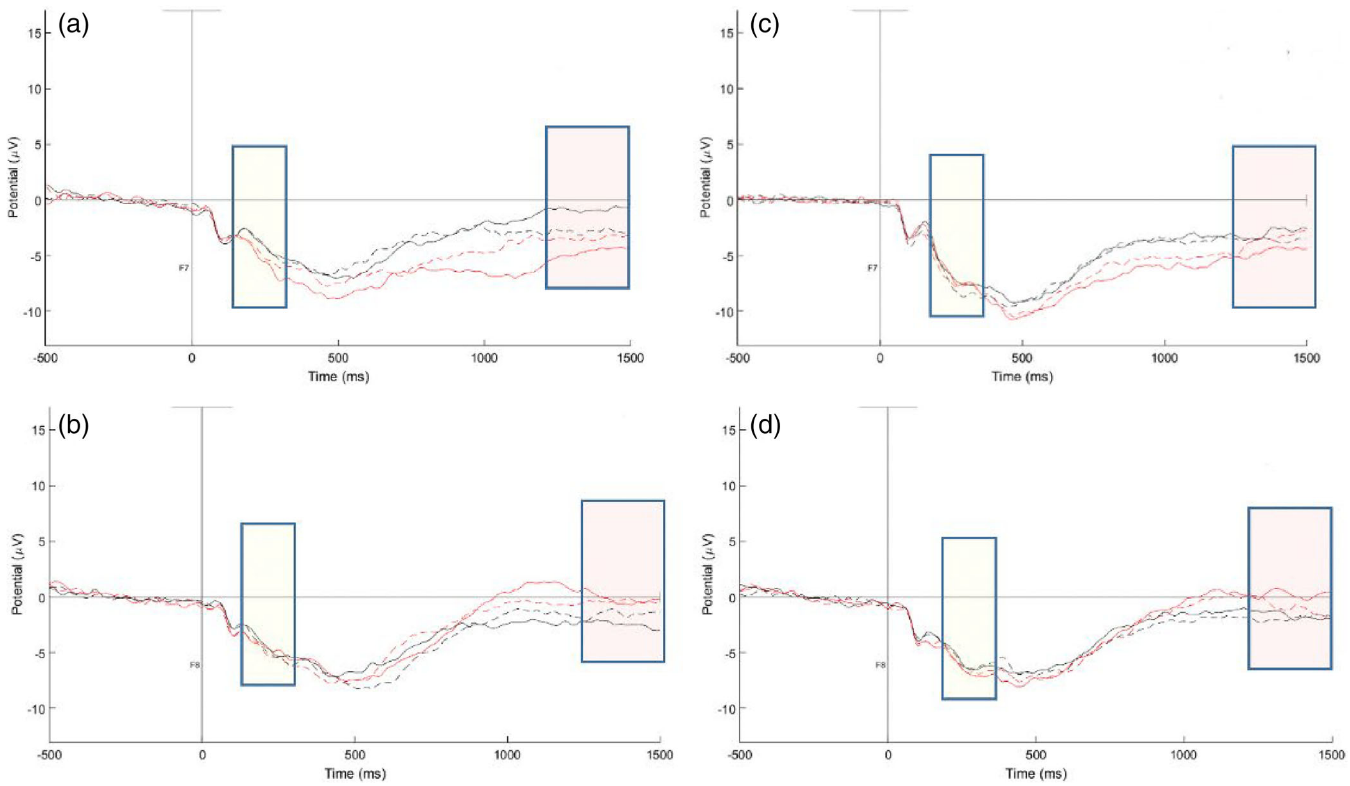

FIGURE 1 Scalp ERPs at (a) F7 for verbalizers, (b) F8 for verbalizers, (c) F7 for visualizers, and (d) F8 for visualizers. Early left anterior negativity (ELAN) shown in yellow. Late negative slow wave (LNSW) highlighted in red. Dashed black = affective categorization/pleasant; dashed red = affective categorization/unpleasant; solid black = evaluative categorization/pleasant; and solid red = evaluative categorization/unpleasant. [Colour figure can be viewed at wileyonlinelibrary.com]

> **RQ2.** How do ELAN and LNSW, and their respective time course, amplitude, and topographic patterns, differ between verbalizers and visualizers?

4 | MATERIALS AND METHODS

4.1 | Behavioral responses

4.1.1 | Participants

Undergraduate students were recruited from a prescreener survey that included the 20-item SOP scale. Participants were identified as either verbalizers or visualizers based on their scale ratings using a median split. A total of 68 participants completed the behavioral task for extra course credit. Three participants did not complete the task accurately and scored poorly on accuracy (less than 20% accurate) and were removed from the analysis. A final total of 65 participants completed the task, including 39 verbalizers and 26 visualizers categorized with the SOP scale.

4.1.2 | Stimuli and tasks

In a 2 (TASK: affective vs. evaluative) * 2 (AFFECT: pleasant vs. unpleasant) within subject * 2 (information processing STYLE: verbal vs. visual) between subject mixed design, we conducted a behavioral experiment using picture categorization tasks. A total of 100 pictures were selected from the International Affective Picture System (IAPS; Lang et al., 1997) picture database. We selected 40 pictures that were considered pleasant affect (e.g., happy family, smiling couple) and 40 that were unpleasant (e.g., man holding a gun, car accident). The 80 pictures were presented in randomized order for each task.

In two separate tasks, affective judgment and evaluative (nonaffective) judgment (Hajcak et al., 2006; Keightley et al., 2003), participants were instructed to categorize the pictures as fast as they can. A feedback screen was presented after each trial to encourage high accuracy.

In the affective judgment task, participants were asked to categorize each picture as either pleasant or unpleasant, using a response box with buttons on the left and right, that represented pleasant versus unpleasant. "Please press left key if the picture is pleasant and press right key if the picture is unpleasant. Please respond as fast as you can." The keys were flipped after 40 trials to counterbalance out any left or right handedness.

In the evaluative task, participants were asked to consider "How many persons in the picture?" and using the response box to respond "one" or "two or more." The following prompt was presented: "Please press the left key if the picture has one person and press the right key if the picture has 2 or more persons. Please respond as fast as you can."

The order of the two tasks was also counterbalanced across the participants. The stimuli were programmed using E-prime, and reaction times (ms) and accuracy of responses were recorded for each of the participants.

4.2 | Physiological responses

4.2.1 | Research design and participants

Similar to the behavioral study, a 2 (TASK: affective vs. evaluative) * 2 (AFFECT: pleasant vs. unpleasant) within subject * 2 (information processing STYLE: verbal vs. visual) between subject mixed design was used. A screener survey with the SOP scale was distributed across campus to approximately 800 students (undergraduate and graduate) in a large university in the Midwest, to recruit participants. A balanced number of 23 participants for each group were invited to participate in the study. A final number of 20 and 19 participants for verbal and visual, respectively, completed the study.

The study took approximately 1 h, including experiment and device set-up, data collection and a follow-up survey. Participants were compensated with gift cards. The EMSE® software (Cortech Solutions Inc, Wilmington, NC) was used to clean the raw data and remove any noise and artifacts from muscle movement and eye blinks. To limit the possibility of distorting the data due to overcorrecting measures, average trials rejected (per condition) were below 10% of the total trials. Participant data with too much noise and artifacts were excluded from the final set of participants, resulting in the final data set of 20 individuals as verbalizers and 19 individuals as visualizers. This sample size is above average for neuroscience studies (whether fMRI or EEG), which range from 6 to 20 subjects (Hirsch, 2010).

4.2.2 | Stimuli and tasks

In addition, a 180-trials-per-participant design was used in this study to maximize statistical power. Stimuli were selected from the International Affective Picture System (IAPS; Lang et al., 1997) picture database as described earlier in the behavioral response, including 40 pleasant pictures, 40 unpleasant pictures and 20 neutral pictures to set the neuro baseline activity.

Each task, both affective judgment and evaluative judgment, consisted of 80 trials (40 pleasant and 40 unpleasant pictures) presented in random order. The affective judgment included an additional 20 neutral pictures, with a total of 100 trials. Instructions were similar to the ones presented in the behavioral task as described above. The order of the tasks was balanced between subjects, where half of the subjects were instructed to complete the affective judgment first and the other half completed the evaluative judgment first. There were no order effects. Interstimulus interval (ISI) included a 3-s instruction screen plus a 1-s visual fixation. The instructions for the affective and evaluative tasks were similar to the behavioral tasks described above.

4.2.3 | Data recording and processing

Our study was conducted in a highly sophisticated lab developed for recording EEG including minimization of noise due to lighting, computer monitors and outside sources to reduce impedance (i.e., to establish a good connection between a participant's scalp and a recording electrode). The electroencephalogram (EEG, filter 0.02–150 Hz, gain 1000, 16-bit A/D conversion) was recorded from an array of 33 Ag/AgCl electrodes on an electrode arrays cap (Sands Research, El Paso, TX), including the midline site (Fz, FCz, Cz and Pz), fronto-lateral electrodes (F7, F8, FT7, FT8, T7, and T8), and occipital site (O1, Oz, and O2) electrodes. The electrode arrays cap was interfaced to a DBPA-1 (Sensorium Inc., Charlotte, VT) that amplified and digitized the data. High quality recordings were obtained by using low impedance (<10 KΩs) standards. The EEG recording data were sampled at 2048 Hz; no resampling procedures were taken.

After manually removing the noise sources, an intermediate band-pass filter (high 20 Hz, low 0.1 Hz) was used to remove other out-of-ERP-range noises such as electromyographic signals (EMG) and electrical line noise. Ocular artifacts were corrected using a covariance-based technique, including empirically derived estimates of the EEG associated with artifact and artifact free data (Source-Signal Imaging, San Diego). The ERP epochs, recordings ranging from 200 to 1500 ms around stimulus onset for this study, were obtained offline for analysis (Luck, 2005).

4.2.4 | Data analysis

Data analysis was carried out using the EEGLAB environment (Delorme & Makeig, 2004). Visual inspection of the data revealed significant differences over fronto-lateral electrode sites for sustained slow waves. Given theoretical considerations, we explored both an early left anterior negativity (ELAN) as well as a late negative slow wave (LNSW) (Figure 1). Early left anterior negativity (ELAN) was analyzed using the following fronto-lateral electrodes: F7, F8, FT7, FT8, T7, and T8 within the 150–250 ms time window. The late negative slow wave (NSW) was analyzed via the same electrode sites as the ELAN within the 1200–1500 ms time window. For all tests, we employed 50% fractional area latency measures to further illuminate the time course of the ERP waveforms. All tests employed repeated measures (RM) ANOVA with Greenhouse–Geisser correction.

5 | RESULTS

5.1 | Behavioral data

5.1.1 | Accuracy rates

Paired *t*-test was conducted to examine the accuracy and reaction time to the categorization task within verbalizers and visualizers. In the affective task, verbalizers accurately categorizing the pictures as pleasant versus unpleasant at a 90.67% rate, while also accurately categorized the pictures in the evaluation task at a 91.67% rate. The visualizers were similar in accuracy rate of 87.55% for categorizing the pictures in the affect task and 91.15% in the evaluation task. In an independent *t*-test, we confirmed that there was no significant difference in accuracy performance between information processing orientation for affective task, $M_{verbal} = 0.9067$ versus $M_{visual} = 0.8755$, $t(63) = 1.814$, $p = .074$; and for evaluative task, $M_{verbal} = 0.9167$ versus $M_{visual} = 0.9115$, $t(63) = 0.493$, $p = .624$.

5.1.2 | Reaction time

Main effects and interaction effects

In a AFFECT * TASK * STYLE mixed MANOVA analysis, results revealed significant main effects of the task, $M_{eval} = 704.18$ versus $M_{affect} = 730.75$, $F(1, 63) = 8.244$, $p = .006$, significant main effects of the picture affect, $M_{pleasant} = 722.50$ versus $M_{unpleasant} = 712.43$, $F(1, 63) = 3.946$, $p = .05$, the between subject effect was marginal, $M_{verbalizer} = 696.61$ versus $M_{visualizer} = 738.32$, $F(1, 63) = 2.991$, $p = .089$. However, there were significant two-way interaction effects between task and style, $F(1, 63) = 14.31$, $p < .001$ and between task and affect, $F(1, 63) = 43.645$, $p < .001$. The two-way interaction between affect and style was not significant, $F(1, 63) = 1.731$, $p = .193$, nor was the 3-way interaction effect, $F(1, 63) = 1.130$, $p = .292$.

Simple effects

To follow up the significant interaction effect between task and style, planned post-hoc paired *t*-test was conducted to examine how fast the verbalizers categorized the pictures based on the task. Verbalizers categorized the pictures significantly faster in the evaluative task than the affective task, $M_{eval} = 665.83$ versus $M_{affect} = 727.40$, $t(38) = -4.959$, $p = <.001$. In the visualizers, they did not categorize the pictures significantly faster based on the task, $M_{eval} = 742.54$ versus $M_{affect} = 734.10$, $t(25) = 0.654$, $p = .519$. In comparing the ratios in categorizing evaluative versus affective tasks for verbalizers and visualizers, respectively, the reaction time ratios were 0.915 versus 1.011.

To follow up the significant interaction effect between task and affect, planned post-hoc paired *t*-test was conducted to examine how fast pleasant pictures were categorized dependent on the task. The pleasant pictures were significantly faster in the evaluative task than the affective task, $M_{eval} = 679.45$ versus $M_{affect} = 755.87$, $t(64) = 5.643$, $p = <.001$. The unpleasant pictures were not significantly categorized faster in one task than the other, $M_{eval} = 713.58$ versus $M_{affect} = 704.27$, $t(64) = -0.923$, $p = .360$. The ratios for evaluative versus affective tasks for the pleasant and unpleasant stimuli, respectively, was 0.899 versus 1.013.

While the interaction between affect and style was not significant, a planned post-hoc paired *t*-test was conducted. Results revealed that there was no significant difference between the response time in pleasant versus unpleasant pictures in verbalizers, $M_{pleasant} = 698.32$ versus $M_{unpleasant} = 694.91$, $t(38) = 0.456$, $p = .651$. However, visualizers were significantly faster in categorizing unpleasant pictures than pleasant pictures, $M_{pleasant} = 746.69$ versus $M_{unpleasant} = 729.95$, $t(25) = 3.138$, $p = .004$. When comparing the ratios in pleasant versus unpleasant stimuli for verbalizers and visualizers, respectively, the ratios were 1.004 versus 1.022.

To dissect this differential effect between verbalizers and visualizers observed in their behavioral responses, we further examine the neural responses to the same image stimuli to understand the processing of emotions, drawing a broader connection of visual information processing with a focus on the extraction of affective information. While the behavioral reaction time shed light on individual differences identified by the SOP scale (and providing initial evidence for the validity of the SOP scale), the underlying explanation for this differential reaction between individuals is further explored using the neuroscience data. The following analysis of the physiological data (neural responses) will be.

5.2 | Physiological data

5.2.1 | Early left anterior negativity (ELAN)

Main effects and interaction effects

RM ANOVA was conducted and significant effects were noted for AFFECT ($F(1, 460) = 4.41$, $p = .036$), a STYLE * AFFECT interaction ($F(1, 460) = 6.12$, $p = .014$), an AFFECT * TASK interaction ($F(1, 460) = 10.23$, $p = .001$), a STYLE * AFFECT * TASK interaction ($F(1, 460) = 15.26$, $p < .001$), and a STYLE * AFFECT * TASK * hemispheric interaction ($F(1, 460) = 16.24$, $p < .001$).

Simple effects

Planned comparisons were utilized to elucidate the nature of the 4-way effect of affective processing differences between verbalizers versus visualizers during affective versus evaluative judgments and any hemispheric effects.

For *verbalizers*, affective processing differences were noted only over the left hemisphere such that unpleasant stimuli elicited more negative amplitudes than pleasant stimuli, $\mu V_{unpleasant} = -5.94$ versus $\mu V_{pleasant} = -4.92$, $p = .005$. For the evaluative judgement task, verbalizers elicited greater amplitudes for pleasant (vs. unpleasant) stimuli over both the left ($\mu V_{pleasant} = -4.79$ vs. $\mu V_{unpleasant} = -3.14$, $p = .001$) and right hemispheres ($\mu V_{pleasant} = -4.39$ vs. $\mu V_{unpleasant} = -3.34$, $p = .017$) (Figure 2a).

Among *visualizers*, amplitudes to pleasant stimuli elicited more negative left hemispheric amplitudes versus unpleasant amplitudes ($\mu V_{pleasant} = -4.25$ vs. $\mu V_{unpleasant} = -3.69$, $p = .022$) during the affective task, which is a reversal of the effect shown among verbalizers. Interestingly, the opposite effect of more negative amplitudes to unpleasant stimuli versus pleasant stimuli ($\mu V_{pleasant} = -3.74$ vs. $\mu V_{unpleasant} = -4.22$, $p = .01$) was shown over the right hemisphere, which is an effect not present among verbalizers. Moreover, for evaluative judgments, visualizers demonstrated more negative amplitudes for unpleasant stimuli versus pleasant stimuli

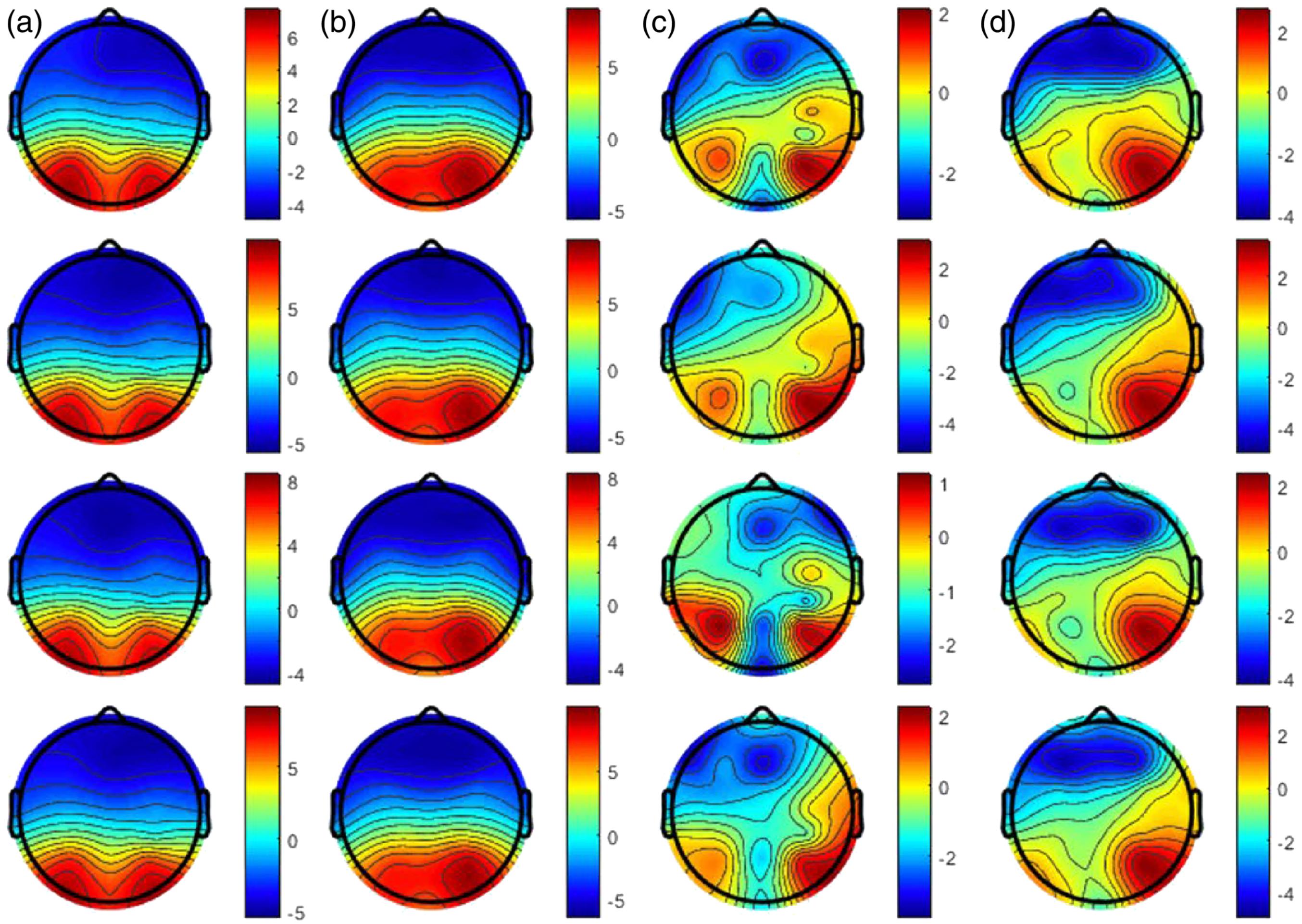

FIGURE 2 Topographic maps for (a) verbalizer (ELAN), (b) visualizer (ELAN), (c) verbalizer (LNSW), and (d) visualizer (LNSW). From top to bottom: affective categorization/pleasant, affective categorization/unpleasant, evaluative categorization/pleasant, and evaluative categorization/unpleasant. Units shown in µV. [Colour figure can be viewed at wileyonlinelibrary.com]

($\mu V_{pleasant} = -3.89$ vs. $\mu V_{unpleasant} = -4.33$, $p = .023$), which again is in the opposite direction of verbalizers. No difference among visualizers was noted over the right hemisphere for pleasant versus unpleasant ($\mu V_{pleasant} = -3.93$ vs. $\mu V_{unpleasant} = -3.74$, $p = .308$) stimuli when making evaluative judgments (Figure 2b).

5.2.2 | Late negative slow wave (LNSW)

Significant effects

Several significant interaction effects were noted for late negative slow wave (LNSW), including an AFFECT * hemispheric interaction ($F(1, 460) = 78.81$, $p < .001$) and a 4-way interaction of STYLE * AFFECT * TASK * hemisphere ($F(1, 460) = 4.00$, $p = .046$), which offers evidence for meaningful crossover effects.

Simple effects

Planned contrasts for *verbalizers* over the left hemisphere revealed significantly more negative amplitudes for unpleasant versus pleasant stimuli ($\mu V_{pleasant} = -2.43$ vs. $\mu V_{unpleasant} = -3.79$, $p = .002$) when making affective judgments. The reverse was observed over right hemisphere for verbalizers, but these effects were less pronounced ($\mu V_{pleasant} = -.62$ vs. $\mu V_{unpleasant} = .22$, $p = .031$). Also in verbalizers, significantly more negative amplitudes for unpleasant versus pleasant stimuli ($\mu V_{pleasant} = -.87$ vs. $\mu V_{unpleasant} = -2.44$, $p = .001$) was observed over the left hemisphere when making evaluative judgments. As per affective judgements, the polarity of effects is again reversed over the right hemisphere ($\mu V_{pleasant} = -1.55$ vs. $\mu V_{unpleasant} = .34$, $p = .001$) (Figure 2c).

The pattern of effects for *visualizers* is comparable with unpleasant amplitudes being more negative than pleasant amplitudes ($\mu V_{pleasant} = -3.00$ vs. $\mu V_{unpleasant} = -3.77$, $p = .02$) over the left hemisphere for the affective judgment task. This effect again reverses such that pleasant amplitudes are more negative than unpleasant amplitudes ($\mu V_{pleasant} = -1.11$ vs. $\mu V_{unpleasant} = -.53$, $p < .001$) over the right hemisphere for the affective judgment task. Interestingly, both pleasant and unpleasant stimuli demonstrate robust negative amplitudes for visualizers during the evaluative judgment task over the left hemisphere, however these amplitudes are only marginally significantly different from each other ($\mu V_{pleasant} = -2.46$ vs. $\mu V_{unpleasant} = -3.00$, $p = .08$). As with verbalizers, visualizers show greater negative amplitudes over the right hemisphere to pleasant versus unpleasant stimuli during the evaluative judgment task ($\mu V_{pleasant} = -1.06$ vs. $\mu V_{unpleasant} = -.09$, $p = .003$) (Figure 2d).

6 | DISCUSSION

In this paper, we demonstrate the use of an ERP approach, an application of EEG methods, to provide insight into varying cognitive processes in verbally and visually oriented individuals, categorized by the initial SOP scale that was scrutinized for its lack of validity. Our findings point to the complexity of our brains, considering both cognitive and emotional processes when encountered with information presented in visual representation. As shown in the behavioral results, the "performance" of learning or evaluating the information is not significantly different between the two groups, evidenced by the similar accuracy rates in the categorization tasks. This finding is also what Ong and Milech (2001) observed in their studies. However, the SOP scale is not meant to predict capability, for example, learning and performance, but differentiates *preference and propensity* in how information is processed by individuals. Hence, drawing the conclusion that the scale does not provide predictive or nomological validity overlooks the underlying differences in cognitive and emotional processes involved in processing information presented in a singular format. We find support for this by showing behavioral reaction time differences in evaluative versus affective categorization tasks, indicating a lag in response in visualizers when processing pictorial information that also communicates emotional information. However, to provide a deeper understanding of the fundamental drivers of such behavioral responses reflected at the surface, we resort to neural data to provide insight into the underlying processes driven by theories and past studies on ERP components that inform us about human cognition. As suggested from our physiological data, we further demonstrate that this lag could be explained by sustained *differential* emotional responses in visualizers versus verbalizers. In alignment with processing fluency theory, visualizers are more fluent in processing affective information presented in pictorial format, limiting the fluency of processing evaluative information, which is not present for verbalizers. This finding itself confirms and supports the premise that there are key characteristics that differentiate visualizers from verbalizers. According to past research on processing fluency, higher fluency would indicate more positive attitudes towards the brand or product associated with image (Lee & Labroo, 2004) and likelihood to choose the option processed with more fluency than not (Brakus et al., 2014; Novemsky et al., 2007).

Furthermore, hemispheric differentiation of the neural ERP data, provides neural evidence of fundamental variances in brain processes between visualizers from verbalizers. Verbalizers demonstrate a left lateralized response to neurophysiological cues during affective processing with unpleasant stimuli exhibiting more negative amplitudes. Theoretical accounts suggest an asymmetric hemispheric specialization of the frontal cortex with a leftward bias for positive affect and a rightward bias for negative affect (Harmon-Jones & Gable, 2018). Because the left hemisphere of the brain is asymmetrically favored for language processing (cf. Rossion & Lochy, 2021), increased negative amplitudes to unpleasant affective stimuli among verbalizers could reflect increased cognitive demands (as compared to pleasant stimuli) within a neural system that they preferentially engage (Meltzer & Braun, 2013). Similarly, theories such as *personality systems interaction theory* or PSI theory (Kuhl, 2000; Kuhl et al., 2021) posit a dominant regulatory function for negative affect in the right hemisphere, whereas a similar function for positive affect is said to occur in the left hemisphere.

In the context of the present study, verbalizers seem especially sensitive to unpleasant stimuli over the left hemisphere, evidenced by both early and late negative slow waves—ELAN and LNSW. The notable exception (among verbalizers) is the evaluative judgment task, which is primarily a counting task. Counting is a left lateralized undertaking, which itself might represent a form of embodied cognition of human (primarily) right-handed dominance (Tschentscher et al., 2012). As defined, verbalizers have a (verbal) *preference* to engage the left hemisphere, favoring left hemispheric functions. That processing unpleasant stimuli during affective evaluations is cognitively more taxing (or not as fluently) as indexed by a more pronounced ELAN is consonant with the notion that verbalizers are positively disposed toward engaging the left hemisphere. Marketing studies on processing fluency have not revealed its significance in processing sensory and affective experiential information (Brakus et al., 2014), but has been shown to explain cognitive processes related to pricing and calculating deals and promotions (Coulter & Roggeveen, 2014). Based on this hemispheric observation in our results, it is suggested that verbalizers are more likely to focus on cognitive tasks such as price calculations, and possibly are more effective (in other words more fluent) in making rational decisions, such as selecting a healthier meal based off of the ingredient labels, under the influence of visual "noise" occupying the consumption environment in the form of marketing content, especially in visual formats. Further support for the left lateralization of the evaluative task is demonstrated in faster categorization reaction time by verbalizers in the evaluative versus affective task, displaying enhanced processing fluency. Thus, and contrary to what Bagozzi (2008) suggested, this pattern underscores the need to retain items in the SOP scale such as "I enjoy doing work that requires the use of words," which captures affect-based preferences.

Parsing these findings further, visualizers elicit larger ELAN to pleasant (vs. unpleasant) judgments over the left hemisphere with the reverse effect over the right hemisphere. Like verbalizers, we can speculate that enhanced ELAN for visualizers may result from dissonance invoked by stimulating pleasantness in the nonpreferred (left hemispheric) neural pathway. Still, the reversal of the ELAN effect between hemispheres can also be interpreted as a function of asymmetric processing of positive versus negative affect in the left versus right frontal areas respectively (cf. Harmon-Jones & Gable, 2018). It is worth pointing out that emotional stimuli, depending on whether it is positive or negative emotions triggered by pleasant or unpleasant stimuli respectively, are processed differently between verbalizers and visualizers, more fluent in one condition than another. In addition, given the asymmetrical hemispheric brain activity specified by ELAN, judgments such as brand perceptions and especially rational-driven decisions such as pricing and comprehending marketing messages and forming counterarguments (which are critical in making responsible decisions in the marketplace), can be impacted by the type of affect triggered by visual images. Considerations for marketers when implementing more socially responsible promotional visual designs include being aware of the potential influence of marketing appeals (tapping into the emotions of consumers), which are often overly utilized in the marketplace. Applying caution is especially relevant when it comes to making important judgements that may influence consumers' purchase decisions, such as careful consideration of pricing information and ingredient labelling as well as other labels for making a better and more sound decision for their wellbeing. While not the focus of this paper, these findings can also rely on prior research that have identified correlated relationships among certain personality traits (Sojka & Giese, 2001), such as need for cognition with verbalizers and need for affect for visualizers. These other observable traits can be cues to identify individual preferences for example in the online space, and paired with our findings can be considered in algorithms designed for online targeting ads.

Notwithstanding, the overall pattern in both verbalizers and visualizers is largely that the LNSW over the left hemisphere is greater for unpleasant stimuli with the right hemisphere evidencing greater LNSW to pleasant stimuli. A possible outcome from the negativity bias which is universal among individuals despite their orientation in information processing (Hilgard et al., 2014).

In summary, this paper takes a neural approach to validating the SOP scale by providing neural evidence explaining possible underlying individual differences in the brain. Specifically, the topographical patterns of differences between verbalizers versus visualizers for both early and late negative slow waves, suggests an early underlying hemispheric lateralization or preference. Neural and behavioral findings together provide clear evidence for individual differences existing between the groups categorized by the SOP scale, pointing to the validity of the scale. Furthermore, the underlying processes driving these topographical differences are critical for marketers to understand so as to be more aware of how consumer judgments are impacted by how emotions (triggered by pleasant vs. unpleasant images) are processed in the brain. As discussed, the level and type of impact is not universal and varies based on the information processing orientation of individuals.

6.1 | Limitations

One common limitation that comes with neuroscience applications in studying cognitive responses, which is based on brain activity to infer its mental processes, is the fallacy of "reverse inference" (Poldrack, 2008). Our study is not an exception and we acknowledge possible confound factors that come with heavily relying on neuroscience data when interpreting the results. However, we have limited the impact of this practice to some degree by including a behavioral study capturing behavioral responses with the same stimuli and setup as the neurological study. The use of IAPS in the paper, a validated and indexed emotion database, was specifically used to implement a simple and controlled experimental design as one approach suggested to minimize the fallacy of reverse inference (Jack et al., 2019). Furthermore, research questions were guided by literature review and theories, which is also a practice recommended to avoid the impact of reverence inferences (Jack et al., 2019). Past literature focused on individual differences in style of processing and its relation to emotions and visual processing, are considered along with the literature on neuroscience studies that describe and predict emotional and cognitive responses.

By comparing and analyzing the two sets of data, the inferences made from interpreting the data is more reliable. Furthermore, the use of pattern classification method, which has been commonly adopted to overcome reverse inference (Kamitani & Tong, 2005) has also been conducted in the analysis of the patterns. Other methods of avoiding reverse inference such as an independent localizer task could be implemented in future studies to further remove this fallacy (Speer et al., 2021).

Another limitation is despite our use of IAPS for image stimuli for the purpose of minimizing reverse inference, such stimuli are not designed to be marketing material. It would be helpful for future research to test and confirm our findings regarding individual differences in processing visual and emotional information using ads and designs presented in a marketing context.

Our findings also have methodological and theoretical implications for marketers and other researchers.

6.2 | Methodological implications

With the exception of the development of the Theory of Mind for Salesperson scale (Dietvorst et al., 2009), there has been no other published study in the field of marketing using neuroscience methods. Their paper demonstrated the use of fMRI to test nomological validity following a series of psychometrics examinations. In this paper we took a similar approach to examine the SOP scale, that also observes individual differences in response to pictorial images. We were able to examine the effects of varying propensity to perform visual imagery and identify underlying mechanism, effectiveness in suppressing emotional process triggered by visualizers, that drives these behavioral and attitudinal differences. Furthermore, behavioral variances are supported by hemispheric and amplitude differences in ELAN and LNSW in verbalizers and visualizers. This points to the potential use of neuroscience as a tool to validate scales, especially scales that are related to rating individuals based on traits and other individual mental characteristics. While past research has used ERP to examine individual differences in sensory abilities and their influence on emotional processes (Lin, Cross, & Childers, 2018; Lin, Cross, Jones, & Childers, 2018), ERP has not been used to validate individual difference scales. Furthermore, while recently a measure for "fluency" has been tested to capture subjective fluency in experimental manipulations (Graf et al., 2018), we provide neurophysiological evidence for objective fluency. Since this was not the purpose for this paper, future research can further investigate the subjective measures with objective measure of fluency taking form of scale validation for additional evidence.

6.3 | Theoretical implications

Since the development of the SOP scale, over 700 papers have cited the work and incorporated the scale for studying its predictive and moderating role on processing information. Including applications of understanding attitudes and preferences based on the stimuli (word or picture) towards products and ads, or comprehension and learning of materials presented in word or picture. Other more psychologically focused studies have examined cognitive processes, focusing on memory recall and affect towards the product. However, a deeper understanding of the driving forces for these differential responses based on SOP was limited to possible processing fluency theory. We provide physiological-based evidence for processing fluency, pointing to the possible brain circuits involved in automatic processing of picture stimuli. Future research should expand this finding to the processing of words and examine if this mechanism is parallel to our findings in visually-oriented individuals, where effectiveness of emotional suppression in verbally-oriented individuals is lower than that of visually-oriented individuals when processing text-based information.

While SOP can be a useful lens to examine consumer and individual responses to information, it is important to keep in mind that the task and modality of the information is also relevant to predicting behavioral and attitudinal responses. Furthermore, a distinction between performance-based behaviors and preference-based decisions when selecting key dependent variables is important to consider for the study of SOP.

Following the literature on emotional regulation (Dunn et al., 2009), a similar application of suppressing emotions is to effectively carry out the categorization task. It has been shown that higher cognitive resource demands reduce effective control over emotions (Gross, 2002). Future research should consider strategies for better emotional control mechanisms related to SOP orientations; and effectiveness of interventions for self-regulation could consider the influence of its presentation, whether in visual or verbal format.

While pictures are generally perceived to be more effective in presenting emotion-based information, whether for marketing commercial, education or other purposes, it is perhaps advisable to be used with caution when the message is more technical and requires a stronger attentional focus on key pieces of information that is irrelevant. And note that this may have differentiating effects on individuals with varying SOP orientations.

ACKNOWLEDGMENTS

We thank Iowa State University for the support of the neuro lab in the College of Business for the use of their equipment and student assistance in data collection.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions. The data that support the findings of this study are openly available in this dropbox drive at https://www.dropbox.com/sh/8hom6m3gof6nwic/AABbwFhE-OO37a4QlmbIxuvQa?dl=0.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Lin, M.-H., Jones, W., & Childers, T. L. (2023). Neuromarketing as a scale validation tool: Understanding individual differences based on the style of processing scale in affective judgements. *Journal of Consumer Behaviour*, 1–15. https://doi.org/10.1002/cb.2166