



## The measurement of perceptual curiosity<sup>☆</sup>

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### Abstract

Perceptual curiosity, as defined by Berlyne (1954), involves interest in and giving attention to novel perceptual stimulation, and motivates visual and sensory-inspection. A 33-item questionnaire constructed to assess individual differences in perceptual curiosity was administered to 320 undergraduate students (202 females; 118 males). The participants also responded to the trait scales of the State-Trait Personality Inventory (STPI), and to selected subscales of the Sensation Seeking (SSS) and Novelty Experiencing (NES) scales. Principal axis factor analyses of the perceptual curiosity (PC) items identified a strong PC factor. With oblique rotation, diversive and specific PC components were found, from which subscales were constructed. Moderate positive correlations of the PC scale and subscales were found with the NES and STPI measures of curiosity and the SSS and NES sensation seeking scales, suggesting that perceptual curiosity involves seeking both knowledge and sensory experience. Divergent validity of the PC scale was demonstrated by minimal relationships with the STPI trait anger scale, and essentially zero correlations with the STPI trait anxiety and depression scales.

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## 1. Introduction

Daniel Berlyne (1949, 1950), one of the most prolific contributors to theory and research on exploratory behavior, conceptualized curiosity as a reaction to novel stimuli that involved feelings of interest or uncertainty. These internal states were assumed to motivate exploration of novel stimuli in order to acquire new information. Berlyne (1954) explicitly differentiated between *epistemic* and *perceptual* curiosity, which differed in terms of the types of stimuli that activated these emotional states and the behaviors that were motivated by them. Epistemic curiosity was aroused by complex ideas or conceptual ambiguities (e.g. scientific theories, intellectual conundrums), which motivated asking questions or testing hypotheses in order to gain knowledge (Berlyne, 1954). Perceptual curiosity, evoked by complex or ambiguous patterns of sensory stimulation (e.g. sights, sounds), motivated behaviors such as visual inspection in order to acquire new information (Berlyne, 1957, 1958).

As Berlyne's (1960, 1966) conception of curiosity and exploration evolved, he also differentiated between *specific* and *diversive* exploratory behavior. Specific exploration was motivated by both epistemic and perceptual curiosity, and involved the detailed investigation of a particular novel stimulus in order to acquire additional knowledge or perceptual information. According to Berlyne, specific exploratory behavior was most likely to occur in situations that were relatively rich with novel stimuli. An example of specific exploration would be to approach and carefully examine a novel object. In situations where there was limited stimulation, feelings of boredom activated diversive exploration, which involved searching the environment for something new and interesting. Thus, Berlyne assumed that individuals were motivated to seek stimulation to arouse their curiosity when bored, and to acquire new information once their curiosity was aroused.

Berlyne recognized the importance of the internal states associated with curiosity as motivators of specific and diversive exploration, but did not consider measuring individual differences in epistemic and perceptual curiosity as personality traits. The distinction between the thoughts and feelings that comprise internal emotional states and individual differences in how often these states were experienced was first recognized and empirically demonstrated by Cattell and Scheier (1960) in their research on anxiety. This state-trait distinction guided the development of the State-Trait Anxiety Inventory (Spielberger, 1975), and also provided the conceptual framework for constructing the State-Trait Curiosity Inventory (STCI: Spielberger & Butler, 1971; Spielberger, Peters, & Frain, 1976, 1981).

The STCI is comprised of scales that assess the intensity of curiosity at a particular time as an emotional-motivational state (S-Curiosity), and how often curiosity is generally experienced as a personality trait (T-Curiosity). Factor analyses of responses to the STCI items have consistently identified meaningful state and trait curiosity factors, demonstrating the importance of this conceptual distinction in the measurement of curiosity (Boyle, 1983, 1989; Spielberger & Starr, 1994). The content of the STCI items emphasizes intellectual stimulation (e.g. "I feel mentally active"), which is closely related to Berlyne's concept of epistemic curiosity. College students with high T-Curiosity scores asked their instructors more than twice as many questions, in a study of classroom behavior, as compared to students with low T-Curiosity scores (Spielberger et al., 1981). It should be noted, however, that perceptual curiosity is not assessed by the STCI, nor does this inventory take into account Berlyne's distinction between diversive and specific exploration.

Individual differences in Berlyne's concepts of diversive and specific exploration are assessed by the Ontario Test of Intrinsic Motivation (OTIM) developed by Day (1969). Consistent with Berlyne's theory, Day assumed that exploratory behavior involving the careful examination of a particular stimulus was motivated by specific curiosity. However, he considered diversive exploration—searching for novel stimulation—to be motivated by *diversive curiosity* rather than by *boredom*, as hypothesized by Berlyne. Day's distinction between diversive and specific curiosity, which is reflected in the OTIM items, was based on his observation that individuals may seek a broad range of novel stimulation (e.g. "I like to go somewhere different nearly every day") or stimulation that is relatively narrow in scope (e.g. "If I find a word I don't understand, I try to figure out its meaning"). Previous research by Langevin (1971) and Ainley (1987) also suggested that exploration may be directed towards a range of topics (breadth), or narrowly focused on a specific topic (depth). While the OTIM's diversive and specific curiosity subscales assess individual differences in breadth and depth of interest, Day's measures do not differentiate between epistemic and perceptual curiosity.

Pearson (1971) theorized that seeking new cognitive or sensory experiences were influenced by individual differences in *novelty seeking*, a concept which is similar to curiosity. Assuming that the source of novel cognitive or sensory stimulation could be either internal (e.g. thoughts, feelings) or external (e.g. reading books, scuba diving). Pearson (1971) developed the Novelty Experiencing Scale (NES) to measure individual differences in the tendency to approach or avoid novel stimuli. Respondents to the NES are asked to indicate whether they like or dislike a variety of novelty-seeking activities (e.g. "Planning moves in checkers or chess"; "Skiing down a high slope"). Seeking novel cognitive stimulation is clearly related to epistemic curiosity, whereas seeking novel sensory experiences is quite similar to *sensation seeking*, as defined by Zuckerman (1979).

The Sensation Seeking Scale (SSS) developed by Zuckerman and his colleagues (Zuckerman, Kolin, Price, & Zoob, 1964) asks respondents to choose between either engaging in or avoiding a variety of sensation seeking behaviors (e.g. "I would like to try parachute jumping"; "I never want to try jumping out of a plane with or without a parachute."). Previous research has shown that SSS scores are positively correlated with promiscuity, drug and alcohol use (Zuckerman, Bone, Neary, Mangelsdorff, & Brustman, 1972), gambling (Kulman, 1975), and behaviors such as skiing (Calhoun, 1988), parachuting, and skydiving (Hymbaugh & Garrett, 1974).

Sensation seeking, which can energize and direct interest in approaching novel sensory stimulation, is similar in some respects to Berlyne's (1954) concept of perceptual curiosity. However, sensation seeking is more concerned with engaging in activities for the purpose of increasing arousal, whereas perceptual curiosity stimulates exploratory behaviors that are directed primarily towards gathering new information. Moreover, sensation seeking motivates behaviors that reflect "the willingness to take physical, social, legal, and financial risks" (Zuckerman, 1994; p. 27), whereas perceptual curiosity stimulates exploratory behaviors that do not generally involve risk-taking (Berlyne, 1960).

### 1.1. Curiosity, novelty seeking and sensation seeking

Measures of curiosity, novelty seeking and sensation seeking share a common theme in that they assess individual differences in tendencies to engage in exploratory behavior (Voss & Keller, 1983), but measures of these concepts differ considerably in their emphasis on acquiring

knowledge as contrasted with seeking sensory experience. In a factor analysis of scores on curiosity, novelty and sensation seeking scales, [Spielberger and Starr \(1994\)](#) found two very strong factors, which were labeled Information Seeking and Experience Seeking. The Information Seeking factor was defined by strong loadings of scores on the STCI Trait Curiosity scale, the OTIM Specific Curiosity subscale, and the NES Internal and External Cognition subscales. Consistent with [Berlyne's \(1954\)](#) concept of epistemic curiosity, the content of the items in these scales emphasizes intellectual inquisitiveness and cognitive processing of information. The Experience Seeking factor was defined by moderate to strong loadings of scores on the SSS Experience Seeking, Thrill-and-Adventure Seeking, and NES External Sensation subscales, and was clearly related to Zuckerman's sensation seeking construct.

While [Spielberger and Starr's \(1994\)](#) Information and Experience Seeking factors identified measures that were related to epistemic curiosity and sensation seeking, none of the measures that were included in this study appeared to assess individual differences in perceptual curiosity. Perceptual curiosity, as defined by [Berlyne \(1954, 1957, 1958\)](#), involves interest in and giving attention to novel perceptual stimulation, and motivates visual and sensory-inspection. While [Berlyne's \(1957, 1958\)](#) research clearly demonstrated that individuals spend significantly more "gaze time" in examining novel, complex, or ambiguous stimuli, as previously noted, he did not endeavor to assess individual differences in his perceptual curiosity construct.

Based on a detailed review of the literature on curiosity, [Collins \(1996\)](#) concluded that no psychometric instrument designed to assess perceptual curiosity has been developed. A reliable and valid measure of individual differences in perceptual curiosity is needed to clarify the nature of this psychological construct, and to determine if it can be distinguished from epistemic curiosity and sensation seeking as a meaningful personality trait. A measure of individual differences in perceptual curiosity would also be useful in determining if people differ in their tendency to seek out novel perceptual information as they do in seeking knowledge ([Spielberger et al., 1981](#)) and sensory experience ([Hymbaugh & Garrett, 1974](#); [Zuckerman et al., 1972](#)).

The major goal of the present study was to determine if perceptual curiosity (PC) could be identified as a meaningful personality construct. A second goal was to develop a scale for assessing individual differences in PC, and to evaluate the relationship of this scale to measures of epistemic curiosity and sensation seeking. If PC can be identified as a meaningful component of curiosity as a multifaceted personality trait, and a scale can be constructed to assess individual differences in PC, the factor structure of this scale will be evaluated to determine whether meaningful components of PC can be identified.

## 2. Method

### 2.1. Participants

The participants in this study were 320 students (202 females, 118 males) recruited from undergraduate psychology courses at a large urban university. The sample consisted of approximately equal numbers of students who entered the university as freshmen, or as community college transfers in their junior year. The participants received extra credit toward their final grade for participating in this study.

## 2.2. Measures

Each participant responded to a battery of six questionnaires, which are briefly described below. The questionnaires were given in the following order: (1) an experimental perceptual curiosity questionnaire (EPCQ); (2) the trait anxiety, anger, and curiosity scales of the State-Trait Personality Inventory (STPI); (3) an experimental depression scale; (4) the Anger Expression (AX) Inventory; (5) the Thrill and Adventure Seeking and Experience Seeking subscales of the Sensation Seeking Scale (SSS); and (6) the Internal Cognition, External Cognition, and External Sensation subscales of the Novelty Experiencing Scale (NES). This order of presentation was determined primarily by similarities in the instructions and rating procedures for each measure.

### 2.2.1. *Experimental Perceptual Curiosity Questionnaire (EPCQ)*

This questionnaire consisted of 33 items with content in keeping with Berlyne's (1954) definition of perceptual curiosity (PC) that were adapted from existing curiosity measures or constructed especially for this study. Although Berlyne's (1957, 1958) research on perceptual curiosity was concerned primarily with responses to visual stimuli, the content of the EPCQ items was based on the broader meaning of his concept of perceptual curiosity (Berlyne, 1954). Thus, the items were designed to assess individual differences in reactions of interest to a variety of different types of novel sensory stimulation, including sight, sound, touch and taste (e.g. "I like exploring my surroundings", "If I hear something rustling in the grass, I have to see what it is", "When I see a new fabric, I like to touch and feel it"; "I enjoy trying different kinds of ethnic foods").

Each EPCQ item was reviewed for consistency with Berlyne's concept of perceptual curiosity by a group of native English speakers comprised primarily of psychology graduate students. In responding to each EPCQ item, the participants were instructed to report how they "generally feel" by rating themselves on a 4-point frequency scale that has been used extensively to evaluate anxiety and anger as personality traits in previous research (Spielberger, 1979, 1983, 1988). The rating alternatives were: 1 = Almost Never, 2 = Sometimes, 3 = Often, 4 = Almost Always. The procedures for adapting or constructing the 33 PC items are reported in greater detail by Collins (1996).

### 2.2.2. *State-Trait Personality Inventory (STPI)*

The STPI consists of six 10-item scales for measuring state and trait anxiety, anger, and curiosity (Spielberger, 1979). The STPI state scales assess the intensity of these emotional states at a particular moment; the trait scales measure how often each emotional state is generally experienced. Only the STPI trait scales were included in the present study. Participants respond to the STPI trait items by reporting how often they experienced the personality characteristics described in each item by rating themselves on the same 4-point frequency scale used with the EPCQ, which was previously described. All three STPI trait scales exhibited good reliability in previous research, with alpha coefficients ranging from 0.80 to 0.96 (Spielberger, 1979).

### 2.2.3. *Anger Expression Inventory (AX)*

The 24-item AX scale was designed to assess individual differences in the expression and control of anger as personality traits (Spielberger, 1988). This scale is comprised of three eight-item subscales that assess suppressed anger (AX/In), anger expressed towards other persons or objects

in the environment (AX/Out), and how often a person tries to control angry feelings (AX/Con). In responding to each AX item, subjects are instructed to report how they react or behave “when they feel angry or furious” by rating themselves on the same 4-point frequency scale used in this study with the EPCQ and STPI trait scales (Spielberger, 1979). The AX subscales have good internal consistency as reflected in alpha coefficients ranging from 0.73 to 0.86 (Spielberger, 1988).

#### 2.2.4. *The Novelty Experiencing Scale (NES)*

The NES was designed to measure the tendency to approach (like) or to avoid (dislike) novel stimuli, using a forced-choice preference format (Pearson, 1971). The four 20-item NES subscales are: (1) External Sensation, (2) Internal Sensation, (3) External Cognition, and (4) Internal Cognition. Alpha coefficients for each subscale range from 0.76 to 0.87 (Pearson, 1971). The Internal and External Cognition subscales were included in this study as additional measures of epistemic curiosity; the External Sensation subscale provided an additional measure of sensation seeking. Since, the Internal Sensation subscale did not appear to be related to the constructs under investigation, this scale was not administered.

#### 2.2.5. *Sensation Seeking Scale (SSS)*

The SSS was developed by Zuckerman et al. (1964) to assess individual differences in the tendency to seek novel sensory stimulation by engaging in social exploratory behavior. Four major sensation seeking dimensions are assessed by 10-item subscales: (1) Thrill-and-Adventure-Seeking (TAS); (2) Experience Seeking (ES); (3) Disinhibition (Dis); and (4) Boredom Susceptibility (BS). In responding to the SSS, subjects report which of two statements best describes their “likes or feelings.” In previous research, the TAS and ES subscales correlated positively with measures of curiosity, whereas the Dis and BS subscales did not correlate with other curiosity measures, suggesting that the aspects of sensation seeking measured by Dis and BS subscales do not involve curiosity (Collins, 1996; Litman, 1998; Litman & Spielberger, 2003; Starr, 1992). Therefore, only the TAS and ES subscales were included in the present study. The internal consistency reliabilities for the TAS range from 0.77 to 0.82; and from 0.65 to 0.67 for the ES subscale (Zuckerman, 1979).

#### 2.2.6. *Trait Depression Scale (T-Dep)*

The 10-item T-Dep scale was designed to assess individual differences in the frequency that depressive feelings (e.g. hopeless, sad, low) are experienced over time. Respondents are asked to report on how often they generally feel depressed by rating themselves on the same 4-point frequency scale used with the STPI trait scales (Spielberger, 1979).

### 2.3. *Procedure*

The EPCQ, the STPI trait scales, the T-Dep and AX scales, and the NES and SSS subscales were administered by Collins (1996) in group testing sessions to the undergraduate university students. At the beginning of the testing session, the experimenter introduced himself, handed out the packet of questionnaires to the participants, and informed them that the goals of the study were to learn about the feelings and attitudes of college students. The participants were also informed that additional information about the study would be made available to them after they responded to the questionnaires, and were asked not to discuss the study with other students.



### 3. Results

In order to identify the best items for measuring individual differences in perceptual curiosity (PC), principal axis factor analyses of responses to the 33 EPCQ items were computed, separately for females and males. Two criteria were employed to determine the number of factors to extract: eigenvalues greater than one and Cattell's (1957) scree test. Psychological meaningfulness was also considered in evaluating the extracted factors (Hatcher, 1994). The eigenvalues criterion suggested five possible factors for females (7.59, 1.80, 1.17, 1.12, 1.03) and six for males (7.12, 1.96, 1.33, 1.24, 1.05, 1.00). However, a visual scan of the scree plots suggested that only two factors should be extracted for both sexes.

The results of the two-factor solutions are reported in Table 1. Of the 33 EPCQ items, 20 had dominant salient loadings of 0.40 or greater on the first factor for both sexes. Although five items had salient dual loadings on the second factor, for both females and males, none of these items had dominant loadings on this factor for both sexes. Thus, one strong perceptual curiosity factor was identified, along with a relatively weak second factor that could not be meaningfully interpreted before rotation.

In keeping with the major goals of this study to develop a scale for assessing individual differences in perceptual curiosity, and to select a homogeneous set of items that most strongly reflected this construct, the 20 items with dominant loadings of 0.40 or greater on the first factor for both sexes before rotation were selected for the preliminary PC scale, and further reviewed for excessive redundancy in content. Since items #9 and #20 were highly similar in wording, and item #9 had stronger factor loadings for both females and males, #20 was dropped. The content of items #31 and #33 were also quite similar, but item #31 was considered more restrictive in meaning, and was eliminated. Given a major goal of this study to determine if perceptual and epistemic curiosity could be differentiated, two additional items with content that appeared to be related to both epistemic and perceptual curiosity (#16, "like to look at puzzling pictures"; #24, "want to know what people are doing") were also eliminated. The remaining 16 items, each with loadings of 0.41 or greater on the first factor for both sexes, were selected for the PC scale.

#### 3.1. Factor structure of the Perceptual Curiosity Scale

The next step in the data analyses was to determine whether perceptual curiosity was a unitary construct or possibly comprised of two component factors, as suggested by the scree plot and the finding that half of the 16 PC scale items had salient dual loadings for either females or males on the second factor. Responses to the 16-item PC scale were further evaluated in separate two-factor principal axis analyses for females and males. Given that the 16-items selected for the preliminary PC scale were very homogeneous, component PC factors were hypothesized to be substantially correlated. Thus, oblique (promax) rotations were conducted, for which the results are reported in Table 2. Each factor was defined primarily by six items with dominant loadings of 0.30 or greater for both sexes. These items are listed in Table 2 in the descending order of magnitude of their dominant loadings on each factor for females. The four remaining items, which had inconsistent loadings for females and males, are listed at the bottom of Table 2.

The items with strong loadings for both sexes on the first factor described exploring new places and seeking a broad range of perceptual stimulation (e.g. #5: "I like to discover new places to

go”). The second factor was defined by items with content that involved engaging in a closer inspection of a specific stimulus (e.g. #27: “When I hear a strange sound, I usually try to find out what caused it”). The content of the items with dominant loadings on the two factors generally corresponded with Berlyne’s (1954) concepts of diversive and specific exploratory behavior, and with Day’s (1969) measures of individual differences in these concepts. The two factors were

Table 1  
Principal axis factor loadings for the 33 perceptual curiosity items for females ( $n=202$ ) and males ( $n=118$ )

Item No. <sup>a</sup>	Item statement <sup>b</sup>	Factor I <sup>c</sup>		Factor II	
		F	M	F	M
5	Discover new places to go	<b>0.61</b>	<b>0.58</b>	−0.27	− <b>0.48</b>
13	Hear musical instrument/like to see it	<b>0.60</b>	<b>0.49</b>	0.12	0.16
9	Walking through interesting buildings	<b>0.60</b>	<b>0.59</b>	−0.13	0.00
17	Hear something/see what it is	<b>0.59</b>	<b>0.56</b>	0.29	0.14
33	Enjoy trying different foods	<b>0.59</b>	<b>0.47</b>	− <b>0.30</b>	− <b>0.36</b>
21	Visiting art galleries/museums	<b>0.57</b>	<b>0.57</b>	−0.21	−0.10
6	Exploring my surroundings	<b>0.57</b>	<b>0.55</b>	−0.29	−0.29
14	Viewing art display	<b>0.57</b>	<b>0.60</b>	−0.19	−0.01
29	Smell something new/find out what	<b>0.57</b>	<b>0.56</b>	<b>0.49</b>	<b>0.43</b>
27	Hear strange sound/find out what caused it	<b>0.57</b>	<b>0.54</b>	<b>0.36</b>	0.21
1	Travel to places/never been to	<b>0.54</b>	<b>0.41</b>	− <b>0.33</b>	− <b>0.32</b>
28	See new fabric/touch and feel it	<b>0.54</b>	<b>0.54</b>	<b>0.35</b>	0.28
26	Cave/want to explore	<b>0.53</b>	<b>0.52</b>	0.05	−0.09
16	Look at pictures which are puzzling	<b>0.53</b>	<b>0.54</b>	−0.17	−0.07
2	Listen to new/unusual kinds of music	<b>0.51</b>	<b>0.49</b>	− <b>0.34</b>	−0.23
10	Rather visit a park/never been to	<b>0.50</b>	<b>0.50</b>	0.01	− <b>0.36</b>
19	Driving/take new routes	<b>0.49</b>	0.24	0.01	−0.19
20	Walk through buildings/no business there	<b>0.48</b>	<b>0.54</b>	−0.05	0.06
31	New food at supermarket/want to try it	<b>0.47</b>	<b>0.49</b>	−0.02	0.00
11	Watching fireworks	<b>0.46</b>	0.19	0.26	0.21
4	Try new foods	<b>0.45</b>	<b>0.36</b>	− <b>0.42</b>	− <b>0.50</b>
18	See vocal group/different voice types	<b>0.44</b>	<b>0.53</b>	0.12	0.24
24	See people/want to know what they are doing	<b>0.41</b>	<b>0.48</b>	0.11	0.18
32	Watch planes	<b>0.39</b>	<b>0.49</b>	−0.03	−0.11
12	Putting together a complicated picture puzzle	<b>0.39</b>	0.24	0.10	0.13
8	Hear a bird sing/try to find	<b>0.38</b>	0.11	0.28	0.15
30	New house/explore	<b>0.38</b>	<b>0.61</b>	0.08	0.28
22	Smell food/try to find	<b>0.35</b>	<b>0.57</b>	<b>0.37</b>	<b>0.45</b>
15	Listening to music	<b>0.34</b>	<b>0.42</b>	−0.07	−0.08
7	Like movies	<b>0.31</b>	0.05	0.06	0.03
23	New cereal/try it	0.29	0.24	0.12	0.24
3	Bored seeing the same old things	0.09	0.06	−0.11	−0.06
25	Prefer old/to new songs	0.01	0.07	0.25	0.10
	Eigenvalues	7.59	7.12	1.80	1.96
	Common variance	0.53	0.43	0.13	0.12

<sup>a</sup> Ordinal position of an item within the questionnaire.

<sup>b</sup> Items are listed in descending order of magnitude of the dominant loadings for females on the first factor.

<sup>c</sup> Factor loadings  $\geq 0.30$  are in boldface.



moderately correlated ( $r=0.52$  for females;  $0.48$  for males), suggesting that the PC scale was comprised of two substantially related, but meaningfully different components of an underlying perceptual curiosity construct. The items with consistent dominant loadings for both sexes on the two factors were selected to form six-item subscales for measuring diversive (PC/D) and specific (PC/S) perceptual curiosity. The four items with inconsistent loadings for females and males could not be assigned meaningfully to either the PC/D or PC/S subscale, but were considered good PC items, as indicated by loadings before rotation of  $0.50$  or greater for both sexes on the first factor. Consequently, these items were retained for the 16-item PC scale.

To verify the factor structure of items selected for the PC/D and PC/S subscales, the responses to the 12 items comprising these subscales were further evaluated in separate, two-factor principal axis analyses for females and males with promax rotation. The results of these analyses, which are reported in Table 2, indicated that the two factors were essentially the same as those found in the analyses of the 16 PC items, but with clearer simple structure. All six PC/D items had dominant loadings on the first factor for both sexes, whereas the six PC/S items all had dominant loadings on the second factor. No salient dual loadings of  $0.30$  or greater were found. The correlations between the two factors were  $0.48$  for females and  $0.43$  for males.

Table 2

Rotated factor loadings for the 16 items that comprise the preliminary Perceptual Curiosity scale, and for the 12 items that comprise the diversive (PC/D) and specific (PC/S) subscales for females ( $n=202$ ) and males ( $n=118$ )

Item No. <sup>a</sup>	Item statement <sup>b</sup>	16 items				12 items			
		Factor I <sup>c</sup>		Factor II		Factor I PC/D		Factor II PC/S	
		F	M	F	M	F	M	F	M
2	Listen to new/unusual kinds of music	0.69	0.41			0.62	0.41		
1	Travel to places/never been to	0.68	0.60			0.73	0.59		
5	Discover new places to go	0.63	0.85			0.68	0.85		
6	Exploring my surroundings	0.59	0.64			0.62	0.64		
21	Visiting art galleries/museums	0.56	0.34		0.33	0.41	0.37		
33	Enjoy trying different foods	0.53	0.35			0.51	0.38		
29	Smell something new/find out what			0.76	0.74			0.74	0.75
27	Hear strange sound/find out what caused it			0.70	0.57			0.66	0.60
28	See new fabric/touch and feel it			0.68	0.64			0.70	0.61
17	Hear something/see what it is			0.58	0.45			0.56	0.51
13	Hear musical instrument/like to see it			0.42	0.48			0.49	0.46
18	See vocal group/different voice types			0.31	0.55			0.36	0.52
14	Viewing art display	0.57			0.47				
9	Walking through interesting buildings	0.47	0.32		0.32				
26	Cave/want to explore		0.37	0.40					
10	Rather visit a park/never been to		0.58	0.33					
	Eigenvalues	4.28	3.74	3.86	3.74	3.05	2.64	3.00	2.76

<sup>a</sup> Ordinal position of an item within the questionnaire.

<sup>b</sup> Items with consistent loadings for both sexes are listed in descending order of magnitude of the dominant loadings for females on each rotated factor in the analyses of the 16 items.

<sup>c</sup> Factor loadings  $<0.30$  are not reported.

### 3.2. Psychometric properties of the Perceptual Curiosity scale and subscales

The means, standard deviations, and *t*-tests of gender differences for the 16-item PC scale, the 6-item PC/D and PC/S subscales, and for each individual item are reported in Table 3. No significant gender differences were found between the mean scores of females and males on the PC scale, or for either subscale. However, females scored significantly higher than males on items #21 and # 28, and males scored higher than females on item #26. These findings suggested that females were more interested than males in viewing art and touching a new fabric, whereas males were somewhat more interested than females in exploring potentially unpleasant places, such as a cave.

Cronbach alpha reliability coefficients for the PC scale and the PC/D and PC/S subscales, and item-remainder (I-R) correlations for each item are also reported in Table 3. The alpha coefficients for the 16-item PC scale were 0.87 for females and 0.85 for males, and were somewhat lower for the two six-item subscales (*mdn subscale alpha* = 0.775). The I-Rs for the PC/D and PC/S items, determined by computing correlations between the score for each item with the corrected total score for the corresponding six-item subscale, ranged from 0.38 to 0.63 (*mdn I-R* = 0.535 for

Table 3

Means, standard deviations, Cronbach's alpha coefficients, item-remainder coefficients, and *t*-tests of gender differences for the perceptual curiosity (PC) scale, the diversive (PC/D) and specific (PC/S) subscales, and each PC scale and subscale item for females (*n* = 202) and males (*n* = 118)

Item No. <sup>a</sup>	Scale/item statement <sup>b</sup>	Females			Males			<i>t</i> -test
		Mean	SD	Alpha/I-R	Mean	SD	Alpha/I-R	
	<b>PC scale</b>	<b>45.5</b>	<b>8.8</b>	<b>0.87</b>	<b>44.7</b>	<b>8.4</b>	<b>.85</b>	<b>.87</b>
	<b>PC/D subscale</b>	<b>18.4</b>	<b>3.6</b>	<b>0.78</b>	<b>17.6</b>	<b>3.4</b>	<b>0.73</b>	<b>1.82</b>
5	Discover new places to go	3.52	0.64	0.60	3.41	0.71	0.63	1.25
1	Travel to places/never been to	3.43	0.76	0.59	3.42	0.79	0.44	0.08
2	Listen to new/unusual kinds of music	2.69	0.97	0.54	2.60	0.90	0.48	0.70
6	Exploring my surroundings	3.25	0.74	0.53	3.35	0.73	0.46	-0.97
33	Trying different foods	2.79	1.04	0.52	2.63	0.94	0.41	1.20
21	Visiting art galleries/museums	2.63	1.03	0.46	2.23	1.04	0.46	3.01**
	<b>PC/S subscale</b>	<b>16.2</b>	<b>4.1</b>	<b>0.78</b>	<b>16.0</b>	<b>4.0</b>	<b>0.77</b>	<b>0.51</b>
29	Smell something new/find out what	2.82	0.87	0.60	2.58	0.92	0.57	2.10
27	Hear strange sound/find out what caused it	2.80	0.94	0.59	2.91	0.91	0.52	-0.91
28	See new fabric/touch and feel it	2.96	0.95	0.59	2.54	0.95	0.54	3.37***
17	Hear something/see what it is	2.74	1.05	0.55	2.85	0.97	0.50	-0.77
13	Hear musical instrument/like to see it	2.58	1.06	0.52	2.58	1.05	0.46	-0.06
18	See vocal group/different voice types	2.41	1.17	0.38	2.50	1.05	0.50	-0.58
	<i>Unassigned PC items</i>							
14	Viewing art display	2.60	1.00	0.55	2.35	1.04	0.57	1.91
9	Walking through interesting buildings	2.92	0.86	0.55	2.85	0.85	0.52	0.61
26	Cave/want to explore	2.54	1.07	0.51	2.95	0.99	0.51	-3.02**
10	Rather visit a park/never been to	2.86	0.93	0.44	2.88	0.90	0.48	-0.14

\*\* *P* < 0.01. \*\*\* *P* < 0.001.

<sup>a</sup> Ordinal position of an item within the questionnaire.

<sup>b</sup> Items are listed in descending order of magnitude of the IRs for females.

females; 0.49 for males). For the four items that were not assigned to either subscale, the I-Rs were based on the correlations of these items with the corrected total score for the 16-item PC scale, and ranged from 0.44 to 0.57 (*mdn* = 0.53 for females; 0.515 for males). The magnitude of the alpha coefficients and I-R correlations indicated that the PC scale and the relatively brief PC/D and PC/S subscales had satisfactory internal consistency.

### 3.3. Correlations of the PC scale and the PC/D and PC/S subscales with other measures

Pearson–product moment correlations of the PC scale with the PC/D and PC/S subscales, and with the measures of epistemic curiosity, sensation seeking, and other personality traits are also reported in Table 4. Strong positive correlations of 0.83 or higher were found between the PC scale and both subscales, due to the fact that the items comprising the subscales were included in the PC scale. Moderate positive correlations (0.48 for females; 0.45 for males) were found between the PC/D and PC/S subscales. While the PC/D and PC/S subscales were substantially related, the moderate size of these correlations was consistent with the premise that these subscales assess meaningfully different components of perceptual curiosity.

The correlations of PC scale and subscales with the STPI T-Curiosity scale were stronger than with the other epistemic curiosity and sensation seeking measures, ranging from 0.43 to 0.63 (*mdn*  $r = 0.545$ ). Although the correlations of the PC scale and subscales with the two NES curiosity measures, which ranged from 0.13 to 0.37 (*mdn*  $r = 0.245$ ), were relatively small, 9 of these 12 correlations were statistically significant ( $P < 0.01$ ). Small to moderate correlations were also found between the PC scale and subscales with the three sensation seeking measures, ranging in

Table 4

Pearson Product–Moment Correlations for females ( $n = 202$ ) and males ( $n = 118$ ) of the PC scale and subscales with other measures of curiosity, sensation seeking, and other personality traits

		PC		PC/D		PC/S	
		F	M	F	M	F	M
Perceptual Curiosity	PC/D	0.84***	0.83***	–	–	0.48***	0.45***
	PC/S	0.85***	0.83***	0.48***	0.45***	–	–
Epistemic Curiosity measures	T-CUR	0.63***	0.57***	0.52***	0.50***	0.57***	0.43***
	NES IC	0.21**	0.24**	0.13	0.26**	0.22**	0.13
	NES EC	0.36***	0.27**	0.23***	0.17	0.37***	0.27**
Sensation Seeking measures	NES ES	0.52***	0.40***	0.44***	0.44***	0.39***	0.20*
	SSS TAS	0.43***	0.29**	0.42***	0.37***	0.29***	0.07
	SSS ES	0.47***	0.30**	0.41***	0.34***	0.34***	0.10
Other Personality measures	T-ANX	–0.11	0.09	–0.05	0.05	–0.14*	0.09
	T-ANG	0.03	0.21*	0.04	0.13	0.01	0.20*
	T-ANG/T	–0.05	0.14	–0.01	0.10	–0.07	0.11
	T-ANG/R	0.00	0.18*	0.01	0.08	0.01	0.19*
	AX/OUT	–0.03	0.28**	–0.03	0.15	–0.03	0.30***
	AX/IN	–0.05	0.16	0.00	0.03	–0.07	0.26**
	AX/CON	0.15*	0.06	0.19**	0.06	0.07	0.09
T-DEP	–0.10	0.15	–0.02	0.10	–0.13	0.10	

\*  $P < 0.05$ . \*\*  $P < 0.01$ . \*\*\*  $P < 0.001$ .

size from 0.07 to 0.52 (*mdn*  $r=0.405$ ); 16 of these 18 correlations were statistically significant ( $P < 0.05$ ). The finding of significant positive correlations of the PC scale and both subscales with the epistemic curiosity and sensation seeking measures provides evidence of convergent validity, and suggests that PC involves seeking both knowledge and sensory experience.

Most of the correlations of the PC scale and subscales with the measures of trait anxiety, anger, and depression were not statistically significant (*mdn*  $r=0.06$ ), which provides evidence of divergent validity. It is interesting to note, however, that significant correlations were found for males between the PC scale with the T-Anger, T-Anger/T, T-Anger/R, Ax/Out, and Ax/In scales, which were due primarily to the significant correlations of the PC/S subscale with these measures. For the females, small but significant positive correlations were found between the PC scale and PC/D subscale with the Ax/Con scale, and a small negative correlation of the PC/S subscale was also found with T-Anxiety.

#### 4. Discussion

A major goal of the present study was to determine if perceptual curiosity could be identified as a meaningful personality construct. In keeping with this goal, an experimental 33-item perceptual curiosity questionnaire (EPCQ) was constructed and administered to undergraduate university students. Principal axis factor analyses of responses to the EPCQ items identified a strong perceptual curiosity factor for both females and males, and a second weaker factor that was not interpretable. Of the 33 EPCQ items, 20 had dominant salient loading of 0.40 or greater on the first factor for both sexes, whereas only one item had a dominant loading on the second factor for either females or males. After eliminating four items with redundant wording or with content that was considered to be related to both epistemic and perceptual curiosity, the 16 remaining items were selected to form the Perceptual Curiosity (PC) scale. The PC scale was found to have good psychometric properties, with alpha coefficients of 0.87 for females and 0.85 for males, and satisfactory item-remainder correlations.

Factor analyses of the 16 PC scale items with oblique rotation identified two factors for both females and males, each defined primarily by six items with content that was clearly related to diversive and specific exploration (Berlyne, 1954, 1960; Day, 1969). The items comprising the diversive exploration factor described exploring new places and seeking a broad range of perceptual stimulation; the items with strong loadings on the specific exploration factor involved closer inspection of a particular stimulus. These findings were generally consistent with previous research reported by Langevin (1971) and Ainley (1987), who concluded that exploratory behavior could be directed towards either a range of diverse topics (breadth), or narrowly focused on a specific topic (depth).

The items with consistent dominant loadings for both sexes on each factor were selected to form six-item subscales for measuring diversive and specific exploration as components of perceptual curiosity. The relatively brief Diversive PC (PC/D) and Specific PC (PC/S) subscales had satisfactory internal consistency for both females and males (*mdn* subscale  $\alpha=0.775$ ). Moderate correlations were found between the PC scale and both subscales with the STPI T-Curiosity scale. Small to moderate correlations of the PC scales were also found with the two NES epistemic curiosity measures, and with all three sensation seeking scales.

The finding that the PC scales correlated more highly with the T-Curiosity scale than with the two NES epistemic curiosity measures raises questions about what is actually assessed by these three scales. The NES Internal and External Cognition items describe reactions to specific stimuli that clearly involve cognitive processing (e.g. “Analyzing a theory to see if its a good one”; “Reading articles that provoke my thought”). In contrast, the T-Curiosity items ask respondents to indicate how often they feel curious without referring to a specific stimulus (e.g. “I feel curious”; “I feel interested”; “I am in a questioning mood”). Thus, the T-Curiosity scale appears to assess internal thoughts and feelings that are common to *both* epistemic and perceptual curiosity, whereas the reactions to specific stimuli described by the NES items are more directly related to epistemic curiosity.

Small but significant correlations were found for males between the PC and PC/S scales with the T-Anger, T-Anger Reaction, AX/Out, and AX/In scales, suggesting that males experience and express angry feelings more often than females. Small but significant positive correlations were found for the females between the PC and PC/D scales with Anger Control, whereas the PC/S subscale correlated negatively with trait anxiety. However, only 10 of the 48 correlations between the PC scale and subscales with the anxiety, depression, and anger measures were statistically significant, as can be noted in Table 4, providing evidence of divergent validity.

The significant positive correlations of the PC scale and both subscales with the epistemic curiosity and sensation seeking measures, suggest that perceptual curiosity involves seeking both knowledge and sensory experience, and provides evidence of convergent validity. The correlations of the PC and PC/D scales with the sensation seeking measures were generally larger in magnitude than the corresponding correlations with the NES epistemic curiosity scales. These findings suggested that persons who are higher in perceptual curiosity, especially PC/D, primarily involve reactions to sensory than cognitive stimulation.

The results of two recent studies (Litman, 1998, 2000; Litman & Spielberger, 2003) provide further evidence that perceptual curiosity is related to seeking both knowledge and sensory experience. In these studies the PC scale correlated positively for both females and males with the NES and SSS measures of epistemic curiosity sensation seeking that were used in the present study. Moreover, as was found in the present study, the correlations of the PC scale with the sensation seeking measures were generally stronger than the corresponding correlations with the epistemic curiosity scales, providing additional evidence that perceptual curiosity involves stronger reactions to sensory experience than to cognitive stimulation.

In conclusion, factor analyses of responses to the items constructed for the present study in accordance with Berlyne’s concept of perceptual curiosity identified a single meaningful perceptual curiosity factor before rotation. With oblique rotation, two substantially correlated factors were identified that were related to diversive and specific exploratory behavior, as these constructs were conceptualized by Berlyne (1960, 1966) and Day (1969). The results of the factor analyses provided the basis for developing a 16-item Perceptual Curiosity (PC) scale, with six-item subscales for measuring diversive and specific PC. The PC scale and both subscales correlated positively with measures of epistemic curiosity and sensation seeking, suggesting that perceptual curiosity involves both seeking knowledge and sensory experience.

An important direction for future research with the PC scale and the PC/D and PC/S subscales will be to determine whether scores on these measures predict individual differences in relevant exploratory behaviors, such as visual inspection (i.e. Berlyne’s “gaze time”), and other perceptual

activities. It will also be important to determine whether the PC/D and PC/S subscales are related to differences in seeking information from sources of stimulation that are broad or narrow in scope. In addition, further evaluation of the relationships of the PC scale and subscales with measures of epistemic curiosity and sensation seeking is needed to clarify how individual differences in seeking knowledge and sensory experience are related or differ from one another.

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