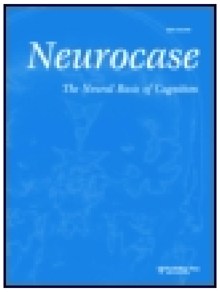

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Different levels of implicit emotional recognition in posterior cortical atrophy (PCA)

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Previous single-case reports in posterior cortical atrophy (PCA) have shown preserved nonconscious visual recognition despite the absence of explicit recognition. In this study, we investigated three levels of visual recognition in both a female patient with PCA and a control group during the presentation of neutral, positive, and negative affective stimuli. Our results confirmed the profile of impaired explicit recognition and intact psychophysiological responses in the patient. In addition, she was able to implicitly recognize the valence and intensity of arousal of these stimuli. We suggest that implicit emotional awareness may mediates explicit and psychophysiological recognition in PCA.

Keywords: posterior cortical atrophy; simultagnosia; emotional recognition; skin conductance response; implicit awareness

Nonconscious visual recognition has been studied in both healthy individuals and patients with neurological disorders. In typically developing participants implicit recognition of stimuli occurs, even in the absence of conscious awareness (Lazarus & McCleary, 1951; McGinnies, 1949; Miller, 1939). Further evidence for nonconscious recognition comes from patients with prosopagnosia, a disorder compromising the recognition of familiar faces. Prosopagnosic patients display greater skin conductance response (SCR) to non-recognized familiar faces than to unfamiliar ones (Bauer, 1984; Tranel & Damasio, 1985). This phenomenon is termed "recognition without awareness".

Other examples of implicit emotional processing in the absence of visual recognition can be found in patients with lesions to the primary visual cortex. These patients exhibit "affective blindsight": they are able to accurately discriminate the emotional valence of facial expressions despite their impairment in conscious visual perception (Tamietto & Gelder, 2008). A similar pattern has been observed in patients with visual neglect. For example, in a case report by Marshall and Halligan (1988), a woman was simultaneously presented with two line drawings of a house, one of which was burning on the left side. She judged that both houses were identical; however, when asked to decide which one she would prefer to live in, she consistently selected the house that was not on fire.

Nonconscious visual recognition has also been observed in patients with posterior cortical atrophy (PCA), a rare early-onset dementing syndrome that present with a progressive decline in visuo-perceptual skills, including visual recognition (Crutch et al., 2012). Initially, Filoteo, Friedrich, Rabbel, and Stricker (2002) reported the case of a patient who demonstrated augmented reaction times to incongruent items of a global–local recognition task, even though he failed to consciously identify global targets. More recently, Denburg, Jones, and Tranel (2009) used a psychophysiology index to examine a PCA patient, and found large amplitude of SCR to negative pictures, despite a lack of overt recognition. However, their experimental design did not include positive stimuli or, differences between objects and persons.

Additional relevant data comes from patients with anosognosia, who, despite their condition, exhibit emotional reaction to failure and subsequent behavioral adjustment (Mograbi, Brown, Salas, & Morris, 2012; Mograbi & Morris, 2013). Mograbi and Morris (2013) interpret such findings as signs of "implicit awareness," a state intermediate between awareness and nonconscious recognition which modulates affect and behavior. To this date, however, no study has explored the role of such intermediate state in PCA.

This paper investigates three levels of visual recognition in a 67-year-old female patient with a PCA diagnosis compared to a group of control participants. Specifically, we looked at: (1) the patient's ability to explicitly recognize the content of emotional pictures (awareness); (2) the implicit manifestation of awareness through the recognition of valence and arousal of the images (implicit

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awareness); and (3) SCR modulation according to the emotional valence of the pictures (nonconscious recognition). Thus, our report is the first to evaluate an inter-level stage (implicit awareness) between explicit and nonconscious recognition in PCA. We also sought to overcome some methodological limitations of previous studies in PCA. First, we included a control group in order to better characterize the patient's results. Second, our stimuli contained images of both persons and objects, which varied in affective valence (negative, neutral, or positive). Finally, given that color elicits emotional reaction and favors explicit recognition, we investigated the potential role of color in recognition by adding blurred pictures.

1. Methods and materials

1.1. *Participants*

The patient was a 67-year-old, right-handed female. She had completed 12 years of formal education and reported no academic problems. She presented to the first interview with a three-year history of progressive visual difficulties and a circumscribed medical history of well-controlled hypertension. She complained about daily-life difficulties in reading and recognizing known places and faces, which was confirmed by her relatives and during clinical observation (failures in recognizing shapes and pictures). A year after the symptoms started, brain MRI and SPECT studies showed no significant atrophy or hypoperfusion. Her ophthalmological examination indicated normal visual fields and normal visual acuity. In line with clinical findings, brain F-fluorodeoxyglucose positron emission tomography revealed hypometabolism in biparietal, posterior temporal, and occipital regions.

The patient was assessed with a complete neuropsychological battery which included tests of attention, executive functions, language, visuo-perceptual skills, and memory. Performance in these tasks was examined through mean *Z* scores, as compared to age- and gender-matched normative data (Table 1). While temporal orientation, memory, general attention, language, and executive functions were relatively spared, the patient showed difficulties in visuo-perceptual functions. Such deficits were evident in simple and complex figure copying as well as the trail making test (which taps visual attention).

Further assessment of the patient's visuo-perceptual skills was conducted on the basis of Humphreys and Riddoch (1993) model of visual object processing. This model proposes that visual processing involves a series of hierarchically structured processes, including perception of basic dimensions of the object – e.g., size, length, orientation, and location – figure and ground segmentation, and subsequent construction of viewpoint-invariant visual information. Upon completion of these pre-categorical visual processes, the viewpoint-invariant information would allow access to stored knowledge about object shapes, which are essential for visual recognition.

In terms of this model, the patient showed difficulties in the pre-categorical dimensions of visual perception. She failed to derive proper information about the objects, as evidenced by her poor performance on the length, size, orientation, and position match tasks. Also, she had problems in posterior figure and ground segmentation. Such

Table 1. Scores obtained by PCA patient in her neuropsychological assessment.

	Normative mean (*SD*)	Patient's score	*Z* score
Cognitive Screening Tests			
Addenbroke's cognitive examination *(max. 100; cutoff, 85)*		79	
Minimental state examination (max. 30; cutoff, 25)		27	
Attention and executive functions			
Forward digit span	6.28 (1.42)	7	0.51
Backward digit span	4.48 (1.44)	4	−0.33
Trail making test Part A	35.8 (11.9)	176	−11.78
Trail making test Part B	81.2 (38.5)	300	−5.86
Language			
Boston naming test (max. 20; cut off, 17)		18	
Phonological verbal fluency	15.2 (4.0)	21	1.45
Categorical verbal fluency	19.2 (5.2)	15	−0.81
Memory			
Rey auditory verbal learning test			
– Immediate recall	49.9 (7.5)	44	−0.79
– Delayed recall	10.2 (2.5)	5	−2.08
– Recognition	11.3 (2.8)	11	−0.11
Visuo-constructional abilities			
Copy of complex Rey figure	30.79 (4.21)	2.5	−6.72
Delayed recall of complex Rey figure	14.21 (7.5)	1	−1.76

difficulties resulted in severe deficits to recognize visual images (including letters, objects, and faces), suggesting an apperceptive visual agnosia.

Nine healthy controls were evaluated. These participants were matched with the patient for age (M = 49.66, DS = 17.76; t = .93, p = .18, z_{cc} = .98), years of education (M = 14.55, DS = 2.69; t = −.89, p = .19, z_{cc} = −.84), and gender (seven female and two male participants; t = .49, p = .31, z_{cc} = .52). All participants provided written informed consent in agreement with the Helsinki Declaration. This work was approved by the Ethics Committee of the Institute of Cognitive Neurology.

1.2. *Experimental task*

We presented four blocks of nine pictures selected from the International Affective Picture System (IAPS). These were classified in terms of valence (negative, neutral, or positive), following previous studies (Gantiva Diaz, Guerra Muñoz, & Vila Castelar, 2011; Leite et al., 2012). One block depicted images of persons and another one contained pictures of objects (see criteria to select stimuli in Appendix 1). The other two blocks contained the same stimuli but pixelated (blurred blocks). The task started with a three practice stimuli followed by blocks of persons and blocks of objects. The blurred blocks were presented before the clear images, and the sequence of pictures within the blocks was randomized. Each trial began with the presentation of the stimulus (3 s) followed by a blank screen (3 s). Immediately afterwards, participants were instructed to either identify the picture (awareness) through a verbal description, or guess its content in case they could not recognize it. The descriptions were recorded verbatim and then analyzed by two judges who assessed whether recognition in each trial qualified as explicit (see Appendix 2 for details). Subsequently, participants categorized each picture's valence as positive, negative, or neutral. Additionally, they rated the subjective arousal of each stimulus on a nine-point Likert scale (implicit awareness). All stimuli and associated SCR modulations were validated in a pilot study with healthy participants (see Appendix 3).

1.3. *SCR recordings*

Psychophysiological responses (nonconscious recognition) were recorded using a constant voltage (0.5 V) with AgAg/Cl electrodes attached to the distal phalanx surfaces of the middle and index fingers of the nondominant hand. The SCR was amplified through a BIOPAC system (MP100) and sampled on AcqKnowledge software at a rate of 200 Hz.

1.4. *Data analyses*

For measures of awareness and categorization of valence, a Mann–Whitney test was used to compare the patient's and the controls' trials (since the control sample's *SD* equaled zero). Comparisons of SCR and subjective ratings of arousal between the patient and control sample were performed with a modified one-tailed t-test (Crawford & Garthwaite, 2002, 2012; Crawford, Garthwaite, & Howell, 2009). This methodology allows the assessment of significance by comparing multiple individuals' test scores with norms derived from small samples. In addition, for the modified t-test, we reported effect sizes (z_{cc}), as suggested by a previous study (Crawford, Garthwaite, & Porter, 2010). SCR data was analyzed using Matlab 7.1 and Ledalab toolbox (http://www.ledalab.de/). To decompose the raw skin conductance signal into phasic components, we used a discrete decomposition analysis, which captures intra-individual deviations from the general response shape (Benedek & Kaernbach, 2010). The SCR area under the curve was calculated by defining a within-response window between 1 and 6 s post stimulus onset. SCRs were considered significant if they were higher than 0.01 mμs.

2. Results

2.1. *Explicit recognition (awareness)*

The patient failed to accurately identify most of the pictures. She verbally recognized only three of the 18 pictures presented (one neutral and one positive image of the persons block and one neutral stimulus of the objects block). Control participants correctly identified all the pictures. A Mann–Whitney analysis of trials comparing explicit recognition revealed significant overall differences between the patient and the control group (U =1,789.50, p = .00) as well as among the patient's answers within each category (see more results in Appendix 4).

2.2. *Implicit awareness*

2.2.1. *Valence categorization*

Despite her incapacity to recognize the stimuli, the patient accurately categorized the emotional valence of most of the pictures. She was able to correctly allocate the valence of 4/6 negative stimuli and 5/6 positive stimuli. Nevertheless, she correctly categorized only 1/6 neutral stimuli. For their own part, control participants accurately categorized the emotional valence of most positive and negative pictures, but also failed to categorize several neutral images (see Table 2). A Mann–Whitney analysis of valence recognition revealed significant differences for negative images of persons (U = 27.00, p = .00), with the patient identifying fewer pictures than control participants. No significant differences were observed in the remaining

Table 2. Patient's score and controls' mean of images accurately categorized (maximum three for each condition).

Block	Valence	Patient's score	Controls' mean	Patient vs. controls*
Persons	Negative	2	3 (.00)	.00
	Neutral	0	1.20 (.91)	.23
	Positive	2	2.90 (.31)	.05
Objects	Negative	2	2.60 (.51)	.42
	Neutral	1	1.60 (1.17)	.63
	Positive	3	3 (.00)	1

Note: *Mann–Whitney analyses of trials.

categories (neutral persons: U = 27.00, p = .23; positive persons: U = 28.50, p = .05; negative objects U = 33.00, p = .42; neutral objects U = 34.50, p = .63; positive-objects U = 40.50, p = 1.00).

2.2.2. *Arousal ratings*

Relative to controls, the patient reported lower ratings of intensity of arousal for negative images of persons (t = −3.98, p = .00, z_{cc} = −4.19; see Table 3). For the remaining types of stimuli, although the patient had rated less arousal than controls, there were no significant differences (neutral persons: t = 1.07, p = .15, z_{cc} = 1.13; positive persons: t = .00, p = .50, z_{cc} = .00; negative objects: t = .85, p = .20, z_{cc} = .89; neutral objects: t = 1.03, p = .16, z_{cc} = 1.09; positive objects: t = .65, p = .26, z_{cc} = .69).

Table 3. Means, DS, and differences between the patient and controls in arousal ratings.

Block	Valence	Patient's mean	Controls' mean	Patient vs. controls*
Persons	negative	5 (1.00)	8.40 (.81)	.00
	neutral	7 (.57)	3.93 (2.70)	.15
	positive	6.5 (2.08)	6.50 (1.97)	.50
Objects	negative	7 (1.73)	5.66 (1.48)	.20
	neutral	6.5 (1.73)	3.73 (2.54)	.16
	positive	7.33 (.57)	5.76 (2.27)	.26

Note: *A modified Crawford's t-test (Crawford & Garthwaite, 2002).

In sum, although the patient failed to explicitly recognize the pictures' contents, she was able to implicitly recognize their emotional valence. Also, she assessed the arousal intensity of these images, except for negative images of persons in this domain she was outperformed by controls.

2.3. ***SCR (nonconscious recognition)***

Although the patient showed less SCR than controls (see Figure 1), no significant differences were found in either images of persons (negative: t = −.49, p = .31, z_{cc} = −0.52; neutral: t = −.33, p = .37, z_{cc} = −.35 and positive: t = −.39, p = .35, z_{cc} = −.41) or pictures of objects (negative: t = −.80, p = .22, z_{cc} = −.85; neutral: t = −.31, p = .38, z_{cc} = −.32; and positive: t = −.55, p = .29, z_{cc} = −.58).

In short, these results show that the patient exhibited a similar psychophysiological response to unrecognized images as controls did to recognized stimuli.

2.4. ***Recognition of blurred pictures***

Both the patient and the control participants, failed to verbally identify the content of blurred pictures. In addition, they exhibited no differences regarding valence/arousal ratings and SCR (see details in Appendix 5).

3. Discussion

This report explored three levels of visual recognition from conscious to implicit emotional recognition in a patient with PCA. Relative to matched healthy controls, our patient confirmed the profile of impaired explicit recognition and intact psychophysiological responses in this syndrome. In addition, our results highlighted the role of implicit awareness as an intermediate processing state that contributes to identifying the emotional valence and intensity of arousal of unrecognized pictures.

To our knowledge, only two case report studies (Denburg et al., 2009; Filoteo et al., 2002) have presented

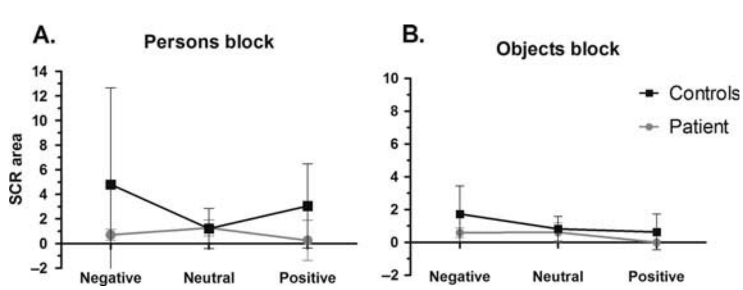

Figure 1. SCR modulation between negative, neutral, and positive images for each block in the patient and control participants. (Bars indicate *SD*.)

preliminary evidence of preserved nonconscious and impaired explicit visual recognition in PCA. However, both reports failed to include a control group of participants to statically support such observations. First, Filoteo et al. (2002) demonstrated preserved nonconscious processing in a PCA patient, by showing a normal pattern of reaction times between unrecognized global stimuli. Then, in their report of another patient with PCA, Denburg et al. (2009) showed intact psychophysiological response between negative and neutral pictures. Also, their patient correctly identified the emotional valence of some images, which the authors interpreted as evidence for (relatively) spared perception without accurate identification. We suggest that these findings also evidence implicit emotional knowledge in the patient.

In the current study, we report a case of PCA patient including a control group and showing three levels of visual recognition: explicit recognition (awareness), implicit awareness (valence categorization and arousal ratings), and nonconscious recognition (SCR). Consistent with previous results (Denburg et al., 2009), our patient's psychophysiological response for unrecognized images was similar to those of controls to recognized stimuli, suggesting nonconscious recognition of the stimuli presented. More interestingly, she was able to implicitly recognize the emotional valence of most images and accurately assess their arousal intensity. The latter finding suggests that our patient was implicitly aware of the emotional content of the pictures presented, as observed in patients with anosognosia symptoms, including patients with hemiplegia, Alzheimer's disease (AD), and other dementias (Fotopoulou, Pernigo, Maeda, Rudd, & Kopelman, 2010; Martyr et al., 2011; Mograbi et al., 2012; Mograbi & Morris, 2013). Although these patients are unable to explicitly recognize their deficits, they show preserved emotional reaction to failure and subsequent behavioral adjustment. Likewise, our patient exhibited visual deficits but was able to, implicitly process emotional features (valence and arousal) of stimuli. Such pattern may reflect partial identification of some perceptual features, such as overall configuration, color, or context (for examples, see the patient's verbal descriptions in Appendix 2). This partial perception may have helped the patient implicitly identify the emotional features of the stimuli. Furthermore, the integration of these implicit perceptual aspects with relevant psychophysiological responses may generate an implicit emotional process that compensates for some of her visual deficits.

Note that most of the evidence suggesting preserved implicit emotional process in the patient is based on the absence of significant differences between the patient and controls. However, the high variability observed in these measures may partially explain these results. This issue should be further explored in future studies including larger patient and control samples.

Finally, although the patient was similar to controls in her ability to recognize the emotional valence and arousal of most stimuli, she demonstrated reduced capacity to categorize the valence and rate the arousal of negative images of persons. On the contrary, for controls, this type of pictures yielded maximum accuracy ratings in emotional valence recognition (see Table 2) and arousal (see Table 3). The absence of such ceiling effects in the patient may have influenced the significant differences between her and the control group. Alternatively, this result would suggest an increased valence/arousal threshold for the strongest stimuli in the patient. Further research is needed to better understand implicit emotional awareness for negative images of persons in PCA patients.

3.1. *Theoretical and clinical implications*

Our findings suggest that implicit visual processing is not only a basic cognitive function but also extends to more complex stimuli, including an emotional level. Moreover, the evidence gleaned from our PCA patient supports the notion that conscious access to visual information may be sub-served by alternative pathways: (1) a "fast pathway," which connects higher-order visual cortices to autonomic centers in the amygdala or the hypothalamus (SCR), and (2) a higher-order mechanism supported by the integration of mnemonic, attentional, and executive networks (Mograbi & Morris, 2013). The latter pathway would provide an implicit access to the emotional content of visual targets, based on partially available information. This mechanism may underlie the preserved global effect on reaction times (Filoteo et al., 2002), partial recognition of valence in pictures (Denburg et al., 2009), and spared sensitivity to intensity of arousal (as demonstrated in the present study).

The notion of implicit emotional processing of visual information in patients with PCA may also have important clinical implications. PCA rehabilitation programs could help patients to develop compensatory strategies by focusing on preserved implicit emotional awareness and teaching implicit rules for interpreting visual images (Ibáñez, Velásquez, Caro, & Manes, 2013). In this population, the use of alternative senses, such as tact, has proved to be a successful strategy to restore daily-life activities (Roca, Gleichgerrcht, Torralva, & Manes, 2010). Our data show that patients who cannot rely on the exact recognition of visual material may nonetheless derive emotional information from it. PCA patients can then be trained to use such emotional information to compensate for visuo-perceptual deficits in everyday scenarios – for example, to avoid possibly harmful situations.

3.2. *Conclusion*

This study introduces a novel approach to dissociate visual perception from implicit emotional awareness in PCA. Specifically, by using methods which tap three distinct levels of processing, we revealed the following pattern in our PCA patient: (1) impaired explicit recognition of visual scenes, (2) partially preserved implicit awareness of emotional valence and arousal ratings, and (3) preserved psychophysiological responses (SCR). Thus, this report confirms and extends preliminary evidence of implicit recognition in PCA while overcoming some methodological limitations of previous reports. However, further studies including a larger patient sample are needed to corroborate these findings.

Our results suggest that, in PCA, explicit visual perception impairments may coexist with preserved nonconscious recognition and implicit emotional awareness through valence and arousal identification. Implicit emotional awareness has been previously identified in anosognosic patients with hemiplegia and AD. However, our findings indicate this phenomenon is not restricted to awareness of one's own disease; rather, implicit emotional awareness may constitute a general property of cognitive processing at large, opening a new research agenda relevant for both clinical assessment and neurocognitive models of conscious access.

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Disclosure statement

The authors report no conflicts of interest.

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Appendix 1. Task design

We used norms from a South American country (Gantiva Diaz et al., 2011) to select the stimuli for the task (see the images selected from the IAPS in Table A1). For the persons block, we selected three pictures with positive valence (>6.5) and high arousal (>5.5), three images with neutral valence (5 and 5.5) and low arousal (<4.0), and three with negative valence stimuli (<2.5) and high arousal (>5.5). Since object pictures had lower arousal ratings than person images, we employed a lower cutoff to select stimuli. Thus, we chose three pictures with positive valence (>7) and relatively high arousal (>4.5), three with neutral valence (4.5 and 5.5) and comparably low arousal (<4.0), and three with negative valence (<3.5) and high arousal (>4.5).

Finally, blurred blocks were constructed by degrading the selected pictures using GIMP software (http://www.gimp.org/) to a pixel size of 65. Through this procedure, we preserved the color features of the stimuli while preventing their explicit recognition.

Appendix 2. Procedure for assessing explicit recognition

The recordings of verbal descriptions were separately analyzed by two judges who assessed the identification of each picture. Participants were judged to have accurately recognized the picture if they mentioned one of the words included in a categorized description (see Table A1). An equal agreement between both judges was required for a picture to be considered as accurately recognized.

The patient failed to correctly identify most of the clear pictures. However, in some trials she was able to accurately determine their valence. For example, when shown a picture of delicious muffins, she said "some white stains scattered on the floor," and she categorized this as "positive, because white color means peace for me." When presented with a picture of two men hanging from the gallows, she said "two men standing up; I can't see what are they doing," and categorized this picture as "negative; they look like suspicious men."

Appendix 3. Pilot study

We tested the task with nine participants (three male and six female). The group's mean age was 27.77 (DS = 6.03), and its mean years of education was 17.66 (DS = 1.73). The experimental settings were the same as those described in the original study.

First, a significant correlation was observed between the participants' ratings of valence (r = .97; p = .00) and arousal (r = .76; p = .00) relative to those reported in former studies (Gantiva Diaz et al., 2011).

Second, we used a non-parametric repeated measures analysis (Friedman's test) to compare the SCR for negative, neutral, or positive pictures (see Figure A1). Significant differences were found in the persons block (χ^2 = 7.82, p = .02). The participants exhibited higher SCRs for negative than neutral pictures (χ^2 = .50, p = .03), and higher for positive than neutral images (χ^2 = 5.44, p = .01). No differences were observed between negative and positive stimuli (χ^2 = .50, p = .47). For the objects block, no differences were observed (χ^2 = .70, p = .70) in a pairwise comparison between conditions (negative versus neutral images: χ^2 = .11, p = .73; negative versus positive pictures: χ^2 = .14, p = .70; and positive versus negative stimuli: χ^2 = 1.00, p = .31).

Appendix 4. Explicit recognition (awareness): comparison between the patient and controls for each block

A Mann–Whitney analysis comparing trial recognition in the patient and the controls revealed significant differences in both the persons block (negative: U = 1,644.00, p = .00; neutral: U = 1,485.50, p = .00; positive: U = 1,485.50, p = .00) and the

Table A1. Description of the IAPS images selected for the experimental design.

	Valence	Image number	Valence rating	Arousal rating	Description
Persons block	Negative	9413	2.38	5.85	Two hanged men, gallow
		3059	1.88	5.82	Mutilated face, dead man
		3005	1.7	5.84	Buried corpse, dead child
	Neutral	2235	5.37	3.76	Grocer in a shop, grocery store
		2493	5.02	3.66	Face of a man
		7493	5.05	3.59	Man on the street
	Positive	4668	7.44	7.08	Erotic scene between man and woman
		4628	6.76	6.01	Newlyweds slicing a wedding cake
		2071	8.08	5.62	Baby with a towel
Objects block	Negative	9832	3.16	4.75	Cigarettes
		9904	2.54	5.61	Car crash, accident
		7359	3.27	4.72	cockroach next to a cake
	Neutral	7504	5.35	3.96	Stairway
		7041	4.83	3.28	Baskets, hampers
		7179	5.1	3.35	Carpet
	Positive	7405	7.53	6.31	Three muffins, cakes
		7492	7.44	6.26	Ship, cruise
		5811	7.5	4.86	Tree, flowers

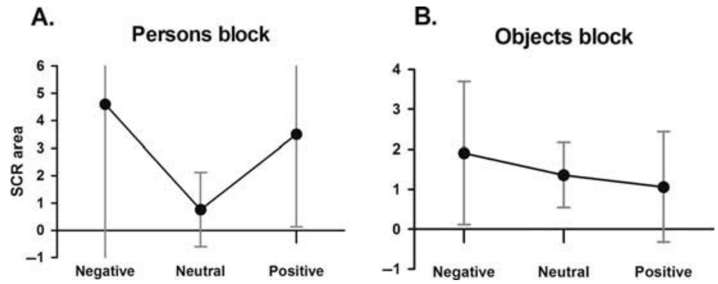

Figure A1. SCR modulation between negative, neutral, and positive images for each block in participants from the pilot study. (Bars indicate *SD*.)

objects block (negative: U = 1,639.50, p = .00; neutral: U = 1,485.50, p = .00; positive: U = 1,642.50, p = .00).

Appendix 5. Recognition of blurred pictures

Explicit recognition (awareness)

Both the patient and the controls failed to verbally identify the content of all blurred pictures.

Implicit awareness

Valence categorization

No differences were found between the patient and controls in their ability to accurately assign the valence of the blurred images (see Table A2). This was the case for both the persons block (negative: t = .20, p = .42, z_{cc} = .20; neutral: t = −1.21, p = .12, z_{cc} = −1.27; positive: t = .20, p = .42, z_{cc} = .22) and the objects block (negative: t = .22, p = .41, z_{cc} = .24; neutral: t = .34, p = .36, z_{cc} = .36; positive: t = .97, p = .17, z_{cc} = 1.02).

Arousal ratings

Likewise, no differences were found between the patient and controls in the arousal ratings. This was true for both the persons block (negative: t = 1.33, p = .10, z_{cc} = 1.40; neutral: t = 1.83, p = .05, z_{cc} = 1.93; positive: t = 1.00, p = .17, z_{cc} = 1.05) and the objects block (negative: t = 1.68, p = .06, z_{cc} = 1.77; neutral: t = .97, p = .17, z_{cc} = 1.03; positive: t = 1.70, p = .06, z_{cc} = 1.79) (see Table A3).

Table A3. Means, DS, and differences between the patient and controls in arousal ratings for blurred blocks.

Blurred blocks	Valence	Patient's mean	Controls' mean	Patient vs. controls*
Persons	Negative	5.66 (2.08)	3.16 (1.78)	.10
	Neutral	6.66 (1.15)	2.93 (1.93)	.05
	Positive	6.33 (1.15)	3.83 (2.37)	.17
Objects	Negative	7.33 (.57)	3.50 (2.16)	.06
	Neutral	6.00 (1.00)	3.56 (2.37)	.17
	Positive	7.33 (.57)	3.66 (2.04)	.06

Note: *A modified Crawford's *t*-test (Crawford & Garthwaite, 2002).

Psychophysiological responses (recognition without awareness)

The patient and controls showed no SCR differences in either the objects block (negative: t = −.59, p = .28, z_{cc} = −.62; neutral: t = −.83, p = .21, z_{cc} = −.88; positive: t = −.46, p = .32, z_{cc} = −.49) or the persons block (negative: t = −.77, p = .23, z_{cc} = −.81; neutral: t = −.72, p = .24, z_{cc} = −.76; positive: t = −.48, p = .32, z_{cc} = −.50) (see Table A4).

Table A2. Patient's score and controls' mean of blurred images accurately categorized (maximum three for each condition).

Blurred blocks	Valence	Patient's score	Controls' mean	Patient vs. controls*
Persons	Negative	1	.80 (.91)	.42
	Neutral	0	1.70 (1.33)	.12
	Positive	2	1.80 (.91)	.42
Objects	Negative	1	1.70 (1.25)	.22
	Neutral	2	1.70 (.82)	.34
	Positive	3	2.20 (.78)	.17

Note: *Mann–Whitney analyses of trials.

Table A4. Means, DS, and differences between the patient and controls in SCR for blurred blocks.

Blurred blocks	Valence	Patient's mean	Controls' mean	Patient vs. controls*
Persons	Negative	.39 (.68)	1.46 (1.72)	.28
	Neutral	.47 (.83)	1.85 (1.57)	.21
	Positive	.32 (.56)	1.36 (2.12)	.32
Objects	Negative	.00 (.00)	1.14 (1.40)	.23
	Neutral	.00 (.00)	.61 (.80)	.24
	Positive	.10 (.17)	.79 (1.36)	.32

Note: *A modified Crawford's *t*-test (Crawford & Garthwaite, 2002).