

# Social Perception Deficits After Moderate to Severe Traumatic Brain Injury

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## Introduction

The Advanced Clinical Solutions for the WAIS-IV/WMS-IV (Wechsler, 2009) is a battery of tests and procedures designed to supplement the standard WAIS/WMS-IV. One component of the ACS is the Social Perception subtest. This subtest is designed to measure processes thought to be involved in social interactions and communication.

Neuropsychological research has associated performance on measures of affect recognition in healthy adults with activation of the amygdala (Habel et al., 2007). The amygdala responds to unfamiliar versus familiar faces in normally developing and aging adults (Schwartz et al., 2003) and is involved in processing fearful sounds (Phillips, Drevets, Rauch, & Lane, 2003). The prefrontal and anterior cingulate cortexes appear to modulate the amygdala's response to fearful images (Hariri, Bookheimer, & Mazziotta, 2000; Hariri, Mattay, Tessitore, Fera, & Weinberger, 2003). Other cortical regions, including the inferior occipital, fusiform, inferior frontal gyri (Engell & Haxby, 2007), and the caudate nucleus (Hare, Tottenham, Davidson, Glover, & Casey, 2005), may also activate during the processing of emotion.

Similar to declines in other cognitive abilities, declines in the accuracy of processing emotional expression occur with normal aging and are associated with less activation in the frontal (Wong, Cronin-Golomb, & Nearing, 2005) and inferior temporal cortexes (Wright, Wedig, Williams, Rauch, & Albert, 2006) although amygdala responses to fearful faces are still observed in older adults (Wright et al., 2006). In normally developing and aging adults, the amygdala plays an important role in emotion processing, particularly for information related to fear.

Injury to the cortical or subcortical regions involved in processing emotions may result in impairments in components of social cognition. Traumatic brain injury can produce deficits in the ability to identify facial expressions of emotion (McDonald & Flanagan, 2004) and in theory of mind tasks (Henry, Phillips, Crawford, Ietswaart, & Summers, 2006; McDonald & Flanagan, 2004; Milders, Ietswaart, Crawford, & Currie, 2006) though this may be due, in part, to deficits in executive functioning (Henry et al., 2006).

More specifically, damage to the ventromedial and prefrontal cortexes is associated with impaired performance on theory of mind tasks (Shamay-Tsoory & Aharon-Peretz, 2007) and comprehension of sarcasm (Channon et al., 2007; Shamay-Tsoory, Tomer, & Aharon-Peretz, 2005), but injury to posterior brain regions does not affect these abilities (Shamay-Tsoory & Aharon-Peretz, 2007). Injury to the anterior temporal lobes can also produce deficits in affect labeling (Schmolck & Squire, 2001). Acute brain injury involving damage to frontal and anterior temporal regions is related to problems with recognition of emotion and theory of mind.

## Methods

### Procedures

The Social Perception subtest is composed of 3 item sets that measure different components of social perception. In the first item set, the examinee sees 6 Faces expression one of 7 possible emotions: happy, sad, angry, disgust, fear, surprise, or neutral. The examinee labels the emotion expressed by each face. In the second item set, the examinee listens to an audio tape while viewing 6 faces on a stimulus page. The audio presents a verbal statement with prosody which is either happy, sad, fearful, angry, surprised, disgusted, neutral, or sarcastic. The examinee must determine the emotion of what was being said on the audio and match it to the correct facial expression. In the third item set, the examinee hears an expression on the audio tape while viewing 4 pictures with people interacting. The examinee must determine the emotion being expressed from the prosody on the audio and match it to the pair of people interacting that best represent what was heard on the audio. The examinee must state the emotion being expressed and if the tone of voice changed the meaning of what was said. If the prosody did change the meaning of what was said, the examinee indicates what the speaker really intended to say. The Social Perception subtest yields 4 scores: total, affect naming, prosody, and pairs. Contrast scores comparing total social perception with WAIS-IV GAI, VCI, and PRI are available to rule out deficits due to general or specific intellectual deficits resulting in low scores on social perception.

### Participants

#### Controls

The sample was comprised of 800 examinees ages 16-90 years of age. Exclusionary criteria included any history of neurological, psychiatric, developmental or medical condition affecting cognitive functioning. Subjects were screened for general cognitive impairment and poor effort. The demographic characteristics of the sample were matched to 2005 census data for ethnicity and education level. Examinees above the age of 70 were excluded based on research with previous editions of this subtest that showed declining visual and spatial discrimination skills interfered with older examinees performance on this subtest.

#### Clinical Groups

The clinical samples were collected as part of the ACS standardization. Twenty-four adults ( $28.3 \pm 6.2$  years of age) with a history of moderate to severe traumatic brain injury were sampled for this study. Age, education, and ethnicity matched controls were randomly selected from the normative sample.

## Results

### Reliability and Correlation with Intellectual Functioning

In the normative sample, obtained internal consistency measures were: Social Perception Total (.70-.84), Affect Naming (.53-.85), Prosody (.64-.79), and Pairs (.78-.85). The Social Perception Total score correlated significantly with WAIS-IV GAI (.40), VCI (.38), PRI (.32), WMI (.29), PSI (.35) and FSIQ (.42).

### Clinical Data

The TBI group performed in the borderline to low average range across the social perception measures: total social perception ( $SS=5.0$ ), affect naming ( $SS=5.5$ ), total prosody ( $SS=6.0$ ), and pairs total ( $SS=5.8$ ). Compared to matched controls, the TBI sample performed significantly lower on all measures ( $p < .01$ ) with effect sizes ranging from 1.22 (total score) to .95 (pairs total). The deficits were significant after controlling for general cognitive functioning. In the TBI sample, social perception scores significantly correlated with caregiver ratings of social functioning ( $r=.62$ ) and self-direction ( $r=.62$ ).

Table 1: Social Perception by Clinical Group

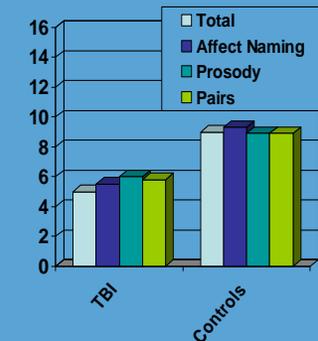
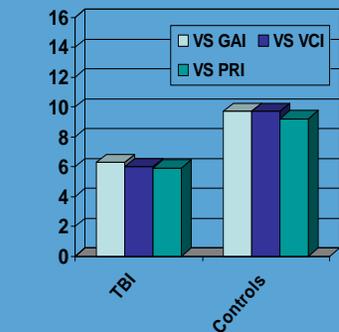


Table 2: Social Perception VS IQ by Clinical Group



## Conclusion

Individuals suffering TBI showed marked deficits in social perception which relate to behavioral deficits in interpersonal relationships and self-direction. Low scores on the ACS Social Perception task were present even after controlling for loss of functioning in verbal and perceptual domains. The results validate the importance of assessing social perception after TBI.