

Person Perception

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Abstract

This chapter is concerned with the ways in which the use of various psychophysiological measures, and the theory that underlies their use, has advanced understanding of person perception. A social neuroscience approach can be useful for testing theory and advancing the science of person perception. In particular, event-related brain potentials (ERPs) provide a time-sensitive means of measuring and separating the rapidly unfolding cognitive and affect-related processes theorized in many models of person perception, and functional brain imaging permits a detailed picture of the neural structures that subserve these processes. Neuropsychological studies also offer important insights into the functions of particular regions of the brain that appear crucial for effective person perception. Most importantly, linking these neural indices with important psychological and behavioral outcomes can provide a more comprehensive understanding of person perception than can be gained by any self-report, behavioral, cognitive, neural, or biological approach alone.

Keywords: person perception, cognitive neuroscience, psychophysiological measures, stereotyping, perception of emotion, face perception, impression formation

In his influential 1990 text, *Interpersonal Perception*, Ed Jones nicely encapsulated the essence of person perception as how people try to determine what another person is “really like” inside. More specifically, Jones described how people “come to understand what makes a particular person—including ourselves—behave in particular ways” (p. 1). People seem innately driven to make such determinations. Indeed, given the ways in which cognitive processing is biased toward formation of and reliance on categories and expectancies (see Allport, 1954; Bruner, 1957), it is virtually impossible for social interactions to proceed in any other way. According to Jones (1990), when we perceive a person we draw conclusions about him or her, often rapidly and

automatically, sometimes thoughtfully and carefully. A brief (and nonexhaustive) list of the psychological processes involved in this pursuit includes some of the most basic, foundational issues in social psychological research: causal attribution, expectancies, assessment of situational constraint—and its converse, the correspondence bias—and various self-presentation goals and strategies. In this chapter we will be concerned with the ways in which the use of various psychophysiological measures, and the theory that underlies their use, has advanced understanding of person perception. However, given the attention paid to them in other chapters in this volume, we will only briefly consider some topics of central interest to person perception researchers,

1 such as stereotyping, perception of emotion, face
2 perception, and impression formation.

3 **Why Study Person Perception from a Social** 4 **Neuroscience Perspective?**

5 Before reviewing the literature on the social neuro-
6 science of person perception, it is important to first
7 briefly examine what can be gained by using a social
8 neuroscience approach to studying this topic. Person
9 perception research has a deep and important history
10 in social psychology. It goes without saying
11 that the behavioral methods traditionally used in
12 person perception research, including recall (i.e.,
13 person memory), response latency, and self-reported
14 evaluations (among others; see Olson, Roese, &
15 Zanna, 1996), have provided a strong foundation
16 for advancing our understanding of how and why
17 people attempt to draw conclusions about others'
18 traits. However, the nature of the cognitive and
19 affective processes thought to be important for
20 person perception makes certain theoretical ques-
21 tions difficult to address when using behavioral
22 and self-report methods alone. For example, when
23 participants are better able to recall information
24 about people in one condition versus another, we
25 infer that the information in the former condition
26 received more extensive processing than the infor-
27 mation in the latter condition. In this sense, recall
28 represents one *outcome* of some cognitive activity
29 associated with memory, but a number of processes
30 likely intervene between stimulus encoding and
31 recall that are not well represented in a memory
32 measure.

33 In contrast, augmenting a memory measure (or
34 other measures) with one or more psychophysio-
35 logical measures can provide insight into theoreti-
36 cally relevant intervening processes. As we review
37 more extensively later in this chapter, for example,
38 event-related brain potentials (ERPs) have been used
39 in a number of studies to elucidate the stage(s) of pro-
40 cessing at which information that violates previously
41 formed impressions of others is processed differently
42 (e.g., more extensively) than information that con-
43 firms prior impressions (e.g., Bartholow, Fabiani,
44 Gratton, & Bettencourt, 2001; Bartholow, Pearson,
45 Gratton, & Fabiani, 2003; Van Duynslaeger, Van
46 Overwalle, & Verstraeten, 2007). Such information is
47 important for understanding not only the timecourse
48 of person perception processes (e.g., Ito, Thompson,
49 & Cacioppo, 2004), but also the specific mechanisms
50 of information processing that are involved.

51 More generally, it is important to consider what
52 kinds of information can be gained by the use of

53 particular psychophysiological and/or neuropsychol-
54 ogy measures and methods. For example, the two
55 primary brain-based measures used in social neuro-
56 science research on person perception, ERPs and
57 functional magnetic resonance imaging (fMRI),
58 provide data relevant to quite different levels of
59 analysis. Specifically, ERPs provide excellent tempo-
60 ral resolution of brain activity (on the order of
61 milliseconds following a stimulus event), relevant to
62 the timing of relevant psychological processes. Such
63 data can be very useful for testing hypotheses derived
64 from multiple-stage models of person perception,
65 such as various dual-process models (see Chaiken &
66 Trope, 1999). However, ERPs can provide only very
67 limited information on the specific neural structures
68 producing relevant information-processing activity
69 (see Chapter 6 in this volume for more information
70 on ERP measures). The converse is true of fMRI:
71 the temporal resolution of the signal is quite slug-
72 gish by comparison, on the order of 4–6 seconds
73 following an eliciting stimulus event, but spatial
74 resolution is very good, allowing for quite specific
75 inferences concerning the neural sources of relevant
76 psychological processes. Such data can be very useful
77 for both exploratory purposes, such as identifying
78 structures involved in forming impressions (e.g.,
79 Mitchell, Cloutier, Banaji, & Macrae, 2006), and
80 for testing hypotheses concerning differences in the
81 activity of specific structures across experimental
82 conditions.

83 Another important difference between ERP and
84 fMRI measures is that whereas ERPs represent a
85 fairly direct measure of the electrical activity of the
86 brain associated with information-processing opera-
87 tions (see Rugg & Coles, 1995), the fMRI BOLD
88 (blood oxygen level dependent) signal is a rather
89 indirect measure, reflecting the dynamics of blood
90 flow and resource utilization (represented by the ratio
91 of oxygenated to deoxygenated hemoglobin in the
92 blood) in various parts of the brain. In other words,
93 fMRI highlights areas of the brain where activity is
94 assumed to have recently increased or decreased, but
95 does not, technically, represent the activity of neu-
96 rons as the brain processes information.

97 **Cognitive Neuroscience Studies of** 98 **Person Perception**

99 Although the social neuroscience of person percep-
100 tion is still a relatively new field, the literature is suffi-
101 ciently large as to limit the coverage any single chapter
102 can provide. Here, we have chosen to focus primarily
103 on research in which measures of brain activity or
104 brain functionality were used. This decision was

1 purely a practical one, and is in no way intended to
2 suggest that studies using other psychophysiological
3 measures, such as cardiovascular and other auto-
4 nomic nervous system measures, are not as useful as
5 brain-based measures.

6 *ERP Studies*

7 Although the existence of bioelectrical potentials in
8 the brain had been known for decades prior (e.g.,
9 Bartholow, 1882), Hans Berger (1929) was the first
10 to describe a method for recording the electrical
11 activity of the human brain (the electroencephalo-
12 gram; EEG) from the surface of the head by placing
13 a pair of electrodes on the scalp and connecting
14 them to a differential amplifier. Other scientists
15 (e.g., Davis, Davis, Loomis, Harvey, & Hobart,
16 1939) later discovered that when stimuli are pre-
17 sented during EEG recording, epochs of the EEG
18 that are time-locked to stimulus onset can be
19 defined. With repeated sampling, that portion of
20 the EEG representing the neural response to a spe-
21 cific stimulus (or stimulus class) emerges from the
22 ongoing, “background” EEG signal as a series of
23 positive and negative voltage deflections known as
24 components. Decades of systematic research has
25 linked these components to specific information-
26 processing operations (see Rugg & Coles, 1995). In
27 general, component amplitude reflects the extent of
28 neural activation associated with a particular cogni-
29 tive operation (or set of operations), while compo-
30 nent latency reflects the time required to carry out
31 that operation (e.g., Gehring, Gratton, Coles, &
32 Donchin, 1992; Fabiani et al., 2007; Rugg & Coles,
33 1995). However, it is important to stress that any
34 given component likely represents numerous simul-
35 taneously occurring processes (see Coles & Rugg,
36 1995).

37 Armed with this knowledge, social psychologists
38 began a series of fruitful collaborations with cogni-
39 tive psychophysiolgists in the early 1990s to better
40 understand the information-processing operations
41 involved in person perception (e.g., Cacioppo,
42 Crites, Gardner, & Berntson, 1994). These early
43 studies focused primarily on a late positive compo-
44 nent in the ERP known as the P3 or P300, so named
45 because of its positive voltage and peak latency
46 (in early studies) around 300 ms post-stimulus. This
47 component had been widely studied by cognitive psy-
48 chophysiolgists for many years, and had been associ-
49 ated with the brain’s response to novelty (Friedman,
50 Cycowicz, & Gaeta, 2001), in that P300 ampli-
51 tude increases as the subjective probability of an elic-
52 iting event decreases (e.g., Donchin & Coles, 1988;

Duncan-Johnson & Donchin, 1977; Squires et al., 53
1975). The P300 has been described as a manifesta- 54
tion of context updating in working memory, based 55
on numerous studies indicating better subsequent 56
memory for stimuli that elicit larger P300 ampli- 57
tude (e.g., Donchin, 1981; Donchin & Coles, 1988; 58
Friedman & Johnson, 2000), and more generally as 59
an indication of the motivational significance or rel- 60
evance of an eliciting stimulus (see Nieuwenhuis, 61
Cohen, & Aston-Jones, 2005). The peak latency of 62
the P300 serves as a neural indicator of stimulus 63
evaluation or categorization time, with longer laten- 64
cies indicating more effortful categorization (see 65
Coles, 1989). Despite its name, it is not uncommon 66
for the P300 to peak substantially later than 300 ms 67
in tasks involving complex social or emotional stim- 68
uli (see Bartholow & Amodio, 2009; Bartholow & 69
Dickter, 2007), a fact that has led some to posit a 70
difference between the “classic” P300 elicited in 71
purely cognitive tasks and a “late positive potential,” 72
or LPP, elicited by stimuli that carry more social or 73
emotional significance (e.g., Schupp et al., 2000). 74

75 Given that the P300 serves as an index of subjective 76
probability in categorization processes (e.g., 77
Donchin & Coles, 1988; Friedman et al., 2001), 78
Cacioppo and his colleagues (Cacioppo et al., 1993) 79
reasoned that it also should mark the implicit cate- 80
gorization of evaluatively consistent and inconsis- 81
tent attitude objects. In their initial study, Cacioppo 82
et al. (1993) developed stimulus sets consisting 83
of valenced (i.e., positive and negative) words pre- 84
sented in sequences in which word valence either 85
was evaluatively consistent or was evaluatively 86
inconsistent. As predicted, Cacioppo et al. found 87
that P3 amplitude was much larger to a given target 88
type when it was preceded by words from a different 89
evaluative category (e.g., a negative target following 90
positive words) than when it was preceded by words 91
from the same evaluative category (e.g., a negative 92
target following negative words).

93 Using a variation of this method, Cacioppo et al. 94
(1994) began to investigate the neural underpinnings 95
of person perception. This work showed that P300 96
amplitude also indexes evaluative categorization of 97
positive and negative personality traits, and that this 98
effect is associated with categorization per se rather 99
than response processes (Crites, Cacioppo, Gardner, 100
& Berntson, 1995), suggesting that the P300 might 101
assess implicit interpersonal attitudes. In a similar 102
experiment, Osterhout, Bersick, and McLaughlin 103
(1997) showed that a P300-like, late positivity in the 104
ERP waveform is sensitive to violations of gender 105
stereotypical noun-pronoun agreement in sentence

1 comprehension (e.g., “Our aerobics instructor gave
2 *himself* a break”). This effect was independent of
3 participants’ self-reported judgments of the accept-
4 ability of the sentences, further suggesting that the
5 P300 might provide a relatively covert indication of
6 implicit person judgments.

7 A more recent study conducted by Ito,
8 Thompson, and Cacioppo (2004) further confirmed
9 this notion. Ito and colleagues had White partici-
10 pants view images of White men’s and Black men’s
11 faces embedded within series of positively- and
12 negatively-valenced images from the International
13 Affective Picture System (IAPS; Lang, Bradley, &
14 Cuthbert, 2001). Based on previous work showing
15 that the P300 is sensitive to changes in evaluative
16 categorization, Ito and colleagues hypothesized that
17 P300 amplitude elicited in the context of frequent
18 negative images would be smaller to infrequent
19 Black faces than to infrequent White faces, and that
20 the P300 elicited in the context of frequent positive
21 images would be larger to infrequent Black faces
22 than to infrequent White faces. Their results showed
23 only modest (and nonsignificant) differences in
24 these predicted directions. However, the difference
25 in P300 amplitude elicited by White compared to
26 Black faces was correlated with scores on self-
27 reported measures of racism, such that those with
28 more negative attitudes toward Blacks showed
29 larger P300 amplitude differences. Thus, these find-
30 ings support the idea that the P300 elicited in tasks
31 of person perception can serve as a sensitive mea-
32 sure of implicit attitudes (see also Ito & Cacioppo,
33 2007).

34 Based in part on the work of Cacioppo and col-
35 leagues and Osterhout et al. (1997), Bartholow
36 et al. (2001) reasoned that processing of interper-
37 sonal expectancy violations also should be manifest
38 in P300 amplitude. Numerous studies in social and
39 developmental psychology indicate that expectancy-
40 violating information about people often is recalled
41 better than expectancy-confirming information (see
42 Stangor & McMillan, 1992). Theoretical models
43 (e.g., Srull & Wyer, 1989) posit that this recall
44 advantage reflects updating of working memory
45 that occurs during *inconsistency resolution*, the pro-
46 cess by which people attempt to reconcile the dis-
47 crepancy between new information and existing
48 “person concepts.” The longstanding notion that
49 the P300 reflects the process of working memory
50 updating (e.g., Donchin, 1981; Donchin & Coles,
51 1988; Friedman & Johnson, 2000) suggests that
52 P300 amplitude should reflect the neural processes
53 associated with inconsistency resolution.

Bartholow and colleagues (2001; see also
Bartholow et al., 2003) tested this idea in a set of
experiments in which participants read paragraph
descriptions of several fictitious individuals in order
to form impressions of them, and then read sen-
tences (presented one word at a time) depicting
behaviors that were either consistent or inconsistent
with those impressions. Consistent with the work-
ing-memory updating hypothesis of the P300
(Donchin & Coles, 1988), P300 amplitude elicited
by expectancy-violating sentence-ending words was
larger than that elicited by expectancy-consistent
sentence-ending words. Expectancy-violating beha-
viors also were better recalled than expectancy-
consistent behaviors, further supporting the notion
that P300 amplitude reflects the extent to which
stimuli are processed during memory encoding (see
Fabiani & Donchin, 1995). Moreover, P300 ampli-
tude was greater to negative than to positive expec-
tancy-violating behaviors, consistent with research
indicating that negative information about people is
more informative or relevant to person perception
than positive information (see Peeters & Czapinski,
1990; Reeder & Covert, 1986; Sherman & Frost,
2000; Trafimow & Finlay, 2001; Ybarra, 2002;
Ybarra, Schaberg, & Keiper, 1999). Figure 27.1
presents relevant ERP waveforms showing these
effects.

Bartholow et al.’s (2001) findings indicated that
the recall advantage long known to accompany
expectancy violations (e.g., Stangor & McMillan,
1992) results from evaluative categorization pro-
cesses occurring quite rapidly following perception,
and strongly implicate a role for working memory
updating—one of a host of so-called executive cog-
nitive functions, thought to be mediated by activity
in the prefrontal cortex (see Miyake et al., 2000)—
in the process of inconsistency resolution (see also
Macrae, Bodenhausen, Schloersheidt, & Milne,
1999). To further test the role of executive working
memory in the inconsistency resolution processes
reflected in the P300, Bartholow, Pearson, Gratton,
and Fabiani (2003) conducted an experiment in
which participants consumed either alcohol or a
placebo beverage just prior to engaging in the person
perception task used by Bartholow et al. (2001).
Alcohol’s effects on interpersonal behaviors are com-
monly attributed to impairment of executive cog-
nitive functions thought mediated by the prefrontal
cortex (e.g., Hoaken, Giancola, & Pihl, 1998;
Peterson, Rothfleisch, Zelazo, & Pihl, 1990; Steele
& Josephs, 1990). Thus, Bartholow et al. (2003)
reasoned that inconsistency resolution might be

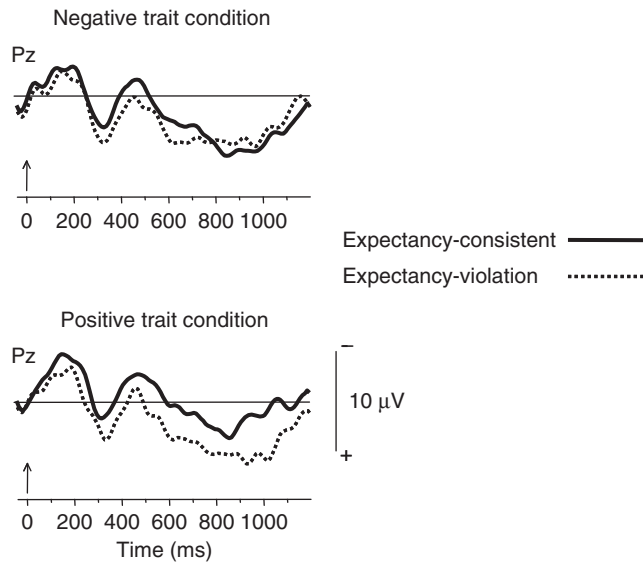


Fig. 27.1 ERP waveforms elicited by expectancy-consistent and expectancy-violating behaviors as a function of whether targets had positive traits or negative traits. Consistency or violation with initial trait impressions was determined by the valence of relevant behaviors, for example, a negative behavior in the positive trait condition would be an expectancy violation. Reprinted from Bartholow, B. D., Fabiani, M., Gratton, G., & Bettencourt, B. A. (2001), with permission of SAGE Publications.

1 impaired during intoxication, and used ERPs to
2 track the time course and severity of hypothesized
3 impairments.

4 For participants in the placebo condition, the
5 P300 and recall data largely replicated those of the
6 earlier report (Bartholow et al., 2001), in that expect-
7 tancy violations—particularly negative behaviors—
8 elicited larger P300 than expectancy confirmations,
9 and recall was better for negative than positive
10 expectancy-violating behaviors. However, for par-
11 ticipants who consumed alcohol the opposite
12 pattern emerged, with generally larger expectancy-
13 violation effects associated with positive behaviors
14 presented in a negative context, and better recall for
15 positive than negative expectancy-violating behav-
16 iors. Bartholow et al. (2003) interpreted this rever-
17 sal in terms of alcohol-induced activation of the
18 cerebral reward system influencing processing of
19 reward-congruent information in working memory
20 (see London, Ernst, Grant, Bonson, & Weinstein,
21 2000). This study also illustrates the use of alcohol
22 as a tool in social neuroscience research. Given that
23 many social-cognitive phenomena are presumed to
24 be mediated by prefrontal cortical activity, examin-
25 ing social cognitive processes in healthy individuals
26 temporarily impaired by alcohol provides a method
27 for bridging gaps between research in neuropsychol-
28 ogy, social cognition, and cognitive neuroscience
29 (see also Macrae et al., 1999).

30 The expectancy violation studies conducted by
31 Bartholow et al. (2001, 2003) provided an initial
32 understanding of the neural events associated with
33 *intentional trait inferences*. Participants in those

studies were instructed to form impressions of target
persons based on trait-related information provided
about them. Later violations of those traits elicited
enhanced neural responses, indicating that traits had
been inferred from the earlier information. However,
outside of the laboratory, people generally are not
told to form impressions of others on the basis of
their behavior; rather, this process happens sponta-
neously, a process known as *spontaneous trait infer-*
ence (see Uleman, 1999; Uleman et al., 1996, 2005).
In a recent series of studies, Van Overwalle and his
colleagues (e.g., Van Duynslaeger, Van Overwalle, &
Verstraeten, 2007; Van Overwalle, Van den Eede,
Baetens, & Vandekerckhove, 2009; Van Duynslaeger,
Sterken, Van Overwalle, & Verstraeten, 2008) have
used ERPs to investigate similarities and differ-
ences in the neural activity elicited under intentional
versus spontaneous trait-inference conditions. For
example, Van Duynslaeger et al. (2007) modified
the paradigm developed by Bartholow et al. (2001)
by telling half of their participants to simply “read
the stimulus materials carefully,” making no men-
tion of forming impressions, and telling the other
half of the participants to form an impression of
each target (cf., Bartholow et al., 2001, 2003). Van
Duynslaeger et al. found that P300 amplitude was
enhanced to trait-inconsistent compared to trait-
consistent behaviors in both the intentional and
spontaneous trait inference conditions, indicating
that the inconsistency-resolution process is very
similar in both cases. However, compared to expect-
tancy violations encountered under intentional
inference instructions, source analysis indicated that

1 expectancy violations encountered under spontane-
2 ous trait inference conditions elicited greater acti-
3 vation in the temporo-parietal junction, a neural
4 region implicated in representing others' mental states
5 (Frith & Frith, 2001) and considered a primary gen-
6 erator of the P300 (see Nieuwenhuis et al., 2005).

7 A number of person perception processes are
8 known to be strongly affected by the social category
9 memberships of both the perceiver and the targets.
10 Certain very basic social categories (i.e., those that
11 are most readily identifiable), such as gender and
12 race, are particularly influential. In recent years,
13 ERPs have been applied to the study of very basic
14 attention-related and evaluative processes occurring
15 during the perception of race (see Ito & Bartholow,
16 2009). ERP studies of race perception consistently
17 show that racial information is processed very
18 quickly and automatically. For example, Ito and
19 Urland (2003) showed that ERP waveforms elicited
20 by pictures of White and Black faces begin to diverge
21 as early as around 120 ms after picture onset (i.e.,
22 the N100 component), a finding that held regard-
23 less of whether participants explicitly categorized
24 the faces by race or according to some other social
25 dimension (e.g., gender). The most consistent find-
26 ing to emerge from studies in this literature is that
27 the P200 (or P2) component is larger to racial out-
28 group than ingroup faces, and the N200 (or N2) is
29 larger to racial ingroup than outgroup faces (e.g.,
30 Dickter & Bartholow, 2007; Ito, Thompson, &
31 Cacioppo, 2004; Ito & Urland, 2003, 2005; Kubota
32 & Ito, 2007; Walker, Silvert, Hewstone, & Nobre,
33 2008; Willadsen-Jensen & Ito, 2006, 2008). Precise
34 interpretation of these patterns is still elusive given
35 that this literature remains relatively small and only
36 recently has emerged. However, current understand-
37 ing suggests that increased P2 and N2 responses in
38 race perception tasks reflect automatic encoding
39 and orienting toward racial category information.

40 Initial studies in this literature (e.g., Ito &
41 Urland, 2003, 2005) relied on White participants,
42 and therefore it was unclear whether the enhanced
43 P2 to Black targets and N2 to White targets reflected
44 responses to features of race specifically (e.g., skin
45 tone; facial structure) or reflected a more general
46 distinction between outgroup and ingroup targets.
47 Dickter and Bartholow (2007) conducted the first
48 race perception ERP study using both Black and
49 White participants. Their results showed the typical
50 pattern for White participants, with larger P2
51 amplitude to Black than to White targets and larger
52 N2 amplitude to White than to Black targets.
53 Among Black participants, however, these patterns

were reversed (i.e., larger P2 to White than to Black
54 targets; larger N2 to Black than to White targets),
55 supporting the perspective that the "race categoriza-
56 tion" effects seen in previous studies actually repre-
57 sent differential outgroup and ingroup categorization
58 effects. Similar results also have been reported by
59 Willadsen-Jensen and Ito (2008) using Asian par-
60 ticipants viewing Asian and White faces.

61 The fact that processing of ingroup faces consis-
62 tently increases N2 amplitude raises questions
63 concerning how this "ingroup categorization" N2
64 compares to N2 responses elicited by other stimulus
65 conditions. For example, increased N2 amplitude
66 has been associated in numerous studies with pro-
67 cesses related to conflict detection, in that the N2
68 often is larger on trials that elicit competing response
69 activations, such as incongruent Stroop trials (e.g.,
70 Liotti, Woldorff, Perez, & Mayberg, 2000) and
71 incompatible trials in flanker tasks (i.e., stimulus
72 arrays including stimuli mapped to opposing behav-
73 ioral responses; see Kopp, Rist, & Mattler, 1996;
74 van Veen & Carter, 2002). Additionally, the N2
75 often increases as a function of stimulus infre-
76 quency, such that low-probability stimuli elicit
77 larger N2s than higher-probability stimuli, regard-
78 less of whether the stimuli themselves elicit compet-
79 ing response activations (e.g., Jones, Cho, Nystrom,
80 Cohen, & Braver, 2002; Nieuwenhuis, Yeung, Van
81 Den Wildenberg, & Ridderinkhof, 2003). It has
82 been unclear whether these conflict- and infrequen-
83 cy-related N2s also respond to race perception,
84 however.

85 Recently, Dickter and Bartholow (2010) investi-
86 gated the potential interaction among these various
87 stimulus conditions by presenting White partici-
88 pants with pictures of White and Black men's faces
89 in the context of a flanker task, in which centrally
90 presented target faces (which had to be categorized
91 by race via button press) were flanked on either side
92 either by same-race faces (i.e., compatible trials;
93 e.g., Black target and Black flankers) or by other-
94 race faces (i.e., incompatible trials; e.g., Black target
95 and White flankers). Trial type frequency was
96 manipulated by varying the probability of compati-
97 ble trials across trial blocks, resulting in 80% com-
98 patible, 50% compatible, and 20% compatible
99 conditions. Dickter and Bartholow found the typi-
100 cal ingroup categorization effect, with larger N2 to
101 White target trials than to Black target trials.
102 However, this effect was qualified by both compati-
103 bility and frequency conditions (i.e., a Race x
104 Compatibility x Probability interaction). As shown
105 in Figure 27.2, the N2 was sensitive to compatibility
106

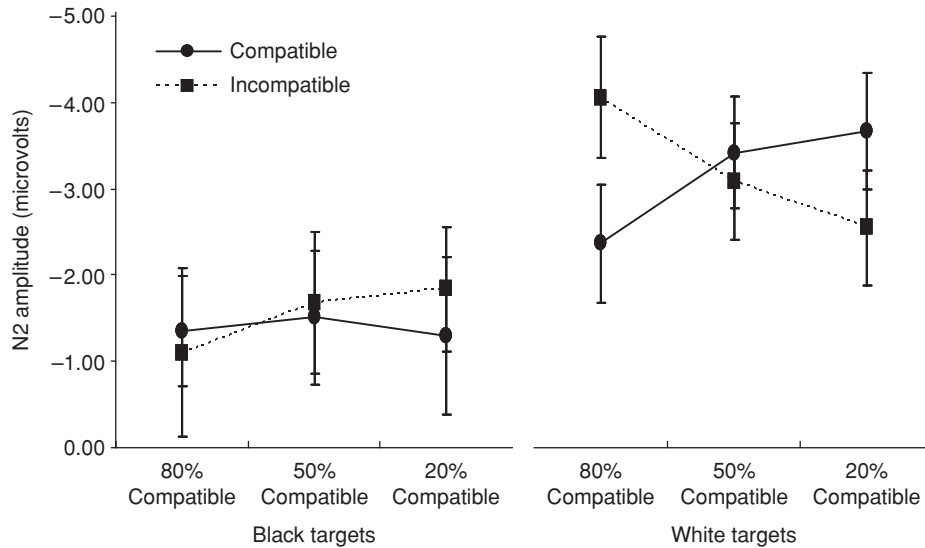


Fig. 27.2 Mean N2 amplitude (measured from frontal electrode locations) as a function of target race, trial compatibility and the probability of compatible trials. It is striking that compatibility and infrequency—stimulus conditions known to reliably affect N2 amplitude—had virtually no effect for Black target trials.

Adapted with permission from Dickter, C. L. & Bartholow, B. D. (2010).

1 and trial type frequency in a predictable manner
2 (see Bartholow et al., 2005; Bartholow, Riordan,
3 Saults, & Lust, 2009), but only on White (ingroup)
4 target trials. Dickter and Bartholow posited that
5 this pattern could reflect that ingroup targets elicit
6 stronger engagement of the processes underlying
7 generation of the N2 than outgroup targets, leading
8 to stronger effects of compatibility and infrequency
9 on ingroup trials. Consistent with this notion, con-
10 siderable work using a variety of methods indi-
11 cates that White participants spontaneously attend
12 more to Black male than to White male faces
13 (e.g., Trawalter, Todd, Baird, & Richeson, 2008;
14 Cunningham et al., 2004; Dickter & Bartholow,
15 2007). Thus, it could be that among White partici-
16 pants Black targets elicit narrower, more focused
17 attention than White targets, which would reduce
18 the influence of both flanker compatibility and the
19 probability of compatible arrays—factors that both
20 rely on manipulations of (peripheral) flanker infor-
21 mation—on Black target trials.

22 That the processing of ingroup faces reflected in
23 the N2 is more sensitive to other manipulations
24 than the processing of outgroup faces was recently
25 demonstrated in a very different context by Henry,
26 Bartholow, and Arndt (2010). These researchers
27 investigated the effects of mortality salience, known
28 to elicit preferences for ingroup members assumed
29 to share one's cultural worldview and to intensify
30 ingroup identification (e.g., Solomon, Greenberg,

& Pyszczynski, 2000), on ERP responses elicited by
31 White and Black faces displaying neutral, happy,
32 and angry facial expressions. Henry et al. found that
33 the ingroup N2 effect was larger and more wide-
34 spread across scalp locations for participants in the
35 mortality salience condition (who, prior to the facial
36 expression task, were asked to write down the feel-
37 ings that the thought of their own death aroused in
38 them) compared to those in a control condition
39 (who, prior to the task, wrote about dental pain).
40 Moreover, whereas control participants showed a
41 larger N2 to happy than to angry White faces, a pat-
42 tern consistent with previous research (Kubota &
43 Ito, 2007), those in the mortality salience condition
44 showed larger N2s to angry than to happy White
45 faces. Henry et al. posited that the preference fol-
46 lowing mortality salience to view ingroup members
47 favorably, coupled with the sensitivity of the N2 to
48 perceived stimulus infrequency (e.g., Nieuwenhuis
49 et al., 2003), could lead to enhanced conflict when
50 processing threatening/angry ingroup targets.
51

The cognitive neuroscience of face processing is
52 reviewed in detail elsewhere in this volume (see
53 Chapter 25). However, given that person percep-
54 tion often is studied with face stimuli, as is evident
55 by our review, here we provide a brief overview of
56 some the face processing research most relevant to
57 this chapter. Given their importance for conveying
58 social information, researchers have long been inter-
59 ested in understanding whether faces are accorded
60

1 special status within the universe of stimuli that
 2 people encounter. ERP studies of face perception
 3 have identified a negative-going component, typi-
 4 cally peaking around 170 ms following target onset
 5 and largest at lateral, temporo-parietal electrode loca-
 6 tions, known as the N170, which appears particu-
 7 larly sensitive to faces (e.g., Eimer, 2000; Kanwisher,
 8 McDermott, & Chun, 1997). Source localization
 9 data indicate that the N170 primarily reflects activi-
 10 ty in the fusiform gyrus (Herrmann et al., 2005),
 11 a cortical structure often associated with face pro-
 12 cessing. Indeed, some have even referred to this
 13 structure as the “fusiform face area” (e.g., Kanwisher
 14 & Yovel, 2006). Other research, however, does not
 15 support the specialization of the fusiform gyrus for
 16 face processing, indicating instead that this area is
 17 active to any stimuli with which participants have
 18 particular expertise (e.g., Gauthier et al., 1999,
 19 2000).

20 Nevertheless, some researchers have tested whether
 21 social factors, such as racial ingroup/outgroup status
 22 of the targets, influence the amplitude of the N170
 23 elicited by faces. Unfortunately, findings to date have
 24 been equivocal. For example, based on the notion
 25 that participants generally have more experience/
 26 expertise interacting with members of ingroups, the
 27 “expertise hypothesis” predicts that the N170 should
 28 be larger for racial ingroup targets than racial out-
 29 group targets. This pattern has been found in one
 30 published report (Ito & Urland, 2005). However,
 31 other research has shown that the N170 is larger to
 32 atypical faces and inverted faces than to “typical”
 33 faces (e.g., Halit et al., 2000), an effect attributed
 34 to a disruption of the configural processing often
 35 applied to faces. Based on these ideas, some research-
 36 ers have argued that N170 amplitude elicited by
 37 racial outgroup faces, which arguably are less typical
 38 for perceivers and which are thought to be processed
 39 in a less configural manner (Mitchell et al., 2006),
 40 should be larger than the amplitude elicited by racial
 41 ingroup faces. Several recent studies have found
 42 such a pattern (Stahl et al., 2008; Walker et al.,
 43 2008).

44 How can these seemingly contradictory findings
 45 be reconciled? Consideration of methodological dif-
 46 ferences among these studies reveals that, in each
 47 study in which the N170 was reported to be larger
 48 to racial outgroup than ingroup faces, participants
 49 had been asked to focus on face identity (e.g., by
 50 having participants detect when two consecutively
 51 presented faces matched, or by having participants
 52 try to remember the faces), whereas studies report-
 53 ing different patterns have asked participants to

focus on other stimulus dimensions (e.g., by having
 participants scan for nonface stimuli or make
 valence judgments). If we assume that the N170
 reflects structural face encoding, and that perceiv-
 ers typically process racial outgroup faces in a less con-
 figural and shallower manner (e.g., as reflected in
 poorer memory for outgroups), tasks that require
 attention to identity may selectively increase recruit-
 ment of face processing mechanisms to racial out-
 group relative to ingroup targets. However, more work
 is needed to understand the factors that influence the
 N170 and its relevance for person perception.

Functional Neuroimaging Studies

Complementing recent electrophysiological research
 on person perception are a number of recent reports
 investigating the neural structures involved in this
 process. The majority of such studies have employed
 fMRI. Unlike ERP recording, which provides a fast
 but spatially coarse measure of the electrical activity
 generated in the brain in response to some stimulus,
 fMRI provides a measure of the hemodynamic
 response (i.e., blood flow) elicited by a stimulus in
 very specific neural structures (see Chapter 5 in this
 volume for a more detailed discussion of fMRI
 methods).

Social categorization

Functional MRI methods have proven particularly
 useful for investigating the neural structures that
 appear to be involved in perceiving and forming
 judgments about individuals in a variety of situa-
 tions. In typical person perception experiments
 involving fMRI, participants passively view faces
 of people from varying social categories (e.g.,
 Cunningham et al., 2004) or make social judgments
 about such faces (e.g., judging personality traits; see
 Todorov, Baron, & Oosterhof, 2008). Not surpris-
 ingly, face stimuli consistently increase hemody-
 namic response in the fusiform gyrus, consistent
 with the ERP research reviewed previously indicat-
 ing that the N170 component associated with face
 perception is generated in the fusiform (Herrmann
 et al., 2005).

Of course, perception of faces also conveys social
 category information. Like ERP studies, brain imag-
 ing research has shown that faces varying according
 to social category membership differentially activate
 the areas involved in face processing. For example,
 Golby, Gabrieli, Chiao, and Eberhardt (2001)
 found that both Black and White participants
 experienced greater activity in the fusiform gyrus
 when viewing pictures of racial ingroup compared

1 to outgroup members. Similarly, Van Bavel, Packer,
2 and Cunningham (2008) found that participants
3 randomly assigned to one of two mixed-race teams
4 showed greater fusiform activity to pictures of their
5 own teammates compared to pictures of members
6 of the other team, regardless of their own or the tar-
7 gets' race and regardless of whether they categorized
8 the targets according to team status or race. These
9 findings suggest that fusiform activity associated
10 with ingroup bias can occur regardless of perceptual
11 expertise or any kind of threat or reward associ-
12 ated with ingroup relative to outgroup members.
13 However, recent work also suggests some specializa-
14 tion in the left fusiform gyrus for sex-based catego-
15 rization, as activation in this area is greater when
16 participants categorize targets along the sex dimen-
17 sion compared to a different dimension (Cloutier,
18 Turk, & Macrae, 2008).

19 The amygdala also has been shown to be sensi-
20 tive to judgments of social category membership.
21 The amygdala is a neural structure considered part
22 of the limbic system, often linked with emotional
23 processes; specifically, the amygdala is thought to
24 be instrumental in the processing of threatening
25 stimuli (LeDoux, 1996; Liddell et al., 2005) and
26 has been shown to be more sensitive to negative
27 than positive information (Satpute & Lieberman,
28 2006; Wager, Phan, Liberzon, & Taylor, 2003; but
29 see Cunningham, Van Bavel, & Johnsen, 2008, for
30 a different interpretation). As with the fusiform
31 regions, the amygdala has been shown to be involved
32 in racial categorization. Specifically, several studies
33 have shown greater amygdala activation to Black
34 targets than White targets, and have demonstrated
35 that the amount of activity in this region is corre-
36 lated with race-related prejudice (Cunningham
37 et al., 2004; Phelps et al., 2000). It appears that
38 these effects are not limited to White participants,
39 either; that is, both White and Black participants
40 show greater amygdala activity to Black than to
41 White targets, suggesting that greater amygdala
42 activation to Blacks is not due to novelty effects
43 but may reflect negative cultural associations of
44 Blacks (Lieberman, Hariri, Jarcho, Eisenberg, &
45 Bookheimer, 2005). However, it also should be noted
46 that some recent work indicates greater amygdala
47 activation for novel ingroup compared to novel out-
48 group targets (Chiao et al., 2008; Van Bavel et al.,
49 2008), suggesting that different psychological mech-
50 anisms might be involved in mediating activity in
51 this important neural structure depending upon the
52 goals of the perceiver and/or the importance or sig-
53 nificance of the target (see Van Bavel et al., 2008).

Neuropsychological research also has contrib- 54
uted to our understanding of the neural processes 55
important for social categorization. For example, 56
Mason and Macrae (2004) investigated the contri- 57
butions to individuation and categorization of 58
neural processes situated in the right and left hemi- 59
spheres (left and right visual fields, respectively) in 60
both healthy controls and a split-brain patient. 61
Participants viewed pictures of two simultaneously- 62
presented faces and indicated (during an individua- 63
tion task) whether the pictures were of the same 64
person or (during a categorization task) whether the 65
pictures showed people of the same sex. All partici- 66
pants performed better on the individuation task 67
when faces were presented to the right hemisphere 68
(i.e., left visual field). Functional MRI data showed 69
that the individuation task yielded increased activa- 70
tion in right inferior frontal and right occipito- 71
temporal areas and that the categorization task 72
yielded increased activation in the left inferior fron- 73
tal and left superior temporal gyri. These findings 74
suggest that hemispheric differences may exist 75
during social categorization and individuation, 76
and support a more general model of processing 77
asymmetry in the brain (e.g., Rhodes, 1985). 78

79 *Impression formation*

80 Due to the apparent role of the amygdala in evaluat-
81 ing valence, recent studies have investigated how posi-
82 tive and negative information influences amygdala
83 activation during impression formation (e.g., Fiske,
84 Cuddy, & Glick, 2007). Investigations of impres-
85 sion formation using fMRI tend to couple self-
86 reported judgments with neural measures, and
87 researchers look for correlations between partici-
88 pants' self-reported judgments and amygdala activa-
89 tion. One recent area of investigation has been the
90 evaluation of trustworthiness. Social psychological
91 research has demonstrated that social perceivers
92 can make judgments about a target individual's
93 trustworthiness very quickly after viewing the tar-
94 get's face (e.g., Willis & Todorov, 2006). Functional
95 imaging investigations of trustworthiness have dem-
96 onstrated that amygdala activation to faces increases
97 as the perceived trustworthiness of faces decreases,
98 using both explicit and implicit trustworthi-
99 ness evaluations (Engell, Haxby, & Todorov, 2007;
100 Todorov, Baron, & Oosterhof, 2008; Winston,
101 Strange, O'Doherty, & Dolan, 2002). Evidence
102 from neuropsychological research provides further
103 support that the amygdala is involved in percep-
104 tions of trustworthiness; specifically, patients with
105 complete bilateral amygdala damage were less able

1 to judge targets on the trustworthiness dimension
2 than normal participants, especially for untrust-
3 worthy target faces (Adolphs, Tranel, & Damasio,
4 1998).

5 Research on the role of the amygdala in impres-
6 sion formation has not been limited to perceptions
7 of trustworthiness, however. For example, Todorov
8 and Engell (2008) conducted an fMRI study in
9 which participants viewed target faces with neutral
10 emotional expressions. These faces had previously
11 been rated on 14 different trait dimensions by a
12 separate group of participants. When participants
13 in the fMRI study viewed these faces, amygdala
14 activation indicated general sensitivity to negativity,
15 correlating positively with prior ratings of negative
16 traits and negatively with prior ratings of positive
17 traits. Additionally, amygdala activation was largest
18 on dimensions with clear negative or positive asso-
19 ciations (e.g., trustworthiness) and smallest on traits
20 with ambiguous associations (e.g., dominance).

21 The neural correlates of facial attractiveness also
22 have been investigated in recent fMRI work. A large
23 number of social psychological studies have detailed
24 the important role of facial attractiveness in person
25 perception, with much evidence supporting a uni-
26 versal (i.e., cross-cultural) standard of facial beauty
27 (e.g., Jones & Hill, 1993). Studies using neuroim-
28 aging methods have attempted to examine how the
29 nervous system responds to variations in facial
30 attractiveness and have identified a number of struc-
31 tures, especially the amygdala (Winston, O'Doherty,
32 Kilner, Perrett, & Dolan, 2007) and the medial or-
33 bito-frontal cortex (OFC; Ishai, 2007; O'Doherty
34 et al., 2003), that respond to facial beauty. Researchers
35 believe that these regional activations are thought to
36 reflect the positive emotions that attractive faces
37 evoke; additionally, these brain regions have been
38 previously associated with the processing of reward-
39 ing stimuli (Chatterjee, Thomas, Smith, & Aguirre,
40 2009). Research also has demonstrated that the
41 brain regions associated with facial beauty may
42 differ depending on the explicit task. For example,
43 Chatterjee and colleagues (2009) presented partici-
44 pants with pictures of target faces. When partici-
45 pants were explicitly judging facial attractiveness,
46 fMRI results showed greater activation in the ven-
47 tral occipital, anterior insular, dorsal posterior pari-
48 etal, inferior dorsolateral, and medial prefrontal
49 cortices to attractive versus unattractive faces.
50 However, when participants were not attending to
51 attractiveness, only activation in the ventral occipi-
52 tal cortex was related to targets' facial attractiveness.
53 Taken together, these studies indicate that brain

regions associated with perceptual, decision-making, 54
and reward processes are activated by facial attrac- 55
tiveness, and perhaps indicate a biological predispo- 56
sition to process beauty. 57

Emotion perception 58

59 Social neuroscience studies of person perception
60 also have contributed to the emerging literature on
61 the processing of emotional faces (for a more com-
62 plete treatment of neuroscience studies of emotion
63 recognition, see Chapter 16). Early work demon-
64 strated that the amygdala was associated with the
65 processing of facial expressions that showed fear. In
66 fact, healthy participants showed increased amygdala
67 activity to fear expressions compared with other
68 emotions (e.g., Adolphs et al., 1998), and patients
69 with amygdala lesions showed impairment in the
70 recognition of facial fear (Adolphs, Tranel, Damasio,
71 & Damasio, 1994; Calder et al., 1996). Additionally,
72 in a study of "normal" adult males, individuals who
73 demonstrated a deficit in facial fear recognition
74 showed reduced activation in the amygdala com-
75 pared to individuals with normal facial fear recogni-
76 tion, providing further support that the amygdala is
77 instrumental in the processing of facial fear (Corden,
78 Critchley, Skuse, & Dolan, 2006). However, other
79 studies have indicated that increased amygdala
80 activity is not limited to the processing of fearful
81 faces. Yang and colleagues (2002) presented partici-
82 pants with happy, sad, angry, fearful, and neutral
83 faces. Functional MRI results demonstrated that
84 amygdala activation was greater for all emotional
85 faces compared to the neutral faces, indicating that
86 the amygdala's role may be broader than previ-
87 ously assumed (Yang et al., 2002). Other recent
88 work consistent with this notion suggests that the
89 amygdala responds to stimuli with particular motiva-
90 tional significance (Cunningham et al., 2008). From
91 this perspective, the considerable literature showing
92 amygdala sensitivity to negative information could
93 be re-cast in terms of negative information having
94 more relevance or significance than positive informa-
95 tion, a view consistent with a voluminous literature in
96 person perception (see Bartholow et al., 2001; Peeters
97 & Czapinski, 1990; Ybarra, 2002) and social percep-
98 tion more generally (e.g., Baumeister, Bratslavsky,
99 Finkenauer, & Vohs, 2001; Ito, Larsen, Smith, &
100 Cacioppo, 1998; Taylor, 1991).

101 Benuzzi and colleagues (2004) used a neuropsy-
102 chological approach to examine additional areas of
103 the brain that are instrumental in processing emo-
104 tion from faces. Specifically, they compared the
105 responses of patients with mesial temporal lobe

1 epilepsy with those of normal controls in a series of
2 facial recognition and matching tasks. Results indi-
3 cated that patients with right-hemisphere damage
4 showed deficits in identifying fear in target faces, as
5 compared to the other participants. Analyses of
6 fMRI data in control participants showed increased
7 activation to fearful faces in the inferior frontal
8 cortex, the fusiform gyrus, and other occipito-
9 temporal regions. These data indicate that a number
10 of structures besides the amygdala, especially areas
11 in the inferior frontal lobe and right mesial tempo-
12 ral structures, are involved in the processing of neg-
13 ative facial expressions.

14 Conclusions

15 As is evident by this and other recent reviews (e.g.,
16 Amodio & Lieberman, 2009; Bartholow & Amodio,
17 2009; Bartholow & Dickter, 2007; Ito, Willadsen-
18 Jensen, & Correll, 2007), the use of neuroscience
19 methods to gain better understanding of person
20 perception processes has increased rapidly in recent
21 years. At the outset of this chapter, we outlined
22 a number of reasons why a social neuroscience
23 approach can be useful for testing theory and
24 advancing the science of person perception. In par-
25 ticular, ERPs provide a time-sensitive means of
26 measuring and separating the rapidly-unfolding
27 cognitive and affect-related processes theorized in
28 many models of person perception, and functional
29 brain imaging permits a detailed picture of the
30 neural structures that subserve these processes.
31 Neuropsychological studies also offer important
32 insights into the functions of particular regions of
33 the brain that appear crucial for effective person
34 perception. Most importantly, linking these neural
35 indices with important psychological and behav-
36 ioral outcomes can provide a more comprehensive
37 understanding of person perception than can be
38 gained by any self-report, behavioral, cognitive,
39 neural, or biological approach alone (cf., Ochsner
40 & Lieberman, 2001; Ochsner, 2004).

41 However, despite the promise of and interest in
42 this relatively recent advancement, it is vital for both
43 scientists and consumers of knowledge in this area
44 to keep in mind that research in social neurosci-
45 ence is only as valuable to advancing knowledge
46 as the research methods and paradigms employed.
47 In other words, the *science* component of social neu-
48 roscience is more important than the advanced
49 technological tools we employ or the colorful and
50 detailed images they produce. To paraphrase John
51 Cacioppo (2003), one of the true pioneers of this
52 field, we as social psychologists and others interested

in person perception cannot stop using our heads 53
simply because we now have the capability to image 54
the brain. It is also important for contemporary sci- 55
entists to recognize the importance of the ground- 56
breaking work of early visionaries who first saw the 57
potential to enhance understanding of person per- 58
ception by measuring bodily responses. One of the 59
first studies of this kind was conducted by Rankin 60
and Campbell (1955), who realized that skin con- 61
ductance (i.e., changes in the electrical properties 62
of the skin due to perspiration, often associated 63
with anxiety) could be a useful indication of White 64
participants' attitudes toward Blacks, even when 65
their self-reported evaluations were generally posi- 66
tive. Research using peripheral psychophysiological 67
measures continues to make important theoretic- 68
al advances in person perception to this day (e.g., 69
Mendes, Blascovich, et al., 2007; Mendes, Gray, 70
et al., 2007). The recent focus on central ner- 71
vous system measures, such as the electrocortical 72
and functional brain imaging research reviewed 73
here, adds to this important tradition in social 74
psychophysiology. 75

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