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INTROVERSION AND AUTISM: A CONCEPTUAL EXPLORATION OF THE PLACEMENT OF INTROVERSION ON THE AUTISM SPECTRUM

by

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A thesis submitted in partial fulfillment of the requirements
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ABSTRACT

The conceptualization of the personality construct of introversion has been problematic since the term's inception due to the complexity and seemingly self-contradictory nature of the collection of attributes of which it is comprised. To advance the understanding of introversion, I propose that it is a continuous segment of the non-clinical part of the autism spectrum, and that it is not the same as the inverse of extraversion. When introversion and autism are placed on the same continuum, the nature of the relationship of the traits becomes more apparent, and new possibilities are available for exploration of both autism and introversion. This review of literature traces the origins and development of the concept of introversion and places it on the autism spectrum, demonstrating the apparent synonymous nature of the traits despite varying degrees of severity in expression. The current factorial structure of introversion demonstrates how autistic features interact to produce the personality dimension. Other factors, including genetic predisposition, relationships to the clinical and non-clinical symptoms of schizophrenia spectrum expression, and neurological findings that support the correlation will be considered. Finally, suggestions for future research and possible theoretical and empirical implications and applications are explored.

In loving memory of Anthony Bibbo.

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CHAPTER 1: INTRODUCTION

From its naissance, the concept of introversion has been indispensable in defining a critical aspect of personality despite its ambiguous and elusive definition. The centuries-old dichotomy of the quiet, pensive, reclusive introvert and his sociable, talkative, and bold extraverted counterpart has been explained with a similarly simple underlying difference: the tendency to focus outward or inward. In modern psychology Jung (1923) used the term "introversion" to refer to a turning inward of energy, set on a continuum with "extraversion," or a turning of energy outward, on the opposing end. However, the placement of introversion and extraversion on opposite ends of the same continuum is a problematic assumption, conceptually and empirically. Hogan and Cheek (1983) explain that the "…construct and predictive validity [of introversion] are enhanced by using separate internally consistent measures that focus on single personality attributes" (p. 343). Grimes (2008) argues that the presence or absence of introversion is not indicative of the presence or absence of extraversion. Similarly, Hogan and Cheek (1983) describe several aspects of inner- versus outer- orientation, showing that these dimensions appear to be two distinct dimensions, not opposite ends of the same spectrum. A better conceptual model of introversion is required.

As one of the foundational dimensions of personality that impacts one's level of effective function and well-being including cognitive, social, and financial success, introversion helps determine one's risk for certain psychopathologies (Wilt & Revelle, 2009). The definition of this personality dimension that includes the subtleties and complexities inherent in a comprehensive conceptual and operational definition is critical to our understanding of many aspects of

personality, including its role in clinical conditions. A new framework is necessary for proper definition of introversion as its own domain of personality.

The present study proposes that introversion should be placed on the autism spectrum, as indicated by consistencies and overlap of introversion and autism definitions. The personality dimension of introversion appears to exemplify a collection of traits and tendencies consistent with non-clinical autism. The colloquial sense and the formal conceptualization and operationalization of introversion have been in close proximity due to their dynamic of iterative refinement and mutual reinforcement. However, this paper outlines the feasibility of a new definition and offers a model for this explication. The similarities between autism, as defined by the DSM-IV-TR (see below), and introversion will be seen most clearly where they would conceptually intersect: severe but non-clinical introversion and high-functioning autism. However, the model proposed here is broader: as a continuum-model, less severe expressions of introversion and more severe expressions of autism would be present at more distal points. Complexities inherent in such an inclusive model are addressed in later sections by explaining component weightings, and by observation of an adjusted (and observably different) result when some traits are expressed more strongly than others. For example, while Asperger's Syndrome is relevant to this discussion, in Asperger's the primary impairment is social (higher social component weightings relative to other facets), but other aspects of introversion-autism would be less affected.

I begin by presenting an overview to introduce the concepts, terms, and reasoning for the formation of this hypothesis. Chapter 2 uses the theoretical framework of the autism-introversion single continuum model to outline the early history of the development of

introversion as a personality construct. Chapter 3 continues the historical review from Jung's conceptualization through present conceptualizations, demonstrating the placement of introversion on the autism spectrum through these iterative theoretical refinements. As Jung's model is the primary basis for current views of introversion, the development of the term in Chapter 3 builds upon the proposed introversion-extraversion continuum model introduced in the preceding chapter. However, new correlates are introduced, and potential new facets of introversion are identified with the development of the term. These are compared to similar phenomena in autism, thus yielding greater support for the proposed single continuum autism-introversion model. Chapter 3 concludes with the introduction of Laney's (2002) operationalization of introversion, and Chapter 4 introduces the four-factor model (Grimes, 2005) to clarify some of the conceptual flaws of the previous model. This four-factor model describes four subtypes of introversion: social, thinking, anxious, and inhibited forms. The factorial framework outlined here will form the basis of further conceptual analysis of the autism-introversion spectrum.

The remaining sections of this thesis transition from definition and historical background to exploring how introversion and autism fit together and define this continuum. The four factors are taken individually, but each chapter presents them in dynamic with other aspects of introversion to demonstrate how these factors relate to each other to create the *relationship* of features that typifies introversion at the non-clinical part of the continuum, and autism in its more severe expression. The fifth chapter defines and describes social introversion empirically and conceptually, and it takes into account findings from autism literature to inform potential causes for the social approach that is characteristic of the temperament. Chapter 6 introduces thinking

introversion, and it describes what it is and the forms that it may take. The resultant thought patterns and their relationships with other aspects of life (including social introversion) are explored. Chapter 7 continues the factorial deconstruction of introversion to follow negative patterns emerging from tendencies evident in thinking introversion. Anxious introversion may have a number of causes and correlates, so its relationships with the other introverted facets and with these contributing factors are discussed. Chapter 9 addresses the fourth subtype of introversion: the inhibited type. This section discusses the ways that this subtype relates to the other factors and explanations from other introversion models and autism findings.

The factorial model is useful for describing the relationship that appears to create that which is termed "autism" or "introversion," but it is not complete. Other factors, including genetic and neurofunctional factors, are examined. I also allow for an expansion of the continuum-model to account for trait variation, and I propose more empirical testing to explore further possible neurobiological correlates. The conclusion in Chapter 10 is a refinement and restatement of the model, demonstrating its simplicity and complexity such that it may be properly applied. The final chapter is a suggested design for an exploratory psychometric study to find support for the autism-introversion single continuum hypothesis.

Overview

Introversion

The problem of proper definition of introversion as a cardinal personality dimension is made more urgent by possible clinical implications of any such relationship. Wilt and Revelle (2009) describe how our understanding of introversion and extraversion might shape our

perspectives on psychopathologies, the connection between the two may be more direct than a mere correlation: the overlap of the two is instrumental in our attempts to describe both the clinical condition and the personality dimension. Jung's empirical sample that was used to represent introversion for many years (Freyd, 1924) was a clinical population of patients with "dysthymia," a chronic but less severe form of unipolar depression, studied in a hospital setting. In more recent years, introversion has been confused with other terms such as "shyness." Despite these connections, the clinical conceptualization was lost over time.

A plethora of mainstream literature recently emerged with a positive spin in favor of "The Happy Introvert" (Wagele, 2006), "The Introvert Advantage" (Laney, 2002), and "Introvert Power" (Helgoe, 2008). The analogy to dysthymia has aptly been lost over the years. Though dysthymia alone does not resemble introversion, a case may be made for similarities between autism and introversion. The comparison to a clinical condition is possible, as the extreme pole of normal behavior may classify clinical behavior (Wilt & Revelle, 2009). The extreme end of introversion, taken to the point of imbalance and maladaptive behavior, inflexibility, and inappropriate behavior in a given situation may characterize autism.

The definition of introversion is complex, underdeveloped, and often contradictory. Eysenck (1947) used the term "introversion" as the opposite of "extraversion," which he used to describe an outgoing, sociable, enthusiastic, and somewhat impulsive personality. The single continuum model for introversion-extraversion as a personality dimension was operationalized as one of the five basic domains of personality (McAdams, 2000). The five-factor model was subdivided by Costa and McCrae (1992) to create the NEO-PI-R, a personality inventory that measures the facets of the "Big Five" factors of Openness, Conscientiousness, Extraversion,

Agreeableness, and Neuroticism. There are six extraversion facets, including warmth, gregariousness, assertiveness, activity, excitement-seeking, and positive emotions. Examples of representative items for each facet are in Table 1 below:

Table 1: NEO-PI-R Extraversion Facets

Extraversion facets:

Warmth: friendly, warm, sociable, cheerful, affectionate, outgoing
"I really like most people I meet"

Gregariousness: sociable, pleasure-seeking, talkative, spontaneous
"I like to have a lot of people around me"

Assertiveness: aggressive, confident, self-confidant, forceful, enthusiastic
"I am dominant, forceful, and assertive"

Activity: energetic, hurried, quick, determined, active, aggressive
"My life is fast-paced"

Excitement-seeking: pleasure-seeking, daring, adventurous, charming, handsome, spunky, clever
"I like to be where the action is"

Positive emotions: humorous, praising, spontaneous, optimistic, jolly
"I am a cheerful, high-spirited person"

This conceptualization was refined only slightly over time to involve a more direct description of the necessary constellation of traits. As such, introversion is described as the inverse of extraversion, but direct definition has replaced implied but unstated content.

Introversion is commonly categorized by a preference of "depth" over "breadth" of interpersonal relationships that is associated with the tendency to have few close social connections instead of many superficial relationships, limited numbers but great passion in interests, and difficulty in changing or juggling tasks. Also present is a predisposition to be

easily overwhelmed and to experience sensory sensitivity, a preference for "quiet" solitary activities, and low excitement-seeking and activity preferences (e.g., Jung, 1923; Aron & Aron, 1997; Costa & McCrae, 1992; McAdams, 2000.) Introverts are also characterized as "withdrawn, retiring, reserved, inhibited, quiet, and deliberate" (McAdams, 2000, p. 305). They prefer professions that include less interaction, often working as artists, mathematicians, engineers, and researchers, and they prefer striving for accuracy over speed. Introversion appears to be a complex trait that impacts all aspects of one's life. However, it is also a rather ambiguous construct that has elicited conflict and confusion regarding its meaning and mechanism.

This view is encapsulated by the work of Laney (2002), whose conceptual definition of introversion defies shyness and social reclusion due to associated anxiety, despite her operational inclusion of such markers. She defines introversion to include confusion, fluctuation in behaviors and attitudes, difficult communication, rumination, anxiety, anxious self-preoccupation, the tendency to be easily overwhelmed, low energy, a disdain for social functions of any degree of formality, and sporadic overwhelming amounts of energy. Laney's picture of confusion and contradiction, coupled with the tendency to become overwhelmed, hints toward clinical implications. She explains that an introvert is "…easily overstimulated by the external world, experiencing the uncomfortable feeling of 'too much.' This can feel like antsyness or torpor." She continues that one can lose "…other perspectives and connections" (p.19). The in-depth narrow focus is overwhelmed by breadth, as detail-focus may cause one to become overwhelmed by larger patterns that one prefers to ignore. As clinical symptoms are marked by discomfort, dysfunction, distress, and/or dangerousness to the self and/or others, the "traits" of

introversion may aptly be considered symptoms of undiagnosed psychological illness, if they are sufficiently severe to be characterized as such.

Autism

Autism is a developmental disorder that involves abnormal social and communication development that results in impaired social interaction and difficulty with communication, a tendency to engage in repetitive behavior and utterances, and limited and obsessive interests (de Bildt et al., 2009; *DSM-IV-TR*; Baron-Cohen et al., 2001). Studies also show selectively enhanced perceptual sensitivity and altered perception (see Baron-Cohen et al., 2009). The DSM-IV-TR defines autism as follows:

A. A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3)

   (1) qualitative impairment in social interaction, as manifested by at least two of the following:
      (a) marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
      (b) failure to develop peer relationships appropriate to developmental level
      (c) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)
      (d) lack of social or emotional reciprocity

   (2) qualitative impairments in communication as manifested by at least one of the following:
      (a) delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
      (b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
      (c) stereotyped and repetitive use of language or idiosyncratic language
      (d) lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

(3) restricted repetitive and stereotyped patterns of behavior, interests and activities, as manifested by at least two of the following:
(a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
(b) apparently inflexible adherence to specific, nonfunctional routines or rituals
(c) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)
(d) persistent preoccupation with parts of objects

B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years:

(1) social interaction,
(2) language as used in social communication, or
(3) symbolic or imaginative play (*DSM-IV-TR*)

Autism is a "spectrum" disorder, indicating varying degrees of symptom severity. Based upon this categorization, Baron-Cohen and colleagues (2001) noted that there is a resultant theoretical population who demonstrate a less severe collection of symptoms that may be tested empirically. In response, they introduced the Autism-Spectrum Quotient (ASQ), a "…brief, self-administered instrument for measuring the degree to which an adult with normal intelligence has the traits associated with the autism spectrum" (p.5). The ASQ assesses five main areas: social skill, attention-switching, attention to detail, communication, and imagination. While Baron-Cohen and colleagues hypothesize that there was no such comprehensive psychometric measure for non-clinical autism symptomology, one might be able to make the case that such a scale may simply have been hiding in introversion literature.

Possible overlap between autism and introversion

Some researchers have undertaken to categorize the constellation of traits associated with autism spectrum disorder as a separate dimension of personality. Baron-Cohen and colleagues' (2001) Autism-Spectrum Quotient is intended to measure the presence of these traits in a non-clinical population. Wakabayashi and colleagues (2006) explored the relationship between the Big Five personality dimensions as measured by the NEO-PI-r and the Autism-Spectrum Questionnaire (ASQ). They found a negative correlation with Extraversion ($r = -.434$, $p<.01$), which indicates an introverted component. Neuroticism showed a positive correlation with ASQ scores ($r = .289$, $p<.01$), but authors suggest that autism is a separate personality dimension, based upon joint factor analyses. While it is possible that this theory may have some practical merit for exploration of the trait in the general population, it is also possible that the psychometric measures used are not comprehensive and conclusive measures of the traits that they seek to explore. For instance, the NEO-PI-r follows the Big Five model of personality, which necessarily assumes that introversion is the opposite of extraversion. As a result, extraversion items can be reverse-scored to represent introversion, or they can be expected to correlate negatively with "introverted" traits. However, it is not merely the presence of certain traits that create the greater personality. The interaction of the traits with each other and with the environment do not allow for such a simplistic model to detail the function of the individual outside of the theoretical realm. In fact, introversion is often described as a difficult temperament for an individual who must assume coping strategies to survive in an extraverted culture.

Greater problems are evident with this model in a simple deconstruction: Jung (1923) indicated that an individual channels energy outward or inward. However, it is likewise possible

that individuals have different levels of energy as part of their individual differences, or that they might not be channeling energy in a singular favored direction. That is to say that the individual who is not currently engaged at an energetic party, for example, is not necessarily partaking in constructive thought or other inward processes. Similarly, Freud's (1918) introduction of the concept of fixation rendered some of this energy unavailable. Therefore, it is not possible to base the definition of energetic usage on a singular continuum. Once specific preferences and tendencies emerge, they also interact with each other and with the environment to produce a personality. Causal direction is unclear. For instance, an individual may have a strong fantasy life, or what Aron and Aron (1997) term a "rich inner life." This would cause one to place oneself in situations that favor indulgence of these preferences. Other associated features of introversion would support these tendencies toward maintenance of one's inner life, as well. For example, social reclusion may be a passive withdrawal from others that arises from an active pursuit of fantasy. The reason for the overt behaviors will cause certain constellations to emerge to support these needs and desires.

Revisiting the psychometric puzzle draws out these same problems: which traits emerge, what drives these traits, how are they weighted, and is it possible for introverted experience to be similar for many individuals whose reason for withdrawing into one's inner world is the same? Studies specific to introversion do highlight traits and dispositions that are not simple inverses of those associated with extraversion. However, they may be specific to certain manifestations of introversion, and not to others. Perhaps the findings of Wakabayashi and colleagues' (2006) will be useful to guide us toward a new conceptualization of autism and introversion, but one that highlights specific components of introversion that are not simple correlates between selected

facets of the inverse of introversion and that singular component measure of high-functioning autism.

A more in-depth study of introversion (Grimes, 2005) revealed a clustering of introverted traits into four subgroups: social, thinking, anxious, and inhibited. Researchers used several measures of components of introversion and related constructs to explore the convergent and discriminant validity of Laney's (2002) Introversion Scale. They found that her scale contained two independent factors, and that other conceptualized (but ineffectively operationalized) components of introversion were not well represented. A collection of these measures could be used to detail the four subtypes of introversion. The results indicate that these factors of introversion may represent the varying collections of specific constellations of introverted dimensions. While autism may show correlation with the inverse of extraversion, a more in-depth consideration of what introversion actually is and how it relates to neuroticism and other correlates demonstrates the strength of the model of a singular introversion-autism continuum with differentially integrated subcomponents whose total weight dictates placement according to severity on the spectrum.

The overlap of definitions of introversion and autism in regard to social discomfort and the tendency to avoid social situations, the difficulty in attention switching and changing task or stuck-in-set perseveration, and the attention to detail, coupled with a lack of ease in producing conversation points toward conceptual overlap between the two constructs. Additionally, in both autism and introversion, we see an inhibited component, discomfort with and avoidance of novelty, detail focus and a proclivity to become overwhelmed, and a tendency to be misunderstood. These similarities find some empirical support, as researchers have found higher

scores on measures of introversion, repression, and social discomfort in adults with autism-spectrum disorders than in controls (Ozonoff et al., 2005). Other published links between autism and introversion appear to be inadvertent comparisons for convenience in summarization, and they draw in the similar and overlapping schizophrenia spectrum disorders. For instance, Meehl (1989) describes schizotaxia with the potentiators of introversion and anxiety, and a personality with autistic traits. Dellaert (1958) explains "instinctive-reactive" dispositions "whose need for communicative relationships remains tied by an *introverted, even autistic,* attitude toward life experiences, leading to feelings of inferiority" (p. 254, italics added). Here, the remaining traits of a lack of assertiveness but increased fantasy (as shown in Grimes, 2005) and diminished communicative skills (Laney, 2002) are brought together in the continuum of the autism spectrum with support for inclusion of autistic, introverted, and schizophrenic traits when differential expression of these traits is allowed.

The conceptual overlap between introversion and autism is present in the predominant measures of both constructs. Table 2 provides a comparison of items taken from Laney's (2002) Introversion Scale with similar items from the ASQ (2001).

Table 2: Introversion and Autism

Social Skills:

Introversion:

"I like to share special occasions with just one person or a few close friends, rather than having big celebrations."

"I feel drained after social situations, even when I enjoy myself."

Autism:

"I prefer to do things with others rather than on my own." (reverse-scored)

"I would rather go to a library than a party."

"I enjoy social occasions." (reverse-scored)

Attention Switching:

Introversion:

"When I work on projects, I like to have larger uninterrupted time periods rather than smaller chunks."

"I can 'zone out' if too much is going on."

"I often feel uncomfortable in new surroundings."

Autism:

"I frequently get so strongly absorbed in one thing that I lose sight of other things."

"I find it easy to do more than one thing at once." (reverse-scored)

"New situations make me anxious."

Attention to Detail:

Introversion:

"I tend to notice details many people don't see."

Autism:

"I tend to notice details that others do not.

Communication:

Introversion:

"I sometimes rehearse things before speaking, occasionally writing notes for myself."

"I usually need to think before I respond or speak."

"I often dread returning phone calls"

"I find my mind sometimes goes blank when I meet people or when I am asked to speak unexpectedly."

"I talk slowly or have gaps in my words, especially if I am tired or if I am trying to speak and think at once."

Autism:

"I enjoy social chit-chat." (reverse-scored)

"I frequently find that I don't know how to keep a conversation going."

"I am good at social chit-chat." (reverse-scored)

Imagination:

Introversion:

"I am creative and/or imaginative."

Autism:

"If I try to imagine something, I find it very easy to create a picture in my mind." (reverse-scored)

Hypersensitivity:

Introversion:

"I don't like overstimulating environments. I can't imagine why folks want to go to horror movies or go on roller coasters."

"I sometimes have strong reactions to smells, tastes, foods, weather, noises, etc."

Autism:

"I often notice small sounds when others do not."

The five facets of autism spectrum that Baron-Cohen and colleagues (2001) proposed show considerable overlap, with only one facet that is projected to have an inverse correlation in the current study: imagination. The fact that imagination is an important part of both constructs may have interesting implications, though the valence may indicate that overlap shows similarity and interrelatedness, but not synonymous definition. The reason for the discrepancy may be found in other factors, such as impaired IQ, increased anxiety, or other confounds that may produce this observed effect. Certain types of introversion may also correlate differently with a creativity factor. For example, anxious and inhibited introversion may correlate with lower creativity scores (Grimes, 2005). Another potential explanation for disassociation of creativity from other autistic traits rests in the overlap of schizophrenia and autism as classified by the DSM-IV-TR. There are notable distinguishing factors between the two diagnoses including prevalence within differing age groups (later onset for schizophrenia that is typically between late teens and early thirties and early onset of autism no later than three years of age), higher incidence of autism in males and schizophrenia in females, and the marked presence of hallucinations and delusions in schizophrenia and not in autism. However, the two diagnoses include core features of social withdrawal, communicative impairment, preference for the abstract, and affective flattening. Perceived creativity may be resultant of interrelatedness of autism and schizophrenia (for an example of correlations of schizophrenia and creativity, see Rawlings & Locarnini, 2008), imposition of a compensatory strength to counter the "problem" of

a lack of sociability (e.g., the introverted form of the "gifts of shyness" (Avila, 2002), or it may actually be present in autism, but not yet clarified by the DSM-IV-TR definition (Rawlings & Locarnini, 2008). Such studies that link creativity with autism and schizotypal traits lend greater strength to the inclusion of creativity as an aspect of thinking introversion as autism and introversion are considered along the same continuum.

Table 2 demonstrates that sensory hypersensitivity is also empirically supported for both autism (Baron-Cohen et al., 2009) and introversion (Laney, 2002 and Aron & Aron, 1997). Baron-Cohen and colleagues did not give a thorough test of this category of sensitivity, but it is represented within the category of "attention to detail." Aron and Aron (1997) introduced a "frazzle/withdraw" reaction to overstimulation, and Laney's (2002) Introversion Scale includes such items as well (ex: "I sometimes have strong reactions to smells, tastes, foods, weather, noises, etc."). The "high sensory processing sensitivity" construct is captured in Aron and Aron's (1997) "Highly Sensitive Person Scale," which assesses aesthetic orientation, sensory hypersensitivity, and the tendency to become overwhelmed by sensory input and to withdraw. The apparent differences between the introversion and autism scales are not indicative of a conceptual variance; they appear to take slightly different approaches to measurement of the same phenomenon, possibly showing differentiation in degree and wording, as described by Block (1995) as the "jingle-jangle" problem. Therefore, exploration of these concepts might benefit through improvement of construct explication, or the ability to operationalize the terms properly may be contingent upon proper conceptual reframing. That is to say, Block's "jingle-jangle" problem appears to describe the tendency of conflicting definitions and conflicting descriptive terms to constrain both theory and research.

The argument

A better description of both autism and introversion and greater clarity in our use of these terms are possible if it can be determined whether autism (as posited thus far through the psychometric account through Baron-Cohen and colleagues' (2001) proposed goal) and introversion lie on the same continuum. Thus, the purpose of the present study is to assess the feasibility of the existence and nature of the relationship between introversion and autism, especially with respect to high-functioning autism or Asperger's Syndrome. If these constructs lie along the same "spectrum," then we may be able to enrich our understanding of both autism and introversion and the behavioral expressions that are common or disparate indicators of social and communicative competency, and to improve our operationalization such that our theory is more cohesive, our understanding enriched, and subsequent measures are more comprehensive and descriptive.

The most effective way to explain the history of introversion is to place it within the autism spectrum as an attenuated expression of the same constellation of traits. This framework allows for a novel perspective on an old problem. The introversion-neutral movement (e.g., Jung, 1923) was re-interpreted to be identified as a negative statement about the construct in comparison to its favored counterpart of extraversion, especially as it was adapted over time (e.g., Meares, 1958; Costa & McCrae, 1992). The introversion-positive movement followed (e.g., Wagele, 2006; Laney, 2002; Aron & Aron, 1997). The view must be rebalanced to be comprehensive and representative of introversion.

It is not simply the theorist's bias that confounds the study of introversion. Besides the complications that emerge from the question of valence, it is unclear how these traits relate to each other or how they could be conceptually or experientially linked without using the framework of the autism spectrum. The tendency to have "gaps" in one's speech, to experience one's mind "going blank," to be easily "frazzled" or overwhelmed, to pay particularly close attention to details, coupled with social withdrawal and thought patterns that show a characteristic preference for a subjective consideration of reality or the creation of a different one yields a complicated picture that can no longer be considered the simple inverse of extraversion. As McWilliams (2006) points out, the complicated concept that is meant by "introversion" is different from the "preference for introspection and solitary pursuits" (p. 2) that is implied by understanding introversion as the Jungian inverse of extraversion (also in Costa & McCrae, 1992). McWilliam's (2006) preference for the term "schizoid," however, is somewhat inaccurate and does not adequately address all aspects of the temperament.

We seem to be describing something that simply fails to make sense as a basic temperament and is at odds with the previous social/thinking conceptualization if we do not consider how all of these traits that have come to characterize introversion fit together in functional context in its more extreme, clinical manifestation. Inward orientation, fantasy, and reflection, seem not to connect with low activity and excitement-seeking, communication problems, and social anhedonia (the inability to experience pleasure derived from social interaction). Introversion must be considered in a new way such that the attempts at definition and model construction that have been unsuccessful for over two millennia may finally begin to form a cohesive picture.

Allowing introversion to be defined as a trait set of variable component weightings that exists on a continuum offers more potential for construct development and explication than the attempt to systematically frame the "temperament" differently based upon desired connotations. Placing introversion on the non-clinical, less extreme end of the autism spectrum allows for the constellation of traits to be understood in proper context and lacking the former obscurity from imposed bias of perspective valence.

Connotations of introversion

The wide variability and ambiguity involved in the terminology and conception of introversion coheres in a common set of certain recognized tendencies. These include priorities that include interests and actions of "territoriality; concentration; internal; depth; intensive; limited relationships; energy conservation; internal reactions; reflective; think, then speak" (Kroeger & Thuesen, 1988, p. 35). Kroeger and Thuesen report that, "of all the Typewatching letters, according to Jung, the division between Extraverts and Introverts is the most important distinction between people, because it describes the source, direction, and focus for one's energy" (p. 36). Introversion is also equated with energy gained through reflection, introspection, and attentional depth. Costa and McCrae (1992) define introversion as the opposite of extraversion, which includes the following adjectives: friendly, warm, sociable, cheerful, affectionate, outgoing, pleasure-seeking, talkative, spontaneous, aggressive, assertive, self-confident, forceful, enthusiastic, confident, energetic, hurried, quick, determined, active, daring, adventurous, charming, handsome, spunky, clever, humorous, praising, optimistic, and jolly. Introverts are shy, aloof, and withdrawn, as well. Keirsey and Bates (1984) take a slightly

different approach to introversion, since intuition/sensation, thinking/feeling, and judging/perceiving divide the traits somewhat differently, and some of the nuances that constitute our understanding of introversion result from its interaction with other traits. The introversion-extraversion distinction is based upon the tendency to feel energized by social interaction (extraversion) versus the tendency to seek isolation to recover energy (introversion). This is marked by a sense of territoriality: private places in the mind and environment are preserved for a restful retreat. Introverts are said to feel lonely even when in the presence of many other people, feeling "a deep sense of isolation and disconnectedness" (p. 15) despite the plethora of people around them. The external/internal, breadth/depth foci are consistent with Costa and McCrae's definition of introversion.

Popular conceptualizations of introversion include a sense of being overwhelmed (Aron & Aron, 1997; Laney, 2002; Rufus, 2003), a sense of being different (Laney, 2002, Rufus, 2003), alienated (Rufus, 2003), a preference for solitary activities (for example, Laney, 2002, Rufus, 2003; present also in Jung, 1923), disrupted circadian rhythms (Rufus, 2003), differences in perception and imagination (Rufus, 2003; Aron & Aron, 1997; Laney, 2002), a sense of superiority and esoteric knowledge (Laney, 2002; Aron & Aron, 1997; Rufus, 2003), and the feeling that interaction is "draining" (Aron & Aron, 1997; Laney, 2002), "work," an "ordeal" and "barrier" to knowledge (Rufus, 2003). Also included is the tendency to withdraw when one is overwhelmed (Laney, 2002; Aron & Aron, 1997) or upset (Rufus, 2003). Laney (2002) notes the tendency of introverts to avoid eye contact. Rufus also draws the comparison to clinical groups with ADHD and social phobia, but she notes the social reclusion and "repetitive relentlessness" that autism and introversion share. For the latter phenomenon, the change in

terminology to "perseveration" obscures the extent of clinical implications and the commonality of the behavior between the two conditions. She never resolves this matter, though it does raise an interesting point in setting forth popular receptiveness to understanding both autism and introversion in terms that might clarify both, an endeavor for both the scientific community and the "misunderstood" (Laney, 2002) general population who seek to understand themselves better.

Baron-Cohen and his colleagues (2001) use the Autism-Spectrum Quotient to examine the presence of autism-spectrum traits in the general population. As a "spectrum" disorder, the qualities that fall under the umbrella term of "autism" demonstrate great variability in extent and with certain distinguishing features. However, even with this variation, the description of autism-spectrum traits overlaps significantly with those of introversion. As sociability versus withdrawal and communication styles/aptitudes characterize the extraversion-introversion dynamic, we find that social withdrawal, social competence, and communicative difficulties are the main features of Asperger's Disorder traits and high-functioning autism. Many other features of introversion unrelated to extraversion, and irreconcilable and seemingly contradictory as they seem by current conceptualizations, begin to take shape if we view them as the non-clinical end of autistic typology.

CHAPTER 2: EARLY HISTORY

The previous chapter provides a basic description of introversion and autism, and of the challenges that face empirical and conceptual development of both. It also demonstrates the feasibility of the development of a model that places introversion and autism on the same continuum. I will build upon these definitions to demonstrate the historical significance of this new model, and to show how the development of our understanding of introversion can be clarified by relating the single-continuum model to previous conceptualizations. The components that make up introversion have been correlated and explored using many theoretical frameworks, and this chapter will demonstrate how all of them support the single autism-introversion continuum model. As introversion has a long and complicated history, the present focus will cover a defined timespan: this chapter begins with Galen's description in 200 B.C. and ends with Jung's definition and its legacy for modern construct explication.

Introversion from Its First Extrojection

Introversion was introduced in ancient Greek psychological systems, attributable to Galen around 200 B.C. (McAdams, 2000). With the beginning of the use of the terms, *introversion* and *extraversion* bore the heavy burden of terminological baggage. Perceived correlates that were not theoretically or empirically linked immediately attached to these "types:" "cheerful," "sanguine," and "volatile," "choleric" describe the positive emotions and impulsivity that would be carried over with later psychometric examination of extraversion (as in the NEO-PI-R: Costa & McCrae, 1992). Introverted individuals were those who were "stoic," "phlegmatic," and "depressive," "melancholic" (McAdams, 2000). The reserved or attenuated

emotion, whether experienced or perceived, coupled with low energy levels and compromised mood would be carried over through the ages to be reformulated and ultimately refuted.

Immanuel Kant set forth a typology of the temperaments based upon an underlying motivational system. The "melancholic" character remained tied to abstraction and remote consideration of principle, while the "choleric" character acts to maintain public appearances and regulated self-presentation (Kant, 1764 in Kant, 1764/1973). While the former encompasses some aspects of what later came to be called introversion and the latter appears to define extraversion, the comparison is drawn more sharply with the inclusion of an impulsive type and a "phlegmatic" or conservative type. These delineations appear to offer a new model, but the adjusted presentation actually maintains the content of the early introversion-extraversion distinctions. According to these early conceptualizations, introversion marked social and emotional tendencies, characterized by withdrawal, depression, and an energy level lower than that shown by non-introverts.

Freud: A psychological model of energy and inward fixation

Early 20th century psychological models of the mind, most notably those described by Freud (1916) and Jung (1923), were based upon energetic systems. Freud's theory is renown for contrasting the dual forces of creative and destructive energy, but he also described the importance of proper direction of energy reserves: "A person falls ill of a neurosis if his ego has lost the capacity to allocate his libido in some way" (p. 480). The investment or attachment of this energy and resultant inability for use in other tasks is described as "cathexis." This fixation can have an external or internal focus, the latter of which describes endocathexis. Later theorists

would describe a balanced system that utilizes introversion (endocathection-extraception) to allow for the "manipulation of external objects through speculative abstract thought or discussion; reflection and discussion about events or systems; data collection and inductive reasoning" (Singh, 2004, p. 235), or an unbalanced form that more closely resembles conceptualizations of "pure" introversion in that it lacks the dual component of "outside" reference (endocathection-intraception): "preoccupation with private experience, psychological, spiritual, esthetic, or metaphysical truth; introspection and deductive reasoning" (p. 236).

Freudian developmental theory included a marked phase of introversion, or endocathection, at the beginning of life. The continuation of introversion past these early stages was considered indicative of arrested development (Coan, 1994). The infant is to be considered incapable of engaging in meaningful interaction with the world, even though there is an understanding of internal versus external phenomena: the infant is dependent upon external figures despite one's "natural autism" in these early stages (Mahler, 2003). Though the infant is endocathected, one is completely dependent upon the mother to serve as an external superego. The ability to distinguish the self from the outside world can be seen in grasping behavior by which the infant seeks to draw something of the external world to the self. Infants may also comprehend essential differences between living and non-living objects in the environment. This differentiation is an interesting one, as "natural autism" does allow for the autistic ability to distinguish living from non-living objects, though the preference is for non-living objects (Fletcher-Watson et al., 2009). The use of these external cues aids in the development of a sense of self and one's interactions with the world as are critical byproducts of the development of the ego to temper the drives of the id. "Persistent" and "intense" sensory input may be

overwhelming, causing one to block out this outside world (Mahler, 2003). In so doing, the individual's sense of self and ability to form relationships with the external world are impaired.

Jung: A foundation for modern conceptualization of introversion

The synonymous nature of introversion and autism was lost by the development of the term "introversion" and the desire to create a neutral term. Jung explained the individual's manipulation of energy as extraversion or introversion. By these two processes, one directs energy outward or inward, respectively. Introversion and extraversion were placed on a continuum, with individual difference evident in a tendency to engage in certain amounts of introversion and extraversion to maintain one's level of comfort and optimal function. The original definition of introversion states that,

> "Interest does not move toward the object but withdraws from it into the subject. Everyone whose attitude is introverted thinks, feels, and acts in a way that clearly demonstrates that the subject is the prime motivating factor and that the object is of secondary importance. Introversion may be intellectual or emotional, just as it can be characterized by *sensation* or *intuition*. It is *active* when the subject *voluntarily* shuts himself off from the object, *passive* when he is unable to restore to the object the libido streaming back from it. When introversion is habitual, we speak of an *introverted type*" (Jung, 1923, p. 453).

While the concept of introversion is only a referent to one's tendency to direct attention and energy inward with less stress placed upon environmental interaction, this basic definition comes with many implicitly related traits and tendencies, and it carries latent conflict and contradiction in its simple but obscure wording. To begin, the "introvert" is described as one whose energy source is within, while the "extravert" finds his energy source without, in the external world and in relations to the object (though still focused on the object and not the subjective quality of the relationship as described phenomenologically), consistent, respectively, with one's orientation.

The basic direction of energy inward with one's "inner world" as a font of energy dismisses the problem of directionality: for the introvert whose energy source is within and whose direction is "inside," it is theoretically implausible for movement to occur. Similarly, for one whose energy source is the outside world with energy focused outward, it is not possible for energy to never "come in" in order to be directed outward. It would appear that the mere source/direction problem defies movement: the extravert never contains energy, and the introvert is an ever-filling well of energy despite the lasting conceptual linkages to diminished energetic feelings. Additionally, "inward" realms of thought versus "outward" realms of sociability, also to be considered subjective and objective areas, respectively, bring forth the invariable problem of such a separation, as it hedges upon Cartesian dualism and the suggestion that mind and body are separable, at least for conceptual consideration. Another explanation for the tendencies that are exhibited through the appearance of social withdrawal, low energy, communicative difficulties, differences in thought and perception, and sometimes depression must be employed, rather than relying upon this shaky "energetic" foundational system that defies physics.

A Jungian foundation for conceptual expansion of introversion

The above definition is foundational to current views of introversion, but it leaves many questions for later operationalization; therefore, it also sets the foundation for confusion and ambiguity in construct explication. Jung's definition of introversion lends itself to interpretation that may include social anhedonia and hypersensitive narcissism, though later literature would also include self-reflection (e.g., Laney, 2002) and anxious self-preoccupation (Pontari & Schlenker, 2000), as well as shyness (e.g., Meares, 1958). Interestingly, the above definition

also hints toward the possibility of a lack of theory of mind: if one is preoccupied with one's own subjective state and the primary focus is on the self, then the ability to understand others might be impaired, as the focus is not on the other. Indeed, social ineptitude is often cited as a major source of social discomfort and preference for solitude (O'Reilly et al., 2004; Kavale & Mostert, 2004). These difficulties may manifest themselves in inability to understand others due to a preoccupation with the self. This can manifest itself in a number of ways, dependent upon interpersonal style. These will be discussed in greater depth under the subheadings of social and thinking introversion and theoretical applications.

Jung's definition renders other conclusions plausible, as well. It may be expected that the introvert displays a lack of empathy despite intuitive proclivities. While empathy was included in later conceptualizations of introversion (Aron & Aron, 1997; Laney, 2002), introversion should not be confused with the similar term "introjection," a possibility that may have lent additional unintentional complexity to the term: while introjection refers to the "indrawing of the object into the subjective sphere of interest," introversion is the turning of libidinal energy inward (Jung, 1923, p. 452). Later definitions that include empathy as a social/thinking aspect of introversion have assimilated this term into the "introversion" sphere of interest. Also, the Myers-Briggs Type Indicator (MBTI; Myers, 1962) is the intended operationalization of Jung's dimensions of personality, but its conceptual definitions includes an explanation by Shapiro and Alexander (1975, in Porter & Roll, 1992) that "the introvert brings the world to him or her, whereas the extravert goes out to meet it" (p. 117). The concept of introjection may allow the introvert to better understand the thoughts and feelings of another if one tries to experience what the other must be experiencing based upon the presumed experience of the other (Goldman,

1989). Introversion does not necessarily involve introjection, though, so it more closely resembles endocathection, or the fixation of libidinal energy on an inner point of focus with an inability to free the energy for use in interaction with the outside world. Additionally, the inability of one to experience simulation would only hinder social engagements in which one actively attempts to simulate the experiences of another; however, social ineptitude itself has proven a controversial point. While introversion-positive theorists (e.g., Laney, 2002) describe good social skills coupled with an unwillingness to exercise them, others (e.g., Argyle & Lu, 1990 in Hills & Argyle, 2001) take a conservative approach in claiming that diminished social competence may account for such documented issues as depressed mood in introversion. The early inclusion of disrupted sociability as a core trait of introversion has helped shape the development of later theories of the construct.

Introversion may also be a presumptive correlate of hypersensitivity, as indicated by possible characterization "by sensation." This line of inquiry culminated in Aron and Aron's work (1997) that describe "high sensory-processing sensitivity" as an introverted characteristic. This innate and hardwired sensory experience is at odds with the assertion that introversion can be a conscious effort to withdraw ("active" type), or an unwanted action that cannot be helped ("passive" type, which is more indicative of an underlying biological mechanism that supports this tendency). While the latter delineation did not last through following literature, introversion has been acknowledged as a "preference" (Laney, 2002), even while its classification as one's very nature that should not be expected to change or hide without discomfort was preserved (Laney, 2002). As can be seen, the possible conflicts latent in the early definitions of

introversion have been brought to empirical and theoretical fruition through later examination of these presumed directions.

The confusion among the terms that qualify the construct of introversion was perhaps borne from its inception and simply maintained or augmented by iterations of conceptual and empirical work that hide the common thread of the very continuum on which it lies. The early definitions and theoretical models described in this chapter introduce an ambiguous construct with many possibilities for further development. However, these ambiguities and complexities find clarification when viewed through the single autism-introversion continuum model. As early conceptualizations and their difficulties support this theory, the development of introversion in later research would build a picture that clarifies this relationship.

CHAPTER 3: THE EVOLUTION OF INTROVERSION SINCE JUNG

The previous chapter focused mainly on how the introversion-autism continuum model is supported from the introduction of the term "introversion" through the development of Jung's introversion-extraversion continuum model. This view of introversion has provided the foundation for later conceptual and operational definitions as introversion-extraversion became a cardinal personality dimension. It is this view that has greatly shaped our perspective. However, its application has also prevented new perspectives that can elucidate the difficulties facing current conceptualizations and terminologies. In this chapter, we will follow the development of introversion as a personality construct, beginning with Jung's work as a springboard for consideration of the autism-introversion continuum model. From here, we will use the clinical perspective to place introversion through its evolution to current conceptualizations.

Shifting foci: Introversion beyond introspection

Introversion and extraversion were formally correlated with a number of traits by which the processes came to be operationalized. Jung's "introverted" personality invests psychic energy in one's own private thoughts, feelings, and fantasies. These individuals tend to prefer solitary, quiet activities, and he operationalized this construct through the use of a hospitalized population of dysthymics to represent "introverts" (Freyd, 1924). By making this connection, emphasis on subjective states, mood, and a tendency to avoid large groups of people, overstimulating situations, and a plethora of novel experiences came to characterize introversion.

The qualities that came to be associated with introversion and extraversion were conceptual contingencies of the basic definition of the terms. The distinction between "inner-

directed" versus "outer-directed" energetic focus defines the introversion-extraversion dimension as conceptualized by Jung (1923). Extraverts focus on their environments and objects external to the self, thereby causing them to think more objectively. Introverts, whose focus is upon the inner world, tend to favor subjective arguments, as these target their perceptions of their own reactions and feelings. It is this perception of the outside world, not the outside world itself that creates the realm of thought for introverts. Emphasizing different parts of the process, or the object versus one's perception of the object, creates an interesting approach to all forms of experience. As models of introversion evolved, foci shifted: inner versus outer orientation became secondary to preference for focus in depth versus breadth. Connections between introversion and dysthymia were lost, but new associations with social problems emerged when theorists shifted in focus from introspectiveness (Jung, 1923) to sociability (Eysenck, 1947). These changes reflect the gradual incorporation of the connotative suggestions in Jung's model. Eysenck's (1947) conceptualization of introversion described the opposite of extraversion, which he defined as the tendency to be outgoing, sociable, enthusiastic, and relatively impulsive. Clinical literature has shown the divisibility of sociability and impulsiveness, as schizophrenia and related disorders lack sociability (*DSM-IV-TR*) but have been tied to impulsiveness (Enticott et al., 2008). Introversion proved to be a multifaceted personality construct, and theorists began to draw distinctions between types of introversion. Guilford (1959) distinguished between thinking and social introversion, but he considered shyness to be a separate construct. Interestingly, he did not include social anxiety in the "social" component of introversion, though many later theorists would believe them to be synonymous (for conceptual example, Meares, 1958; for operational example, Laney, 2002).

If the "external" "social" world and "internal private world" (McAdams, 2000) are taken as opposite courses of energetic direction, then the conceptual link between sociability and personal experience, perception, and thought is inescapable. Eysenck (1947) would add enthusiasm, impulsivity, and "heedlessness" to the definition, though energy level and "social dominance" would continue as important parts of the extraversion definition while impulsivity would become a mere correlate (e.g. Gray, 1987; McCrae & Costa, 1990). The evolution of "introversion" was marked by iterations of streamlining and added complexity, partially based upon individual difference in the population of "individuals."

The emergence of the "Big Five"

Subsequent theorists worked with Jung's framework to describe a facet of personality so basic that it became the first of the five dimensions of the Big Five personality inventory (McAdams, 2000; John, Donahue, & Kentle, 1991) and one of the four facets of the Myers-Briggs Type Indicator (Myers, 1962). However, some theoretical issues remain. The Big Five's extraversion subscale assesses positive emotions, sociability, and excitement-seeking, so its inverse, introversion, is not operationalized with an introspective, fantasy, or anxious component (John, Donahue, & Kentle, 1991). This definition does hint toward Jung's conceptual and operational tie to dysthymia and mood disorder, social withdrawal, and limited scope and extent of activity, even though it lacks the essential component of "inner thought." Grimes (2008) explains that the direction of energy inward is not necessarily correlated with these personality traits, and that it is inaccurate to assume that the lack of introversion must indicate the presence of extraversion and vice versa. Introversion and extraversion may be on two continua,

commensurate with their status as independent processes that are not mutually exclusive. In fact, one may be a "high-energy ambivert" or a low-energy individual, thereby detailing the effects of simultaneous high or low introversion and extraversion. By this model, we may see different subsets of traits emerge based upon the interplay of introversion and extraversion. Additionally, the type of introversion under consideration will greatly impact the emergent personality when subjected to certain environmental stimuli.

Personality across cultures

The temporal evolution and expansion of the term *introversion* is complemented by its geographical popularization and generalization across cultures. This helped refine how researchers view the term in various contexts. Cross-cultural work complicates the picture of introversion further than the consideration of Western conceptualizations alone will allow: as noted by Takeo Doi (1985), the inner self and outward projection of the self are both interdependent and separable. The way that one understands the self, the way that one wishes to be understood, and the means by which one attempts to relate based upon one's understanding of the expectations and communicative mores of others and the society at large cause introversion and extraversion to expand into an interdependent system and, perhaps most aptly, a set of talents that requires manipulation for proper use in expression of the self within societal constraints and allowances, while proper self-understanding also occurs through this same filter. Therefore, introversion without object relations is not only impossible in practice, as allowed by Jung's continuum model, but it is even impossible in theory because the two processes are necessarily interdependent. We know the self through the object, and the object through the self.

Other variables: Motivation

Introverted type is dependent upon multiple factors, including motivational cues. These vary across cultures, age groups, and other personal factors. These are important to understand in order to accurately assess the dynamic that creates introversion and autism, and how similar these phenomena are. Broadly, Jung's original definition appears to be one of object-avoidance, not of moving toward the self. This compulsion toward or aversion from a focal point becomes important in assessing introversion. For instance, one may require withdrawal into one's inner world for the purpose of meditative self-reflection or to ruminate (Trapnell & Campbell, 1999), or one may be involved in a rich inner world (Aron & Aron, 1997), fantasy (Davis, 1983), or one may simply be overwhelmed and feel the need to avoid the overstimulating outside world (Aron & Aron, 1997). According to Aron & Aron's (1997) conceptualization, the motivation to withdrawal is twofold: one becomes overwhelmed by external stimuli and withdraws, but one also has a "rich, complex inner life." In this way, we can see the individual moving toward the inner world and/or away from the outer world. While the objective result and qualitative behavioral reaction may be the same, there are marked differences in motivation, so the nature of the introversion and the constructs with which we can expect it to relate will vary greatly.

Unfortunately, terminological confusions have predominated from nearly a century of obfuscated discussion. The words "introversion, low energy, and low sociability" are often used interchangeably, both in colloquial conversation (Rufus, 2003) and in empirical studies (Laney, 2002; Grimes, 2005). The most recent and prominent example of problems that emerge from the transition of theory to operationalization is evident in Laney's (2002) conceptualization.

Laney's definition of introversion

Laney's foundational work, *The Introvert Advantage: How to Thrive in an Extrovert World* (2002) is intended to clarify the definition of introversion and to offer a psychometric measure to comprehensively test for the presence of the trait. The actual definition remains somewhat elusive, as it is distinct from "withdrawn personality" and "shyness" (p. 19), but also included are rumination, general low energy with periods of overwhelming energy, inconsistent but recurring trouble with communication, confusion, anxious self-preoccupation, enjoyment of the company of others but disdain for social functions (including those that are informal), a sense of being overwhelmed at any acknowledgement of one's own success (p.2). The devotion to inner thought that typifies the "thinking" or "introspective" aspect of introversion would be undermined by mental confusion. "Low energy" appears to be consistent with the dual continua model (Grimes, 2008), as this energy is not necessarily projected inward. Additionally, the contradictory nature of oscillating energy levels appears most consistent with dysfunction that may otherwise be classified as "bipolar disorder" (*DSM-IV-TR*). Conflicted feelings about the presence or absence of others and a lack of desire to share accomplishments, coupled with communication problems are symptomatic of autistic disorder (*DSM-IV-TR*). This fluid, ambiguous, and contradictory picture appears to make most sense when understood through a clinical lens, even if the subjects under consideration are not clinical patients: rather, the constellation of traits and tendencies may be the non-clinical end of a spectrum whose extreme end has familiar clinical classifications.

Introversion is distinctly defined as a temperament, however, and it is pointedly argued that it is not a pathology (Laney, 2002, p. 10). Laney even argues of this population that, "…there is nothing wrong with them. They are just introverted" (p. 10). She attempts to frame the causal mechanism for these clinically familiar groupings of traits using another descriptive model:

> The strongest distinguishing characteristic of introverts is their energy source: Introverts draw energy from their *internal world* of ideas, emotions, and impressions… They can be easily overwhelmed by the external world, experiencing the uncomfortable feeling of 'too much.' This can feel like antsyness or torpor. In either case, they need to limit their social interactions so they don't get drained. However, introverts need to balance their alone time with outside time, or they can lose other perspectives and connections. Introverted people who have the ability to balance their energy have perseverance and the ability to think independently, focus deeply, and work creatively (p.19).

As such, one's "natural niche" is where the individual is most comfortable on the extraversion-introversion continuum, to use Jung's (1923) single continuum model. This allows for healthy fluctuation contingent upon environmental demands while favoring a certain expression of both traits in a unique combination. While either introversion or extraversion is favored, the argument against clinical ties that relies upon "adaptability" is strained by the tendency to become "overwhelmed" due to an inability to exercise this flexibility.

Similarly, task-focus and other traits demonstrate different expression in introverts and extraverts according to Laney's model. For instance, introverts are seen as most comfortable working in great depth with narrow focus, and they become overwhelmed when they must work on multiple tasks (p. 20). Her brief summary of traits for introversion includes fewer friends who are closer to the individual, a need for rest following even "enjoyable" "outside" activities, listening more than talking unless the subject is of particular interest, the appearance of an "observer" (and not an "actor"), taking time to think before speaking or acting, the experience of

the mind "going blank" in situations involving groups of people or other sources of pressure, and an aversion to feeling "rushed" (pp. 29-30). Interestingly, the subject pool for the development of this conceptualization was also reminiscent of Jung's work: Laney's own experiences and those of her clients may allow for subjective analysis and application, especially with a formative sample representing clinical phenomena that are not necessarily generalizable to non-clinical trends or those that are not based upon idiosyncratic personal experience. Though the actual experience of her introversion and that of her clients may be well-documented, the data source might tell more about the construct than that which she has actually said: perhaps it is seen most clearly as it becomes more extreme, i.e., when the location of consideration is far enough down the continuum to be seen in its clinical manifestations.

Laney's source and conceptualization depict a rigorous assessment of current views of introversion, despite the persistence of conceptual and operational flaws. The model she outlines serves as the summation of popular and scientific views accepted today. It also serves to form a critical foundation for a new line of thought: is introversion another temperament that has nothing to do with a clinical manifestation, as observed here, or is it synonymous or does it overlap with a preexisting (and formally-acknowledged) clinical condition? Further, does it have any correlation to these preexisting conditions, as hinted by its conceptualization? A view of introversion in depth *and* in breadth may offer more answers about the nature of the temperament, possible clinical correlates, implications, and new empirical possibilities.

The current view of introversion is the product of much conceptual and empirical work that underscores its importance as a personality dimension. However, many questions remain unsolved from the time of Jung, and new questions accompany new presumptive correlates. The

autism-introversion continuum model appears to address some of these problems and to allow for greater coherence of the related factors. However, as autism has been described using a factorial model, greater clarity requires extension of this theory to explore how factorial models of introversion support placement on the autism spectrum, as well.

CHAPTER 4: A FACTOR APPROACH TO INTROVERSION

The previous chapter concludes the evolution of introversion as a single-factor construct. As indicated by Carrigan (1960) and Hogan and Cheek (1983), for example, a single-factor model may not be sufficiently descriptive of the true meaning of introversion. Grimes (2005) introduced four subtypes and used psychometric analysis to explore the factorial structure of introversion. This chapter introduces the four-factor model of introversion to demonstrate its parallel to autism factors. This will allow for greater exploration of the autism-introversion model, and it will begin to elucidate how these factors interact to produce the phenomena of autism and introversion.

Laney's introversion as a multifactorial construct

As indicated in the previous chapter, Laney's Introversion Scale appears to address multiple components ascribed to the dimension of introversion, though it was intended to be a unitary scale. This operationalization may have been confounded by the multifactorial nature of the construct itself. Grimes (2005) factor analyzed Laney's Introversion Scale to discover the presence of two main subscales: one that contained items that showed high correlations with shyness (as measured using the Shyness Syndrome Inventory; Cheek & Melchior, 1985) and a factor that addresses social emotions. The remaining 15 items did not correlate significantly with the rest of the scale. It is possible that this is based upon an unclear conceptual foundation: the definition of introversion contains many contradictory statements and fluctuations in behaviors and attitudes. Despite the assertion that introversion is not the same as shyness, eleven of Laney's items appear to represent the construct well. Perhaps the greatest flaw in her

definition is its unitary nature: it appears that collections of traits may demonstrate the observable condition that we term "introversion," but it must be considered by its components to be examined and understood. As these components are conceptually separate, their presence or absence does not necessarily involve any implication for other possible correlates. Perhaps there are individuals who demonstrate one type of introversion and not another, while both types have the observable result of a personality that appears withdrawn and quiet.

The picture of introversion as clarified by a view that includes the proposed four subtypes demonstrates some notable similarities with autism spectrum disorders. The nature of this disorder should also be considered relative the concurrent history of introversion. A simple breakdown of the components supports their alignment on a single spectrum. This section previews the overlap of the basic defining components, as the nature of these components, how they overlap, implications, and the dynamic in which they exist will be explored in greater detail later. The current goal is to demonstrate more broadly the feasibility of the proposed approach.

Defining components

The first major areas of introversion-autism overlap include social and communicative aspects. "The essential features of Autistic Disorder are the presence of markedly abnormal or impaired development in social interaction and communication and a markedly restricted repertoire of activity and interests" (*DSM-IV-TR*, p.70). First, the abnormal or impaired social interactions can be seen in the tendency to become "frazzled," "overwhelmed," or "drained" after social interactions (Laney, 2002 and Aron & Aron, 1997). For instance, Laney's (2002) scale includes items such as, "I like people to come to my home, but I don't like them to stay too

long," and "I feel drained after social situations, even when I enjoy myself." A feeling of awkwardness characterizes Laney's introvert's social interactions, as undertones of intrusion are present: "I often dread returning phone calls," "I don't like to interrupt others; I don't like to be interrupted," and "I prefer to be introduced rather than to introduce others." The shyness component of the social/anxious factor demonstrates a level of social unease, possibly related to ineptitude in interaction, though causal direction is not indicated. This is indicative of a *subtype* of introversion, however, as a "preference for solitude" (Burger, 1995) appears more closely related to social anhedonia than to ineptitude and anxiety. Interestingly, these asocial trends adhere to the DSM-IV-TR's qualification that individuals with Autistic Disorder have trouble initiating or sustaining a conversion. Perhaps, as Laney suggests, doing so is "draining" because it requires additional effort to overcome the inherent difficulty of this activity if, indeed, autism and introversion overlap or share synonymy.

Communicative impairment may underlie some components of communicative discomfort evident in Laney's (2002) introversion scale. Items include, "I sometimes rehearse things before speaking, occasionally writing notes for myself," "I usually need to think before I respond or speak," and "I talk slowly or have gaps in my words, especially if I am tired or if I am trying to speak and think at once." The tendency to have "gaps" in speech or for one's mind to "go blank" when asked to respond in real-time interaction (Laney, 2002) represents the diminished communicative abilities that are common of autism and introversion. The rate and rhythm of speech, as well as other aspects of prosody (including affect, intonation, etc.) are abnormal in autistic communication, and speech is restricted, both in development and

production (*DSM-IV-TR*). To "have gaps" in one's words is a prosodic abnormality, whether included in the definition of introversion or autism.

Also integral to the autism-introversion conceptualization is the commonality of an aversion to novelty and tendency to maintain narrow interests. The restricted repertoire of activities and interests can be seen in correlations found between activity level and extraversion, with lower activity level correlating with measures of introversion (Grimes, 2005). The relative depth versus breadth of interests varies with preference for depth, unifaceted focus, and narrow interests in introversion. An unwillingness to be interrupted in activity and speech is common of autism and introversion. Additionally, interruptions of work or an inability to finish, also characteristic of obsessive-compulsive disorder in its overlap with autism (*DSM-IV-TR*) is met in introversion with a discomfort in demonstrating one's work to others before it is completed. Such behavior may also be categorized as a lack of spontaneous seeking to share interests and activities with others.

The types of introversion and underlying motivation are important to understanding the construct itself, even if they should be individually tested. Consider the aforementioned types of social introversion and thinking introversion. According to Eysenck (1947), Freyd (1924) was the first psychologist to use sociability as a defining factor of the extraversion-introversion dimension. He discussed the introvert's tendency toward "…exaggeration of the thought processes in relation to directly observable social behavior, with an accompanying tendency to withdraw from social contacts" (p. 74). This appears to agree with the predominant conceptualization of the introvert who has few friends who are very close, though this definition demonstrates a frightening omission of the closeness of those contacts: complete withdrawal in

this sense typifies the onset of schizophrenia and schizotypy (*DSM-IV-TR*). Social disinterest is also present in autism (*DSM-IV-TR*), and anhedonia appears to accompany depression, often with a social component (Rey et al., 2009). This important clinical implication of social withdrawal as caused by social anhedonia, asocial and antisocial personality disorders, and other clinical symptomology may have prompted other psychologists to assume that compensatory social energy must be invested in the few friends that are kept: in this way, the same amount of social energy is present for both introverts and extraverts, but introverts favor depth of relationships while extraverts favor breadth. Freyd's model reflects a uniform and unchanging amount of energy, most of which is dedicated to thought in introversion. This limits the energy invested in action and physical activity, and also in social pursuits, as consistent with later models that reflect low energy (NEO PI-R; Costa & McCrae, 1992) and low sociability (Aron & Aron, 1997). Freyd introduces an interesting perspective that the introvert's level of energy invested in social pursuits does not allow for breadth of contacts, but it does not necessarily support depth of relating with few contacts if the energy is invested in internal thought, instead. One's ongoing and transient social needs will be met, but additional social energy is not necessarily present, though later theorists claim that depth of relationship replaces breadth and that social energy is constant (e.g., Laney, 2002).

The type of social investment interacts with other factors, as well. Attachment style formation may impact one's ability to invest socially in depth, in breadth, or at all. Nakashi-Eisikovits and colleagues (2002) found that introversion, withdrawal, and internalization correlate with anxious/ambivalent attachment styles. This energy may be invested elsewhere, much as the "workaholic" may compensate for an unfulfilling personal life. Insecure attachment

might cause one to be more inclined to invest in many others so no one social investment is as risky, or one might prefer a greater investment in a proven few with some conflicted ties to these few that result in a need to withdraw. Yet, one's social energy to be invested is not constant over time, as situational factors place the individual in flux. Additionally, such dynamics also reflect interpersonal difference (e.g., Hill, 1987; Burger, 1995). Freyd argues that energy is taken from all social processes to feed internal thought processes. The nature of these thought processes may also impact one's social presentation and ability to relate to others. Freud (1918) introduced the concept of endocathexis to describe one whose energy is fixated on one's inner world such that external investment is rendered impossible. Therefore, the nature of this inward-directed energy, the inner object to which it is directed, and its goal are all said to be crucial to understanding introversion in its many manifestations.

The utility of a factor approach

The underlying motivation that produces the dynamic observed as introversion or autism is fundamental to any conceptualization of these phenomena. The facets outlined above demonstrate the necessity for component-by-component deconstruction, with preservation of the motivation and total dynamic of autism and introversion. The type of inward focus contains multiple components which are most easily considered using basic categorization with subcategorization indicating valence, focus, motivation, etc. Grimes (2005) introduces four "relatively distinct types of personality constructs" (p.13) or subtypes of introversion: social, thinking, anxious, and inhibited. These factors of introversion are mirrored by a set of factors of autism, as the component approach is favored for both (Grimes, 2005; Begley & Springen,

1996). "…Different combinations of autism's components produce the array of conditions known by the umbrella term autism" (Begley & Springen, 1996 p.70). These introversion subtypes will serve, in the following chapters, as a basic framework for component-by-component comparison of autistic and introverted traits the various "idiosyncracies" that combine differentially to typify both conditions in an overlapping way with differentiation mainly in extent, and therefore partially in interactive expression.

The common defining trait set and the common dynamic thereby created is targeted by definition through a factor approach. It is argued that overlap in both of these areas produces the most cogent support for the autism-introversion continuum model. The expression of the subtypes of introversion are based upon differences in sensory experience, cognitive processes, and interactive tendencies. High sensory processing sensitivity (Aron & Aron, 1997) causes sensory stimuli to be experienced and processes with increased sensitivity and perceived magnitude, often with an attention to detail as a result. Similarly, anxiety is not an implicit part of introversion (e.g., Laney, 2002; Grimes, 2005). However, anxious introversion addresses an absence of positive emotions and a presence of negative emotions, including both depression and anxiety, a sense of feeling misunderstood, hypersensitive narcissism, and self-doubt. As these influence cognitive processes, emotionality and cognitive habits are another key component of the introversion-autism puzzle. The final introversion component, inhibition, appears to describe conceptually a lack of extraversion, not introversion in the pure sense of "turning energy inward." Yet, as previously discussed, energy *may* be turned inward as a result of the continual direction of energy despite the inhibition from turning it outward, i.e., energy may be turned inward to avoid turning it outward. Given these two possibilities, we see that "inhibited

introversion" describes inhibition from partaking in an activity, either due to "running toward" an inward target or "running away" from an outward target. The final option is that no running is occurring at all, and that energy is simply not channeled (Grimes, 2008).

Introversion became associated with "inhibition" due to its longstanding conceptualization as the inverse of extraversion, a temperament that is believed to encompass impulsivity (Eaves & Eysenck, 1975). Hans Eysenck includes both sociability and impulsivity in his definition of extraversion, and this second factor is a combination of impulsivity and activity level, referring to a preference of high physical activity. Grimes (2005) explored this aspect of "inhibited introversion" psychometrically using Buss and Plomin's (1975) EASI Sensation-Seeking factor of impulsivity and activity. This includes nuances of an openness component, both to novelty and to breadth of experience (ex: "I generally seek new and exciting experiences and sensations" and "I'll try anything once."). The inverse of these scores would represent inhibited introversion, as negative correlations to measures of introversion were found. However, the fact that openness is included may limit propriety of application of this scale in the measurement of certain introverted features. While the Autism-Spectrum Quotient (ASQ) (Baron-Cohen et al., 2001) demonstrates many commonalities with measures of introversion, the operationalized tendency to avoid great breadth in activity preferences and the desire to avoid novelty appear to be preserved from the ASQ to inhibited introversion.

While autism appears to share some important features with inhibited introversion in that novelty is avoided and openness to experience is lacking, the preference of low activity for the purposes of fantasy and enjoying a "rich inner life" (Aron & Aron, 1997) are not necessarily shared. Preference for activities that require little interaction with the environment (due to low

energy levels) and with others (low sociability) is an important phenotypical indicator of introversion that is also an indicator of autistic behavior.

Since the introduction of Baron-Cohen and colleagues' (2001) ASQ, operational revisions have been suggested that cause its psychometric function to better support conceptual overlap with introversion. Stewart and Austin (2009) found that deficits in "Socialness," enhanced "Patterns/Attention to detail," and diminished "Communication" skills provide the factorial framework for the most effective testing for autism spectrum traits. It is also apparent that the qualities of introversion should include social components, attention to detail, and possible anxious components. However, social introversion is also evident in schizotypal traits of social anhedonia and reclusiveness, anxiety, and creative thinking. Still, inhibition is markedly absent from schizotypy and schizophenia diagnoses (*DSM-IV-TR*). The interplay and possible overlap of autism spectrum, schizophrenia spectrum, and introversion traits will be explored in the following chapters using the four-factor model of introversion to provide the framework for this discussion.

CHAPTER 5: SOCIAL INTROVERSION

In keeping with the factor model of introversion (Grimes, 2005), each of the four types of introversion will be considered as parts of the autism spectrum. The social, thinking, anxious, and inhibited aspects of the introversion personality dimension are considered individually, with gradual integration to demonstrate the dynamic that creates the construct. As these factors exist as distinct but dynamic and interactive, they are explored conceptually in this same way by layering them and defining them iteratively in interaction.

Empirical foundation

This chapter examines social introversion using the autism-introversion continuum model as a theoretical foundation. Social introversion refers to social aspects of introversion. As previously explained, the introvert's social preference is in depth of personal relationships over breadth, and in quieter social activities in lieu of overstimulating social environments. The related traits and tendencies range from one's desire for the company of others to one's approach in relating to others. Social introversion is based psychometrically in Grimes's (2005) empirical study using the following measures:

1) The inverse of Costa and McCrae's (1992) NEO-PI extraversion warmth and gregariousness subscales, which measure friendliness, warmth, sociability, cheerfulness, affection, and the tendency to be sociable, talkative, outgoing, and spontaneous.

2) The preference for solitude scale (Burger, 1995), which indicates one's enjoyment of time spent alone independent of socially aversive causal factors such as social anxiety.

3) Low scores on the affiliation motivation (Hill, 1987) subscale of "positive stimulation," which measures a positive emotional reaction to interpersonal closeness and communion, based on Murray's (1938, in Hill, 1987) conceptualization of affliative need: "the tendency to receive gratification of harmonious relationships and from a sense of communion." This also encompasses the feelings of love, intimacy, belongingness, and affection.

Social ineptitude and a preference for solitude

The individual described as above enjoys time spent alone and does not find oneself experiencing negative affect or emotions when engaging in solitary activities or when one is simply "left alone." Rather, the introvert is one who avoids large groups and social activities because doing so is easier and preferred to complex social engagements. Similarly, autism is linked with a preference for solitude and difficulty in dealing with groups or other social situations (Baron-Cohen et al., 2001). Solitary activities and individual interaction with objects are preferred in both introversion (from Freud, 1918 and Jung, 1923 through to modern conceptualizations as summarized by Laney, 2002) and autism spectrum disorders (*DSM-IV-TR*; Baron-Cohen et al., 2001). Making new friends is difficult and undesirable (Rufus, 2003; Baron-Cohen et al., 2001). Social awkwardness is another important indicator of social discomfort in autism (Baron-Cohen et al., 2001) and in introversion (Argyle & Lu, 1990 in Hills & Argyle, 2001). Therefore, the phenomena of social ineptitude, the preference for solitary activities and reduced interaction, and the dislike of social situations are common to autism and introversion.

Placing social phenomena: Correlates

As mentioned briefly, one possible reason for difficulty in understanding other people or feeling understood oneself (Laney, 2002) is an impaired ability to communicate effectively. Introverts often feel "misunderstood" (Laney, 2002), and they have long been found to be mysterious (Jung, 1923) and aloof (Costa & McCrae, 1992). Introverts "speak slowly" or often have "gaps" in their words. Additionally, their minds may "go blank" when asked to reply. As such, communication is impaired, even as introversion-positive theorists seek to explain these difficulties as endearing "quirks" (Laney, 2002). While introverts have a difficult time with reacting in the moment, communicating one's thoughts in interaction despite ability to think of the words later, and maintaining proper prosodic flow to speech (Laney, 2002; Helgoe, 2008), autism has long been associated with communicative impairments that include abnormalities in affective content, prosody, and ability to maintain consistent speech. Similarly, schizophrenia includes speech abnormalities that include affective and organizational deviation. Laney (2002) states that introverts "may start talking in the middle of a thought, which can confuse others" (p. 84). While this may complicate matters for the introvert socially, it may also appear to manifest a disorganization of thought that leads to linguistic abnormalities that are not different from their expression in schizophrenia except for the degree of severity. As autism and schizophrenia have significant overlap (*DSM-IV-TR*), the commonalities may shed light on the nature of the underlying predispositions and causal factors. In all cases, a deviation from the norm can be a cause or product of social withdrawal, which is a core phenotypic indicator of all three standing classifications.

Some of the social difficulties result from one's presentation. Introverts "appear glazed, dazed, or zoned out when stressed, tired, or in groups" (Laney, 2002, p. 84). The tendency to be

overwhelmed and to withdraw as a result is common in autism and schizophrenia spectrum disorders (*DSM-IV-TR*). Additionally, the apparent disregard for the thoughts and feelings of others links introversion and schizoid personality disorder (Rufus, 2003; DSM). However, autism may be associated with deficiencies in oxytocin levels. The chemical promotes social bonding, and Hollander (in Begley & Springen, 1996) has found that administration of oxytocin to autistic patients made them more talkative and "happy." Recent studies also show that autistic patients exhibit greater social interest and communicative interactivity with others when oxytocin is administered (Andari et al., 2010). Thus, introversion may be linked to reduced oxytocin levels, but remediation may be possible through therapeutic administration of oxytocin. The association of depression and introversion may be partially attributable to an inability to feel "positive stimulation" from the interactions with others (Hill, 1987).

Autism and schizophrenia spectrum disorders share a component referred to as "introvertive anhedonia" (Nettle, 2006). This refers to an inability to feel pleasure from social interaction and a resultant tendency to avoid it. Eysenck noted that the introvert tends to be "…fond of books rather than people…" (1975, in Hills & Argyle, 2001). The ability to understand the clinical conditions may provide more information as to why introverts prefer solitude, as the displeasure when subjected to social situations shares a common description, even as its manifestation is less extreme. Also involved is the introvert's "courage" and "perspective" to "say unpopular things" (Laney, 2002, pp. 12-13). The tendency to think differently from the group and to be comfortable disturbing the social order may be due to obliviousness of social nuances and mores, a lack of care about them, or an inability to perceive the impropriety upon initiation of the delivery of the information and normal adaptation online.

It is, of course, also possible that this is an act of courage, though the tendency to try to avoid overstimulation would cause insensitivity to be a more plausible cause.

Social stimulation is effectively reduced by many habits of the introvert at the expense of understanding and connecting with the other. For example, withdrawing allows for complete removal of stimulation. Intermediate levels of stimulus attenuation occur with avoidance of eye contact. While this is common in introversion (Laney, 2002; Helgoe, 2008), it is also common in autism, resulting in an outright fear of looking others in the eye (Begley & Springen, 1996; *DSM-IV-TR*). The inability to read social situations is also evident in schizoid personality disorder (*DSM-IV-TR*), and the complexity of social situations, especially involving larger groups, causes such situations to be draining and difficult, especially for one whose difficulty in focusing attention causes the stimulus to be even more difficult to process (Allen & Courchesne, 2001).

Introversion is often said to be mediated by the compensation of breadth of social contacts by depth of involvement with certain others (e.g., Laney, 2002). However, findings indicate that there is no significant difference in reported closeness of friends between introverts and extraverts. Additionally, extraverts are more likely to discuss personal concerns with close friends than are introverts (Hills & Argyle, 2001). The ability to share such closeness with another is important to both populations, as “happy introverts” and “happy extraverts” share the same social behavior, even within a different scope of others. The withdrawal of contacts altogether is indicative of early symptoms of pathology (*DSM-IV-TR*), and the allowance of very few very close contacts may signal a premorbid phase of paranoid schizophrenia (*DSM-IV-TR*; Karakula & Grzywa, 1999).

The introversion-positive movement

Despite the trouble with communication and apparent reduced social interest, some questions may remain regarding the actual similarity of autism and introversion by these parameters. Perhaps the introversion-positive movement might be a source of doubt of the negative correlation of introversion and social competence (Hills & Argyle, 2001). Further studies may elucidate the problem by using a psychometric study to empirically explore possible correlations between introversion, social competence, and happiness using an introverted and extraverted sample, grouped by introversion scale scores (e.g., Laney, 2002). Bias may impact the current possibilities for finding a connection between introversion and social competence, even with communicative impairment as a necessary part of the definition of the construct and social withdrawal as a core component. A high-functioning autistic (or Asperger's disorder patient) comparative sample would show diminished social competence and lower subjective levels of happiness.

Other questions may merely be a matter of survey. While some authors prefer to look at case studies instead of numbers to determine whether introverts or extraverts are more inclined to assume positions of leadership (e.g., Rufus, 2003), the picture of an introverted "leader" with a subservient extraverted "warrior" class (Aron & Aron, 1997) clashes with others' perception of leadership skills as an inherent part of extraversion (e.g., McCrae & Costa, 1990). Questionnaires may be developed to ask subjects about preferences in role assumption, but a survey of those in leadership positions may also lend better insight. Additionally, such roles might benefit from necessary subdivision into tiers and types of leadership positions. While

some private leaders may live with less personal interaction, especially in the age of booming technology, others, especially politicians, require much interaction.

Other introversion facets may share a causal link with social introversion. Social withdrawal could result from introverted thinking patterns and behaviors, or inhibition or anxiety may be the cause or effect of diminishment of social stimulation. While the picture is likely more complex than a single directional model would allow, a cohesive understanding of the topic requires a basic framework of social introversion attributes with other accompanying traits that, collectively, depict a phenomenon much more like the autism spectrum trait set and less like a simple social preference. One simple but fundamental example of this dynamic can be seen in the social manifestation of an aspect of thinking introversion.

Applications of introverted ways of thinking to social and self-understanding

Thinking introversion must also include an ability to project the mind beyond its place of immediacy. This has important ramifications for social interactions and interpersonal relating. The ways in which we understand others change our social selves. Grimes (2005) grouped "fantasy," as measured by Davis's (1983) Interpersonal Reactivity Index, with thinking introversion, but it may also be understood as a social component: this subscale measures empathy as the fantasized projection of the self into another's situation. This theory of mind technique, also known as simulation theory, involves trying to understand how another thinks by placing the self in the other's situation; this technique has found support in studies of mirror neurons and apparent deficits in the mirror system in autism causing corresponding deficits in social cognition and theory of mind (Williams et al., 2001; 2004).

The underlying assumption of simulation theory of mind is that the individual can distinguish the self from the other, and that one can recognize the other as "like me." As such, it is appropriate to equate one's experience with that of another with only situational (and not confounding subjective) variance. Yet, the early preference for the mechanical in autism may also speak of one's natural tendencies in that affiliation with these objects could stem from seeking those "like me" (Gallagher, 2005), or one could develop relationships based upon these interactions, which must follow rules that do not require a theory of mind. The ability to develop primary and secondary intersubjectivity is impaired when interaction is insufficient (Gallagher, 2004). As such, current therapeutic models for social development in autism follow rule-based learning instead of employing interactive modes of understanding such that predictable rules allow offline consideration (Kavale & Mostert, 2004), as is typical in models of introversion, as well (Laney, 2002).

The ability to understand others through various mechanisms of perspective-taking includes this empathic "simulation" of another's experience. An alternative approach, "theory theory" is an application of a folk psychological theory to understand the thoughts and feelings of others. Southgate and Hamilton (2008) attribute social difficulties to a complex system of cognitive abnormalities in lieu of a "broken mirror" theory that explains social difficulties through impaired mirror neuron systems in autism and a resultant inability to "feel" what another feels. Theory theory finds opposition in Gallagher (2004), as this offline processing does not seem to apply to most situations. Instead, "interaction theory" describes our online interaction with another that is primarily reactive to the situation without much metacognitive investment in such offline manipulations. In real life, it would appear that we understand others by attempting

to simulate another's experience far less often than we simply react with another and simply *know* how to interact online. It is this interactivity that also shapes cognitive development (Gallagher, 2005), thereby rendering this theory of autistic social and cognitive development more comprehensive in accounting for the constellation of traits that are expressed, with impaired interpersonal understanding as a symptom in a much more complex matrix.

It is well-documented in autism literature that autism-spectrum disorders render an individual incapable of such online assessments, and that training simulation or theory application may be a useful tool in teaching proper interaction. Frith and Happé (1999) explain the utility of introspection for high-functioning autistics and individuals with Asperger's syndrome, as it can be applied to learning and exercising an explicit theory of mind to compensate for the lack of an implicit social interactivity. However, without recovery of an implicit theory, social understanding is likely to be compromised, as application of "implicit" folk theories has demonstrated accuracy comparable with "scientific" personality theory (Semin, Rosch, & Chassein, 1981). Additionally, success is contingent upon effort to overcome inward orientation, the desire to withdraw from social stimulation, and a shift in attention to shuffle perspectives. Ideally, the naturally self-centered perspective is exploited to understand the other.

Whether this facet of thinking introversion can truly apply to social introversion relies upon a trait codependence indicative of a particular constellation of introversion. However, one trait does not imply the presence of another by its own expression, nor can one trait account for the results of interaction among other traits. For instance, Aron and Aron (1997) find only partial independence of high sensory-processing sensitivity from "social introversion" and emotionality. The impact of patterns of sensitivity and the type of sensitivity, combined with its

impact on perception and interaction create a complex and dynamic state. The cognitive abnormalities that coexist with variation in perceptual experience may be associated with other aspects of introversion that may complicate the ability to fight the tendency toward inward-focused, narrow investment.

More research is required to truly understand how introverted theory of mind functions. It may be based upon simulation of another's experiences (e.g., Davis, 1983), or one may have to effortfully construct a theory of how others think. Perhaps interpersonal relating is more difficult for introverts due to impairment of interactive theory of mind processes. It is also possible that such impaired processes, coupled with the projection of such impairment onto other people may play a role in causing an introvert to feel misunderstood. The nature of interpersonal understanding (or misunderstanding) may prove to be a fundamental part of the social aspect of introversion.

This chapter has offered operational and conceptual definitions of social introversion as a foundation for further explication of this facet of introversion using its placement on the autism-introversion spectrum. Observed behavioral similarities suggest similarities between social components of autism and introversion, and empirical findings that support theoretical causal factors are shown to be potential factors in both conditions. As development of the autism-introversion continuum model unfolds, these social factors will be shown in their dynamic with the other factors of thinking, anxious, and inhibited introversion.

CHAPTER 6: THINKING INTROVERSION

The autism-introversion continuum contains multiple traits that exist in an interdependent dynamic. To follow the construction of this model past social components, this chapter introduces thinking introversion. This facet can be further split by valence: positive or neutral thinking introversion and negative thinking introversion are associated with different patterns of thought and interact differently with other introversion factors. This chapter is dedicated to the immediate focus of thought: basic self-directed thinking. It identifies how the subjective inner focus described by Jung can be associated with negative thought patterns, and it outlines the trends, potential causal factors, and ramifications of these patterns as a function of introverted and autistic trends. This is important to understand general thought patterns and previous ties to clinical conditions, such as dysthymia. Negative thinking is also an important consideration for placement of introversion relative to its clinical autistic equivalent on the continuum, and to assess its dynamic with related anxious components, considered in chapter 7. The dynamic created by introverted thought patterns, is related to social aspects of introversion and to the anxious and inhibited factors. In this dynamic, the overall trends and greater dynamic of thinking introversion are elucidated by the proposed model of introversion and autism.

Self-directed thinking

Thinking introversion is based upon a cognitive component of introspectiveness (as in Guilford & Guilford, 1936), but it includes all aspects of thought, including topics of consideration, methods of contemplation, and valence, for example. The inward focus of energy (Jung, 1923) is directed toward thought, with the self as both the observer and the attentional the

focal point. "Self-consciousness," as addressed by Fenigstein, Scheier, and Buss's (1975) "private self-consciousness" refers to "attending to one's inner thoughts and feelings" (p. 523). Understanding the self extends beyond the tendency to self-reflect to encompass who we believe we are. This includes identity orientation, or how we come to define ourselves, conceptually and operationally (as through the Aspects of Identity Questionnaire; Cheek, 1989). We may do so through our associations with others or through the groups in which we are members, and we may see ourselves as part of a community, using our perception of our interactions to understand ourselves.

We may engage in other forms of self-understanding and –contemplation that do not capitalize on the tactic of understanding ourselves through understanding our place with others. A view that centers more on the self and less upon interaction may better fit an introvert whose orientation is inward to the self, not outward toward many or few others. Dennett's "intentional stance" can be applied to one's own mind to understand the self and one's beliefs and motives. He describes the intentional stance as follows:

> First you decide to treat the object whose behavior is to be predicted as a rational agent; then you figure out what beliefs that agent ought to have, given its place in the world and its purpose. Then you figure out what desires it ought to have, on the same considerations, and finally you predict that this rational agent will act to further its goals in the light of its beliefs. A little practical reasoning from the chosen set of beliefs and desires will in most instances yield a decision about what the agent ought to do; that is what you predict the agent will do.
> (Dennett, 1989, p. 17)

In this way, Dennett describes metacognitive self-reflection. Other authors debate the propriety of this application of the intentional stance, as autism and the ability to understand others appears to present a special case, especially as the approach to understanding others is different from that which is applied to understanding one's own intentionality (de Gelder & Tillburg, 1990). Other

forms of reflection may center instead on one's interaction with the environment, or with contemplation of the environment and its affordances (Gibson, 1979), or possibilities for interaction with the self.

A number of questions arise from this proposal. Can the extravert truly be less aware of one's own feelings about something or of one's own metacognition? Do introverts tend toward metacognition more than extraverts? Perhaps Fodor (1975) may question if internal representations require more offline manipulation, consistent with his model of the mind as a computational machine that processes internal representations. Does it necessarily follow that extraverts take an interactive approach with their environment, while internal manipulations are of interest to introverts? Does the introvert's mind work in a more computational fashion, while extraverts are more interactive and engage as situated, embedded, embodied agents? If so, would it truly be descriptive to say that extraverts have a firmer grasp upon objective reality, while introverts are predisposed to the psychological illness implied by the schism between one's perception of reality and the reality as it is? These questions remain outstanding in the literature, as term confusion has precluded further contemplation of the ramifications of such a framework. Yet, perhaps Jung's relation of introversion to dysthymia hints toward an unintentional but important point: that clinical implications should be considered for introversion, especially if the reason for the rift that divides perception and reality, and between the subjective world and the "real" outer world is related to one's inner state. Perhaps a retreat is necessary to preserve this inner understanding, or perhaps withdrawal is a symptom of disrupted patterns of relationship with the environment, others, and one's own thoughts. In either situation, introversion's

correlation with abnormal perceptions and psychological states may show a critical relationship with certain types of psychological illness.

Introverted subjectivity

Some of these concerns are addressed by the validity of the self-contemplation, or how representative it is of the reality of one's interactive potential with the environment and with one's own thoughts. The valence of such contemplations is also important to this form of bias: Trapnell and Campbell (1999) distinguish between reflection and rumination. These two modes of "private self-attentiveness" are aspects of "private self-consciousness" (Fenigstein, Scheier, & Buss, 1975), which refers to "consciousness of one's inner feelings, thoughts, and physical sensations" (Trapnell & Campbell, 1999, p. 284), as opposed to one's thoughts regarding appearances to and impressions upon others. These feelings of "public self-consciousness" will be considered in greater depth in relation to attentional mechanisms and anxiety.

To delineate the nature of these private self-consciousness items by motivation and resultant approach, researchers operationalize "neurotic self-attentiveness," or rumination, separately from "self-attentiveness," or reflection (Trapnell & Campbell, 1999, p. 287). Some ambiguities still exist in this model, however. First, the self-focus could be based upon assessment of performance, or thought about action, or it may be based upon the nature of the self, or thought about potential for action. For example, thoughts regarding the nature of the inner self (as captured by reflection scale item 15, "I love exploring my inner self") are different from consideration of one's actions (item 18: "I love analyzing why I do things."). The abstract consideration of the self versus the concrete analysis of a particular action, especially as typified

by ruminative thought, are qualitatively different. Second, authors appear to focus on a self-focused consideration, whether the point of interest of the observer is the self or the environment as it is perceived or understood. Social items and interactive items do not appear to predominate these considerations. Self-doubt may be a proactive process by which one considers failure before assessing outcome (imposed by the environment or circumstances) or social consequences (assessment imposed by others regardless of quantifiable outcome of action); self-doubt may also arise in retrospective assessment of perceived failure after assessing the outcomes. In either case, the focus of reflective or ruminative thought may vary in a way that proves significant given neuroticism or comparison to clinical populations; thought content should be assessed as potentially different in degree between clinical or non-clinical populations, or the actual way in which one is neurotically self-focused may vary.

The outcomes of different patterns of thought reflect the variance in nature of self-contemplation and of the self's experience of the external environment. These also speak to the implicit relational potential of the two, as one cannot understand the self as separated from the interactive dynamic of the environment, or disembodied (Gallagher, 2005). As such, one's ability to understand the self may lend greater clarity, though the "subjective" nature of these contemplations (Jung, 1923) does not necessarily account for alignment with reality or the reality that others may perceive. Here, it is important to maintain the bond between private and public considerations of the self.

Negative trends: Reflection/rumination, depression, and neuroticism

In fact, the ability to pinpoint the placement of the negative reflection (the object, the self, or any part of relating with the object, whether external/circumstantial/object-based or internal/ability/self-based) may lend more information about the negative component of introversion, whether it is external and causes withdrawal (Aron & Aron, 1997) or internal and causes depression (Jung, 1923). There may be an affective component to introversion beyond and possibly separate from feelings of being misunderstood or from a lower level of oxytocin. In fact, the DSM-IV-TR links depression and autism when the individual has insight and can understand the nature of one's affliction. Whether this is cognitive and a product of feeling impaired if extreme or simply different if the traits are milder in their expression is unclear. "Dysthymia," or at least mild depression may be related to lower energy level or other traits. As autism and introversion are complicated in their causal mechanisms, the affective element and the directionality of its relationship with other features is unknown.

Relationships between introversion and depression are not linear, either. The "happy introvert" (Hills & Argyle, 2001; Wagele, 2006) may exist, while allowing for placement on the autism spectrum. Eysenck (1959) explains that dysthymics are found to be most introverted when according to psychometrically with the Maudsley Personality Inventory, and that "…the regression line of [Neuroticism] on [Extraversion] is significantly bent at the extreme introverted end, showing a marked tendency, both in normal and in neurotic groups, for subjects with very low extraversion scores to have unduly high neuroticism scores" (p. 177). This may account for later mixed results (e.g., Hills & Argyle, 2001), as extraversion was found to be correlated with happiness (e.g., DeNeve & Cooper, 1998 in Hills & Argyle, 2001) and predictive of positive affect (Costa, McCrae, & Norris, 1981). Others have reported that "the main characteristic of the

extravert is social activity, which can be a major source of happiness" (Argyle & Lu, 1990 in Hills & Argyle, 2001). The main aspect of Asperger's Syndrome and schizoid personality disorder is a dramatic reduction of social activity. Depression is often comorbid, especially if the patient has any insight as to the nature of one's condition (*DSM-IV-TR*). While Jung attempted to make both extraversion and introversion neutral temperaments, it appears that introversion, with reduced social contact, may be predisposed to depression if it is extreme enough. It may be that the expression of the introverted traits interact in such a way that depression occurs after a certain point, that social connection reaches a critical level, or perhaps that the clinical/non-clinical delineation between introversion and autism or other related social disorders such as schizophrenia spectrum disorders occurs where depression and neuroticism increase dramatically on this correlative curve.

The descriptive potential of the curvilinear relationship of introversion and neuroticism is further complicated by exactly what it describes. "Psychiatric patients who were traditionally diagnosed as neurotics tend to score very high on this dimension, but many individuals score high without having any psychiatric disorder: Neuroticism is a dimension of personality on which people vary only in degree" (McCrae & Costa, 1990, p. 41). While this statement points out the potential for the general population to exhibit neurotic traits to a nonclinical extent, thereby allowing the possibility of further consideration of the placement of introversion on the complicated and intertwined autism and schizophrenic spectra, it also allows that the inclusion of these traits with introversion scores may not develop a cohesive and complete picture of the relationship of the two. The ability to distinguish the effects of degree of exhibition of these

traits, and not mere presence thereof, would advance understanding of the relationship between neuroticism and introversion. This may require the development of better psychometric tools.

The actual definition of neuroticism may rest upon one of the cardinal differences between introversion and extraversion: favor of depth over breadth in introversion, and of the inverse in extraversion. This may extend to the realm of behavior and related thought. For instance, autism and obsessive-compulsive disorder have narrow thought-action frames, causing behavior and its motivational thought to be restricted. Both conditions cause restricted behavior in response to a thought, and the inability to carry out the behavior causes one to become upset (*DSM-IV-TR*). This bares great similarity to schizotypal symptoms in clinical and non-clinical populations (Tallis & Shafran, 1997; Roth & Baribeau, 2000) and to Aron and Aron's (1997) highly sensitive person and Laney's (2002) introvert. These groups become upset when their routines, thresholds, or single-minded attentional foci become disrupted.

Breadth, depth, and originality of thought

Valence is a fundamental means of appraising thought content in introversion and autism, as arguments support an anxious, neurotic, or depressive aspect. However, other patterns may also indicate the presence of the dynamic of traits that characterizes autism and introversion. As described previously, depth is favored over breadth in many aspects of introversion and autism. Does a lack of breadth rule introverted thought patterns? Grimes (2005) used the Big Five's "Openness" trait to explore openness of thought, creativity, and breadth of curiosity. While creativity and openness are related to detail and environmentally-focused aesthetic orientation (Aron & Aron, 1997) and artistic prowess in introversion and in autism and schizophrenia

spectrum disorders (Nettle, 2006; Rawlings & Locarnini, 2008), narrow but deep and fixated orientation characterize these conditions. Laney's (2002) Introversion scale showed a very weak correlation with Openness ($r = .02$ for $N=225$ for the full scale), but her factors demonstrate a slightly greater negative correlation when taken independently (Shyness Factor: $r = -.14$, $p<.05$; Social Emotion Factor: $r=-.02$; in Grimes, 2005). Laney conceptualizes the introvert as one whose interests are narrow, though these foci are considered in great depth. As such, the operationalization may be out of line with the conceptual definition of the introvert: despite one's presumably extensive realm of thought, the general trend of preference for depth over breadth appears to lend greater continuity to the character of the introvert, rather than drawing a description of one whose temperament is defined by limitation in extent but immersion in few areas, contrasted with one realm of expansive breadth at the sacrifice of depth. In fact, thought and work patterns seem to support this, as attention-switching is compromised (Laney, 2002), even in thought (Trapnell & Campbell, 1999).

While Jung's (1923) model details an introspective, contemplative individual, he does not limit the topical consideration as does Laney's evolved (2002) model. However, Laney's introvert appears to share much in common with Aron & Aron's (1997) "highly sensitive person" and Baron-Cohen and colleagues' (2001) individual who bears autism-spectrum traits. Most pertinent to this particular introverted facet are the common tendency toward assumption of a narrow spectrum of interests and the tendency to indulge in in-depth pursuit until task completion with psychological disturbance resulting from an inability to do so.

Our current analysis of imagination involves metacognition and primary sensory processing, but the ability to manipulate this information, especially to create an idea offline that

does not currently exist is not yet represented. Openness hints at creativity, but also important are fantasy and empathy, as captured empirically in the Grimes (2005) study by the use of Davis's (1983) interpersonal reactivity index. Of course, the type of fantasy might not be restricted to fantastical projection of the self into another person's situation.

The difficulty with operationalization of "fantasy" and the "inner world" in the Grimes (2005) study stems from the inability to measure the nature of these thoughts psychometrically. For instance, "fantasy" was primarily seen as a part of empathy, but fantasy may be oriented with or without the self as the main character, as simulation of the experiences of another is not the only way to enjoy a story. Similarly, creativity is not represented comprehensively by narrative transportation, so following a fantasy that is mostly contrived by another to a degree dictated by the medium of presentation is not the same as the ability to build a fantasy in the creation of one's own work, or even the use of imagination in varying types of daydreams. Additionally, the frequency of daydreams is simple to quantify, but their nature would be difficult to record psychometrically.

The creativity of the introvert may not rely upon detail-fixated aesthetic orientation (as in Aron & Aron, 1997), but may rest instead upon abnormal thought patterns and associations that are also connected with unusual perceptual experiences and as are present in autism and schizophrenia spectrum disorders. Nettle (2006) finds that poets and artists have unusual experiences at a level comparable to schizophrenia patients and higher than controls. However, they lack introvertive anhedonia and avolition present in the clinical groups. The constellation of traits that manifest as introversion may show differentiation as described in autism by (Begley & Springen, 1996), and different weightings of components of introversion (as proposed by

Grimes, 2005) may demonstrate differences in manifestation including creativity. Nettle also suggests that different forms of creativity also require different ways of thinking, so schizophrenia and affective disorder show more similarity to artistic creativity in poetry and art, while mathematicians share thought patterns more closely with autism. The former is said to utilize divergent thinking, while the latter employs convergent thinking. These results are partially supported by Rawlings and Locarnini (2007), who found that positive schizotypy and hypomania appear to result in unusual word associations. The extreme end of this continuum may be considered to be the schizophrenia disorganized thought and speech (*DSM-IV-TR*). However, weaker support was found for the association between autism spectrum disorders and creativity in the sciences. The type of thinking introversion demonstrated, whether in line with postulates of expansive thought (Laney, 2002; Aron & Aron, 1997) or narrow but deep thought (as is evident be conceptual reanalysis of the same works as present in this paper) may be associated with different forms of creativity, if introversion and creativity truly are linked. Other factors likely interact with abnormal sensory experiences and thought patterns to create the creative profile of the individual.

Abnormal thought patterns are likely to exist in both autism and introversion. Though such traits are often conceptually linked to schizophrenia, Ghaziuddin and colleagues (1995) describe “poor reality testing, perceptual distortions, and areas of cognitive slippage” (p. 311) associated with high functioning autism and even greater levels of disorganized thought in Asperger’s Syndrome patients, despite their lesser severity on the autism spectrum. They were also typified as more “introversive” with more elaborate fantasies and greater focus on internal experience and perception. Perhaps the nonlinear correlation with neuroticism and introversion

might also relate to this complication in trait relationship: with greater severity might come greater limiting symptomology, as a greater degree of these traits might cause function to drop off when interaction causes the individual to be incapable of coping with environmental interaction in the same way. Therefore, one's "creative" ability might be trumped by irrepressible anxiety, or one's fantasy might be undermined by decreased IQ, as is typical of lower-functioning (and more severe) autism. It is also possible that higher sensory sensitivity might not allow one to retreat into one's inner world as effectively, as withdrawal may simply be impossible with great enough sensitivity.

The influence of "high sensory-processing sensitivity"

"High sensory-processing sensitivity" is operationally included in the Grimes (2005) study as a component of thinking introversion. Aron and Aron (1997) describe high sensory-processing sensitivity as a causal factor for overstimulation and a need to withdraw from external stimulation. Individuals have a greater awareness of subtleties in the environment, piqued physical sensitivities, and aesthetic orientation. The authors indicate that, "At several levels in the processing of input, introverts seem to be more attentive, discriminating, or reflective" (p. 347). While Laney's introvert possesses many of these qualities, the overlap also appears to increase with Baron-Cohen and colleagues' (2001) autistic traits.

Attention

The well-documented introverted preference for depth over breadth may be a result of attentional mechanisms. Introversion and autism are both characterized by narrow focus with

difficulty changing tasks (e.g., Laney, 2002; *DSM-IV-TR*). This may be a result of piqued sensitivity to stimuli and resultant detail-orientation (Aron & Aron, 1997; Laney, 2002; Baron-Cohen et al., 2001). Similar patterns are found in autism: Allen and Courchesne (2001) describe "overly focused" attention in autism, and Lovaas and Koegel (1979) describe the problem of "stimulus overselectivity" as it causes individuals to be hyperattentive to certain stimuli and seemingly oblivious to others. Allen and Courchesne postulate that abnormal attention may underlie other cognitive and social deficits, as they describe a pattern of selective deficits *and* abilities pertaining to selective, sustained, and shifting attention. Sustained attention is superior in *certain* tasks, consistent with other findings that report comorbidity with obsessive-compulsive tendencies (Hollander et al., 2009). This may be due to cerebellar hypoplasia (as in Carper & Courchesne, 2000), or to limbic abnormalities, as the limbic system has many connections to the cerebellum (Kemper & Bauman, 1993). These functions may also play into the tendency to become overwhelmed (*DSM-IV-TR*) that is also present in introversion (Laney, 2002; Aron & Aron, 1997) or to prefer less stimulating activities (in Hills & Argyle, 2001; Aron & Aron, 1997; Eysenck & Eysenck, 1985; Laney, 2002; Morris, 1979). Cerebellar deficits are also linked to difficulty in changing attention (Allen & Courchesne, 2001). These may relate to obsessive-compulsive tendencies and narrow interests in introverted (Laney, 2002), autistic (Baron-Cohen et al., 2001), and schizophrenic (Roth & Baribeau, 2000; Tallis & Shafran, 1997) traits in the general population whose expression of these constellations of these traits rests on the non-clinical part of these spectra.

The cerebellum might be implicated in introverted "depth" of attention, preference to work uninterrupted for long stretches of time, inability to present work until it has been

completed, and dismay when interrupted or asked to shift foci quickly (for example, Aron & Aron, 1997; Laney, 2002). The inability to assimilate quantities of information may also be related to such a deficit. The cerebellum functions to prepare the neuronal circuits for optimal function in response to an anticipated stimulus. This process is intended to maximize acquisition of sensory input. Autistic subjects show diminished performance in quickly shifting and orienting attention, especially when one is already absorbed in another activity. Attention was not found to be impaired when no switching was involved (Allen & Courchesne, 2001). Authors conclude that the abnormal responses demonstrated when presented with social cues may result from a lack of preparation involving the limbic system, as well.

Perhaps the limbic and cerebellar abnormalities can also account for the alexithymia and anhedonia found in autism and schizophrenia spectrum disorders. Allen and Courchesne point out that lower motivation from a lack of limbic system preparation for stimulus reception might show that social stimuli, as complex input, might be difficult to "sort out" (as described by Laney, 2002) due to an attentional problem. The reported tendency to require additional time to think about something might trace its origin to difficulties in attention allocation.

Some theorists describe a tendency to use a lack of eye contact to diminish stimulation and to reduce distraction in conversation (e.g., Helgoe, 2008; Laney, 2002). The communicative difficulties may be more drastic than attentional problems restricted to preference of one form of sensory input over the use of several, i.e., attention to all aspects of social content might be overwhelming, and eye contact and nonverbal decoding may exacerbate this effect. While reduced attention to social qualities of the environment are typical of autism, Fletcher-Watson and colleagues (2009) found that superficial attentional preference for social information in the

environment was shown in eye movements of adults with autism spectrum disorder. However, social attention problems are evident upon closer examination with more sensitive measures. It is the insensitivity to more subtle features of the social environment that the autistic individual continues to lack throughout the lifespan. Direction of attention did not improve attention regulation and saccadic scanning preference for people over objects (Benson et al., 2009). The recurring patterns of atypical strengths and weaknesses in perception and performance in autism is maintained as autistics outperformed controls on tasks of visual memory on non-agentive figures, while inferior performance was demonstrated for memory of agents (Blair et al., 2002). Therefore, attention, saccadic scanning, and visual memory preference appears to favor the preservation of solitary memory and focus in autism. The nature of this attentional mechanism should be explored for similarity to introverted processes.

Whether a withdrawal from overstimulation or unrelated attentional difficulties are to blame for visual social interaction and information-collection, or if some interplay is involved, verbal communication fails to support or compensate for these impairments. Words themselves may contain too much content. One quality may be favored at a time (Iarocci & McDonald, 2006; Lord, Rutter, & Le Couteur, 1994), thereby also causing speech to lose its prosodic quality (including affective content) or meaningful content (stereotypic or restricted language) differentially. While an autistic child may scream, thereby preserving the communicative value of the affective output, verbal use is clearly absent. These phenomena may be tied to this hyper-restricted attention that is related to social dysfunction, as onomatopoetic qualities of words and contextual meaning are a multifaceted means of conveying information.

Other factors for attentional problems might include a problem in reduction of signal-to-noise ratio. As the cerebellum plays a key role in this process, the primary sensory abnormalities and patterned hypersensitivity of autism and introversion and subsequent sensations of feeling overwhelmed might result from a lack of reduction of "noise" because of a lack of attention modulation in anticipation of a stimulus. The ability to filter the daily bombardment of information allows only salient stimuli to be processed, but hypersensitivity and the inability to filter out "noise" causes one to become" overwhelmed and incapable of efficient informational processing from sensory input (Blakemore, Frith, & Wolpert, 1999). Stimuli may be overwhelmingly strong, causing the hypersensitive individual to be distracted from other stimuli (Bogdashina, 2003). Similar problems are evident in studies involving the introduction of novelty. Autism is associated with a preference for routine and an aversion to novelty (*DSM-IV-TR*), but neuropsychological studies demonstrate abnormalities in stimulus modulation and integration (Kootz, Marinelli, & Cohen 1982; Ornitz, 1983). Cascio and colleagues (2008) found that some sensations were enhanced in autism, while others were normal or attenuated. This may be due to attention to one stimulus at the sacrifice of attention to a competing concurrent stimulus (O'Neill & Jones, 1997).

The integration of sensory experiential factors and resultant processing styles leads to one's sense of self by models that set forth a bottom-up approach to identity and private experience. Singer (1984) describes a "private personality" model by which "…the basic systems through which information is initially received and stored [leads to] variations that ultimately shape the unique sense of a private personality. The psychophysiological, affective, and cognitive systems are reviewed with reference to the kinds of input they provide. These

include variations in response to bodily cues… or in the styles of cognitive complexity" (p. 7). The sensory experience of the individual shapes one's experience of the self and definition thereof. As cognitive complexity is adjusted to account for focus on breadth or depth and sensitivity to bodily sensations is included in introversion literature, these factors also describe the embodiment of the self with which it interacts with the world, thereby shaping the experience and perceptual capabilities themselves. This cycle accounts for attention modulation from both a top-down and bottom-up approach that interacts and iteratively shapes experience.

The attention appears to be directed inward in autism, much as in introversion, as Jung had defined it. Kanner (1943) describes an autistic patient whose attention was endocathected: "He displayed an abstraction of mind which made him perfectly oblivious to everything about him… and to get his attention almost requires one to break down a mental barrier between his inner consciousness and the outside world" (p. 218). This description could be aptly applied to the introvert whose inner orientation, different patterns of thought into which one appears to be well-invested, and a lack of desire to leave this realm of thought for social interaction mirrors autistic behavior well. The presence of normal intelligence in an autistic sample, indicative of "high functioning autism" or a less severe manifestation of the other traits that constitute the classification of autism align with tendencies of introversion.

One may also retreat into this inner realm because one feels overstimulated. The attentional shift may not be a passive preference, but an active avoidance of overwhelming stimulus input. Eysenck and Eysenck (1985) postulate that "introverts should be better able to cope with extremely low levels of stimulation whereas at high levels of sensory stimulation it should be extraverts who are less adversely affected" (p. 249). However, the implicit preference

and the notation of optimal function in light of preference has also found that action is modified as a result of it, thereby giving introversion and sensory sensitivity a more prominent role in the way that individuals live. Bullock & Gilliland (1993) explain that "the overaroused condition of introverts leads them to exhibit more restrained and inhibited behaviors and to seek social situations that are non-arousing in an effort to reduce external stimulation" (p. 113). This is similar to the feeling of sensory overstimulation experienced in autism. The patterns of thought that characterize introverted and autistic trends may have an attentional component and a primary sensory abnormality in modulation of input.

Primary processing sensitivity is not only higher in autism, but researchers have also found comparatively high sensitivity in introversion. Aron and Aron's (1997) model of high sensory-processing sensitivity in introverts and other theorists' conjectures that lower stimulus thresholds exist in introversion than in extraversion (Eysenck, 1967) has found support in the work of Stelmack and Michaud-Achorn (1985). They found greater N1-P2 amplitude in introverts than in extraverts listening to the first of four low-frequency tones. While neither habituation nor attention is implicated for this result, it may cause attention to be channeled differently to adjust for this sensitivity. The aversion to novelty that might diminish one's openness to new experiences may be due to this phenomenon and one's desire to maintain one's optimal range of stimulation.

Signal-to-noise ratios might be adjusted in autism, but the way in which stimuli are selected may disrupt normal interactive patterns. Self-agency recognition is dependent upon sensory and proprioceptive feedback which may be disrupted in autism. Blakemore and colleagues (1999) found that one's own self-generated actions produce attenuated feedback,

while the actions of others is experienced with greater intensity. This may contribute to the desire to withdraw if the sensory input is great enough to be overwhelming. One's behavior is likely to be shaped by one's sensory experience, and idiosyncratic patterns of sensory hypo- and hypersensitivity (O'Neill & Jones, 1997; Kern et al., 2006) are likely to cause patterns of withdrawal, impaired performance, and superior performance, which is documented in both introversion (Helgoe, 2008) and autism (e.g., Lord, Rutter, & Le Couteur, 1994). As sensory modulation is disrupted, abnormal processing and reaction are likely to result (Ornitz, 1983). As the introvert and the autistic individual are both differentially affected by sensory overstimulation and narrowness of attention to perceptual information, these findings may shed some light on behavior of both groups to varying degrees, especially as a potential causal factor for social reclusion.

The abnormal sensory experience can lead the individual to be detail-oriented, a phenomenon linked to both autism and introversion, but such attention to detail may lead the individual to filter out other information, especially that which may be salient in a social situation (Klin et al., 2003). Bogdashina (2003) details the impact of sensory hypersensitivity using Temple Grandin's story as a prominent example. Stimuli can be so intense that they are "painful," or they may cause one to feel "overloaded by too much sound; visual stimulation; emotional or/and physical demand and environmental expectation" (p. 11). For the introvert, whose characteristic low energy level, desire to "recharge" in quiet solitary activity, and whose sense of being easily overwhelmed by "too much" sensory input and affective deviations from non-introverted trends, this explanation appears to summarize one's experience. While Aron and Aron (1997) assert that extraverts can also have high sensory-processing sensitivity, introverts

work to diminish activity, social stimulation, breadth of pursuits, exposure to deadlines, and excitement-seeking. These tendencies are more in line with introversion, justifying the overlap of high sensory-processing sensitivity and autism, while also describing the trends to maintain "optimal stimulation" (Eysenck, 1967). As social and emotional overstimulation are described as problematic for the autistic individual, the reclusive introvert may share such feelings that manifest in negative social emotions leading to withdrawal (Grimes, 2005).

The problem of sociability in autism and introversion is also complicated by the complexity of social interaction, and it may also be linked to difficulties in assuming broader attentional foci. Temple Grandin (2008) describes the greater ease with which autistic individuals can communicate with pictures and music, as verbal communications are uncomfortably direct and involve more sensory modalities. As such, one may find that impaired communicative ability may stifle sociability and make it more difficult for both groups.

The inability to shift attention may also manifest itself in self-other attention, thereby causing difficulty in collection and processing of social input. Frith and DeVignemont (2005) explain that difficulty may arise in switching between an egocentric and allocentric perspective. If "narrowness" of sensory input characterizes introverted thought and private self-consciousness, and sensory hypersensitivity contributes as an important part of an introverted perspective, the withdrawal from social interaction may be the behavioral manifestation of a self-focus due to an inability to assume an external focus with attention centered on strong internal stimuli and overwhelming sensory experience replacing breadth of interest.

These thought patterns begin with self-directed subjective perspectives as described by Jung (1923), radiating to perspectives of the environment. To build upon introverted thinking as

"self-directed" or "inward-directed" thought, a more comprehensive and descriptive view must include ways of thinking that are significantly mediated by inner conditions (e.g., attentional preference and capacity). The preceding section provides a description of the lens through which the introvert experiences events and situations and processes one's experiences. The following section sets thinking introversion as described in this way in motion so it can be seen as a dynamic, interdependent with other features of introversion.

Thinking and social introversion factors interact with sensory perception and other factors to produce the introverted experience. The nature of this experience is further elucidated by comparison to the clinical factors of autism and the relationship of autistic factors to explain interactive effects. However, autism and introversion are the products of a combination of factors that appear to be common but vary in severity along the continuum. These components may be present to varying degrees along the continuum, which is an assessment only of overall function: differences in component weightings is possible along the continuum in both autism and introversion. This additional dimension to the autism-introversion continuum model becomes evident with variance in the valence and type of thinking that takes place, as described in this chapter. The differential factor weighting along the continuum is a product of interaction of various components with each other and with the environment. This will become clearer in the next chapter, which explores the third introversion facet: anxious introversion.

CHAPTER 7: ANXIOUS INTROVERSION

The previous chapter focused on thinking introversion and its relationship to social introversion using the autism-introversion continuum model as a theoretical framework. This chapter introduces anxious introversion, a factor that may be present to varying degrees and with variance in expression. The origins of anxious introversion may have social or thinking roots, and they may also impact these facets. The origins, nature, outcome, and dynamic of anxious introversion are explored in this chapter.

The anxiety-provoking component of introversion may result from sensory hypersensitivity and an inability to attenuate and sort stimuli, though other sources may be rooted in social origins. Attentional mechanisms that help modulate emotional states may be impaired, preventing the perception of emotional content, as is true in depression (Bermpohl et al., 2009). Though depression has been correlated with introversion and autism, it is not the sole connection to abnormalities in emotional regulation: Schrader (1997) found that anhedonia may have trait-like properties. As such, it is unchanged by fluctuations in depression severity. While attention problems may impair proper stimulus processing for comprehension of emotional and social content, an underlying problem in emotional regulation and comprehension (alexithymia) and attenuation (anhedonia) may worsen the ability to focus on salient cues and then to process these stimuli for proper relating with others.

Social anhedonia and alexithymia

Social anhedonia leads to a greater predisposition to depression and anxiety. Rey and colleagues (2009) found correlations among schizotypy, anhedonia, depression and anxiety,

indicating an interrelatedness of these groups of symptoms. This supports the work of Chapman and colleagues (1976), who also cite Rado's view that anhedonia prevents "zest for life, impairs the ability to relate to other people, and weakens the feelings of joy, affection, love, pride, and self-respect" (p. 374). It is unclear if blunted affect is the result of overcompensation in response to overstimulation. However, many aspects of introversion, especially interactive development of a sense of self and understanding of the environment, lower level of energy and activity, and a lack of experience of positive stimulation and affiliation motivation are impacted by a lack of joy and proper reinforcement of behavior from these stimuli. Deficits in awareness of one's own emotions as is present in schizophrenia (Baslet et al., 2009) and autism (Silani et al., 2008) may contribute to differences in attentional focus and patterns of thinking, and it may also relate to social withdrawal, a lack of understanding of others, and depressive tendencies. Baslet and colleagues (2009) found that higher levels of emotional awareness correlated with better quality of life and lower levels of anhedonia. Schizophrenia spectrum disorders were associated with impairment in anticipation of others' emotional responses in social situations, and disruption in integration for emotional processing is indicated. Silani and colleagues (2008) found that empathy was also reduced with alexithymia, thus indicating that the inability to understand one's own emotions is linked to understanding the emotions of others. Impairments in self-reflection and mentalizing were not related, thereby supporting earlier conclusions involving fantasy and theory of mind. However, the ability to understand oneself and others may lead to social deficits without the necessary involvement of thinking introversion.

Social deficits

The inability to understand others, to regulate how one may be seen by others, or the ability to comprehend how others may see oneself may increase anxiety in introversion and autism, and also in schizophrenia spectrum disorders. A lack of understanding of others can lead to an inability to develop an adaptive public self-consciousness (as described by Fenigstein, Scheier, & Buss, 1975). An apparent lack of concern for how one is perceived by others (Rufus, 2003) has been tied to very painful feelings, especially about social situations (*DSM-IV-TR*), as is true of schizoid personality disorder. This may cause the individual to withdraw socially, despite any potential desire for social interaction and indulgence of one's affliative need. The sense of feeling "misunderstood" may cause negative affect, as previously asserted, and it may cause one to have social misgivings that feed negative social emotions.

When one cannot read the intentions and thoughts of another and finds oneself misunderstanding others, this can result in problems with how one believes others see the self and in how one interprets the thoughts, feels, and motives of others. In schizophrenia spectrum disorders, this is tied to social reclusiveness, a lack of trust (except, in many cases, of certain immediate family members), suspiciousness, excessive social anxiety, and ideas of reference (*DSM-IV-TR*; Raine, 1991). Similarly, introversion shows strong correlations with shyness and relatively strong correlations with hypersensitive narcissism, with strong inverse correlations with positive emotions and assertiveness (both are subscales of the NEO-PI Extraversion facet) (Grimes, 2005). Hypersensitive narcissism causes one to feel vulnerable and to experience hypersensitivity (Hendin & Cheek, 1997). The inward self-focus manifests itself in "grandiose self-relevant fantasies" and a sense of entitlement (p. 589), insecurity, and "negative emotionality" (p. 597). The negative emotionality and self-preoccupation, sensitivity to

rejection, and strong correlation to neuroticism mirror the self-aggrandizing delusions and paranoid feelings that, in this more extreme form, may be present in schizophrenia.

The problem of a detachment from social reality may exacerbate the problem in an iterative fashion. Interpersonal sensitivity is important to the development of positive affect, and it has also been found to correlate positively with more favorable and adaptive psychosocial functioning (Hall et al., 2009). It is possible that impaired functioning increases dysfunction (Bogdashina, 2003), but it is also possible that social introversion may be a commonality among mental illness with degree of interpersonal sensitivity as the primary cause, effect, or both. Other constellations of traits may manifest as social dysfunction, as differences in perceptual or cognitive function could be exhibited in the ability or inability to interact with others whose perceptual and cognitive mechanisms constitute the norm. While this does not mean that social introversion is necessarily indicative of dysfunction, the withdrawal from others who do not relate to or support one's cognitive or behavioral style is plausible. However, other traits and underlying motivations may render thinking introversion the cause of social reclusion, just as social anhedonia may cause reclusiveness. The link between introversion and autism therefore shares a much more important and comprehensive overlap than the social manifestation, though the affective component may be related to the social component in both conditions. Perhaps the anxiety present in both anxious introversion and autism spectrum disorders is partially due to social dysfunction, but the picture appears more complicated than such a hypothesis would allow. Just as impaired social function might exacerbate dysfunction, so dysfunction may impair social function in a similar way. In schizophrenia spectrum disorders, autism spectrum disorders, and introversion, individuals tend to trust only those who are especially close to the

self, including old friends and family members; they tend to avoid and distrust all others, deriving either anxiety or a lack of pleasure from encounters with others.

These problems are likely to extend to communication, as French and Schuldberg (1994) studied the accuracy and expressive content of emotional communication. They found that anhedonia showed a strong correlation with less emotional expressiveness in real-life social situations, though laboratory communication and self-monitoring did not differ from norms. These emotional deviations appear to underlie proper social understanding, theory of mind, and understanding of the self. Anxiety and anhedonia or alexithymia could therefore be considered a subcomponent of social introversion as much as social aspects may be included under anxious categorization.

Emotional dysregulation and abnormal cognitive patterns can create difficulty in understanding the self and others. If Dennett's intentional stance is applied to the self to understand the self as it can be applied to others, then an inability to understand the self would pervade applications to other minds, as well. Carruthers (2009) defends the perspective that our knowledge of our own attitudes comes from self-mindreading. While this may require some level of unconscious and instant self-interpretation, he argues that schizophrenia is a dissociation of metacognition and mindreading, and that autism is the inverse. The level of overlap between the two disorders (*DSM-IV-TR*) does not indicate such vastly different problems with understanding other minds, especially when considering difficulties in recognition of affect. The inability to shift focus to the mind of another, to leave one's "inner world" for interaction, or to have great difficulty in reading emotion in others due to the inability to understand emotion through one's own experience seems to link introversion, autism and schizophrenia.

The placement of anxious introversion in the conceptual framework: An integration of anxious components and ties to other facets

Perhaps the greatest utility of the conceptual mapping of autism and introversion onto the same spectrum rests in its ability to elucidate the problem of anxious introversion. If introversion is a neutral term as Jung had intended, or if it is desirable as others have argued (e.g., Aron & Aron, 1997; Laney, 2002; Helgoe, 2008), it should follow that anxious introversion does not exist. Yet measures of introversion appear to show their strongest correlations to measures that include an anxious component (Grimes, 2005). For instance, the "positive emotion" subscale of the NEO-PI (Costa & McCrae, 1992), might demonstrate a relationship that is more complex and significant than a correlation with social withdrawal alone would allow. The lack of positive emotions could also be related to anhedonia, with causal direction unknown. The reason for such strong introversion-anxiety correlations may be that the nature of introversion also overlaps with autism and related disorders in this way, too, with anxious components expressed to a degree indicative of the location on the autism spectrum: if introversion is not clinical "autism," then anxious markers may be less severe.

Other anxious components complicate the introversion and autism dynamics. Autism and obsessive-compulsive disorder have been shown to overlap with each other and with generalized anxiety disorder (Cath, 2008). This may include a need for control and for an anxious reaction when one perceives a lack of control, especially in social situations (Blackshaw et al., 2001). The frequency of development of anxiety disorders is higher in autistic children than in those who do not have a developmental disorder (Kimel, 2009). Therefore, anxiety, especially related

to control, a lack of mastery of theory of mind, and systemizing tendencies have been tied to autism. Introversion may be caused by a turning inward to discover a sphere of control when none can be discerned in the external world. Perhaps an avoidance of the external world may motivate such a preference. If no other bastion of control is conceded by introversion literature as of yet, current theories support the retreat into the internal world to regulate sensory stimulation as one withdraws to avoid overstimulation (Bogdashina, 2003; Laney, 2002; Aron & Aron, 1997). However, such possibilities are set forth by clinical literature. Problems with emotional understanding and regulation are related to attribution of control. Loas and colleagues (1998) found that an external locus of control was tied to alexithymia and anhedonia with depression. As such neurotic components are also present in introversion but without explanation, we may have to turn to the extreme end of the spectrum to understand the relationship of these variables as they interact in the introverted mind.

Research has uncovered ties among sensory processing sensitivity, alexithymia, autism, depression, and anxiety. Cheek and colleagues (2009) found separate factors of Aron and Aron's (1997) Highly Sensitive Person Scale into physical sensitivity/sensory overstimulation, which show some possible overlap when factor analyzed, and an aesthetic component that does not overlap with the other factors. Grimes (2005) found high correlations between the "overwhelm/frazzle" component and Laney's (2002) introversion measure ($r=.55$, $p<.01$; $N = 225$) but weak correlations between aesthetic orientation and introversion ($r = .15$, $p<.05$; $N = 225$). These findings are corroborated by the work of Liss and colleagues (2008), who discovered ease of excitation and low sensory threshold were related to autism symptoms, alexithymia, anxiety, and depression, but aesthetic sensitivity was related to the autistic attention

to detail and anxiety, but not to depression; a component of alexithymia was negatively correlated with aesthetic sensitivity. Researchers conclude that higher ease of excitation and inability to identify feelings causes an increase in anxiety.

The experience of novelty has been approached from a "stimulus hypersensitivity" or "overstimulation" perspective with evidence that a lack of attenuation causes novel stimuli to be of greater magnitude when perceived by introverts than extraverts. However, Corbett and colleagues (2006) noted abnormally high cortisol levels with experience of novelty in autistic populations. Kootz and colleagues (1982) note that "…blood pressure, heart rate, peripheral blood flow…and peripheral vascular resistance…[show] patterns consistent with rejection of external sensory information" (p. 185) and "…greater response disruption and an increased heart rate, consistent with their behavioral need to preserve sameness…" (p. 185) in autism. These physiological reactions to novelty may be found to exist to a lesser extent in introversion, thereby accounting for a desire to reduce stimulation through avoidance of sensation-seeking and exciting activities.

Other introverted preferences may be viewed as temperamental idiosyncracies, but they may show an underlying connection with a maladaptive condition in autism. Rufus (2003) describes the introvert's desire to sleep through the afternoon and to be active during the night. Corbett and colleagues (2008) found evidence that connects sensory sensitivity, cortisol levels, and stress in autism, and Hu and colleagues (2009) found circadian rhythm dysfunction in autism tied to a genetic variant. Autistic groups also showed circadian dysregulation and increased cortisol in anticipation of re-exposure to novel stimuli, which were perceived as stressors (Corbett et al., 2008). Increased levels of cortisol are generally found in the morning with

decreasing levels during the day, while chronic stress patients often increase during the day. This may account for the findings that impact circadian rhythm, as well, as autistic individuals are predisposed to anxiety disorders. Problems of distraction and overstimulation during the day with difficulties in modulating attention may account for the introvert's preference for the reduced stimulation, interactivity, and expected activity that would be experienced at night. Such a preference would be expected to extend to autistic groups, as well (Bogdashina, 2003), as decreased stimulation would be optimal for introverts and autistic individuals alike. Whether preference or stress and neurological stimulation lead to such disruption is unclear. However, Killgore and colleagues (2007) also showed extraverts appear to show greater resistance than do introverts to the adverse effects of decreased vigilance and attention when deprived of sleep. The problems of circadian rhythm dysregulation do not resolve in resultant adaptability, nor does superior function cause the disruption. However, it might contribute to other areas of possible underperformance, especially as can be seen in areas of deficit in autism and negative symptoms of schizophrenia spectrum disorders.

Social, thinking, and anxious introversion reflect autistic trends as factors considered independently, and their dynamic shows similarity to that of autism spectrum disorders, as well. The confusion surrounding the negative aspects of anxiety, depression, stress, and overstimulation, for example, may be dissipated as they are placed conceptually as cohesive parts of the introverted picture. The construct of introversion becomes clearer as the dynamic that creates the personality dimension becomes more conceptually viable. Additionally, this theoretical model opens new possibilities for empirical exploration of facets of anxiety in both autism and introversion, and perhaps new methods of remediation to alleviate the anxious factor.

CHAPTER 8: INHIBITED INTROVERSION

Anxious components may be closely related to the introverted factor of inhibition. Anxiety can cause inhibition directly, or the factors that may cause or result from the anxiety (e.g., anhedonia) may correlate with inhibition. However, inhibition can also be considered a function of sensory experience, physical limitations, or tendencies to promote optimal function. Introverts have a lower threshold for external stimuli and tend to become overwhelmed when they are overstimulated by sensory or emotional stimuli. They seek to maintain their optimal level of arousal so they can prevent overstimulation and the sense of becoming overwhelmed. Additionally, that which appears to be inhibition may be a mere appearance of holding back when one is actually unmotivated to act at all. The concept of vitality provides an alternative explanation for seeming inhibition and it describes that which is inhibited. Gray's model of the behavioral inhibition and behavioral activation systems offers more support for viability of this facet and its proposed extreme expression as an autistic trait. The interplay of thinking introversion with these biological factors demonstrates the dynamic of this introversion facet. The goal of this chapter is to explore the underlying causes and relationships of variables related to inhibited introversion and how these relate to other factors of introversion.

Anhedonia, alexithymia, and the inhibited facet of introversion

Optimal arousal

Emotional dysregulation or attenuation may also motivate sensation-seeking experiences. Anhedonia shows a partial relationship with sensation-seeking in some, and researchers believe that correlations show compensatory behavior for emotional deficits (Carton et al., 1995). The

presence of anhedonia may undermine other correlates with introversion and autism, including increased inhibition and decreased emotional response to strong stimuli. Other researchers concur that the ability to experience and regulate emotions in alexithymia shows similar relationships with sensation-seeking and engagement in high-risk activities (Woodman et al., 2009). With emotional attenuation, *increased* stimulation is necessary for optimal arousal.

Extraversion has long been associated with sensation-seeking, as extraversion requires more stimulation to reach an "optimal level of stimulation" (Eysenck, 1967; Eysenck & Zuckerman, 1978). However, it would appear that introversion may be conditionally related to excitement-seeking. Analysis of the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975) reveals a "psychosis" dimension, defined as a trait that underlies that which may become clinical psychosis under certain circumstances. Those who are expected to score high on this dimension include those with personality disorders *and* art students (Eysenck & Zuckerman, 1978). These individuals share "non-conforming, atypical attitudes indicating a lack of socialization or a weak 'superego.' …Sensation-seeking is also related to a similar dimension…" (p. 483). Extraversion was found to correlate with disinhibition, but researchers also found lower correlations with thrill and adventure-seeking and insignificant ties to experience-seeking and boredom susceptibility. Later conceptualizations that include "excitement-seeking" in components of extraversion (Costa & McCrae, 1992) may have simply included a conceptual indicator that is more aptly characterized as a correlate. Yet, researchers prefer to include sensation-seeking in the definition of extraversion (Eysenck & Zuckerman, 1978), despite the possibility of nonconforming alexithymics who are socially withdrawn. Perhaps emotionality requires subcategorization of introverted groups to account for some of the

phenotypical differentiation between “impulsive” and “uninhibited” excitement-seekers and easily overwhelmed inhibited introverts with high sensory-processing sensitivity and lower optimal thresholds for stimulation.

Other areas of disjunction in introversion relate to task performance and the tendency to become overwhelmed by cognitive load; this is manifested by apparent inhibited response. Gooding and Talent (2003) find that working memory deficits associated with match-to-sample tasks involving spatial, identity, and cognitive information are not a result of social anhedonia, but appear to show the “difficulty and/or inefficiency in handling cognitively taxing tasks” (p. 247). Pontari and Schlenker (2000) find that extra cognitive work can either inhibit effective self-presentation by leaching necessary cognitive resources, or the challenge may facilitate self-presentation by drawing attention from negative self-preoccupation. Introverts who do not experience social anhedonia but do suffer from social anxiety and negative self-preoccupation and public self-consciousness may vary in task performance depending upon the difficulty involved if they may otherwise be hindered by their ruminative or fearful thoughts. Fear can prevent action and elicit a withdrawal response. However, one may not place oneself in these overwhelming situations with reduced efficacy in attention modulation. Nor does anxiety predispose one to better handling of cognitive tasks or aesthetic orientation for distractive purposes. Similarly, Stahl and Cheek (1993) note that compensatory gifts do not necessarily accompany shyness. If attention-shifting is not possible, then the additional cognitive work is likely to be compromised while the negative self-reflection remains a point of inward attentional fixation. The amount of additional work may also prove to be “overwhelming” and cause an introvert to “shut down” (Laney, 2002). Inhibition may come from an inability to juggle

multiple tasks, or it may be fear-based, thereby causing individuals to have different ways of overcoming the problem and to be affected in different ways and contexts.

It is also possible that such affective differences cause relative inhibition or impulsivity depending upon both affective disposition and cognitive workload to distract from these processes, also subject to attentional capacity for such distraction. Of course, in the social realm, inhibition may be due to anxiety with or without anhedonia. As anhedonia is the inability to experience pleasure from social interactions, social anxiety may still be present. Researchers have found strong correlations among measures of social anxiety and anhedonia (Park et al., 2009). This fits with reports from schizoid individuals who experience social anhedonia but privately feel painful sensations due to a lack of positive stimulation from relationships (*DSM-IV-TR*). Other research concurs that "shy people oscillate between social interest and fear while experiencing both approach and avoidance tendencies" (Stahl & Cheek, 1993, p. 5). The lack of a pleasurable experience from socialization may be due to attention drawn to stressful aspects of social contact which cause the introvert to "pull back" (Laney, 2002, p. 3) from contact with the external world for modulation of stress-associated overstimulation as is the typical reaction to stressful events. Whether a lack of skills or affective disturbance is the cause, the tendency for the introvert to feel "alone in a crowd" likely hinges on one's social inhibition, from an inability to open oneself to emotional connection and/or from an inability to initiate, interpret, and maintain communication.

Overstimulation and withdrawal

Through the clinical lens of autism and schizophrenia, inhibited introversion appears to be the product of a withdrawal from activity for the purposes of avoiding overstimulation or possible anxiety. In severe cases of autism, other factors, such as impaired intelligence and proper insight might render one incapable of this activity, but less severe forms closer to the introverted part of the spectrum are likely to involve multiple types of reactions that result in inhibitive reaction to stimuli. This may happen proactively, as Temple Grandin (in Bogdashina, 2003) describes tuning out information or shutting down receptiveness to stimuli, or it may happen retroactively as one withdraws instead of reacting, especially impulsively (Laney, 2002).

Some of the relational pattern of anxiety and inhibition appears in earlier manifestations of inhibition. Moehler and colleagues (2008) found that behavioral inhibition during the second year of life was predictive of anxiety later in life, especially as shown through exaggerated emotional disturbance and distress when exposed to novel stimuli. The anxiety provoked by the presentation of novel stimuli shows early comorbidity of inhibition and anxiety. Interestingly, the display of abnormal behavior seems to coincide with the time frame during which such behavior often first appears in autism. Children who are diagnosed with autism spectrum disorders show inhibited behavioral patterns that start before the age of three (*DSM-IV-TR*).

Vitality: What is inhibited?

Part of the picture of inhibited introversion includes a somewhat conflicting concept. The desire to react followed by restraint is inhibition, but a lack of desire to act, and therefore a lack of need for restraint, would be caused by lower energy levels. Ryan and Frederick (1997) describe vitality as a feeling of energy and "aliveness," reflective of well-being and constituted

of psychological and somatic factors. As this definition rests upon one's perception of one's state, those with insight into their perceptive abnormalities, or those who experience elevated anxiety and depression are unlikely to experience vitality or high energy.

The behavioral inhibition system

Other theorists refute the involvement of inhibitory mechanisms in autism partially and indirectly. Carver and White (1994) describe Gray's behavioral inhibition and behavioral activation systems. The behavioral inhibition system is sensitive to stimuli that signal impending punishment, nonreward, and novelty. As described, autistic individuals may be insensitive to cues that should elicit an anticipatory response, thereby precluding normal sensory focus and attenuation. Yet, social anxiety is also predictive, even if through the anticipation of negative consequences. Perhaps behavioral inhibition can support an argument for selective ability to anticipate and prepare for consequences, as is dependent upon attentional capabilities and areas of selective focus.

Apparent inhibition may also be delayed reaction to stimulus prompts. For instance, the inability of the introvert to act in the moment and the preference to spend more time processing information before speaking or reacting (Laney, 2002; Aron & Aron, 1997) could account for seeming inhibition. Decision-making and cognitive processing takes longer, so introverts may appear to be more inhibited, while extraverts can react more quickly and appear more impulsive.

As perception and thought processes affect social and cognitive experience, anxiety helps shape these perceptions and function, and inhibition is a product of and contributor to patterns of

narrowness and reduction in stimulation sought by introverts, wherever they appear on the autism spectrum and regardless of their unique balance of these factors. The severity and exact manifestation of these traits, whether they appear as schizophrenia spectrum disorders, autism spectrum disorders, or the less severe and non-clinical form, introversion, is contingent upon both environmental and genetic factors.

The complex and comprehensive four-factor view of the autism-introversion continuum demonstrates the importance of trait dynamic and interaction. The current findings relating to introversion uphold the working model. However, the autism-introversion continuum model with differential factorial weightings also introduces new questions: what causes these differences? What has research taught us about possible neural substrates and biological mechanisms that cause, result from, or contribute to the patterns that create observable behavior indicative of placement on this spectrum? The following is a brief review of current research that exploits the continuum model to further inform our understanding of introversion and autism.

CHAPTER 9: BIOLOGICAL CORRELATES

There are many factors that cause the manifest symptoms of autism and observable behaviors and preferences of introversion. The interplay of the detailed factors and their relative weightings contributes to these tendencies. This chapter outlines variables that contribute to expression of the introverted factors and those that may be researched by neurological studies to better understand differences from non-introverted groups.

Research has not yet offered conclusive evidence as to the cause of autism or introversion, but a genetic component has been suggested to interact with the environment in a way that may cause expression of autistic or introverted behavior. Begley and Springen (1996) explain that an autistic individual's identical twin is 90% likely to be autistic, as well. Additionally, they note that the infliction of brain damage causes the expression of autism, while the absence of trauma causes some idiosyncracies in behavior that are not classifiable as autism. The genetic predisposition appears to interact with the environment and with biological compromise in a way that causes expression of the disorder. The incidence of introversion among families with autistic relatives should be explored. Previous research has only examined the preponderance of related trait sets of "broader autism phenotype," or mild autistic traits, in parents of autistic children (Scheeren & Stauder, 2008). Social impairment is shown in fathers of autistic children, thereby strengthening the argument for an autistic predisposition in the family's genetic code. Research that includes introversion measures should be more sensitive and comprehensive.

Heritability

Introversion research has suggested heritability and a strong genetic component that is exacerbated when exposed to certain environmental conditions and may change the character (e.g., Eaves & Eysenck, 1975). As these conditions are likely to change over the lifespan, expression changes accordingly with age. McCrae and colleagues (2000) explain that temperaments are biologically-based. These traits include emotional stability and thoughtfulness. Factors such as introversion are "a constitutional predisposition" (p. 173). As the genetic-environmental combination changes the unitary nature of the extraverted temperament (Eaves & Eysenck, 1975), researchers are unlikely to find conclusive evidence to support the unidimensionality of introversion and extraversion (Carrigan, 1960) despite other assertions that extraversion is a conceptually unitary temperament (e.g., Eysenck, 1967; Eaves & Eysenck, 1975). While the conceptual simplicity is admirable, the necessary existence of confounding factors that make up our interactive existence renders this implausible. Nonetheless, the fluctuation and individual difference in weightings of introverted and extraverted components is an important statement of interactive potential.

Emergence of variation in autistic/introverted patterns

The changing circumstances of life cause dispositional interaction with the environment to change over time and across cultures. McCrae and colleagues (2004) studied these patterns. They find cultural differences and a general trend of increasing introversion over the life span. However, these data begin at age ten. The autistic pattern would show marked increases in introversion prior to age three with the potential to develop more socially interactive behavior over the course of time, possibly due to development of social and linguistic skills. The extent

and general trend do appear to separate clinical autism from introversion. However, a study that is based upon introverted trends and does not include extraverts' data would be more useful as a comparative sample.

A neuroscientific model: Current findings

The study of autistic brains might also help shape future studies of brain-behavior ties in introversion. Introversion findings are mixed, but the potential for interesting insights into the temperament has been established. The circadian abnormalities and variation in introversion-extraversion response to stimulation levels have been explored with preliminary studies (as in Zuckerman, 2003), though the ability to draw fruitful conclusions rests upon refinement of technique. EEG characteristics are highly heritable (Lykken, 1982a, 1982b), so such studies may lend important insight for introversion-extraversion patterns. Other nervous system studies support lower excitability thresholds in introversion and greater response to stimulation. Cerebral blood flow patterns demonstrated higher cortical arousal in introverts than in extraverts (Mathew, Weinman, & Barr, 1984 in Zuckerman, 2003). Extraverts showed reduced excitability as shown through reflex recovery, thereby demonstrating inhibitory nervous processes (Pivik, Stelmack, & Bylsma, 1988 in Zuckerman, 2003). These designs may be applied to autistic samples for a relevant and interesting comparison group.

However, researchers conclude that results are mixed in understanding chemical, blood flow, and structural differences in introversion and extraversion (Zuckerman, 2003). These differences may be resolved through exploration of other aspects of the temperaments, especially by using findings in neuroimaging of autism to guide exploration of introverted traits and

tendencies. Current work has shown some temperamental differences that could support differences in cognitive processes, movement, communication, and distribution of sensory information (Johnson et al., 1999). As these findings are relatively vague, more work is necessary to understand the functional neuroanatomy of introverted brains, especially as they may compare to autistic samples. Authors even note that "the present study did not provide a definitive answer concerning the relation between personality and brain activity" (p. 256). Wright and colleagues (2006) found differences between introversion and extraversion in neuroanatomical structure of the prefrontal cortex, without significant difference in the amygdala. This may account for some executive and integrative differences in introversion and extraversion, but it does not support the emotional component that places lability as a result of overstimulation.

Other studies also suggest the possibility of a biological basis of personality differences through differences in cortical arousal as measured by fMRI. Kumari and colleagues (2004) found a negative relationship between extraversion and resting levels of cortical arousal. They also point out a negative relationship between schizotypy and striatal activity, using the assumption that introversion is synonymous with this personality disorder. As other variables impact the viability of these groups as comparison samples with inter-group differences shown using a psychometric measure by Eysenck intended to verify his theory, these findings need more empirical support.

Zuckerman (2003) concludes that neuroimaging for introversion is likely to be constrained due to the expense of the methods and resultant limitation of their application to the study of medical conditions. Streamlining techniques and regions expected to be affected by

comparison to the more extreme clinical sample may offer a valuable chance to understand the introverted brain based upon studies on clinical populations. With phenotypic similarity, we should expect to find the same type of structure, function, and brain-behavior ties in introversion and in autism, but the difference would rest in the extent of manifestation, both in physiological findings and behavioral ramifications.

Implications for future research

Callosal hypoconnectivity

Indeed, we do have some foundational information about the structure of the autistic brain. Though only a cursory view is provided here, a brief overview is sufficient to demonstrate the potential of generalization of autistic findings to introverted findings. The proportion of gray matter might be secondary to its interconnections and supportive white matter. Hardan and colleagues' (2009) conclusion of significantly diminished cortical connectivity based upon overall diminution of the corpus callosum when explored regionally using volumetric comparison of MRIs may indicate a more important trend to understanding the neurophysiology that underlies the disease. The corpus callosum is the major connective pathway between the hemispheres, allowing integration and modulation of information, especially for global perception. Detail focus is one notable result of an inability to integrate information.

As myelination of the corpus callosum occurs between six and eleven years of age (Thompson et al., 2000) and other phases of neuronal growth and axial patterning occur before this (Paul et al., 2007), it is possible that symptoms may appear after a period of normal growth (*DSM-IV-TR*) commensurate with a disruption of the stage of development of white matter tracts.

Such processes, possibly combined with other interactive factors (such as neurotransmitter levels, environmental interaction, etc. as it acts with genetic factors) might mean that the actual volume of gray matter is less important to diagnosis. The interaction that provides learning opportunities is altered, thereby altering the nature of the resultant connections (as are formed by learning) that support normal interaction. The DSM-IV-TR notes the possibility of both macroencephaly and microencephaly in autism, while schizophrenia is often associated with diminishment of gray matter in the cortex, increased volume of the ventricles, and abnormal activity. Individuals with autism may later be diagnosed with schizophrenia (*DSM-IV-TR*), so previous assumptions that they are on "opposite ends of the spectrum" or are inverses of each other (Crespi & Badcock, 2008) should be reconsidered. In fact, some studies have already found evidence of an overlap of autism and schizophrenia spectrum disorders, including genetic components and even perceived comorbidity of the diseases (Arehart-Treichel, 2008). With such phenotypical similarities with introversion, perhaps those who are considered "extremely introverted" should be subject to empirical examination involving comparative brain scans, especially volumetric analyses of MRIs to explore possible micro- and macro-encephaly when compared to an "extraverted" group, and association and commissural tracts may be explored for diminishment commensurate with autistic disorder. Interactivity with the environment, sensation, and movement abnormalities possibly tied to cerebellar involvement may also impact projection tracts.

Abnormal activity

Abnormal brain activity is possible in autism and schizophrenia. Both diseases are linked with the increased potential for seizures (*DSM-IV-TR*; Hollander et al., 2009). These abnormal patterns may be detected by EEG scans, or they may be indicative of disrupted activity from overstimulation and dysregulation. While this has not been an area of focus as of yet, it would be interesting to note the prevalence of introversion or extraversion in epileptic patients in case there is a predisposition to the disease by temperament. This possible connection has been informally supported by the tendency for introverts to feel overwhelmed by sensory input and to have lower stimulus thresholds. Such stimulation may be linked to triggering an epileptic seizure, if the stimulus is strong and of long enough duration, but more work must be done to confirm such a claim.

Neurotransmitters

Better understanding of the neuroanatomical, functional, and neuropharmacological differences in introversion and autism can also lead to better definition of both. Hirsch and colleagues (2009) propose a new structure to refine the "big five" model of personality by introducing new "metatraits" to account for the interrelatedness they found among the standing five personality traits. Their justification lies in the function of serotonin and dopamine systems as they impact incentive-based motivation and exploration (dopamine) and satiety and restraint (serotonin). This model of engagement and restraint of behavior seems to revisit Gray's behavioral inhibition and behavioral activation systems, and such lines of work should be reconsidered for better understanding of behavior correlates and their neural substrates.

These findings may advance our understanding of interactions that produce the expression of autism, as well. Our knowledge of the ways in which the environment and genetic factors, and the resultant traits interact, has progressed through clinical studies. Brain-derived neurotrophic factor, which regulates synaptic plasticity and neurotransmission, has been correlated to expressions of introverted or extraverted temperament, and this work has already begun to elucidate interactions with genetic factors such as the serotonin transporter gene that cause correlated traits to be expressed (Terracciano et al., 2009). As this research has found some possible causal interactions for neuroticism, it may help explain the introverted and neurotic factors that must be addressed for better adjustment of individuals on the introversion spectrum.

CHAPTER 10: CONCLUSION

Commonalities between introverted and autistic trait heterogeneity: Support for a common trait dynamic

Both autism and introversion are commonly described as "spectrum" phenomena. Jung's (1926) introversion-extraversion continuum allows for varying degrees of associated tendencies, much as the autism spectrum encompasses degrees of severity. The two scales also share other important descriptive qualities. The heterogeneity of introverted traits (e.g., Grimes, 2005) despite its definition as a unitary personality trait parallels that of autistic symptoms. Researchers find such variability to create practical problems in the clinical diagnosis of autism (Volkmar et al., 2008). This prompted Ring and colleagues (2008) to explore the possibility of different subcategories of autism such that phenotypic variation suggested differences in etiology and clinical syndrome classification. Psychometric analysis yielded results consistent with a singular spectrum model of autism with variability based upon severity and IQ.

Other interpretations may argue in favor of a factor model of introversion, as posited by Grimes (2005). The new model would combine these introversion facets on a continuum that includes a clinical extreme end that produces different results based upon the interaction of the traits as they are combined with variable weighting. A particular constellation of introverted traits, especially social, anxious, and inhibited introversion, when taken to the extreme, may also characterize autism. However, the prominence of other introverted traits may be indicative of schizotypy. These would include anxious, thinking, and social introversion, while omitting inhibited introversion such that schizophrenic impulsivity and disinhibition are present. The DSM-IV-TR includes "introverted anhedonia" as a schizotypal trait, referring to a tendency

toward attenuated emotion and social withdrawal with a lack of pleasure from social and physical stimulation. Unstable mood and socially inappropriate behavior accompany a lack of adhesion to social norms, but reckless behavior and disjointed or discontinuous thought and trouble concentrating are also present. Some studies show correlations between artistic creativity and schizophrenia (Rawlings & Locarnini, 2008), so "thinking introversion" and aesthetic orientation may be introverted traits more closely related to schizotypy than to autism, which is thought to cause diminished imagination and fantasy (Baron-Cohen et al., 2001). The "social" introversion component is common to both disorders, though high-functioning autism may not impact one's affiliative desire, even if one's social skills are impaired (*DSM-IV-TR*). Therefore, underlying cause or motivation for social withdrawal becomes important for how severity interacts with this introverted trait along various points of the continuum.

Where schizophrenia fits in the model

The link among schizophrenia, autism, and introversion is a tenuous one, but it has already found some empirical support. Nettle (2006) describes mathematical creativity as a product of a systemizing mind with narrow associations and appreciation for routine. This constellation argues for a creative trend with low incidence of unusual experiences, disorganization, and impulsive nonconformity as would be found in schizophrenia, though he points out that these traits are characteristics found in Baron-Cohen's (2003) systemizing model of autism spectrum disorders. The tendency toward order and regularity and the aptitude for dealing with numerical values and concepts is characteristic of autism (Baron-Cohen et al., 2001), while unusual experiences and openness characteristic of visual arts and music appear to

correlate higher with schizotypal traits (Rawlings & Locarnini, 2008). Both creative types differ from their clinical correlates by the exclusion of introvertive anhedonia, but not by the degree of inclusion of the other traits (Nettle, 2006). In this case, the introversion facet referenced is social and possibly anxious. Social introversion may be indicative of the inclusion of other factors, or it could be a product of isolation due to ineptitude or lack of affliative motivation.

However, the link among the schizophrenia and autism spectra, and the introversion continuum might simply be a matter of degree of severity plotted as a function of developmental course. Different components that make up introversion or autism are present with variation in weighting, creating an interaction that is unique to the individual. As such, the dynamic created that forms the pattern of introversion also interacts with the environment through the body in different ways throughout the course of the life span, subjected to various stressors and trophic factors. The timing and severity at various points in life, coupled with the exact pattern of factorial weightings creates the diagnosable phenomenon. Autism spectrum disorders are early onset disorders, meaning that the child's interactions are deeply disturbed from early in life, and all interactions through which the child would learn are compromised after the first year but before the second. If such "overstimulation" takes place later in life, the result is likely to be different. Hallucinations and delusions might be the result of a schism between one's "inner world" and the outer world when divorcing oneself from the reality discovered by extensive interactivity that is the product of many years of "normal" function (according to the *DSM-IV-TR*, onset is generally during the late twenties for women and mid-twenties for men). The ways that one makes sense of this schism might produce these positive symptoms, while the retreat to the inner world more closely resembles the negative symptoms. Autistic interactivity is much

more limited and therefore shows a different overt behavior typified by developmental delay and continued behavior indicative of restricted interaction and learning. The degree of overstimulation and one's threshold, combined with the amount of "normal" interactivity to date could produce what we would call autism versus schizophrenia or any other trait set under the umbrella that appears to be the "quirky" but perhaps clinical umbrella of "introversion."

Subcategorization assisted by neurological experimentation

Our ability to subcategorize may be assisted further through comparative fMRI such that the characteristic enlargement of the ventricles and diminishment of gray matter (especially in frontal and temporal areas) in schizophrenia or macroencephaly with comparative diminished volume of the corpus callosum and other white tracts in autism (Hardan et al., 2009) could be compared to samples of creative individuals who do not exhibit clinical symptoms of either disease. Findings associated with clinical disorders may guide future studies involving non-clinical introversion. The introversion results may also provide us with a better expectation of ideal outcomes, as therapy may create functional neuroanatomical similarity to introversion, but the clinical brain may simply never wire similarly to that of an extravert. Understanding improvement of severely introverted brains might help us understand how to deal with greater impairment in cortical connectivity, for example (as is argued to be an underlying problem in autism by Hardan et al., 2009).

Subcategorization and behavior

From these findings, it would seem that the inclusion of "introversion" and inappropriate affect, whether blunted or incongruent, characterize the schism between creativity and clinical classification. This form of "introversion" appears to refer primarily to social introversion with some implicit thinking and anxious components. However, social introversion has been widely demonstrated as a non-clinical personality trait, and it has also been found in non-clinical creative populations (Nettle, 2006; Rawlings & Locarnini, 2008). Therefore, it would seem more plausible to conceptualize introversion as a multifaceted construct with different weightings of the various components that yield individual differences on one end of the spectrum and arrays of clinical symptomology on the other. We may also use this model to better comprehend creativity and how the brain supports it.

Terminological confusion reframed as a function of unrecognized synonymity

Placing introversion and autism on the same spectrum allows for expansion of the trait set into a non-clinical population and refinement of both concepts. The pressure to accomplish both of these goals has piqued in clinical literature (e.g., Baron-Cohen et al., 2001) and the ballooning popular psychology literature that seeks to find a place for introversion and to build a nomological network for the elusive construct. Operational similarities as those between Laney's (2002) introversion scale and Baron-Cohen and colleagues' (2001) Autism-Spectrum Quotient only begin to hint at the pervasive and necessary similarities that result from variance in terminology that only explains a difference in extent and not in inclusive trait set.

Resultant connotations also seem to favor the use of a singular continuum to describe autism spectrum and schizophrenia spectrum disorders and introversion spectrum temperament.

McWilliams (2006) specifically avoids use of the term "introversion" in favor of the use of "schizoid" to describe the introverted temperament. She refers to a non-clinical population, but also notes that the application of a term that is traditionally associated with clinical pathology due to extent of expression to the point of maladaptive behavior to a similar trait set that is not thereby classifiable as "clinical" is not favored. The clinical term is stigmatizing, but it is more descriptive. She says of those with schizoid personalities,

> "…There is a range of mental and emotional health in such people that runs from psychotically disturbed to enviably robust. Although I have become persuaded that schizoid individuals do not have 'neurotic-level' conflicts (cf. Steiner, 1993), I note that the highest functioning schizoid people, of whom there are many, seem much healthier in every meaningful respect… Although the Jungian concept of 'introversion' is perhaps a less stigmatizing term, I prefer 'schizoid' because it implicitly refers to the complex intrapsychic life of the introverted individual rather than to a preference for introspection and solitary pursuits, which are more or less surface phenomena." (pp.1-2).

While some of these aspects of a "rich inner life" (Aron & Aron, 1997) are present in introversion, the use of additional terms that are introduced to indicate some perceivable aspect, or subset thereof, of introversion only obfuscates the study of these terms and their interrelationship. Instead of distinguishing these presumed correlates and theoretically preventing overlap as Aron and Aron have done with high sensory processing sensitivity for the purposes of claiming novelty, perhaps we must finally integrate what we know and set forth a model based upon these facts and not upon personal biases.

Goals for future research

Understanding the "rich inner life"

We must increase our understanding of both autism and introversion in order to advance studies of both, and to understand critical and tangential issues facing psychology. Introversion

does not make sense, especially in its variation from person to person and from idiosyncratic results of application to differing situations and environments. Murphy (1947) describes an introverted boy who exemplified Jung's definition of the construct in his preferences, tendencies, and the creation and maintenance of a "preposterously rich fantasy world" (p. 609), but his IQ was only 65. Such an example demonstrates clear overlap with the definition of autism, including the impairment in intelligence. It also demonstrates that the presumed empty inner life of one who could be diagnosed with autism may be richer than believed by others. Perhaps we must refine our understanding of the inner life of introverts and autistic patients.

Understanding intelligence

The problem with our understanding clearly involves our definition and use of comparison groups, but it also involves our measurement capabilities. Murphy's introverted child may have tested with inferior intelligence on standard measures of intelligence, but a rich inner life requires intelligence. Perhaps this inner world is the manifestation of a sort of intelligence that cannot be effectively communicated or shown socially, since these skills were not present prior to onset of the most severe symptomology (and withdrawal). The autistic aptitude for detail orientation and rule-bound or numerical manipulation hints toward a different sort of intelligence that may be difficult for one with communicative problems to express. It is also probable that this type of intelligence is not supported by standard communication. For instance, if this inner world is full of concepts and vivid imagery, verbal description can only be as effective as one's vocabulary and eloquence will allow, and depictions through other media

requires sufficient artistic or other skills. Perhaps our comparison of clinical and non-clinical intelligence is an unfair measure of standard intelligence moderated by communicative ability.

Examining related constructs

The factorial structure of autism and schizophrenia spectrum disorders and description of severity offered by a continuum model allows for flexibility in description and diagnosis (e.g., Ring et al., 2008; Karakula et al., 1999; Gruzelier, 1996; Raine, 1990) and for extension of these traits into a non-clinical population with less severe expression and non-clinical trait interaction (Baron-Cohen et al., 2001; Rust, 1988). Recently, factor approaches to introversion have proven comprehensive and descriptively better, as even unifaceted models of introversion and extraversion have not been proven to work empirically as unitary tools (e.g., Carrigan, 1960; Cheek et al., 2009; Grimes, 2005). If the continuum approach is tempered to accommodate these findings, we may have a more comprehensive view of introversion. The temperament also begins to more closely resemble the non-clinical end of the autism and schizophrenia spectrum.

Autism and introversion exist on the same continuum; while some overlap with schizophrenia spectrum disorders is indicated, the ways in which these continua overlap should be better explored. The autism-introversion continuum model is offered to simplify a complex and dynamic representation of personality. The palette of introversion is the same as for these clinical conditions, but the personality is painted in lighter hues, as the withdrawal into the inner world is not absolute and the trait set is attenuated in expression as a result and as a causal factor. Schizophrenia and autism spectrum disorders require different weightings of components set in different situational dynamics to create these different constellations, and the introverted

temperament describes a lighter weighting of all components preserved by a supportive situational flux. Clinical conditions demonstrate heavier and/or imbalanced component weightings. These components refer to social, thinking, anxious, and inhibited aspects and approaches, and it must also include other related but important parts of the personal dynamic, including affect, stimulation threshold, sensitivity, etc. The interplay of these traits are subject to variation in expression, accounting for individual difference and difference in individual "growth."

CHAPTER 11: FUTURE DIRECTIONS

In order to justify the new model of introversion and autism and subsequent empirical exploration thereof, I propose a correlational psychometric study to assess the presence, degree, and nature of the relationship of measures of introversion and autism in individuals diagnosed with high-functioning autism or Asperger's syndrome, introversion, and extraversion. Three groups of participants should be matched for age, gender, and cultural backgrounds. These groups will be self-reported extraverts, introverts, and clinically-diagnosed high-functioning autism spectrum disorder. For the purpose of simplicity and to avoid the confounding problem of administering too many measures to an easily overwhelmed population, schizophrenia spectrum disorders and measures designed for the assessment thereof should not be included in this preliminary study. Further support for the generalizability for these results including the correlation of autism and schizophrenia measures for individuals with mild symptoms of both disorders should form the hypothetical framework of follow-up studies.

Each participant will be individually administered each measure in a single sitting and in a quiet and isolated environment. It is estimated that a complete administration of the three instruments will take 30- 60 minutes. Subjects will be asked questions from the Autism-Spectrum Quotient, Introversion Scale, and Highly Sensitive person Scale, and investigators will assist in indicating the score on a response sheet.

The autism measure, the Autism Spectrum Quotient (ASQ) (Baron-Cohen et al., 2001) is a self-administered questionnaire designed to assess the presence of traits characteristic of autism spectrum disorder in adults of normal intelligence. The ASQ is made up of five subscales that

explore areas of social skill, attention-switching, attention to detail, communication, and imagination. A copy of the ASQ is provided in the Appendix.

Laney's (2002) Introversion Scale is a questionnaire designed to assess traits characteristic of introversion in adults. These include items that assess hypersensitivity, the tendency to become over-stimulated and consequent withdrawal, narrow interests, a preference of depth over breadth in pursuits, and social emotional qualities. A copy of the Introversion Scale is provided in the Appendix.

The Highly Sensitive Person Scale (Aron & Aron, 1997) is a measure of high sensory processing sensitivity. Items target hypersensitivity, aesthetic orientation, the tendency to become frazzled and overwhelmed and subsequent withdrawal and self-isolation, a preference for solitude, and attention to detail. It has been found to correlate with introversion measures (Grimes, 2005), and it is conceptually linked to introversion (Laney, 2002). However, the nature of these items also suggests significant overlap with the Autism Spectrum Quotient.

Established scales of introverted factors are selected to represent the conceptual realm of the domain factors for introversion, explored by Grimes (2005), based upon high loadings in each of the four factors/subtypes: social, thinking, anxious, and inhibited introversion. To keep the measures concise and to avoid overwhelming the subject, specific items are taken that are conceptually most pertinent to the factors as defined in the establishing study (Grimes, 2005). These items will be correlated by domain with Laney's (2002) Introversion Scale, Aron and Aron's (1997) measure of high sensory processing sensitivity, and the Autism-Spectrum Quotient (Baron-Cohen et al., 2001). Each domain will be compared to scores from the ASQ and Introversion, as it is expected that some domains will show a stronger correlation with both

of these measures than will others: specifically, social, anxious, and inhibited introversion have been found to correlate more strongly with the Introversion scale than did the "thinking" domain factor (Grimes, 2005). However, as previously stated, the nature of thought may vary, thereby causing some measures to be more sensitive to the type of "thinking introversion" that is exhibited.

The first domain of introversion focuses on the social tendency to prefer "depth" to "breadth" in social relationships. Laney (2002) characterizes an introvert as one who prefers solitary activities, requires "alone time," and enjoys a limited amount of social interaction with a few close companions. Larger social settings and broad networks of interpersonal interaction can be found to be overwhelming, and they are specifically avoided. The "social introversion" domain factor is best represented by Burger's (1995) Preference for Solitude Scale and the Positive Stimulation subscale of Hill's (1987) Interpersonal Orientation Scale. Burger focuses on how time spent in isolation affects individuals and the valence of these consequences. Individuals vary in enjoyment of time spent alone, demonstrating that some prefer solitude. Hill's (1987) scale takes a somewhat different approach. "Positive stimulation" is a specific type of affiliation motivation, based upon Murray's (1938, as cited in Hill, 1987) model, and it arises from one's feeling of gratification from close relationships. The affective and cognitive stimulation that results from affection, love, belongingness, and intimacy drive people to seek interpersonal relationships. However, the drive for positive social stimulation is conjectured to be reduced in populations that have a low affiliative need. The preference for solitude and need for positive stimulation are expected to correlate negatively, but the target population is conjectured to have higher preference for solitude scores and lower affiliative need scores.

The following items have been selected to represent the social introversion domain factor:

Burger (1995) Preference for Solitude Scale

1) I enjoy being around people

I enjoy being by myself

4) After spending a few hours surrounded by a lot of people, I usually find myself stimulated and energetic

After spending a few hours surrounded by a lot of people, I am usually eager to get away by myself

6) I often have a strong desire to get away by myself

I rarely have a strong desire to get away by myself

9) If I were to take a several-hour plane trip, I would like to sit next to someone who was pleasant to talk with

If I were to take a several-hour plane trip, I would like to spend the time quietly

11) I have a strong need to be around other people

I do not have a strong need to be around other people

Positive Stimulation subscale of the Interpersonal Orientation Scale (Hill, 1987):

1) One of my greatest sources of comfort when things get rough is being with other people

14) I find that I often have the desire to be around other people who are experiencing the same thing I am when I am unsure of what is going on

20) I think it would be satisfying if I could have very close friendships with quite a few people

21) I often have a strong desire to get people I am around to notice me and appreciate what I am like

23) I usually have the greatest need to have other people around me when I feel upset about something

25) I would find it very satisfying to be able to form new friendships with whomever I liked

The second domain of interest is "thinking introversion," or a pattern of thought that reflects a cognitive component of turning energy inward, resulting in introspection. The Big Five Inventory's "Openness" subscale measures one's broad thinking and desire for novel experience . While introversion does focus energy inward for thought, it is defined by a tendency toward deep focus in few areas of interest. The translation of this concept to the realm

of thought should produce low openness scores correlating to introversion. As autism is commonly associated with an aversion to novelty, it is expected that ASQ scores will likewise correlate negatively with items from this scale.

Davis's (1983) conceptualization of empathy includes a "fantasy" component that reflects simulation applied to theory of mind. This trait would cause one to be able to readily use fantasy to enhance empathic comprehension of the experiences of another. The tendency to create scenarios and ideas result in emotional reactions, physical arousal, and consequent altruistic behavior. Laney's introversion scale has only shown a moderate correlation with this scale ($r=0.28$, $p<.01$; Grimes, 2005). However, its importance to the theoretical conceptualization of introversion necessitates the inclusion of key items in the present research, and similar correlations are expected for both the ASQ and Introversion Scale with Fantasy items.

The final "thinking introversion" scale items to be used are from the Private Self-Consciousness subscale of the Self-consciousness Scale (Fenigstein, Scheier, & Buss, 1975). The subscale is intended to measure direction of attention inward to the self and one's inner thoughts and feelings. While thinking about others as measured by the Fantasy scale allows for a creation of inner thought and placement of the self in an imagined situation, self-consciousness refers to a type of reflective thought that centers on the self and one's own experiences, not upon one's experiences of another's situation. Therefore, both scales are referenced for "thinking introversion" items.

The following items have been selected to represent the thinking introversion domain factor:

Openness Scale of the Big Five Inventory (John, Donahue, & Kentle, 1991)
5) Is original, comes up with new ideas
10) Is curious about many different things
15) Is ingenious, a deep thinker
20) Has an active imagination
35) Prefers work that is routine
40) Likes to reflect, play with ideas

Fantasy Scale of the Interpersonal Reactivity Index (Davis, 1983):
1) I daydream and fantasize, with some regularity, about things that might happen to me
11) I sometimes try to understand my friends better by imagining how things look from their perspective
26) When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me

Fenigstein, Scheier, & Buss, (1975) Private Self-Consciousness Subscale of the Self-consciousness Scale
16) I know the way my mind works when I work through a problem
35) I enjoy analyzing my own thoughts and ideas about myself

The "anxious" domain of introversion includes negative thought items. This may include depression items, as well, as more extensive study has found strong negative correlations among anxiety measures such as the Shyness Scale (Cheek & Melchoir, 1990) and the Positive Emotions and Assertiveness subscales of the NEO-PI (Grimes, 2005). For the purposes of the present study, this domain is represented with its strongest conceptual correlates: the Shyness Scale (Cheek & Melchoir, 1990), the Rumination Subscale of the Reflection-Rumination Questionnaire (Trapnell & Campbell, 1999), and the Hypersensitive Narcissism Scale (Hendin & Cheek, 1997).

Shyness is commonly mistaken for introversion, though it was conceptually separated from low sociability and introversion by Cheek and Melchoir (1990). The scale measures social anxiety, including self-critical and ruminative thought pertaining to social situations, feelings

about social situations and others' perceptions of the self, and resultant preferences top avoid anxiety-provoking situations.

Trapnell and Campbell (1999) argue that reflection can also be associated with psychological distress if the self-attention is not an intellectual consideration, but instead these self-thoughts are neurotic and anxiety-ridden. Rumination refers to these negative self-thoughts, which can be continued, obsessive, and self-critical.

Hypersensitive narcissism measures covert narcissism, which Hendin and Cheek (1997) define as "vulnerability" and "oversensitivity." Thoughts are self-directed, but may be indicative of negative social motivation and interaction.

Collectively, these measures present a possible basis for difficulty in establishment of social relationships, and they may provide insight as to commonalities of underlying social factors in autism and introversion.

The following items represent the anxious introversion domain factor:

Cheek & Melchoir (1990) Shyness Scale items:
1) I feel tense when I'm with people I don't know well
3) I am socially somewhat awkward
5) I am often uncomfortable at parties and other social gatherings
14) I often have doubts about whether other people like to be with me
20) I feel inhibited in social situations

Trapnell & Campbell (1999)
Rumination Questionnaire
6) I seem to "ruminate" or dwell over things that happen to me for a very long time afterward

Hendin & Cheek (1997) Hypersensitive Narcissism Scale
2) My feelings are easily hurt by ridicule or the slighting remarks of others
5) I dislike being with a group unless I know that I am appreciated by at least one of those present
8) I easily become wrapped up in my own interests and forget the existence of others
18) I try to avoid rejection at all costs

Hans Eysenck included two components in his description of extraversion: impulsivity and sociability (Eaves & Eysenck, 1975). The “impulsivity” factor includes both impulsivity or excitement-seeking and a high activity level. The extraverted impulsivity explored by the Buss & Plomin (1975) EASI subscales of activity and impulsivity should show a negative correlation with autism and introversion, thereby demonstrating inhibited introversion.

The NEO-PI Excitement-seeking and Activity facets also address these extraverted components, based in part on Buss and Plomin’s work, and reliant upon the same underlying theory. Sample items from these scales demonstrate the lower levels of activity, excitement-seeking, and impulsivity indicative of the construct of inhibited introversion as conceptually defined (Laney, 2002).

The following items will be used to represent the inhibited introversion domain:

Buss & Plomin (1975)
EASI Temperament Survey (Emotionality, Activity, Sociability, Impulsivity)
1) For relaxation I like to slow down and take things easy (Reverse-scored)
3) I like to keep busy all the time

Costa & McCrae (1992) NEO-PI Excitement-seeking subscale of the Extraversion scale:
5) I often crave excitement
17) I sometimes have done things just for "kicks" or "thrills"
29) I like to be where the action is
35) I love the excitement of roller coasters
41) I'm attracted to bright lights and flashy styles

Costa & McCrae (1992) NEO-PI Activity subscale of the Extraversion scale
22) I often feel as if I'm bursting with energy
28) I'm not as quick and lively as other people
46) I am a very active person

The primary statistical analysis will consist of total group means and standard deviations for each measure, and correlational analyses of the group responses on all three measures, and

analysis of variance to compare the results of each group to other groups. In addition, an exploratory factor analysis will be performed on the Introversion Scale and Highly Sensitive Person Scale measures to explore multidimensionality of the scales when administered to a population of participants diagnosed with autism spectrum disorder versus introversion. Grimes (2005) found two distinct factors in the introversion measure, while Cheek and colleagues (2009) found two independent factors in the high sensory processing sensitivity scale. Application of the measures may demonstrate particular facets that correlate with greater strength with the Autism Spectrum Quotient and its subscales, or administration to a clinical population could unify the scales as the previous studies on non-clinical participants did not. A "unitary" construct of introversion (as refuted in Carrigan, 1960) may solidify as projected by Laney (2002) with the autistic sample more than has been found in previous research conducted in non-clinical populations (e.g., Grimes, 2005).

The autism, introversion, and high sensory-processing sensitivity measures are expected to show a strong positive correlation, especially in the autistic group. However, the factorial structure of introversion may cause some differentiation in weightings of the characteristics that may diminish the correlation in the non-clinical populations, especially in the extraverted group. Therefore, some introverts may have a higher activity level, for example, while some extraverts may describe themselves as shy (Zimbardo, 1977). The traits that make up "introversion" are expected to demonstrate a stronger correlation to each other and to autism with greater strength of expression: for example, more social withdrawal, more inward thought orientation, and less comfort with novelty should reinforce the other features, while less social withdrawal may still correlate with less thinking introversion, though the neuroticism traits need not disappear.

The reason for the dissolution of the trait set as introversion diminishes along the continuum is that interaction creates the phenomenon. Factors are expected to fall apart as introversion continues to extraversion because the interdependent trait set disappears. Extraversion is defined as the absence of introversion, as it is the outward projection of energetic focus as opposed to the introverted or inward-projected focus of energy. Therefore, the personality that emerges is not necessarily the inverse as trait interaction and environmental-trait interaction combine to produce a qualitatively distinct result with different temperaments. Additionally, the absence of the introverted trait set would cause other factors that normally function but are not dominant over the pattern that characterizes introversion to be allowed expression. The pattern we call "extraversion" may not be the opposite trait constellation of introversion, but simply that which occurs in the absence of it. Other motivating factors can cause overt behavior that resembles some facet of introversion, thereby producing the "shy extravert" (Zimbardo, 1977), for example, and other similar phenomena. However, the combination of effects of the tendency to project attention (and therefore, energy) coupled with the relative dominance of other traits, trait-trait interaction, and trait-environment interaction are most likely to cause the idiosyncratic pattern of introversion or extraversion.

Extraversion is the opposite of introversion from the primary perspective of initial energetic channeling, but real world interactions and other confounding variables create a completely different set of tendencies that do not interrelate in the same way. Even one change of a secondary characteristic is likely to cause notable variation in observable behavior due to the way it interacts with all other parts of personality. As such, the nature of this interaction

underscores the importance of the *synthesis* and unitary functionality of a personality, not a component-by-component model that could be realistic in its dynamic.

Pending successful completion of this exploratory study through the finding of empirical support of the placement of introversion and autism on the same continuum, further examination of this relationship should follow. We may compare neuroanatomical structures in autism and introversion, as through the volumetric analysis of MRI used by Hardan and colleagues (2009). Further studies could study fMRI images as introverted and autistic individuals complete tasks, and eye-tracking could be used to compare eye-gaze and saccadic scanning similarities and differences in introverted and autistic groups. We may find differences in sensory threshold, primary sensitivity, and aesthetic orientation in both groups, and we may even learn more about the creative process and how creative thinking functions. Unlimited opportunities are possible for research to improve understanding of both clinical conditions and the related basic temperaments using a revised model as a foundation, and a centuries-old enigma may finally begin to work toward a more fruitful resolution simply through the use of a new approach.

APPENDIX: QUESTIONNAIRES

Highly Sensitive Person Scale (Aron & Aron, 1997)

INSTRUCTIONS: Please read each item carefully and decide to what extent it is characteristic of your feelings and behavior. Fill in the blank next to each item by choosing a number from the scale printed below.

1= no, strongly disagree
2= slightly disagree
3= neutral
4= slightly agree
5= yes, strongly agree

____ 1. Are you easily overwhelmed by strong sensory input?

____ 2. Do you seem to be aware of subtleties in your environment?

____ 3. Do other people's moods affect you?

____ 4. Do you tend to be more sensitive to pain?

____ 5. Do you find yourself needing to withdraw during busy days into bed or into a darkened room or any place where you can have some privacy and relief from stimulation?

____ 6. Are you particularly sensitive to the effects of caffeine?

____ 7. Are you easily overwhelmed by things like bright lights, strong smells, coarse fabrics, or sirens close by?

____ 8. Do you have a rich, complex inner life?

____ 9. Are you made uncomfortable by loud noises?

____ 10. Are you deeply moved by the arts or music?

____ 11. Does your nervous system sometimes feel so frazzled that you just have to get off by yourself?

____ 12. Are you conscientious?

____ 13. Do you startle easily?

____ 14. Do you get rattled when you have a lot to do in a short amount of time?

Highly Sensitive Person Scale (Aron & Aron, 1997)

INSTRUCTIONS: Please read each item carefully and decide to what extent it is characteristic of your feelings and behavior. Fill in the blank next to each item by choosing a number from the scale printed below.

1= no, strongly disagree
2= slightly disagree
3= neutral
4= slightly agree
5= yes, strongly agree

____ 15. When people are uncomfortable in a physical environment do you tend to know what needs to be done to make it more comfortable (like changing the lighting or the seating?)

____ 16. Are you annoyed when people try to get you to do too many things at once?

____ 17. Do you try hard to avoid making mistakes or forgetting things?

____ 18. Do you make a point to avoid violent movies and TV shows?

____ 19. Do you become unpleasantly aroused when a lot is going on around you?

____ 20. Does being very hungry create a strong reaction in you, disrupting your concentration or mood?

____ 21. Do changes in your life shake you up?

____ 22. Do you notice and enjoy delicate or fine scents, tastes, sounds, works of art?

____ 23. Do you find it unpleasant to have a lot going on at once?

____ 24. Do you make it a high priority to arrange your life to avoid upsetting or overwhelming situations?

____ 25. Are you bothered by intense stimuli, like loud noises or chaotic scenes?

____ 26. When you must complete or be observed while performing a task, do you become so nervous or shaky that you do much worse than you would otherwise?

____ 27. When you were a child, did parents or teachers seem to see you as sensitive or shy?

Laney's (2002) Introversion Scale

INSTRUCTIONS: Consider each of the following statements in terms of what is generally true or false for you, not how you wish you were or how you are some of the time. Don't analyze or think too deeply about each statement. Your first impression is usually the best. Answer the questions T or F.

T = True or mostly true of me
F = False or mostly false of me

_____ 1. When I need to rest, I prefer to spend time alone or with one or two close people rather than with a group.

_____ 2. When I work on projects, I like to have larger uninterrupted time periods rather than smaller chunks.

_____ 3. I sometimes rehearse things before speaking, occasionally writing notes for myself.

_____ 4. In general, I like to listen more than I like to talk.

_____ 5. People sometimes think I'm quiet, mysterious, aloof, or calm.

_____ 6. I like to share special occasions with just one person or a few close friends, rather than have big celebrations.

_____ 7. I usually need to think before I respond or speak.

_____ 8. I tend to notice details many people don't see.

_____ 9. If two people have just had a fight, I feel tension in the air.

_____ 10. If I say I will do something, I almost always do it.

_____ 11. I feel anxious if I have a deadline or pressure to finish a project.

_____ 12. I can "zone out" if too much is going on.

_____ 13. I like to watch an activity for a while before I decide to join it.

_____ 14. I form lasting relationships.

_____ 15. I don't like to interrupt others; I don't like to be interrupted.

_____ 16. When I take in lots of information, it takes me awhile to sort it out.

_____ 17. I don't like overstimulating environments. I can't imagine why folks want to go to horror movies or go on roller coasters.

Laney's (2002) Introversion Scale

T = True or mostly true of me
F = False or mostly false of me

_____ 18. I sometimes have strong reactions to smells, tastes, foods, weather, noises, etc.

_____ 19. I am creative and/or imaginative.

_____ 20. I feel drained after social situations, even when I enjoy myself.

_____ 21. I prefer to be introduced rather than to introduce others.

_____ 22. I can become grouchy if I'm around people or activities too long.

_____ 23. I often feel uncomfortable in new surroundings.

_____ 24. I like people to come to my home, but I don't like them to stay too long.

_____ 25. I often dread returning phone calls.

_____ 26. I find my mind sometimes goes blank when I meet people or when I am asked to speak unexpectedly.

_____ 27. I talk slowly or have gaps in my words, especially if I am tired or if I am trying to speak and think at once.

_____ 28. I don't think of casual acquaintances as friends.

_____ 29. I feel as if I can't show other people my work or ideas until they are fully formulated.

_____ 30. Other people may surprise me by thinking I am smarter than *I* think I am.

Autism-Spectrum Quotient (Baron-Cohen et al., 2001)

INSTRUCTIONS: Please read each item carefully and decide to what extent it is characteristic of your feelings and behavior. Circle the most appropriate response.

1	I prefer to do things with others rather than on my own	definitely agree	slightly agree	slightly disagree	definitely disagree
2	I prefer to do things the same way over and over again	definitely agree	slightly agree	slightly disagree	definitely disagree
3	If I try to imagine something, I find it very easy to create a picture in my mind	definitely agree	slightly agree	slightly disagree	definitely disagree
4	I frequently get so strongly absorbed in one thing that I lose sight of other things	definitely agree	slightly agree	slightly disagree	definitely disagree
5	I often notice small sounds when others do not	definitely agree	slightly agree	slightly disagree	definitely disagree
6	I usually notice car number plates or similar strings of information	definitely agree	slightly agree	slightly disagree	definitely disagree
7	Other people frequently tell me that what I've said is impolite, even though I think it is polite	definitely agree	slightly agree	slightly disagree	definitely disagree
8	When I'm reading a story, I can easily imagine what the characters might look like.	definitely agree	slightly agree	slightly disagree	definitely disagree
9	I'm fascinated by dates	definitely agree	slightly agree	slightly disagree	definitely disagree
10	In a social group, I can easily keep track of several different people's conversations	definitely agree	slightly agree	slightly disagree	definitely disagree
11	I find social situations easy	definitely agree	slightly agree	slightly disagree	definitely disagree
12	I tend to notice details that others do not	definitely agree	slightly agree	slightly disagree	definitely disagree
13	I would rather go to a library than a party	definitely agree	slightly agree	slightly disagree	definitely disagree
14	I find making up stories easy	definitely agree	slightly agree	slightly disagree	definitely disagree
15	I find myself drawn more strongly to people than to things	definitely agree	slightly agree	slightly disagree	definitely disagree
16	I tend to have very strong interests, which I get upset about if I can't pursue	definitely agree	slightly agree	slightly disagree	definitely disagree
17	I enjoy social chit-chat	definitely agree	slightly agree	slightly disagree	definitely disagree
18	When I talk, it isn't always easy for	definitely	slightly	slightly	definitely

	others to get a word in edgewise	agree	agree	disagree	disagree
19	I am fascinated by numbers	definitely agree	slightly agree	slightly disagree	definitely disagree
20	When I'm reading a story, I find it difficult to work out the characters' intentions	definitely agree	slightly agree	slightly disagree	definitely disagree
21	I don't particularly enjoy reading fiction	definitely agree	slightly agree	slightly disagree	definitely disagree
22	I find it hard to make new friends	definitely agree	slightly agree	slightly disagree	definitely disagree
23	I notice patterns in things all the time	definitely agree	slightly agree	slightly disagree	definitely disagree
24	I would rather go to the theatre than a museum	definitely agree	slightly agree	slightly disagree	definitely disagree
25	It does not upset me if my daily routine is disturbed	definitely agree	slightly agree	slightly disagree	definitely disagree
26	I frequently find that I don't know how to keep a conversation going	definitely agree	slightly agree	slightly disagree	definitely disagree
27	I find it easy to "read between the lines" when someone is talking to me	definitely agree	slightly agree	slightly disagree	definitely disagree
28	I usually concentrate more on the whole picture, rather than the small details	definitely agree	slightly agree	slightly disagree	definitely disagree
29	I am not very good at remembering phone numbers	definitely agree	slightly agree	slightly disagree	definitely disagree
30	I don't usually notice small changes in a situation, or a person's appearance	definitely agree	slightly agree	slightly disagree	definitely disagree
31	I know how to tell if someone listening to me is getting bored	definitely agree	slightly agree	slightly disagree	definitely disagree
32	I find it easy to do more than one thing at once	definitely agree	slightly agree	slightly disagree	definitely disagree
33	When I talk on the phone, I'm not sure when it's my turn to speak	definitely agree	slightly agree	slightly disagree	definitely disagree
34	I enjoy doing things spontaneously	definitely agree	slightly agree	slightly disagree	definitely disagree
35	I am often the last to understand the point of a joke	definitely agree	slightly agree	slightly disagree	definitely disagree
36	I find it easy to work out what someone is thinking or feeling just by looking at their face	definitely agree	slightly agree	slightly disagree	definitely disagree
37	If there is an interruption, I can switch back to what I was doing very quickly	definitely agree	slightly agree	slightly disagree	definitely disagree
38	I am good at social chit-chat	definitely agree	slightly agree	slightly disagree	definitely disagree
39	People often tell me that I keep going	definitely	slightly	slightly	definitely

	on and on about the same thing	agree	agree	disagree	disagree
40	When I was young, I used to enjoy playing games involving pretending with other children	definitely agree	slightly agree	slightly disagree	definitely disagree
41	I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.)	definitely agree	slightly agree	slightly disagree	definitely disagree
42	I find it difficult to imagine what it would be like to be someone else	definitely agree	slightly agree	slightly disagree	definitely disagree
43	I like to plan any activities I participate in carefully	definitely agree	slightly agree	slightly disagree	definitely disagree
44	I enjoy social occasions	definitely agree	slightly agree	slightly disagree	definitely disagree
45	I find it difficult to work out people's intentions	definitely agree	slightly agree	slightly disagree	definitely disagree
46	New situations make me anxious	definitely agree	slightly agree	slightly disagree	definitely disagree
47	I enjoy meeting new people	definitely agree	slightly agree	slightly disagree	definitely disagree
48	I am a good diplomat	definitely agree	slightly agree	slightly disagree	definitely disagree
49	I am not very good at remembering people's date of birth	definitely agree	slightly agree	slightly disagree	definitely disagree
50	I find it very easy to play games with children that involve pretending	definitely agree	slightly agree	slightly disagree	definitely disagree

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