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Pragmatic Language Characteristics of Individuals with Asperger Syndrome: Systematic Literature Review and Meta-analysis

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Abstract

The purpose of this Systematic Literature Review and Meta-analysis ((SLR & Meta-analysis) was to examine the differences between Asperger syndrome (AS) individuals and typically developing and achieving individuals (TD) regarding language competence and how are these differences related to AS individuals' age and the significance such differences add to our knowledge of understanding their language performance as issues that are still underdiagnosed and ill-treated entities.

The study followed SLR & Meta-analysis protocol and was armed with data of 456 AS subjects and controls (231 and 225, respectively) abstracted from 14 studies that have been collected from different electronic bibliographic databases including web of science, Scopus, EMBASE, Cochrane library, PubMed, PsycInfo and google scholar along with unpublished literature. Outlined results show deterioration in language competence of AS subjects in comparison to TD controls. Such deterioration impairs conversational implicature more than it does to conventional maxims of AS individuals' pragmatic language and has no relationship with their age. Results also show that difference in intelligence feature of the mental reality in the language competence becomes smaller with increasing age, and that difference in representational content feature becomes larger. These findings help experts in the field not only predict pragmatic language impairments in AS individuals but also enable AS individuals themselves to decode and/or interpret speech inputs; therefore, perceive the world around them and interact with its community members. Outcomes should be considered to lay out a path for further exploration of genetics, etiology, and response to treatment of all these premises that is currently unsearched in AS individuals.

Keywords: Pragmatic Language Characteristics, Language Competence, Mental Faculty, Mental Reality, Features, Language Performance, Pragmatics, Conventional Maxims, Conversational Implicature, Asperger Syndrome, Systematic Literature Review, Meta-analysis

Introduction

During the past century, grown body of research on Asperger syndrome (AS) has emerged (Eisenmajer, et al., 1996), suggesting that understanding pragmatic language characteristics of individuals with AS may lead to understand how, when and why these characteristics are impaired. Psychoneurolinguists believe that understanding what AS individuals "know" may help explain what they "do" and how they "behave" and more importantly why, which enable them solve these individuals' problems of behavioral responses (Bankier, et al., 1999; Ehlers, et al., 1999), reactions (Shtayermman, 2011 a), behavioral manifestations (Ghanizadeh, 2011) and audiovisual speech perception and eye gaze behavior (Saalasti, et al., 2011) along with social interactions and communicative disturbances (Ellis, et al., 1994).

Pragmatic-based communication skills and issues lie beneath speech act along with encoding problems all were highly considered over the course of years in the AS development (Rodman, 2003; Stanford, 2003). On most measures of language functions; however, a pragmatically-based distinction ought to be made between AS individuals and other typically developing and achieving (TD) individuals in terms of speech act relations and utterances' expressions and interpretations (Gillberg, et al., 2001),

While Al Yaari, et al., (2017) addresses a bilingual case with AS as a way to understand the relationship between pragmatic language, AS and bilingualism, Klin (2006) believes that the problem of these individuals is in the way they speak that is in a way or another abnormal. Precisely, abnormalities in AS individuals' speech, according to McPartland & Klin (2006), include: Verbosity, abrupt transitions, literal interpretations and miscomprehension of nuance, humor (Emerich, et al., 2003), irony and teasing (Kasari & Rotheram- Fuller, 2005), pausing and disfluencies and inability to make inference (de Villiers, et al., 2014) and comprehending indirect requests (Miller & Ozonoff, 2000).

Language characteristics' impairments encompass a wide range of difficulties affecting language as well as verbal and nonverbal pragmatic skills (Lust, 2006; Norbury, et al., 2008). Over the past few decades, however, evaluating the relationship between implicit meaning in contextual speech and AS has become necessary due to the fact that impairments/deficits' rate of pragmatic language characteristics in individuals with AS has consistently increased (Sandra, et al., 2012; Allison, et al., 2016).

Theoretical frameworks of pragmatic comprehension studies vary widely where researchers attempted to explain how the hearer interprets speaker's meaning on the basis of contextual factors agreed upon social community (Sperber & Wilson 1995). It is already known that individuals with anomalous language comprehension and language-based learning disabilities present significant difficulties in language interpretation. These problems are, strictly speaking, due to their tendency to understand language literally (Rapin & Dunn 2003) in addition to their deficiencies in pragmatic skills and comprehension abilities and many other pragmatic language abnormalities (Bishop, 1989). Since pragmatic impairments are connected to the features of mental faculty (perception, will, reason, initiation, imagination and memory) and those of mental reality (intelligence, representational content, intentionally broad understanding and conscious experience) of the language competence, AS individuals' mental capacity is always prone to fail in many tasks. Strictly, language competence features and pragmatic language characteristics are important to run a conversation because both interlocutors need them. Abstract meanings; for instance, are connected to phonemic fluency and message decoding (Spek, et al., 2009) and this is what shapes pragmatic comprehension in social communication. To that end, Tesink (2009) have rightly observed:

"*Language comprehension in (verbal) social communication calls upon pragmatic language skills, since the listener is often required to work out the non-literal meaning of the speaker's message by using the context and his own knowledge of the world."* (Tesink, 2009: p.1942).

This is not surprising, if we take into consideration that much of what AS individuals need to understand in order to communicate their ideas is not directly stated, said, written, or depicted. A probable reason might be that they are not able to succeed in understanding it; therefore, they fail to construct meaning via processes of inference from social scripts, metaphors and speech acts (Dennis, et al., 2001). In fact, impairment of novel metaphor comprehension has been observed in 10–41-year-old AS individuals (Gunter, et al., 2002) and this can help understand the characteristics of AS individuals' pragmatic language (Hermann, et al., 2013) in various social and workplace scenarios (Murza & Nye, 2013).

Moreover, researchers urge to pay more attention to the pragmatic language characteristics as it helps, Gilliam (2001) and Duggal (2001) emphasize, determine who is disposed to exhibit the conditions of AS and who is not and help see who may show later unique behavioral characteristics to be documented for tracking behavioral progress. More importantly, monitoring AS individuals behavior helps understand their pragmatic language impairments (Furusho, et al., 2001; Myles & Hagiwara, 2001; Oktem, et al., 2001).

Pragmatics is the domain of language concerned with how speakers use language appropriately in decided to social knowledge conventions and rules- governing to have a successful communication and/ or socio-cognitive understanding i.e. attempts to understand the relationship between what speakers say and what they mean or intend to communicate (Ariel, 2010; Austin, 1962; Leech, 1983; Levinson, 1983; Mey, 1993). Problems related to the appropriate use and interpretations of language in different contexts are reported in AS individuals (Tager-Flusberg, 2006).

The situation becomes worse when addressing this in AS individuals who are pragmatically impaired (Tager-Flusberg, 1999) which makes the characteristics of their pragmatic language of worth-investigation.

Inferencing is an important characteristic in pragmatic language and one of its key components, as meaning is constructed by making connections between information and atmospheric context (Singer, 1993; Thorndike, 1976; van den Broek, et al., 1995). AS individuals, however, lack the ability to connect the two, which makes them liable not to understand the speaker's intention or realize the point behind his utterance. Research on language in AS has mainly focused on pragmatic language since most of AS individuals have pragmatic impairments that are directly related to language interaction be it on the level of production or comprehension (Adams, et al. 2002).

More specifically, these pragmatic deficit include: Impairments of comprehension, misinterpretations of literal/implied meanings and understanding of figurative language (Attwood, 2007) and less knowledge about the social rules of appropriate communication (Gibbs, 1999; Marriage, et al. 1995) along with impairments in humor (Ozonoff & Miller, 1996) and irony/ sarcasm (Happe, 1993, 1995; Martin & McDonald, 2004) and one-sided interaction way (Burgoine & Wing, 1983).

To repeat, involvement of pragmatic language characteristics in AS is always seen in aspects that are susceptible to to pragmatic incomprehension by AS individuals who tend to violate them notably those that play a part in finding the literal content of the speech act made and the literature is full of examples (Bach, 1994 a, b, 2001; Carston, 1988, 2002; Perry, 1986; Récanati, 2001, 2002,
2004; Searle, 1978, 1980; Sperber & Wilson, 1986; Travis, 1985, 1991.). This problem of not understanding is not only restricted to pragmatic aspects' violation; rather, it extends to include faux pas also (Leofanski, n.d). A working definition of faux pas might be when a speaker says something without considering if it is something that the listener might not want to hear or know, and which typically has negative consequences that the speaker never intended (Garcia-Molina & Clemente-Estevan, 2019; Golding, 2005; Thie´baut, et al., 2016).

Severely, AS individuals are smacked of deficits in cognitive capacities concerning the appropriate use of pragmatic language and have immense trouble understanding indirect speech acts, and conversational implicature. Even when indirect speech was tested to see if it affects the ability of AS individuals to understand texts, these individuals reported significantly more errors in indirect sentences comprehension than TD individuals (Haji, et al., n.d). It is true that pragmatic language characteristics of nonliteral language comprehension do not seem to pose particular difficulties for TD individuals, but it is a part of AS individuals' daily speech (Gentner & Bowdle, 2001) along with novel problem-solving (Channon, et al., 2002).

Current research examines AS attributes by drawing on a half-century of literature discussing studies' findings. The analysis reveals that impairments in the characteristics of pragmatic language overpass that of other features. The results of Thakur, et al. (n.d), for example, show that pragmatics is an alternative way of differentiating between groups of children with Autism Spectrum Disorders (ASDs) than the current criteria. Pragmatic language also found to be most deteriorated from among other pragmatic language parameters where AS individuals show poor performance in inferring speakers' implied meaning (Iveung, n.d).

The success to identify the majority of integrated findings from many existing studies as is seen in this systematic literature review (SLR) and meta- analysis is hoped to ensure valid and reliable conclusions. Understanding the differences in language competence between Asperger syndrome (AS) subjects and controls and in which categorical age of the individuals' life the features of language competence could be seen and identifying in particular the aspect (s) of the pragmatic language performance being impaired in this or that period of life might not only specify impaired pragmatic language aspects but also aid early prediction of these impairments.

Research Objectives and Hypotheses

The current systematic literature review (SLR) and meta-analysis study has three (3) major objectives that are formulated as follows:

To examine the differences that could be seen between AS subjects and controls regarding language competence.

To see how these differences between AS subjects and controls in language competence are related to age.

To investigate the significance these differences between AS subjects and controls in language competence add to our knowledge of understanding language performance of AS individuals.

Based on these objectives, the research hypotheses are stated as follows:

H1: Deterioration in language competence hinders AS individuals to interpret what is meant by speaker's utterance.

H2: Deterioration in language competence in AS individuals impairs conversational implicature more than it does to conventional maxims of their pragmatic language.

Methodology

Design of the Current Research

This systematic literature review (SLR) and meta-analysis was written and conducted in accordance with the preferred reporting items for systematic reviews and meta-analysis (PRISMA statement) checklist recommendations (Moher, et al., 2009, 2010) that have been used as guidelines. The study did not involve any patients. Ethical approval and patient consent was not applicable.

Information Sources and Methods Search Strategy

A broad comprehensive search of the literature was performed in an academic setting using different electronic bibliographic databases as sources for selecting research studies including world most common databases. These were: Web of science, Scopus, EMBASE, Cochrane library, PubMed, .PsycInfo and google scholar in addition to unpublished literature on the topic under investigation. A combination of free-text and MeSH-terms and index/key words has been performed in the present study to search these databases. In addition, reference lists of the identified articles were inspected for additional relevant studies.

Search results were imported into a single grouping using American Psychological Association, sixth edition (APA-6) and screened for duplicate entries. In addition, bibliographical searches of the articles included in the review were conducted using the "cited by" function in Web of Science. This extensive search was conducted to identify the available relevant papers with the combination of the following free text and psycholinguistic subject headings and key words where applicable: [Features of Language Competence OR Aspects of Language Performance].

Since search strategy was designed to combine the features of language competence and aspects relating to language performance as characteristics of language in general and pragmatic language in particular, targeted features of language competence included [mental faculty (Perception OR reason OR will OR memory OR imagination OR initiation)] AND [mental reality (Intelligence OR representational content OR intentionally broad understanding OR conscious experience)] whereas pragmatic parameters included: [Conversational implicature AND cooperative principle: Conventional maxims (Quantity OR quality OR relation, OR manner)] AND [AS OR Asperger syndrome OR Asperger's syndrome OR Asperger's OR Asperger's Disorder (AD) OR Asperger Syndrome Disorder (ASD)].

Eligibility Criteria and Study Selection Inclusion Criteria

To be included in the analyses, the selected articles had to fit the following predetermined seven criteria: They should (a) be written in English, published or under submission at the period between 01.01.1980 and 30. 05. 2019, (b) include subjects diagnosed with Asperger syndrome (AS) between four to fifty nine years old, (c) assess at least one feature using standard measures, (d) compare the two groups of interest (i.e., AS and typical developing and achieving (TD) controls), (e) provide sufficient information to allow for effect size calculations (e.g, mean [SD] for participants, (f) include age- and intelligence quotient (IQ)-matched of all participants, (g) report original empirical data based on direct, valid and reliable tests.

Exclusion Criteria

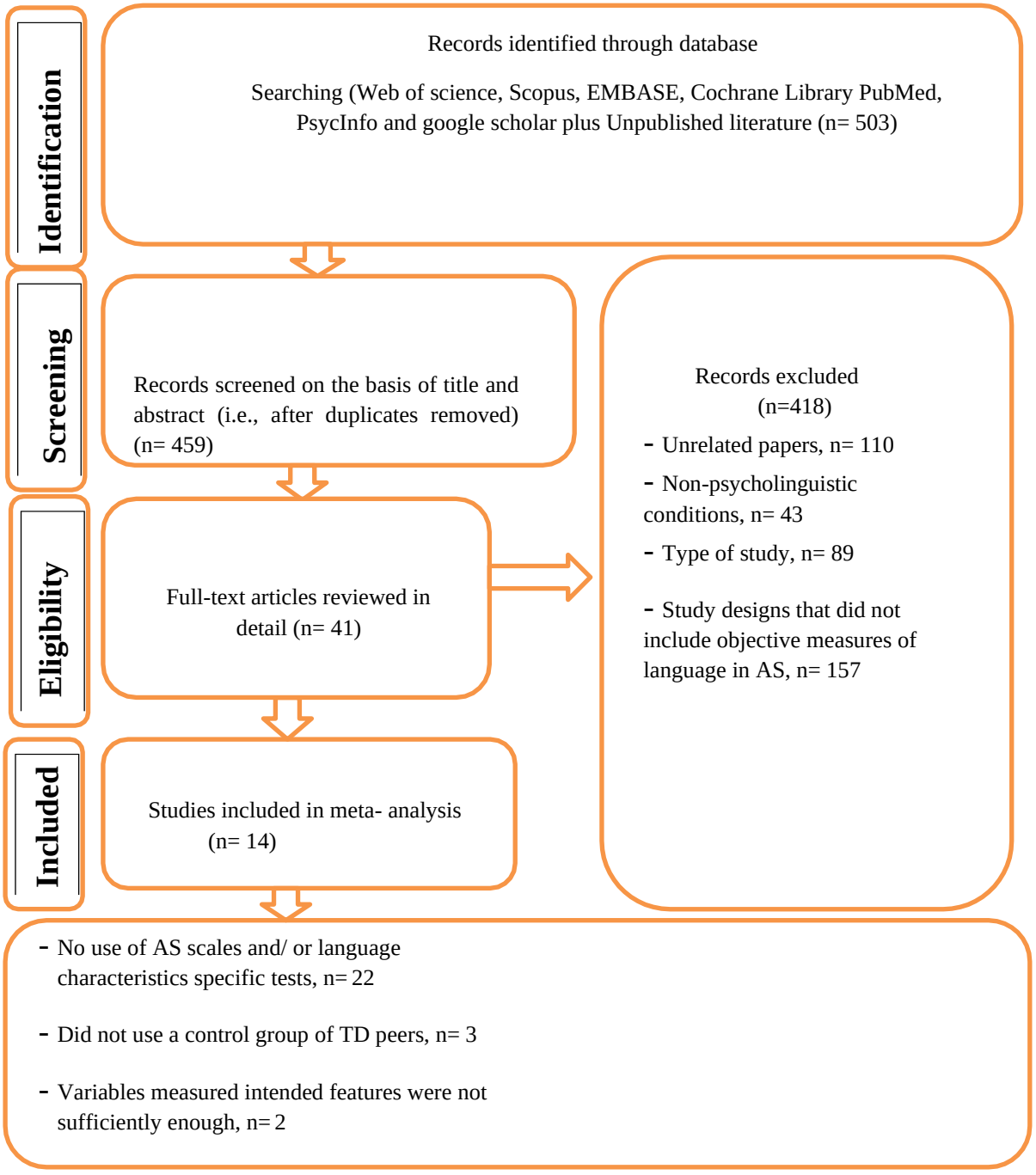
After initial screening of the abstracts, studies were excluded for eighteenth reasons: If participants were (1) younger than five and older than sixty years old or (2) initially seen with comorbidity of any medical or chronic neurologic condition characterized by recurrent spontaneous seizures altering cognition (e.g., epilepsy). Also, if the study (3) included a nonclinical population (e.g, with autistic-like traits), (4) indicated to Asperger syndrome (AS) as Higher-Functioning Autism (HFA), (5) were not analyzed using Analysis of Variance (ANOVA), (6) were published before 01.011980, (7) included no data on any of the specified cognitive domains (e.g., intelligence quotient (IQ), or (8) written in language other than English.

In addition, (9) cross-sectional, prospective cohort studies, single case studies, reports, comments, descriptive and case-control studies were all excluded along with those (10) recruited a group of AS individuals with no comparative typically developing and achieving (TD) controls, (11) had different assessment methods but were statistically incomparable, (12) were part of other studies already included in the present study without any new contribution, or (13) measured participants' capacity so to distinguish those who passed from those who did not.

Exclusion has extended to include studies (14) with one of the features of the language competence or the aspects of the language performance being absent, (15) did not have an author or were not journal articles, (16) were based on children and youth population samples only, (17) included population with intellectual disability based on IQ low levels, or (18) were masters theses and/ or doctoral dissertations.

Peer Review

Initially, after eliminating duplicates using the web-based software platform Covidence, potentially relevant publications selected by independent title and abstract screening were then assessed by two independent reviewers previously trained and calibrated for reviewing the list of articles separately, selecting eligible studies according to the criteria defined. If at least one of the exclusion criteria was fulfilled or one of the inclusion criteria was not met, the study was automatically excluded. This led to 100% agreement in study characteristics among the persons responsible for screening studies and consensus was reached before the final decision was made. Stages for peer reviewing included: Identification, screening, eligibility and included articles. Consider:



Full=text articles excluded, with reasons (n= 27)

PRISMA Flow Diagram: Study SchemeRisk of Bias

Individual studies were reviewed with reference to four types of bias (confounding, selection, information, and reporting) and an overall level of bias for each paper was determined from a combination of these subgroups (Higgins, et al., 2019). Each type of bias was classified as "low," "moderate", "serious" or "critical". Risk of bias analyses was also performed with regard to diagnostic validation of diagnostic and statistical manual of mental disorders, fourth edition (DSM-IV), international classification of diseases and related health problems, tenth edition (ICD-10) and the autism diagnostic interview-revised (ADI-R) vs. Autism Diagnostic Observational Schedule (ADOS) and self- reported diagnosis checklist.

Participants

Individuals with Asperger syndrome

As is mentioned earlier, the context or environment where the present systematic literature review (SLR) & Meta-analysis has been conducted was
456 participants, age ranges between four to fifty-nine years old of both genders. Of 456 participants that were recruited, 231 of them were diagnosed as Asperger syndrome (AS) subjects. Characteristics of AS individuals can be seen in Table 2, 1, below.

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Typically Developing and Achieving Controls

Typically developing and achieving (TD) comparison individuals were used as baseline measure comparators for performance by the AS groups. As has been clearly stated above, out of 456 participants recruited in the present study, 225 of them were TD controls of both genders. Characteristics of TD controls are clarified in Table 2.2 below.

Table 2.2 Characteristics of Typically Developing and Achieving Participants

TD N.	**TD. Age x** b	**TD. Age SD** c	**D. IQ x** d	**TD IQ.**	**TD PIQ.**	**D PIQ SD** g
15	5.166667	2.583333	6.9	1.8	N.A	N.A
28	22.9	1.5	N.A	N.A	N.A	N.A
16	23.1	3.07	106.8	12.6	N.A	N.A
8	16.88	8.1	115.75	8.63	N.A	N.A
17	30	9.12	106.47	10.94	105.24	14
17	30	9.12	106.35	10.89	105.24	14
13	15.6	3.1	110.2	12.3	106.9	12.9
20	15.58	39.4	126.4	10.6	113.1	14.7
20	13.82	0.67	N.A	N.A	10.76	2.41
10	15.9	3.6	98.4	10.9	N.A	N.A
16	11.5	NA	NA	NA	NA	NA
20	7.35	NA	NA	NA	NA	NA
15	9	NA	104.5	11.33	107.07	8.98
15	27.8	4.5	117.90	17.5	110.20	7.7
12	6.416667	2	7	2.5	7.4	2

Study	Craig &. Baron-Cohen (1999)	Giora, et al., (2012)	Gold, et al., (2010)	Gunter, et al. (2002)	Jolliffe & Baron-Cohen (2001)	Jolliffe & Baron-Cohen (1997)	Kaland, et al., (2011)	Kaland, et al., (2002)	Koning & Magil-Evans (2001)	Le-Sourn-Bissaoui, et al.(2009)	Myles, et al., (2003)	Paynter & Peterson (2009)	Planche & Lemonnier (2012)	Zalla, et al., (2008)	Ziatas, et al., (1998)

a. Number of typically developing and achieving (TD) participants.
b. Mean of age in typically developing and achieving (TD) participants.
c. Standard Deviation of Age for typically developing and achieving (TD) participants.
d. Mean of verbal intelligence quotient for typically developing and achieving (TD) participants.
e. Standard Deviation of verbal intelligence quotient for typically developing and achieving (TD) participants.
f. Mean of nonverbal intelligence quotient in terms of performance typically developing and achieving (TD) participants.
g. Standard Deviation of nonverbal intelligence quotient in terms of performance for typically developing and achieving (TD) participants.

Context

Data Extraction

All articles were retrieved before 30.05.2019. Extraction of all data for involved studies was included in five comprehensives excel tables: Table of extracted bibliographic data, table of coding system, two-work sheet table of analysis (descriptive data and data of the analysis of variance (ANOVA)), table of measurement instruments' data and detailed table.

Data Synthesis

Quantitative Domain: Procedural Principles of Data Manipulation

Meta-analysis was conducted to perform a quantitative synthesis on the data extracted from primary studies which required proposing some statistical designs and models. For each dependent variable, an effect size was calculated using Hedge's g (Borenstein, et al., 2007; Hedges, 1983). In most of the studies included, several tasks were used to assess linguistic performance. In order to take into account all measurements, as well as correlation between results of different tasks on the same participants, a three-level meta-analysis with random effects was done (Cheung, 2015).

The three levels of heterogeneity were: 1) sampling variance of effect sizes at level 1, 2) variance between effect sizes on the same sample (within each study), and 3) variance between effect sizes from different samples (i.e. different studies). Hypothesis of homogeneity was tested using Cochrane's Q (Cochran, 1954).

Qualitative Domain: Operational Practice and its Innovativeness

Study design is systematic literature review (SLR) before meta-analysis takes place. As the name implies, systematic literature review is a qualitative means of providing a full narrative synthesis of the findings reported in the studies at hand on the topic under investigation (Armstrong, et al., 2011). Qualitative analysis covered the psycholinguistic part of the study from different angles at levels of both language and the cognitive neurosciences. In fact, it was expanded to include details on all the characteristics of pragmatic language of the individuals in question and the way they live with them. Internal and external variables were examined and that is what confirmed the validity and reliability of the research. Needless to say, that all backdrops of data collected were methodically organized before they were psycholinguistically assessed. Features of language competence were analyzed to examine what was known about the differences they could make in the language performance of the participants, namely pragmatic language compared with what has been been found.

Analysis of Subgroups or Subsets

Analysis of subgroups and/or subsets in the meta-analytic part of the current systematic literature review (SLR) & Meta-analysis was not possible because sufficient data was not available nor was there potential sources of heterogeneity that might affect outcomes.

Analyses and Results

Quantitative Part Characteristics of the Sample

A total number of 456 Asperger syndrome (AS) and typically developing and achieving (TD) participants (231 AS subjects and 225 TD controls) from four linguistic backgrounds, namely English, French, Danish and Hebrew were involved in the analysis of the fourteen studies included in this current systematic literature review (SLR) & Meta-analysis. Tables 2.1 and 2.2 summarize the characteristics of the participants included in the studies.

Model of Systematic Literature Review and Meta-analysis

Pooled mean home practice data and meta-regression were conducted using the software program Comprehensive Meta-analysis and RevMan 5.3. Four models were analyzed: 1) model with random effects within and between studies, 2) model with random effects only between studies, 3) model with random effects only within study, and 4) model with fixed effects only.

Four model comparisons of nested models were performed using likelihood ratio: Model with both levels random vs. models with only one level random and models with only one level random vs. the model with fixed effects. Final model was chosen based on these comparisons and Akaike criterion corrected. Outcomes of the current systematic literature review (SLR) & meta-analysis were graphically represented and displayed on forest plot. Funnel plot model was implemented for data visualization as a graph designed to check for the existence of publication bias and also one of the best ways to show outliers (McGill, et al., 1978).

Differences between Asperger Syndrome Individuals and Typically Developing and Achieving Individuals in Language Competence Differences in Mental Faculty Features of the Language Competence Perception

Unlike single studies that represent experts' personal judgements, one of the current systematic literature review (SLR) and meta-analysis main objectives, recalls, was to investigate the differences that could be seen in Asperger syndrome (AS) individuals in comparison to those in typically developing and achieving (TD) individuals in matters concerning language competence. To that end, perception feature in the mental faculty of the language competence was broadly investigated through related tasks. As is seen, the profile of the perception feature in the mental faculty of the language competence was assessed through a number of tasks that have administered to examine the performance of AS participants compared to that of TD controls. This feature found to be deteriorated in AS individuals whose scores were significantly worse than those of their equivalent TD peers in almost all tasks.

Perception feature has been visualized in forest plot (see appendix 3, Figures 1). Effect sizes were computed as Hedge's. For example, in Planche & Lemmonier (2012)'s study, effect size was -0.32, indicating that AS group had better result on WISC III vocabulary than the TD. However, the 95% confidence interval spans from -0.41, 1.05 and so forth. Since it includes 0, difference between the AS and TD group in this study was not significant.

The four diamond shapes at the bottom of the forest plot represent the overall effect estimates from the four models. Cochranes test of heterogeneity was significant, indicating that a model with random effects should be used. There was no significant difference in model fit between the model with both level 2 and 3 effects random, and that with only between studies (level 3) effect random. On the other side, keeping only within studies effect random resulted in worse fit. The model with random effect between studies also had the lowest values of AIC, BIC and AICc. That is the second model in the forest plot. Final estimate of effect size for perception was -0.76 with 95% confidence interval between -1.73 and 0.22. Thus, no significant difference in perception was found between AS and TD groups.

Funnel Plot was implemented in perception feature as well as all other features for the purpose of checking the existence of publication bias where studies with high precision were plotted near the average, and studies with low precision were spread evenly on both sides of the average, creating a roughly funnel-shaped distribution. Deviation from this shape could indicate publication bias (see appendix 3, Figure 2). There were no gaps in the funnel point, indicating no publication bias. There were several outliers in the plot, as could be expected since we have found significant heterogeneity between the studies in the meta-analysis.

Differences in Mental Reality Features of the Language Competence Intelligence

Well-aptitude and intellectual skills are needed for interacting, responding and manipulating relevant information in the execution of an action. Intelligence feature of mental reality in the language competence has been investigated in the meta-analysis to see what differences could be seen in Asperger syndrome (AS) individuals compared to their typically developing and achieving (TD); therefore, understands what damage intelligence feature causes to language performance in case if it gets deteriorated. Performance of the participants show deterioration of intelligence feature in AS group compared to TD controls and results of the meta-analysis are represented in the forest plot (see appendix 3, Figure 3).

Addressing these results in the forest plot, it was found that the best estimate of the risk ratio of the intervention for Kaland, et al., (2002), for example, was -2.16 for the number of the prompt questions (mental state inference, B stories) and -2.68 for the number of the prompt questions (mental state inference, A stories). Again, while a dot on the line refers to ratio - 2.16.and -2.68 both for B and A stories subset, short vertical lines on the borders represents -2.92 and -1.40 vs. -3.51, and 1.85 in brackets, respectively and so on. Like in the feature of perception, the line no effect was zero.

Model with random effect between the studies and fixed effect within the studies had the best fit. Thus overall effect was estimated as -1.16, with 95% confidence interval from -2.23 to -0.08, indicating significant difference between AS and TD group. In order to check the existence of publication bias in this feature, forest plot has been used (see appendix 3, Figure 4). There was no indication of publication bias, but there were some outliers indicating heterogeneity at study level.

Representational Content

A potential but almost inevitable goal of the present systematic literature review (SLR) and meta-analysis concerns the difference in language competence between the Asperger syndrome (AS) group and typically developing and achieving (TD) group. This raises the possibility that the findings are primarily due to a difference in representational content feature of the mental reality in language competence that could be deteriorated in AS individuals. In order to ensure this possibility, an intensive analysis has been undertaken for the studies included and results show deterioration in this feature where performance of AS individuals found to be less well than that of TD controls. Reading these results in the forest plot, it was found that, like in the perception and intelligence features, each of the lines emanating out of each box in the forest plot of the representational content feature was the 95% confidence interval of study involved. The best estimate of the risk ratio of the intervention for Ziatas et al., (1998), for example, was -0.81 for the belief term expression task and the like. Results were combined from all studies examined representational content feature. Resembling to the features of perception and intelligence, the line no effect for the representational content was zero.

Comparing the fit of the four models, there was no significant difference in fit between the model with random effects at both the second and the third level. Model with random effect at only the second or only the third level did not differ significantly from the fixed effects model. However, the AIC, BIC and AICc were the smallest for the model with only the third level random. Using this model, overall effect for Representational content was estimated at -
0.39 with 95% confidence limit from -1.06 to 0.28, indicating a non-significant overall effect size. These results are represented in the forest plot (see appendix 3, Figure 5). Funnel plot (see appendix 3, Figure 6) did not indicate existence of publication bias.

Intentionally Broad Understanding

The present systematic literature review (SLR) and meta-analysis examined whether differences do exist between Asperger syndrome (AS) individuals in comparison to their typically developing and achieving (TD) peers in language competence of which intentionally broad understanding is one of its mental reality's features.

Differences have been shown in terms of results both groups obtained against tasks that examined their abilities to provide context-appropriate explanations (justifications) for a speaker's nonliteral utterance (in the mentalistic conditions sometimes wherein they had to infer to the intended meaning). AS and TD participants were given time to respond fast with a reasoned explanation as to why a particular action/ reactive decision had occurred or being made in the way it was. Therefore, scores could be obtained o be used as explanatory evidences on the deterioration of the intentionally broad understanding feature in AS individuals that may explain their pragmatic language impairments.

Participants' results were interpreted in forest plot where, like in the perception, intelligence and representational content features, in intentionally broad understanding feature, each of the lines emanating out of each box was the 95% confidence interval of study involved. The best estimate of the risk ratio of the intervention for Ziatas et al., (1998), for example, was -0.62 for the belief term comprehension task and son for other studies addressed this feature. Like with other features the line no effect for the intentionally broad understanding was zero. For intentionally broad understanding the best fit model was also model with random effects between studies, and fixed effects within studies. Overall effect size was -0.69 with 95% confidences interval were (-1.11, - 0.27), indicating significant difference in intentionally broad understanding between the AS and TD groups. For better understanding of these outcomes, they were illustrated in forest plot to make the picture clearer (see appendix 3, Figure 7). Publication bias may be visible in the funnel plot (see appendix 3, Figure 8), as studies with small sample size and small difference between AS and TD groups were lacked (lower right corner of the funnel). However, since there were several larger studies with small or positive effects, they probably balanced this. Outliers in the funnel plot corroborated heterogeneity between studies and the need for random effects model.

Conscious Experience

A major aim of this systematic literature review (SLR) and meta-analysis was to compare the language competence of Asperger syndrome (AS) individuals and typically developing and achieving (TD) controls, and to see if differences could be seen between the two groups' performance on the tasks designed to examine features of the language competence of which conscious feature in the mental reality is of special importance. Results of AS individuals were worse than those of TD controls and this can be seen in their performance that was low compared to that of TD group.

However, results of both AS participants and their equivalent TD controls were represented in forest plot where, like in the perception, intelligence, representational content and intentionally broad understanding feature, in the feature of conscious experience, each of the lines emanating out of each box was the 95% confidence interval of study involved. Similarly, the best estimate of the risk ratio of the intervention for Zalla et al., (2008), for example, was -
1.73 for the task's total score and son for other studies addressed this feature. Again, like what was shown in the features of perception, intelligence, representational content and intentionally broad understanding features, the line no effect for the conscious feature was zero.

For conscious experience, model with random effects within studies, and fixed effects between studies had the best fit. Overall estimate of effect size from this model was -1.18 with 95% confidence interval -1.50, -0.86, indicating statistically significant difference between AS and TD groups. This is illustrated in forest plot (see appendix 3, Figure 9).

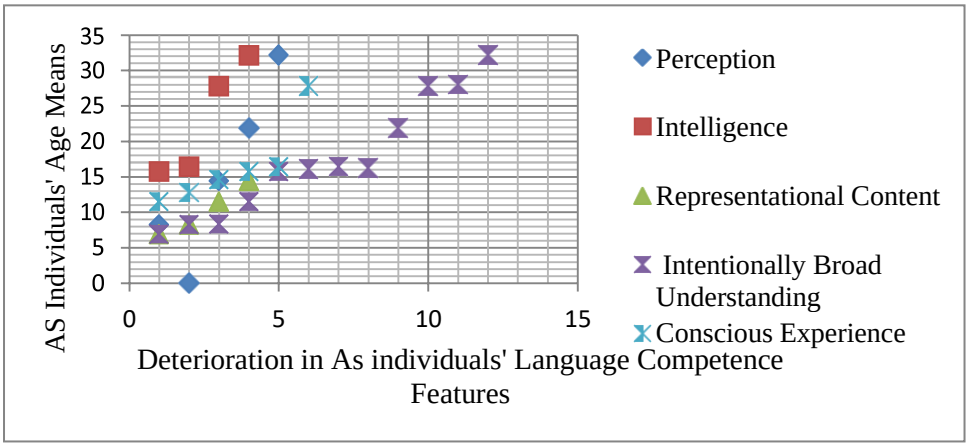
The funnel plot does not indicate presence of publication bias in this feature (see appendix 3, Figure 10)

Language Competence of Asperger Syndrome Individuals and Typically Developing and Achieving Individuals throughout Lifespan

Deterioration in language competence features found not to be restricted to certain age which makes relationship between age factor and any of these features not of special significance and this is clearly seen when looking at the means of all participants' age. These means are better be illustrated through scatter plot, which is one of the best ways to show a relationship between two variables as is seen in Figure 3.1 below.

Figure 3.1.

Scatter Plot of Deterioration in Language Competence Features of Asperger Syndrome Individuals Compared to their Age Means



Evidently, a relationship ought not to be made between Asperger syndrome (AS) and typically developing and achieving (TD) participants' performance in language competence features be it that of mental faculty or that of mental reality and age factor. Having it identified, analyzed and screened, age of the AS and TD individuals found not to represent a more stable clinical characteristic to AS individuals regardless if they were functioning up/below the mental age criterion as their profile shows. It could be that group differences in age appeared to decrease with the language impairment and how the AS individual cope with that impairment personal-wise, academic-wise, social-wise and otherwise.

Psycholinguistically, age was not considered a negative factor for AS individuals even some may not be able to speak fluently before six years (Szatmari et al. 2000), but that does not make any change nor does it add any significance to their language performance that depends on some factors including linguistic intelligence, type of impairment, familial, academic and social environments and further considerations.

Qualitative Part

Understanding Language Performance of Asperger Syndrome Individuals through Differences between them and Typically Developing and Achieving Controls in Language Competence

Mental Faculty Features and Pragmatic Language Perception and Conventional Maxims

To better understand how deterioration at any of the competence features of Asperger syndrome (AS) individuals impairs their performance compared to typically developing and achieving individuals (TD) controls, Table 3.1. provides a summary of one of the language competence features, namely perception in the mental faculty of the language competence that involved factors being categorized by focus on the perceptional feature they measured in participants (AS individuals and TD individuals) surrounding the contribution they add to our knowledge of understanding the way these individuals speak pragmatically the way they do.

The fourteen (14) studies included in the current systematic literature review (SLR) and meta-analysis contained a hundred and two (102) dependent variables, of which twenty-eight (28) of them discussed the conventional maxims by exploring the perception feature. Here is the summary of frequency of these variables for this feature and the conventional maxims. The following Tables and graph show that:

Table 3.1. Frequency of the Dependent Variables of Mental Faculty Features (Perception) of the language competence in light of Conventional Maxims of the language performance

Mental Reality Features and Pragmatic Language

No_Study * Language Competence and Language Performance Cross tabulation		
Study	**Perception**	**Total**
	Conventional Maxims	
Craig & Baron-Cohen (1999)	0	0
Giora et al., (2012)	10	10
Gold et al., (2010)	8	8
Gunter et al., (2002)	0	0
Jollife & Baron-Cohen (1997), Jolliffe & Baron-Cohen (2001)	0	0
Kaland et al., (2011)	0	0
Kaland et al., (2002)	0	0
Koning & Magill-Evans (2001)	1	1
Le Sourn-Bissaoui et al., (2009)	0	0
Myles et al., (2003)	8	8
Paynter & Peterson (2010)	0	0
Planche & Lemmonier (2012)	1	1
Zalla et al., (2008)	0	0
Ziatas et al., (1998)	0	0
Total	28	28

It is already known from the quantitative analysis of the present systematic literature review (SLR) and meta-analysis that typically developing and achieving (TD) individuals performed better than individuals with Asperger syndrome (AS). It was found in that part that AS participants failed to adopt with mental reality-based tasks in accordance with abstract information presented or assumed to be understood in those tasks. To a large extent, one can clearly see how the AS group could not respond appropriately to the utterances that required them to make use of mental reality features (intelligence, representational content, intentionally broad understanding and conscious experience).

Precisely the same level of arguments can be made about the relation between responding time to crucial requests and/ or questions, which, in turns, required them to swiftly implement a certain level of mental and cognitive capacities and linguistic abilities. On the other side, the provision of TD group found to be pertinent to this issue. Table 3.2. casts light on the relationship between mental reality features and pragmatic language aspects, namely conversational implicature, with clearer picture showing obvious deteriorations in these features of the language competence and impairment severity to conversational implicature.

Again, the fourteen (14) studies included in this systematic literature review (SLR) &Meta-analysis contained a hundred and two (102) dependent variables, of which seventy-four (74) of them discussed the conversational implicature by exploring the intelligence, representational content, intentionally broad understanding and conscious experience features. Here is the summary of frequency of the variables for these features and the conventional maxims. The following Tables and graph show that:

Table 4.2. Frequency of the Dependent Variables of Mental Reality Features (Intelligence, Representational Content, Intentionally Broad Understanding and Conscious Experience) of the language competence in light of Conversational Implicature of the language performance

No_Study * Language Competence and Language Performance Cross tabulation					
Study	**Mental Reality**				**Total**
	Conversational Implicature				
	Int. a	**RC. b**	**IBU c**	**CE d**	
Craig & Baron-Cohen (1999)	0	0	0	1	6
Giora, et al., (2012)	4	0	4	0	18
Gold, et al., (2010)	0	0	4	0	12
Gunter, et al., (2002)	0	0	4	0	6
Jolliffe & Baron-Cohen (1997), Jolliffe & Baron-Cohen (2001)	5	0	1	2	8
Kaland, et al., (2011)	2	0	4	4	10
Kaland, et al., (2002)	2	0	4	6	12
Koning & Magill-Evans (2001)	0	2	0	0	3
Le Sourn-Bissaoui, et al., (2009)	0	0	4	0	4
Myles, et al., (2003)	0	4	4	1	17
Paynter & Paterson (2010)	0	0	4	0	4
Planche & Lemmonier (2012)	0	1	3	0	6
Zalla, et al., (2008)	0	0	1	1	2
Ziatas, et al., (1998)	0	1	1	0	2
Total	**13**	**8**	**38**	**15**	**74**

a. Intelligence b. Representational Content c. Intentionally Broad Understanding d. Conscious Experience

Subjectively, the AS individuals whose conversational implicature found to be harshly impaired seemed to show a good performance of some tasks which was borne out by the fact that their intelligence quotient (IQ) was at normal average, yet that good performance in certain number of tasks was incomparable to their big failure in all other tests' subsets.

Conclusions

This systematic literature review (SLR) and meta-analysis of fourteen studies investigated language competence in Asperger syndrome (AS) by comparing performance differences of 231 AS individuals to those of 225 typically developing and achieving (TD) controls against sixteen of language competence measurement instruments. The purpose was to investigate what differences could be seen between the two groups of participants and whether or not such possible differences are related to age and, more importantly, the contribution these differences could add to our knowledge of understanding AS individuals language performance.

Overall, there were significant differences in the language competence performance as was seen in the analysis' findings of the related tests where features of language competence found to be deteriorated in AS participants, not TD controls. Results revealed no relationship between deterioration in the features of mental faculty and mental reality of the AS individuals' language competence and their age. Outcomes shed light of the trend to focus more on the features of the language competence being deteriorated than on the age of the AS individuals in order to understand which aspect of their language performance may be impaired as age found not to prevent language competence features from being deteriorated but understanding that deterioration helps protect certain aspects of language performance from being severely impaired. These aftermaths were discussed from two-in-one conclusive perspective: Quantitative (Statistical) and qualitative (Psycholinguistic).

With exceptions to the reason, will, memory, imagination and intuition features of mental faculty of the language competence, the main results showed that the vast majority of the AS individuals' deteriorated performance in general has fallen into the features of mental reality. In comparison to TD individuals, language competence profiles on the mental reality revealed that intentionally broad understanding feature in AS individuals is the most deteriorated (see appendix 3, Figures 7 and 8) followed by mental faculty feature of perception (see appendix 3, Figures 1 and 2). The conscious experience feature of the mental reality came at the third rank (see appendix 3, Figure 9 and 10). While intelligence feature of the mental reality occupied the fourth rank, the representational content feature came at last (see appendix 3, Figures 4, 5 and 5, 6, respectively).

A total of hundred and two (102) dependent variables have measured five features of the mental faculty and mental reality in the language competence across all fourteen studies included and investigated them against the conventional maxims and conversational implicature of the language performance. Table 4.1. summarizes the frequency of these variables for these features.

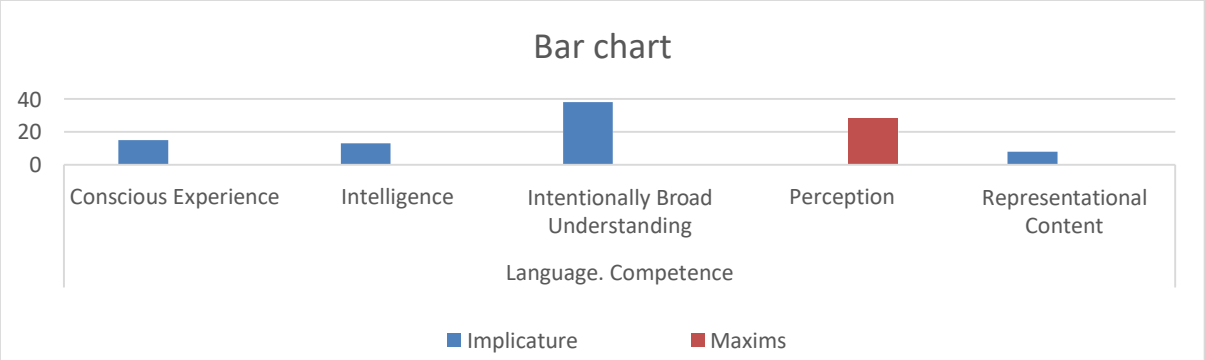
Table 4.1. Frequency of variables of Language Competence features to Show What Goes with Conventional maxims and Conversational implicature

Language. Competence * Language. Performance Cross tabulation						
Language. Performanc	**Language. Competence**					Total
	Conscious Experience	**Intelligence**	**Intentionally Broad Understanding**	**Perceptionnt**	**Representational Content**	
Implicature	15	13	38	0	8	**74**
Maxims	0	0	0	28	0	**28**
Total	**15**	**13**	**38**	**28**	**8**	**102**

Evidently, deterioration in mental reality features is linked with conversational implicature impairments whereas deterioration in mental faculty feature is connected to impairments in the conventional maxims of pragmatic language of the AS individuals. More importantly, intentionally broad understanding feature of the

mental reality found to be deteriorated more in the mental reality of the language competence compared to other features followed by perception feature of the mental faculty. Figure 4.1. below illustrates this picture.

Figure 4.1. Frequency of Language Competence features to Show What Goes with Conventional maxims and Conversational implicature



Significantly, outcomes displayed above mean that executive parts of the language competence in the AS individuals' brains are unable to transform solid knowledge into functional parts, which incapacitates the figurative mentality of AS individuals to understand what is meant by speakers' utterance. Put differently, inability to get AS individuals' concreteness connected to their abstractness is due to deterioration in their language competence that impairs their pragmatic language performance and this can be clearly seen in their metaphorical language. This impairment may also help explain AS individuals' uncomprehend reactions towards situations. This finding supports suggestion of Hermann and his colleagues who in 2013 proposed using metaphorical language as a means through which one can understand characteristics of pragmatic language in AS individuals.

The observation of significant deterioration in the intentionally broad understanding feature compared with the conscious experience feature of the mental reality of the language competence in the population of this SLR & Meta-analysis coincides with many researchers in the field (Dretske , 1980; Dreyfus, 1982; Searle , 1983; Dennett, 1987; Perry , 1994; Crane, 1998, 2007) but contradicts Strawson (1994), who reported supremacy of conscious experience over other features of the mental reality in the language competence.

It is an interesting finding though, that deterioration seen in features of the language competence of AS individuals compared to that in TD individuals is not restricted to mental reality. Perception feature of mental faculty found to be deteriorated more than other features of mental faculty (see Figure 4.1, see also appendix 3, Figures 1 and 2), yet those of conscious experience, intelligence and representational content (see appendix 3, Figures 9, 10; 3, 4; and 5, 6, respectively) of mental reality. Stimuli recognition gathered by sensory experience and actions in response to these stimuli depends on the basics assumed to be common in both interlocutors and this is what form perception of the individual.

However, it should be pointed out here that the particular memory's abilities at which function overrides shape in AS individuals' perceptual generalizations, is debatable, with some studies suggesting broad investigation of roles and functions played by these abilities in the language characteristics of AS individuals (Ozonoff, et al., 1991). It is for this reason that AS individuals' perception feature in the mental faculty of the language competence has been subsumed under the performance umbrella of maxims of the cooperative principles.

However, AS individuals found to lack conscious experience (see appendix 3, Figures 9 and 10); otherwise, they would have been aware of the discourse skills. This does not mean that they could not control what not to be understood as this process is automatically done in the brain; rather, it means that their metacognitive experience lacks informative background that functions as an alarm to tell them what they do not know when they do not know. In other words, their strategies were not shifting.

Likewise, results revealed deterioration in the feature of intelligence (see appendix 3, Figures 3 and 4) in mental reality of the language competence and this is not surprising. Intelligence in general refers to the way one can find logic and reasonable solution for a problem, saving time, money and effort. Technically, it could be seen as the capability of implementing critical thinking, understanding, self-awareness (Goh, et al., 2003) for the purpose of solving certain problems within contextual environment.

In the current study, intelligence quotient (IQ) in all its aspects (verbal, non-verbal, performance and full scale) was included as a covariant that could make change and/ or at least affect general outcomes. Intelligence is in mutual relationship with representational content that occupied the last rank in the features being deteriorated in the language competence of the AS individuals be it in their mental faculty or mental reality features (see appendix 3, Figures 3, 4 and 5,6, respectively). More importantly, it could explain what incapacitates the mentality of AS individuals to manipulate the content before producing it. This finding supports Nass & Gutman (1997); Attwood (1998); Gillberg (1998); and Volkmar & Klin, (1998), who believe that intelligence in AS individuals is at the normal (sometimes above normal) average.

Utterances as potential interferences in the personal rights, autonomy and wishes (Grice, 1975) have been violated by AS individuals. This violation in the maxims of the cooperative principles found not to be restricted to deterioration in mental faculty features (see appendix 3, Figures 1 and 2) but also to deterioration in the mental reality features as has been obviously seen (see appendix 3, Figures 3,4,5,6,7,8,9 and10) where speech of AS individuals has been characterized as being ambiguous, obscure, irrelevant and provable by adequate evidence. These are the symptomatic features of inability to process information due to language competence deterioration and that what has been found in AS individuals.

Upon further examination of their dependent variables, it was found that, unlike perceptional feature's variables of the mental faculty that address cooperative principles, the findings of mental realty features suggested that they are concerned with conversational implicature of the contextual/ utterance meaning. These findings confirmed researchers' predictions that AS individuals' failure to reason and/ or imagine have consequences relating to language misunderstanding and speech misinterpretation including facial expressions (Sawyer, et al., 2014), acoustic perceptions (Filipe, et al., 2014), communicative behavior (Reyes, 2014) and other linguistic and paralinguistic tasks (Durdiaková, et al., 2014 b; Steeb, et al., 2014).

AS individuals' failure to give persuasive reasons to convince others that their behavioral responses and social reactions are appropriately acceptable by rules and principles commonly agreed upon society members is in fact due to deterioration in their language competence. This failure has put them in critical situations simply because they are following their own rules assuming them to be logic; therefore, misunderstanding questions, AS individuals believe, should turn into and/ or be posed for the other side (community members) to answer them in terms of who misunderstands who? And whose rules should be followed? Likewise, incompetence to use imaginative mentality in order to understand abstract meaning does not mean in any way that AS individuals are slow-understanding people. Conversely, it shows that they are busy with details that "prevent" their imaginative capacity from looking into the metaphorical meaning and "project" it to focus on details (Piaget, 1972; Frith, 1989).

There were few differences in the deterioration profiles and age factor in AS participants as between youngers and adults, but they were insignificant as this is restricted to certain variables and observed differences were small in absolute magnitude. Thus, although their language competence deterioration may have differed, age of AS individuals differed statistically in only a few areas at adolescence which means that no relationship could be drawn between language competence deterioration and age (see Figure 3.1).

Finally, it seems to conclude that hitherto seemingly promising evidence from the current SLR & Meta-analysis about the AS more accurate definition as a psycho-neuro-developmental disorder that incapacitates interpretive ability of those exhibiting the syndrome to diffuse their intended messages and absorb others' un-codable utterances and clues due to deterioration in their language competence that impairs their language performance, namely pragmatic language, leading to negative behavioral responses, inappropriate social interactions and communicative disturbances.

Understanding what AS individuals "know "may help explain what they "do"; therefore, avoiding reciprocal misunderstanding between these individuals who feel shunned and alone and external world around them including their parents who get hurt by their children's inability to act naturally and do what please and/ or displease others like what most children seem to do. Moreover, it helps society members reconsider AS individuals more as different from their equivalent TD peers than as patients.

Verifications of the Hypotheses

The current systematic literature review (SLR) and meta-analysis has stated two hypotheses:

H1: Deterioration in language competence hinders Asperger syndrome (AS) individuals to interpret what is meant by speaker's utterance.

H2: Deterioration in language competence in AS individuals impairs conversational implicature more than it does to conventional maxims of their pragmatic language.

Both hypotheses are accepted. Deterioration in language competence found to hinder AS individuals and obstruct them to interpret speaker's speech. This deterioration had more effect to conversational implicature than it did to the conventional maxims of AS individuals and this was clearly seen in their performance in competence language tasks compared to that of typically developing and achieving (TD) individuals wherein results show obvious deterioration represented by inability in AS individuals' interpretive capacity to comprehend the point behind speaker's utterance. However, the results also revealed the pivotal role played by features of mental reality of language competence, notably the feature of intentionally broad understanding that found to be most deteriorated.

Certainly, the innovative concept of Chomsky's linguistic theory in 1967 of competence and performance is consistent with the findings of the present SLR & Meta-analysis whereby AS individuals found to exhibit the idiosyncratic tendency more to misinterpret speech than being unable to differentiate ill- formed from well-formed structures. From an initial focus on the necessary and sufficient language competence features at the cognitive-wise and mental-wise and their explanations of AS individuals' performance at the productive and receptive levels, the discussion of this SLR & Meta-analysis hypotheses turned to Premack & Woodruff (1978)'s theory of mind (ToM) seen as the ability to attribute mental states in terms of understanding that others have beliefs, desires, intentions, and perspectives that are different from one's own and the hypothesis that language competence stability is necessary to foster the neighborhood information exchange during language performance (Unger, 1981).

For pragmatic language, Bishop (1989) promoted the hypothesis regarding friendship and pragmatic language abilities overlap between AS individuals and TD by notifying that poor understanding of the meaning is evidenced in children with AS who have borderline or low pragmatic language abilities and this is supported by this SLR & Meta-analysis outcomes as it was supported right after it has been introduced at that time by some researchers who noticed negative effects on the personal level (Kohn, et al., 1998; Lincoln, et al., 1998) and social level (Twachtman-Cullen, 1998; Ropar & Mitchell, 1999) of the AS individual.

Through an investigation of Chomsky's linguistic theory and Gricean pragmatic theory, and using the hypotheses proposed by Bishop and those introduced in the present SLR & Meta-analysis to make very specific predictions about connection ought to be made between competence and performance for the purpose of giving crucial answers to the relative debate among researchers of 1990s who believed that ToM can explain language deterioration in AS (Bowler, 1992) and those who do not (Scragg & Shah, 1994; McKelvey, et al., 1995; Eisenmajer et al. 1996; Dahlgren & Trillingsgaard, 1996).

Again, the findings of the current SLR & Meta-analysis replicate earlier conclusions, confirming that deterioration in language competence impairs interpretive ability of AS individuals' pragmatic language and incapacitates these individuals to grasp interlocutor's hidden meaning in conversational speech (conversational implicature) (Towbin, 1997). The central coherence hypothesis is a very influential cognitive model for AS (Jolliffe & Baron- Cohen, 1999 a, b; Jolliffe & Baron-Cohen, 2001) found to be in consistence with the hypotheses of the current SLR & Meta-analysis and now there is little evidence to support this hypothesis from the findings. Lack of proficiency in integrating discourse elements in AS individuals in this study may help understand how meaning changes coherently and cohesively at the level of proposition (oral form) and sentence (written form) as per the intentional use and usage of the speaker.

Taken together, hypotheses verifications against the current SLR & Meta- analysis' hypotheses, objectives and findings could be due to that intellectual disability is not a real but an artefactual confounding factor which means that AS individuals are better be described more as unable to interpret the meaning than as disable to understand speech. This may have influenced researchers of the studies involved in this SLR & Meta-analysis that seem to have missed chronological IQ as a covariant. If that was true, the present study would in contrast overestimate definition of AS population in the domain of being more described as different individuals as being classified by Piaget in 1972 than as patients.

Research Limitations Method Limitations

As is mentioned in the methodology of this research, the study design is both systematic literature review (SLR) and meta -analysis. While the former was used to qualitatively analyze narrated findings, the latter has been implemented to synthesize quantitative data. In this regards, some statistical models and designs have been used to manipulate data and analyze studies' outcomes as per the design's needs. Research-wise, any possible problems reported by the studies' researchers related to participants' recruitment is noted when interpreting the results. Yet, it is important to notify here that gender factor has been eliminated from the analysis because (a) it is not discussed in many of the studies included and (b) it does not have a remarkable influence on AS individuals; that is perhaps what made the focus of the research to be dedicated more on the role of the pragmatic language characteristics in AS "individuals" than on "male-females".

The results from this study was, generally speaking, be in line with previous related research examining the language characteristics in AS. Jolliffe & Baron-Cohen (2001) used the same participants of 1997 to replicate results; that is why, results of both studies were combined. Qualitative part has been addressed using ANOVA analysis. Quantitative part, on the other hand, was addressed using the descriptive analysis because they were enough papers with good descriptive data.

Clinical Implications

The language characteristics of competence and performance were only investigated in the current study; hence, other language characteristics were excluded. Main focus on the characteristics of language performance was given to the aspects of pragmatic language because (a) they fit the language characteristics of the individuals with AS on both levels of competence and performance. Cooperative principles phrased by Paul Grice in his pragmatic theory were what have been used here in this systematic literature review (SLR) and meta-analysis. While the six mental faculty features were adopted from Proctor (1984), the four features of mental reality were adopted from Strawson (1994).

Partial differences between results and conclusions reported in the studies involved were probably due to functions of different diagnostic characteristics used by the various researchers in the field. Giora and her colleagues, for instance, adopted broad definition of AS while Planche & Lemonnier used DSM-IV, ICD-10 and ADI-R definition of AS but eliminated the onset criteria, thus making their AS definition broader than that of Giora and colleague's criteria. Different scales, tests and instructive guidelines have been used in the studies involved. It is true that they were not equally used in the studies but they were equally standardized. Put differently, they have similar standardized guidelines and included nearly alike instructions; therefore, even though some of these tests were used in each study, they were fairly enough to be used as tools of assessment.

Although above mentioned measurement instruments used in the studies included were considered to represent pure measures of various meta-analytic aspects, it is possible that higher level cognitive knowledge of participants in some of the studies at hand might contribute to the tasks' power of measurements notably in matters concerning language skills and language components. It is important here to differentiate between language and cognitive tasks that were more or less reliant on psycholinguistic abilities because the participants recruited in the studies included were mainly suffering from psycholinguistic problems. It should be pointed out here that the present study limits itself to the studies under investigation and more specifically to the participants in those studies who have been randomly selected by authors. The study is delimited to pure psycholinguistic issues; rather, it expands to include other related issues like speech language science, special education, psychiatry and psychoanalysis.

Recommendations

Following the protocol of such kind of studies, the current systematic literature review (SLR) and meta-analysis outlines some of the language competence characteristics of Asperger syndrome (AS) individuals being described as having pragmatic language problems using different sources of information. It is one of the first studies to use a more objective assessment and psycholinguistic parameters as well as statistical models to define data input before analyzing their output and finally interpreting their outcomes. It also has an advantage of using individuals within a classified age band, thereby controlling for developmental factors.

Since lack of exact data in available literature is obvious, the current SLR & Meta-analysis recommends further research using the same pragmatics' parameters to investigate language competence in AS gender to see in which gender it is more deteriorated. Furthermore, investigating relationships between language competence and different autism spectrum disorders (ASDs) subgroups (e.g., higher-functioning autism (HFA), pervasive developmental disorder not otherwise specified (PDD-NOS)) and/ or other autistic spectrums using parameters from different linguistic disciplines (e.g., phonetics, phonology, morphology, syntax, semantics and discourse skills) is also recommended to see what contribution language competence adds to our knowledge of these individuals' language performance. This will help better assessing individuals exhibiting these syndromes and will also provide specialists in the field with more accurate diagnostic data. For example, focusing on features of language competence in this study be it those of mental faculty or mental reality will help assessing the validity of the current diagnostic tools and develop new ones to predict impairment (s) in the aspect (s) of the language performance of AS individuals; therefore, work on avoiding exhibiting it.

Additional outcome studies of ASDs' subgroups, using solid nosologic criteria of diagnoses, are needed to clarify the differences in developmental progression and in particular, age factor among them. The results of future research may be one of the strongest defenses for in/validating a controversial differentiation between AS and HFA — provided the differences in outcome measures are/are not a direct function of intelligence quotient (I.Q) as a covariant or language levels. The aim of verifications of hypotheses section should therefore, be considered to lay out a path for further exploration of genetics, etiology, and response to treatment of all these premises that is currently unsearched in AS individuals.

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Appendices

Appendix 1: Studies Included

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Appendix 2 Additional Tables

Study	M.Ia	DV Nb	Dc P	Dc Neg	F. Md
Craig &. Baron-Cohen (1999)	TTCT	6	6	0	Con.
Giora, et al., (2012)	RD	18	2	16	Per., Intel., Inten.
Gold, et al., (2010)	RD	12	4	8	Per., Inten.
Gunter, et al. (2002)	RHLB,UMT,	6	6	0	Inten.
Jolliffe & Baron-Cohen (2001)	SFT	6	2	4	Intel., Con.
Jolliffe & Baron-Cohen (1997)	EFT, MRFT	3	1	2	ntel., Inten.
Kaland, et al., (2011)	SEL	10	4	6	ntel., Inten., Con.
Kaland, et al., (2002)	SEL	12	4	8	ntel., Inten., Con.
Koning & Magil-Evans (2001)	CASP, CELF-R	3	3	0	Per., Rep.
Le-Sourn-Bissaoui, et al.(2009)	SPT	4	4	0	Inten
Myles, et al., (2003)	TOWL-3	17	14	3	Per., Rep., Inten., Con.
Paynter & Peterson (2009)	ToM T	4	4	0	Inten
Planche & Lemonnier (2012)	NEPSY, WISC III	6	6	0	Per., Inten., Rep.
Zalla, et al., (2008)	FPT	2	2	0	Inten., Con.
Ziatas, et al., (1998)	BTCET	2	2	0	Rep., Inten.,

Table 1 Measurement Instruments Utilized to Assess Language Competence

a. M.I Measurement instruments, **TTCT** Torrance tests of creative thinking, **RD** researchers' design, **RHLB** The right hemisphere language battery, **UMT** Unusual metaphors test, **WRMT** Warrington recognition memory test, **SFT** Shuffled fragments test, **EFT** Embedded figures test, **MRFT** Modified Rey figure test, **SEL** Stories from

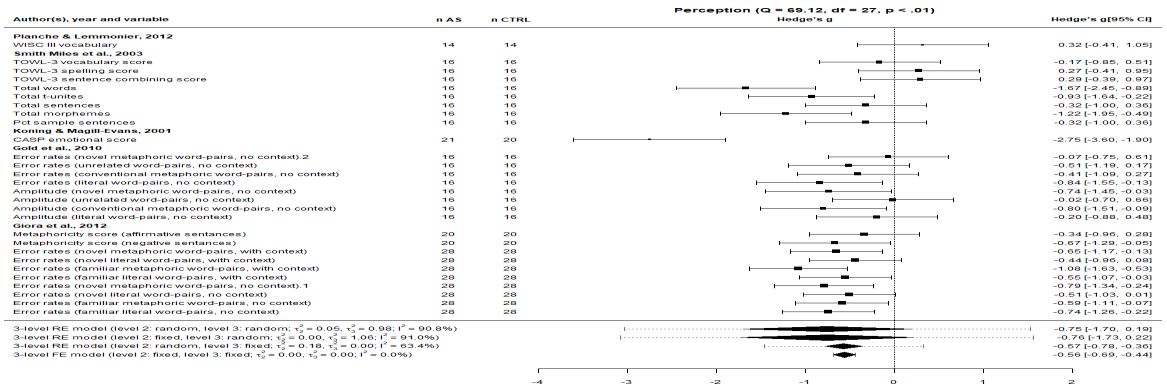
everyday life, **CASP** Child and adolescent social perception measure test, **CELF-R** Clinical evaluation of language fundamentals–revised, **SPT** Semantic & pragmatic tasks, **TOWL-3** Writing a story, test of written language, **ToM T** Theory of Mind tasks, **NEPSY** neuropsychological tasks, **WISC III** Wechsler intelligence scale for children-Third edition, **FPT** faux pas test, **BTCET** belief term comprehension and expression tasks.

b. Number of dependent variables**.** **c.** Variables' directions (positive/negative).

d. Feature (s) of language competence being measured. **Per.** Perception**, Intel.** Intelligence**, Rep.** Representational Content**, Inten.** Intentionally broad understanding**, Con.** Conscious experience**.**

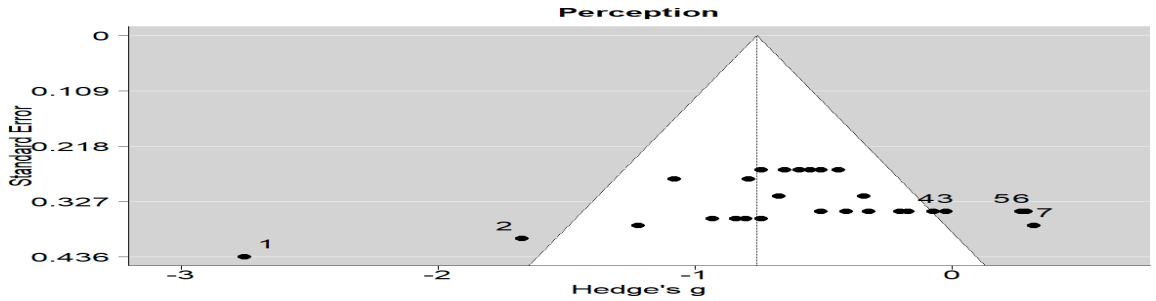
Appendix 3 Illustrative Figures

Figure 1 Forest Plot of Individuals' Effect Sizes and Overall Effect Sizes: Perception



1. Results are estimated using different multi-level random and fixed effects meta-analyses for outcomes associated with perception.
2. **N. AS** number of participants with Asperger syndrome (AS).
3. **N. CTRL** number of typically developing and achieving (TD) control participants.
4. **CI** confidence interval. A negative Hedge's g value indicates impairment of competences in AS group.

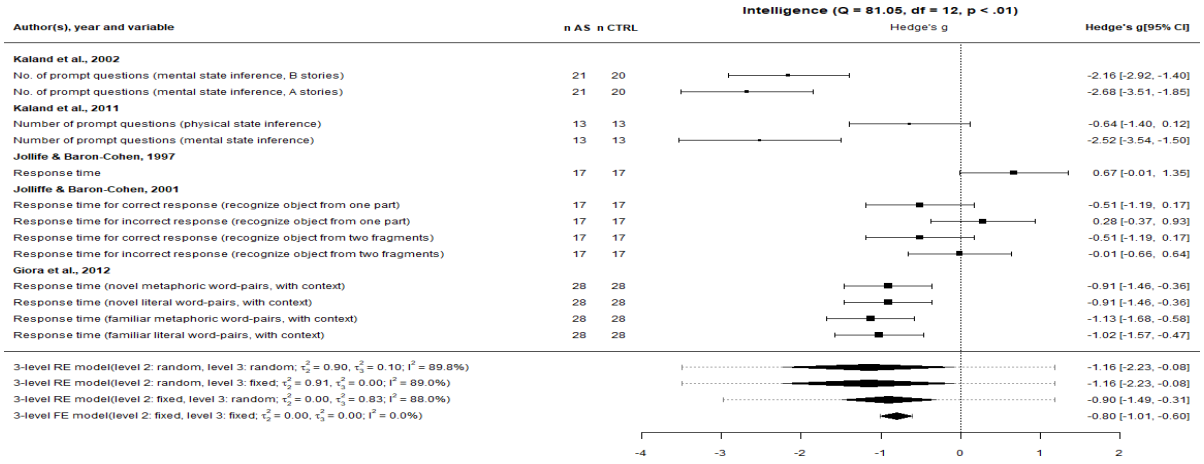
Figure 2 Funnel Plot for Outcomes Related to Perception.



Outliers are:

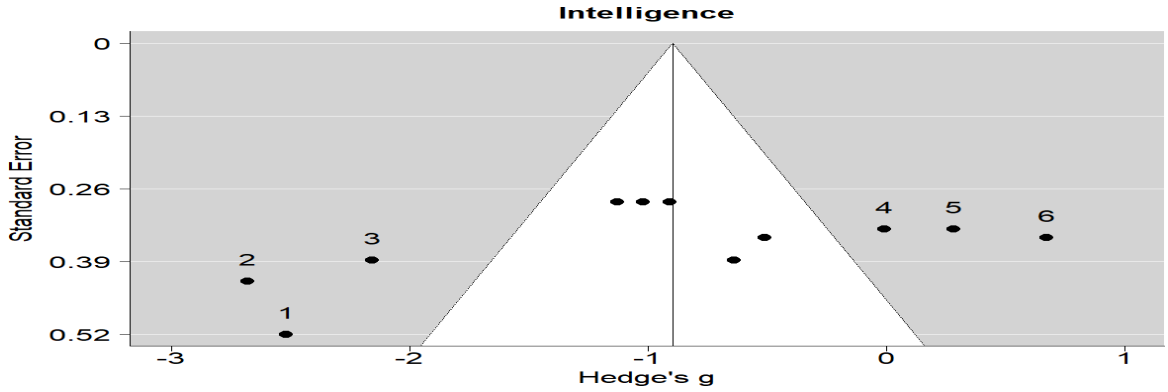
1. Koning & Magill-Evans, 2001 / CASP emotional score
2. Myles, et al., 2003 / Total words
3. Gold et al., 2010 / Amplitude (unrelated word-pairs, no context)
4. Gold et al., 2010 / Error rates (novel metaphoric word-pairs, no context)
5. Myles, et al., 2003 / TOWL-3 sentence combining score
6. Myles, et al., 2003 / TOWL-3 spelling score
7. Planche & Lemmonier, 2012 / WISC III vocabulary

Figure 3 Forest Plot of Individuals' Effect Sizes and Overall Effect Sizes: Intelligence



1. Results are estimated using different multi-level random and fixed effects meta-analyses for outcomes associated with intelligence.
2. **N. AS** number of participants with Asperger syndrome (AS).
3. **N. CTRL** number of typically developing and achieving (TD) control participants.
4. **CI** confidence interval. A negative Hedge's g value indicates impairment of competences in AS group.

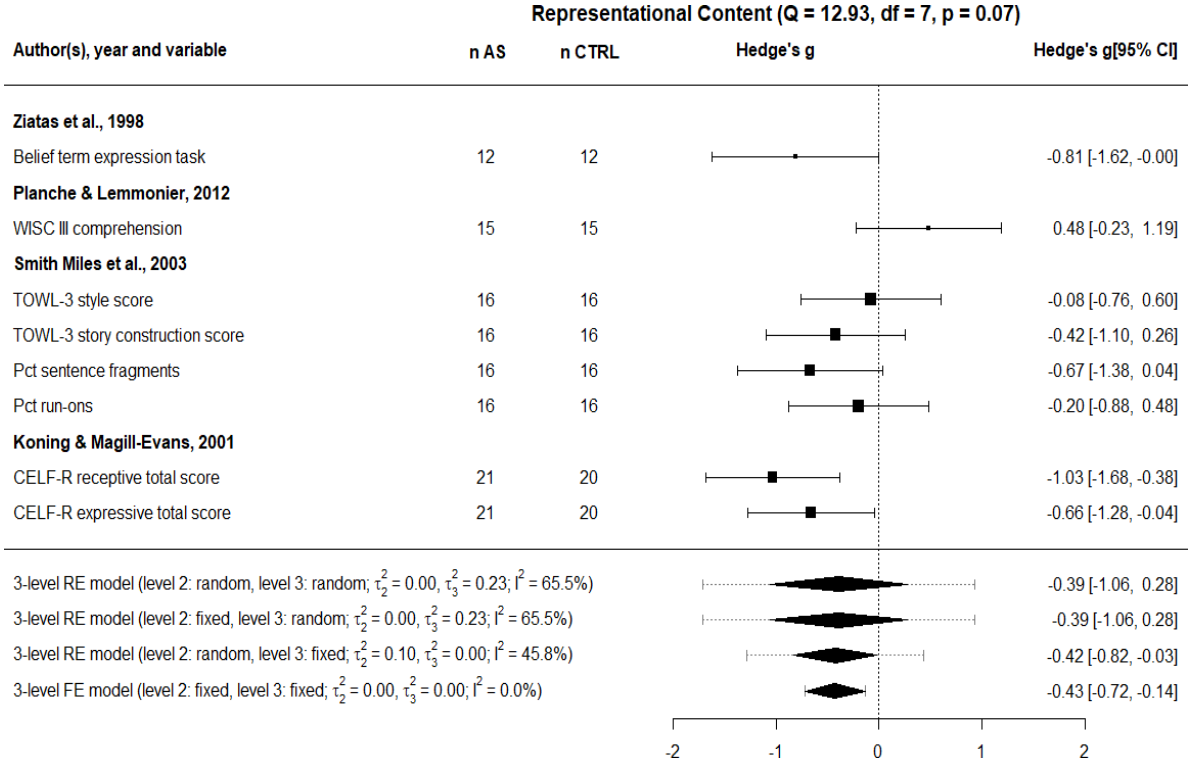
Figure 4 Funnel Plot for Outcomes Related to Intelligence



Outliers are:

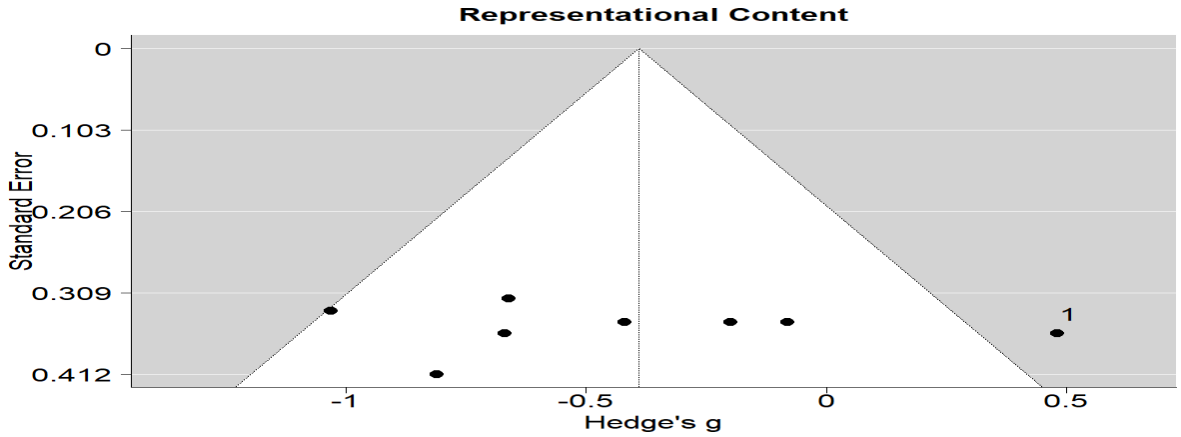
1. Kaland et al., 2011 / Number of prompt questions (mental state inference)
2. Kaland et al., 2002 / No. of prompt questions (mental state inference, A stories)
3. Kaland et al., 2002 / No. of prompt questions (mental state inference, B stories)
4. Jolliffe & Baron-Cohen, 2001 / Response time for incorrect response (recognize object from two fragments)
5. Jolliffe & Baron-Cohen, 2001 / Response time for incorrect response (recognize object from one part)
6. Jollife & Baron-Cohen, 1997 / Response time

Figure 5 Forest Plot of Individuals' Effect Sizes and Overall Effect Sizes: Representational Content



1. Results are estimated using different multi-level random and fixed effects meta-analyses for outcomes associated with representational content.
2. **N. AS** number of participants with Asperger syndrome (AS).
3. **N. CTRL** number of typically developing and achieving (TD) control participants.
4. **CI** confidence interval. A negative Hedge's g value indicates impairment of competences in AS group.

Figure 6 Funnel Plot for Outcomes Related to Representational Content



Outliers are:

1. Planche & Lemmonier, 2012 / WISC III comprehension.

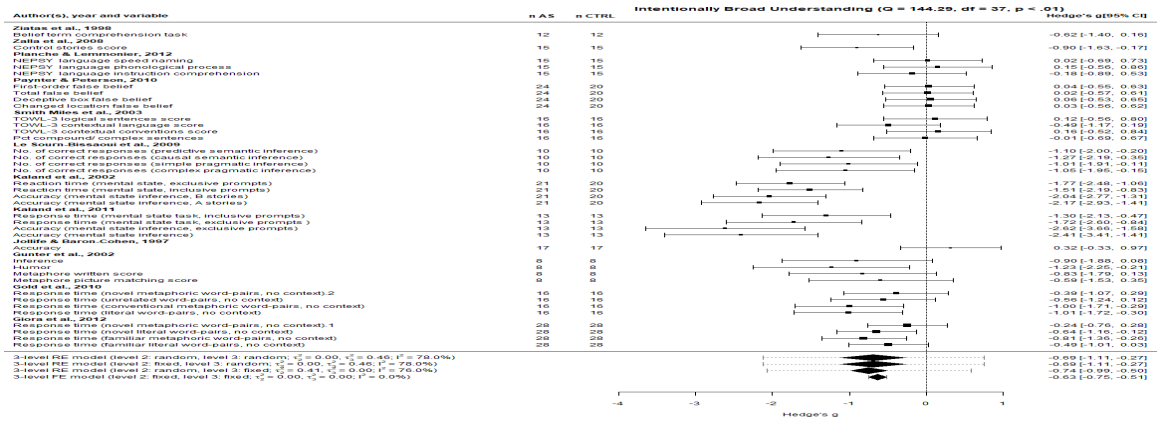
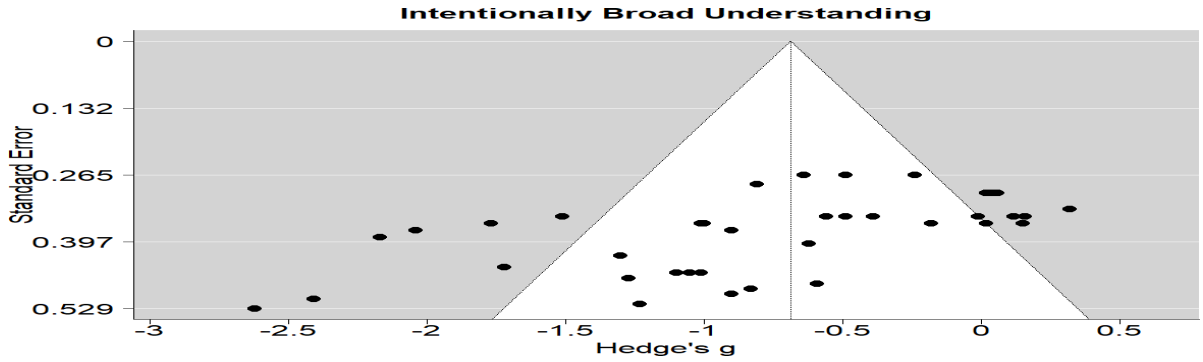


Figure 7 Forest Plot of Individuals' Effect Sizes and Overall Effect Sizes: Intentionally Broad Understanding

1. Results are estimated using different multi-level random and fixed effects meta-analyses for outcomes associated with intentionally broad understanding.
2. **N. AS** number of participants with Asperger syndrome (AS).
3. **N. CTRL** number of typically developing and achieving (TD) control participants.
4. **CI** confidence interval. A negative Hedge's g value indicates impairment of competences in AS group.

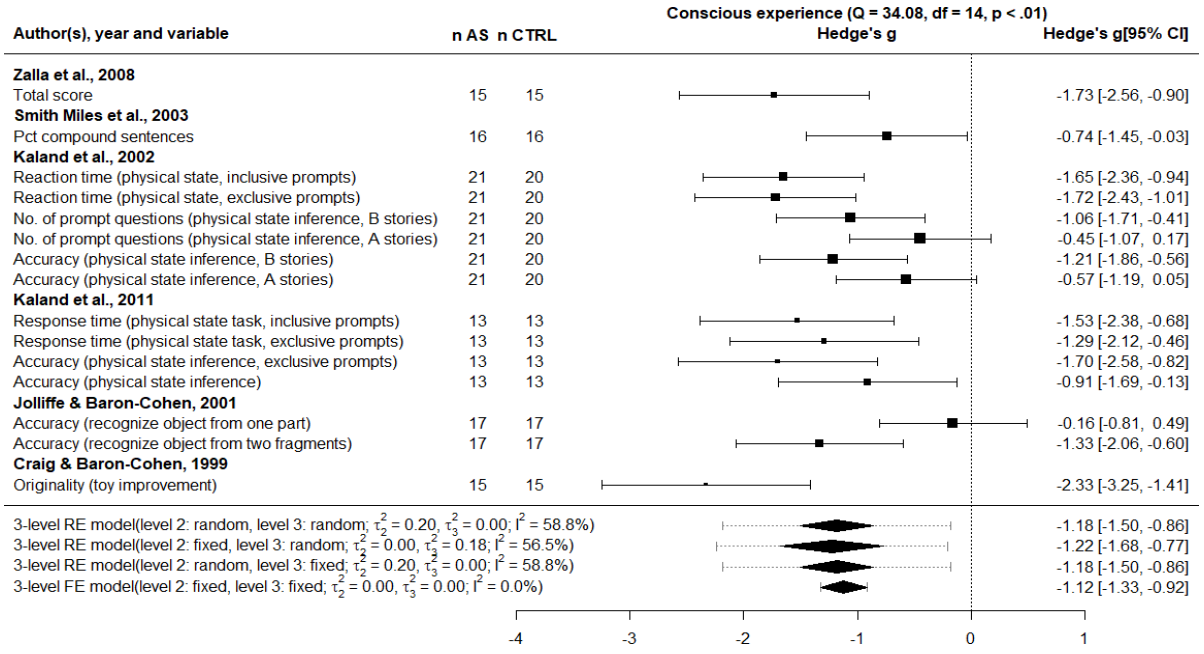
Figure 8 Funnel Plot for Outcomes Related to Intentionally Broad Understanding

Outliers are:



1. Kaland et al., 2011 / Accuracy (mental state inference). 2. Kaland et al., 2011 / Accuracy (mental state inference, exclusive prompts). 3. Kaland et al., 2011 / Response time (mental state task, exclusive prompts). 4. Kaland et al., 2002 / Accuracy (mental state inference, A stories). 5. Kaland et al., 2002 / Accuracy (mental state inference, B stories). 6. Kaland et al., 2002 / Reaction time (mental state, inclusive prompts).7. Kaland et al., 2002 / Reaction time (mental state, exclusive prompts).8. Jollife & Baron-Cohen, 1997 / Accuracy.9. Myles, et al., 2003 / Pct compound/ complex sentences.10 Myles, et al., 2003 / TOWL-3 contextual conventions score.11. Myles, et al., 2003 / TOWL-3 logical sentences score.12. Paynter & Peterson, 2010 / Changed location false belief. 13. Paynter & Peterson, 2010 / Deceptive box false belief.14. Paynter & Peterson, 2010 / Total false belief.15 Paynter & Peterson, 2010 / First-order false belief.
16. Planche & Lemmonier, 2012 / NEPSY language phonological process. 17. Planche & Lemmonier, 2012 / NEPSY language speed naming.

Figure 9 Forest Plot of Individuals' Effect Sizes and Overall Effect Sizes: Conscious Experience



1. Results are estimated using different multi-level random and fixed effects meta-analyses for outcomes associated with conscious experience.
2. **N. AS** number of participants with Asperger syndrome (AS).
3. **N. CTRL** number of typically developing and achieving (TD) control participants.
4. **CI** confidence interval. A negative Hedge's g value indicates impairment of competences in AS group.

Figure 10 Funnel Plot for Outcomes Related to Conscious Experience

Outliers are:

1. Craig & Baron-Cohen, 1999 / Originality (toy improvement)
2. Jolliffe & Baron-Cohen, 2001 / Accuracy (recognize object from one part)
3. Kaland et al., 2002 / No. of prompt questions (physical state inference, A stories)