

Moral Dilemmas Film Task: A Study of Spontaneous Narratives by Individuals With Autism Spectrum Conditions

Jennifer L. Barnes, Michael V. Lombardo, Sally Wheelwright, and Simon Baron-Cohen

People with autism spectrum conditions (ASC) have difficulties with mentalizing, empathy, and narrative comprehension. A new test of social and narrative cognition, the *Moral Dilemmas Film Task*, was developed to probe individuals' spontaneous understanding of naturalistic film scenes. Twenty-eight individuals with ASC and 28 neurotypical controls, matched for age, sex, and IQ, watched four short emotionally charged film clips each depicting a moral dilemma, and were asked to write about what they had seen. Individuals with ASC produced significantly shorter film-based narratives and showed a smaller bias for mental states over objects in their narratives than controls. A significant correlation was found between verbal IQ and the level of mentalizing in film narratives for the ASC group, but not the control group, while the reverse pattern was found with a measure of self-reported cognitive and affective empathy. These results suggest that to the extent that both groups succeed in viewing moral dilemmas in terms of mental content, they do so in different ways, with individuals with ASC using verbal scaffolding to increase their ability to draw meaning from social scenes. The well-established empathy deficit in ASC extends to spontaneous interpretation of moral dilemmas. This new film task has the potential to assay different aspects of how the social world is represented differently in ASC, including during moral comprehension.

Keywords: autism; empathy; story-telling; narrative; verbal ability; moral cognition; film

To make sense of and predict the actions of others, we view behavior in a social context, taking into account the situation and each person's intentions, plans, personality, knowledge, emotions, and desires. The way we do this has been likened to the way we search for meaning in films, novels, stories, and other narratives [Keen, 2006; Nichols, 2004]. Social competence and narrative competence both require the ability to understand agents' mental states and their causal role, a skill that has been referred to as employing a "theory of mind" (ToM).

Individuals with autism spectrum conditions (ASC), characterized in part by significant social impairments (DSM-IV, 1994), have deficits in ToM [Baron-Cohen, 1995; Baron-Cohen, Leslie, & Frith, 1985]. Some individuals with ASC are impaired at simple ToM tasks, such as those involving first-order false beliefs [Baron-Cohen et al., 1985]. Those who are not may show their impairment in understanding second-order false beliefs ("he thinks that she thinks") [Baron-Cohen, 1989; Bowler, 1992], while those who can pass these may only be impaired on tasks based on more complex, subtle narratives that closely approximate real-world interactions. Three such experiments have used film, arguably the closest approximation to the requirements of

real-world social processing, to probe what individuals with and without ASC understand about social scenes.

The "Reading the Mind in Films" task [Golan, Baron-Cohen, Hill, & Golan, 2006], the "Awkward Moments" Test [Heavey et al., 2000], and the "Movie for the Assessment of Social Cognition" [Dziobek et al., 2006] ask participants to view short film scenes, after which participants are asked to either answer multiple choice questions about characters' emotions, or questions that incorporated classic tests of social cognition, such as understanding of mental states, faux pas, false belief, and sarcasm. In all three experiments, individuals in the control group were more successful than individuals with ASC at making the correct inferences about the social content of the scenes.

Although these tasks use ecologically valid film stimuli, they limited the scope of their investigation to the understanding of mental phenomena and do not provide any information about individuals' spontaneous representations of what they have viewed. In order to tap into spontaneous social understanding, Klin [2000] created the Social Attribution Task, adopting a method similar to that used in experiments studying narrative production in autism [Losh & Capps, 2003] and to experiments examining the ways in which neurotypical populations

Jennifer Barnes's present address is Department of Psychology, Yale University, New Haven, Connecticut. From the Autism Research Centre, Department of Psychiatry, Cambridge University, Cambridge, UK

Received September 12, 2008; revised February 28, 2009; accepted for publication May 29, 2009

Address for correspondence and reprints: Jennifer Barnes, 2 Hillhouse Avenue, New Haven, Connecticut 06511. E-mail: jennifer.barnes@yale.edu

Grant sponsors: MRC, Shirley Foundation, US-UK Fulbright Commission

Published online 2 July 2009 in Wiley InterScience (www.interscience.wiley.com)

DOI: 10.1002/aur.79

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view ambiguous animations [Heider & Simmel, 1944]. In the Social Attribution Task, individuals with Asperger syndrome (AS), high functioning autism (HFA), and neurotypical controls viewed a film of geometric shapes moving in ambiguous ways and were asked to describe what they saw. Because the film stimuli were ambiguous, the film could be described in either social/anthropomorphic or geometric/physical ways. Individuals with ASC identified fewer social elements in the stimuli and spontaneously attributed fewer pertinent ToM terms to the geometric shapes than did neurotypical controls. It is unclear, however, whether or not the results obtained in this task would persist if individuals with autism were asked to describe scenes that included human beings.

Another experiment attempted to investigate differences in the way in which individuals with ASC view naturalistic social scenes in films; however, this experiment investigated individuals' viewing strategies, rather than their spontaneous understanding of what was viewed. Klin, Jones, Schultz, Volkmar, and Cohen [2002] showed participants with ASC five clips from the movie *Who's Afraid of Virginia Woolf?* While participants watched the clips, an eye-tracker monitored their gaze patterns, and their viewing behavior was coded for the amount of time spent looking at mouths, eyes, human bodies, and objects respectively. The control group fixated twice as much on the eyes, a region thought to be particularly important in reading the emotions of others [Baron-Cohen, Wheelwright, & Jolliffe, 1997], compared to the group with ASC. Further, for the ASC group, viewing patterns were correlated with measures of social competence in the real world: increased concentration on the mouth was correlated with their level of social adjustment and negatively correlated with their level of social impairment.

Because this study did not directly examine participants' understanding of the material they viewed, it is difficult to draw connections between the different viewing strategies used by individuals with ASC and the ways in which these strategies affect their spontaneous representations of what they have viewed. For example, it is unclear whether increased attention to the mouth region by individuals with higher social competence in the ASC group is indicative of a compensatory strategy that involves concentrating on speech and relying on verbal abilities to extract social meaning from the scene.

Viewed as a whole, the *Virginia Woolf* gaze tracking study, the Social Attribution Task [Klin, 2000], the Reading the Mind in Films [Golan et al., 2006], and Movie for the Assessment of Social Cognition [Dziobek et al., 2006] provide a consistent picture of the way in which an individuals' understanding of film narratives may reflect the social deficits in ASC. Participants with ASC, who perform worse on tasks that require them while viewing films to form conclusions about characters'

mental states, also appear to spend less time fixated on the eyes, an area that is key for interpreting complex emotions [Baron-Cohen et al., 1997], and they are more likely to describe ambiguous stimuli in physical, rather than mental terms.

This body of research can be used to support a unified theory in which individuals with ASC view social stimuli, as well as ambiguous stimuli, less in terms of mental and emotional content than controls. Under this theory, the differences in gaze patterns found by Klin et al. [2002] reflect differential strategies of searching for meaning in the scenes and would result in ASC representations of the films being skewed more to objects and less to people's emotions than controls. When asked questions about a specific character's emotions or mental states, an individual with ASC might then demonstrate the kinds of difficulties the ASC group shows on tasks like the Reading the Mind in Films Task [Golan et al., 2006], because their representations of what they have viewed simply include less mental content from which to draw conclusions.

Alternatively, it could be the case that individuals with ASC are paying attention to emotional content and actively attributing mental states to film characters as they view the scenes, but are simply doing so inaccurately, because of difficulties in reading facial expression [Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001] and tone of voice [Rutherford, Baron-Cohen, & Wheelwright, 2002]. Similarly, the results of the Social Attribution Task [Klin, 2000] may indicate either a generalized decreased tendency towards mentalizing in ASC, or it may indicate simply that neurotypical individuals hypermentalize, even when it is inappropriate to do so. These possibilities can be directly addressed by combining the narrative elicitation method used by Klin [2000] with unambiguously mental, realistic film stimuli similar to those used in the other experiments discussed above.

The goal of the current experiment is to bridge the gap in the literature outlined above by directly assessing the degree to which individuals with and without ASC seem to view social film stimuli in terms of social content per se. A new test of social cognition, the *Moral Dilemmas Film Task*, was developed, which uses mentally and emotionally charged film stimuli to elicit narratives in order to examine not only what individuals on the autistic spectrum *can* do with the information they have gained from watching a narrative but also how they spontaneously represent and re-tell the story that they have seen. In other words, rather than asking participants particular questions about what they have viewed, the Moral Dilemmas Film Task simply asks participants *what* they think they have seen, and by examining their resulting narratives, probes the degree to which their spontaneous re-telling of the scene focuses on mental, rather than physical content.

If the body of research previously outlined reflects a general deficit in viewing social scenes in mental, rather than physical terms, we would predict that individuals with ASC would produce film-based narratives that are impoverished in mental, but not physical content. Specifically, we predicted that ASC film-based narratives would contain more references to objects and fewer references to mental states than control narratives. Additionally, we predicted that ASC narratives would be impoverished not only in terms of the amount of mental content they contained, but in the complexity of that content, with individuals with ASC attributing mental states to fewer total characters than neurotypical participants and producing fewer narratives that contained second-order ToM. Finally, because individuals with ASC and neurotypical controls show different patterns of looking even when they *are* concentrating on people, we predicted that different factors might predict mentalizing in film-based narratives, with the ASC group, who tend to visually fixate on the mouth region of the face, using verbal ability to scaffold their performance, and control individuals, who tend to concentrate on the emotion-rich eyes, exhibiting mentalizing in correlation with self-reported empathy.

As a whole, the *Moral Dilemmas Film Task* aims to provide a complementary view to experiments that use film stimuli to probe viewing patterns or individuals' abilities to correctly answer specific questions about mental states, providing a supplementary window into the similarities and differences in the way that individuals with and without ASC view social scenes.

Methods

Participants

Twenty-eight individuals with a clinical diagnosis of either AS or HFA and 28 neurotypical controls participated in this experiment. Individuals in the ASC group were recruited via the Autism Research Centre volunteers database at Cambridge University (www.autismresearchcentre.com); in order to register to take part in studies, all participants must have been diagnosed by suitably qualified professionals, such as psychiatrist or psychologist, using internationally accepted criteria [APA, 1994; ICD-10, 1994]. Participants with ASC completed the Autism-Spectrum Quotient (AQ), a self-report questionnaire that measures the number of autistic traits an individual possesses [Baron-Cohen et al., 2001], and the scores for the ASC group (mean = 34.25; 71% scoring 32+) were similar to those obtained by Baron-Cohen et al. [2001] (mean AQ = 35.8, 80% scoring 32+). The groups did not differ in terms of sex ($n = 14$ males, $n = 14$ females in each group), age (ASC: mean = 30.29, SD = 7.78; control: mean = 30.21, SD = 6.98; $t(54) = -0.036$, $P = 0.97$) or Verbal IQ (ASC:

mean = 116.29, SD = 10.75; control: mean = 116.93, SD = 8.79; $t(54) = 0.245$, $P = 0.81$).

Control participants were recruited through fliers posted in the city of Cambridge, and all participants were compensated at a rate of £10 per hour for their time. Exclusion criteria for both groups included serious psychiatric conditions (e.g., psychosis, bipolar depression), English as a second language, and having seen more than one episode of the television show from which the stimuli were derived. All participants gave informed consent for their participation in the experiment, and the protocol was approved by the University of Cambridge Psychology Research Ethics Committee.

Stimuli

The four film clips used in this experiment were taken from an American television show, *House*, that features short, self-contained scenes with highly emotional, mentalistic content. The clips selected for the Moral Dilemmas Film Task contained two characters interacting with each other, requiring the viewer to follow the "story arcs" of more than one character at once. Additionally, the clips selected for this experiment contained moral dilemmas and emotional content that require a viewer to mentalize in order to fully appreciate the content of the scene. Each clip contained two characters (one male and one female), ran between 30 sec and 2 min in length, and featured a self-contained story with a beginning, middle, and end. While all four clips were taken from the same show and were therefore stylistically similar, they were set in different locations and no character appeared in more than one clip. A précis of each of the four clips is given in Appendix A.

Procedure

After participants had been told that this experiment would involve watching film clips and writing about what they saw, they were asked to write on an open prompt: "Take about five minutes and write about something that interests you." The narratives produced in response to this prompt were later used to match participants in the two groups on measures related to writing ability, in an effort to ensure that any differences found in their later retellings of film-based scenes were not based in a generalized tendency for the control group to write more complex narratives, regardless of whether or not these narratives were based on social stimuli.

After finishing their interest narratives, participants were then shown one of the four film clips and were asked to: "Take about five minutes and write about what happened in the scene you just saw." This process was repeated for each of the four clips, which were presented in a counterbalanced order across participants.

In addition to the film task, participants also completed the verbal subtests of the Wechsler Abbreviated Scale of Intelligence (WASI) [Wechsler, 1999] and the Empathy Quotient (EQ), a self-report questionnaire that requires individuals to answer 40 questions geared at gauging an individual's ability to recognize and correctly respond to the emotions of others [Baron-Cohen & Wheelwright, 2004]. The WASI was used to match the two groups on nonwriting verbal ability, and both the EQ and the WASI were used to investigate any relationships that existed between self-reported empathy and/or verbal ability and performance on the MDFT.

Scoring

Interest narratives. In order to ensure that participants in the two groups were equally able to produce written narratives of the same relative complexity, all participants were asked to write for five minutes in response to a control prompt "write about something that interests you." These narratives were then coded for two variables used to match the participants on writing ability. First, Interest Narratives were coded for total length in words, to ensure that participants in both groups could, within the same time frame, produce narratives of the same relative length. Second, a readability score was obtained for each interest narrative, using the scoring processor embedded in Microsoft Word. The Flesch-Kincaide Grade Level formula takes into account both a rough metric of vocabulary complexity (the number of syllables per word in a document) and an approximate measure of syntactic complexity (the number of words per sentence), and the resulting number maps onto the US grade level to which the passage is written (with 1 being first grade, 12 being 12th grade, and anything above 12 being collegiate). This measure has also been found to be correlated with overall writing ability [Gansle, Noell, & VanDerHeyden, 2002] and has been used to verify stimuli in the study of autism [Paul, Augustyn, Klin, & Volkmar, 2005] and as a measure of writing ability in neurotypical adults [e.g., Holtzman, Elliot, Biber, & Sanders, 2005].

Film-based narratives. Participants' film-based narratives were coded for total length in words, the number of references to mental states or emotions, the number of characters across the four clips (out of 8) to whom mental states were attributed, and the number of references to objects. It was predicted that individuals with autism might write impoverished film narratives that would contain fewer mental state terms applied to fewer characters, but not fewer references to objects than controls. Finally, each participant's set of four film-based narratives was coded for the presence or absence of second-order ToM (i.e., "he thinks that she thinks"), as an additional indication of mental complexity in film-based narratives. Coding was done by an individual blind to group identity, and a second, independent coder, also blind to group identity, analyzed scores for 25% of all

participants. It should be noted that although this new task is named the Moral Dilemmas Film Task, this reflects that the content of each film clip is an emotionally charged moral dilemma, used as a powerful device for eliciting narratives of social scenes. This test could be used to investigate moral understanding, but that usage is not the primary aim of the current experiment.

Results

Reliability

Inter-rater reliability on continuous variables was assessed using intra-class correlations, and coefficients ranged between 0.93 and 1.0. For the dichotomous variable (second-order ToM), reliability was assessed using Cohen's κ ($\kappa = 0.86$).

Writing ability. To ensure that the two groups were matched on writing ability, two *t*-tests were conducted, with length in words of Interest-based narratives and Flesch-Kincaide Grade Level as the dependent variables. The ASC and control groups did not differ on the length of Interest narratives produced (ASC: mean = 124.04, SD = 45.6; control: mean = 126.04, SD = 27.8; $t(54) = 0.198$, $P = 0.84$), or in terms of writing ability, as measured by the Flesch-Kincaide (ASC: mean = 9.26, SD = 2.19; control: mean = 8.50, SD = 2.13; $t(54) = 1.33$, $P = 0.19$).

Moral dilemmas film task. The differences in film-based narratives produced by the ASC and control groups were first examined using five planned comparisons, comparing narratives produced by the two groups in terms of total length (in words), the number of mental state terms applied to the film's characters, the number of references to objects, the bias for mental states over objects (calculated by subtracting the number of references to objects from the number of references to mental state terms), and the number of total characters to whom mental states were attributed. Because these were planned comparisons with directionalized hypotheses, one-tailed *t*-tests were used to examine differences between groups. Levene's test for Equality of Variance was used to determine whether or not equal variance could be assumed for each variable and the appropriate *t*-test was then used. Cohen's *d* was calculated for significant results as a measure of effect size, and Bonferroni corrections were applied to the five nonorthogonal dependent variables, and the α level was set at 0.01.

Though individuals with ASC and controls produced Interest-based narratives of similar length, as predicted, when asked to produce narratives based on mentally-rich film stimuli, individuals with ASC produced significantly shorter narratives compared to the control group (ASC: mean = 91.05, SD = 24.73; control: mean = 130.44, SD = 39.00; $t(54) = 4.52$, $P < 0.0005$, Cohen's $d = 1.21$). See Figure 1.

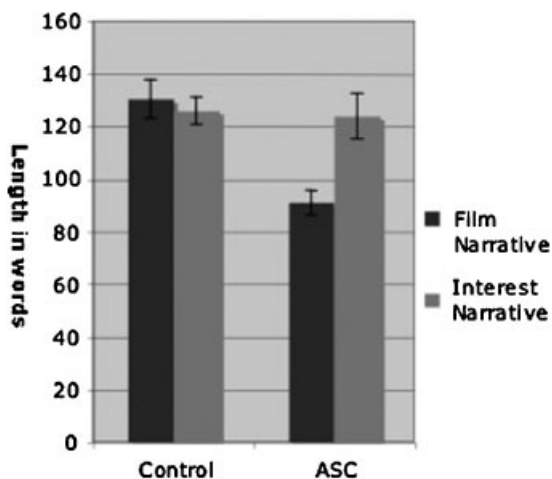


Figure 1. Comparison of the mean length of narratives produced for the Film and Interest conditions for the ASC and control groups. Bars indicate \pm one SE.

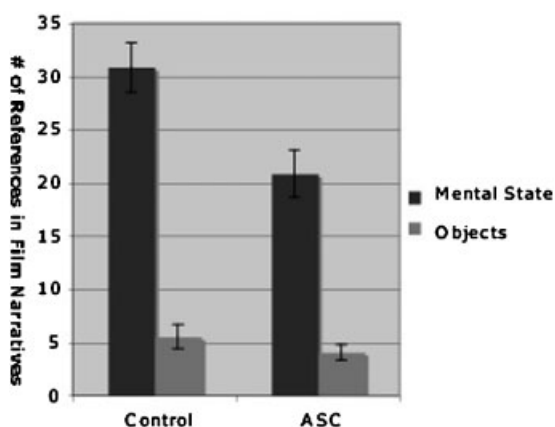


Figure 2. Comparison of the bias for referencing mental states over objects for each group. Bars indicate \pm one SE.

While individuals in the ASC group produced shorter film-based narratives, it was not the case that they produced fewer elements than controls across the board. For example, while control film-based narratives contained, on average, more mental state terms than ASC narratives (control: $M = 30.82$, $SD = 12.27$; autism: $M = 20.86$, $SD = 11.81$, $t(54) = 3.10$, $P = 0.0015$, Cohen's $d = 0.83$), the two groups did not differ in the frequency with which they referenced objects (control: $M = 5.54$, $SD = 6.06$; autism: $M = 4.07$, $SD = 3.79$, $t(54) = 1.08$, $P = 0.14$). As predicted, individuals in the control group attributed mental states to more of the films' characters ($M = 6.93$, $SD = 0.86$) than individuals with ASC ($M = 6.04$, $SD = 1.73$, $t(54) = 2.44$, $P = 0.009$, Cohen's $d = 0.65$). The vast majority of individuals in both groups demonstrated a bias for referencing mental state terms over objects; however, this bias was significantly stronger in the control group (control bias: $M = 25.29$, $SD = 12.79$;

autism bias: $M = 16.78$, $SD = 13.65$, $t(54) = 2.40$, $P = 0.01$, Cohen's $d = 0.64$). See Figure 2.

We then explored the hypothesis that individuals with ASC might be less likely than controls to show evidence of complex mentalizing in their narratives by including references to second order ToM. Twenty out of 28 individuals in the control group spontaneously applied second-order ToM to at least one character, while 14 out of 28 individuals in the autism group did so. A one-tailed χ^2 analysis revealed that this difference approached significance ($\chi^2(1, N = 56) = 2.695$, $P = 0.085$). Further examination revealed that 13 out of 14 control females spontaneously attributed second-order ToM to a character, while only 7 out of 14 control males did. Despite the relatively small sample size, this difference was significant with a two-tailed χ^2 analysis ($\chi^2(1, N = 28) = 6.300$, $P < 0.05$). There was no difference in second order ToM production between males and females with ASC ($\chi^2(1, N = 28) = 0.571$, $P = 0.71$), or between male controls and the ASC group ($\chi^2(1, N = 42) = 0$, $P = 1$). Examples of ASC and control narratives can be found in Table I.

Finally, because it was predicted that different factors might underlie control and ASC performance, Pearson correlations were performed to examine the relationship between participants' Verbal IQ and Empathy Quotient (EQ) and narrative length and content. Within the control group, there was no correlation between verbal IQ and any outcome measure, such as total number of mental state terms ($r(26) = -0.025$, $P = 0.90$) or the number of people to whom mental states were attributed ($r(26) = -0.138$, $P = 0.48$). In contrast, within the ASC group, verbal IQ was correlated with the number of mental state terms produced ($r(26) = 0.496$, $P = 0.007$) and the number of people to whom mental states were attributed ($r(26) = 0.559$, $P = 0.002$), but was not correlated to the length in words of film-based narratives ($r(26) = 0.164$, $P > 0.40$). This pattern of results held for the ASC group even when writing ability, as indexed by Flesch-Kincaide scores, was partialled out (for mental state terms: $r(26) = 0.438$, $P = 0.022$; for number of people: $r(26) = 0.514$, $P = 0.006$). Using Fisher's r -to- z transformation to statistically test for group differences in the correlations [Steiger, 1980], we found that the difference between the correlations for the ASC and control groups was significant for mental state terms ($z = -2.01$, $P = 0.04$) and number of people to whom mental states were attributed ($z = -2.72$, $P = 0.006$).

Analysis of the relationship between EQ and performance on the Film Task revealed a different, but complementary, pattern of results. Within the ASC group, there was no correlation between EQ and the total length of narratives produced ($r(26) = -0.053$, $P = 0.79$), or with the total number of mental state terms produced ($r(26) = -0.005$, $P = 0.98$). Within the control

Table I. Example ASC and Control Narratives

Group	Narrative
Control	A young woman is receiving the results of organ donor compatibility test from her male doctor. She is relieved to know that she is compatible and therefore potentially able to save someone close to her through the level of emotion she shows . She also finds out she is pregnant. She is happy ; however, the doctor reveals to her that as such she is not eligible to be a donor; her feelings immediately change from joy to shock and sadness . She remains strong and states that she needs to speak to her husband of the dilemma that she now faces
ASC	The man received the woman's results back from the lab. The woman matches "You do match" The man also tells the woman that she's pregnant: The woman holds her hands together. She inhales deeply. The man tells her she cannot be a donor. The woman stays holding her hands and breathing strongly. The man does not say anything else. The woman says "I have to tell my husband." The man is shadowed by something he has stubble on his face. The woman has brown hair and she is younger than the man. They are sitting down in <u>armchairs</u> . The woman is sitting forward and the man is sitting back in <u>his chair</u> . There is music in the background
Control	A woman is sitting in a room with her doctor. She wants to know whether she is a match for a tissue so she can donate to save someone's life. The doctor gives her the good news, she is a match, the woman is visibly extremely happy . The doctor then gives her some more wonderful news; she is pregnant, the woman's happiness goes up another notch, she looks like the happiest woman on the planet; she obviously wanted both of these things. Not at the same time, but she does not mind , until the doctor then gives her a piece of bad news, she cannot donate if she is pregnant, she is distraught , she now has a huge decision to make, keep the baby and the other person may die or have a termination and donate to help save the other persons life. She leaves the room saying she has to talk to her husband
ASC	<ul style="list-style-type: none"> ● A lady and a man were sitting in <u>identical grey leather chairs</u> ● The man was probably a doctor because he had <u>some charts</u> ● The man had a beard ● The man was telling the lady that the results matched and that she was pregnant ● The lady looked shocked and the man was speaking quietly ● The man told the lady that she could not be a donor in her condition ● The <u>wallpaper</u> was orange and the <u>chairs</u> were grey with tubular steel frames ● The lady went off to find her husband to tell him the news of what the doctor had told her ● The lady looked like she was crying because she was either very happy or very sad
Control	A young woman sits in a waiting room, as a consultant delivers news of her compatibility to donate either blood or organs to someone of importance to her. He tells her that she is indeed a match, and that she is also pregnant. The woman is shocked and overjoyed , until the consultant goes on to explain that in her current condition she cannot possibly be a donor. The woman, tears running down her cheeks, is crushed . She has the chance to save a life just within her grasp, but must give it up for the sake of this new life inside her. We can see that her brain is working overtime . She is presumably considering abortion, but clearly wants this baby. It seems too much for her to take in . The woman forces a smile and thanks the doctor, while remaining lost in her thoughts
ASC	The scene is about a doctor and his patient. She seems to have had some tests done. The doctor tells her that she does not have something, but that she is pregnant and therefore she cannot donate in her current condition. The woman is very upset and leaves the room because she says that she needs to talk to her husband. I would imagine that she is feeling relieved, upset, happy but at the same time very emotional about the situation. I think she needs time to herself but also lots of support from others

Items coded as mental state terms appear in bold; references to objects are underlined.

group, however, EQ was significantly correlated with the length of narratives produced ($r(26) = 0.468, P = 0.012$), and with the total number of mental state terms produced ($r(26) = 0.461, P = 0.013$), but not with the length of narratives in the Interests condition ($r(26) = 0.232, P = 0.236$). Comparison of group differences in the correlations revealed significant differences for both length of narratives produced ($z = 1.98, P = 0.04$) and total number of mental state terms produced ($z = 1.78, P = 0.0375$ (one-tailed test)).

Discussion

In this experiment, individuals with and without ASC watched a series of film clips featuring interpersonal interactions centered on moral dilemmas and were asked to write about what they saw in each clip. Individuals with ASC produced film-based narratives that were significantly shorter and contained significantly fewer

mental state terms than controls, but the groups did not differ in the frequency with which they referenced objects. The majority of participants in both groups showed a bias for referencing mental states and emotions over physical objects, but the control group attributed mental state terms to significantly more of the film characters than the ASC group did. Surprisingly, individuals with ASC were just as likely as control males to attribute second-order ToM to the film characters. Different factors predicted mentalizing for individuals with and without ASC, with control performance correlated with empathy, but not verbal ability, and individuals with ASC showing the reverse pattern. Taken together, the results of the Moral Dilemmas Film Task provide an interesting complement to and extension of previous work investigating the way that people with ASC view the social world.

Specifically, this work supports a theory under which individuals with ASC have a decreased tendency to focus on mentalistic content when viewing social scenes,

compared to controls. In other words, while the Moral Dilemmas Film Task does not require individuals to *correctly* attribute mental states to film characters, it still seems to be the case that there are important differences between groups in the willingness and frequency with which individuals include mental states in their retellings *at all*. Given that previous research in narrative production has found that, when creating narratives based on simple, rather than socially complex stories, individuals with ASC and neurotypical controls do not differ in the degree of mental content in their narratives [Capps, Losh, & Thurber, 2000], it seems that these important differences might reflect differences in comprehension of the films viewed, rather than differences in narrative production *per se*.

Simultaneously, however, it should be noted that the results found in this experiment do not strictly parallel the differences found when individuals with and without ASC create narratives based on geometric animations [Klin, 2000]. While individuals with ASC did demonstrate a decreased tendency to concentrate on mental states over objects, the vast majority of participants in the ASC group *did* show a bias for grounding their retellings of social scenes in mental content, rather than simply describing the physical objects present in the scene. While it could be the case that a more nuanced coding system that takes into account not only the number of references to mental states and objects, but the amount of detail included in descriptions of each, would reveal a stronger object-bias in the ASC group, it does seem notable that individuals with ASC do seem to view these mentally rich scenes in terms of mental content to some degree. Further, individuals with ASC (in this very high functioning sample) were just as likely as neurotypical males to include references to second-order ToM in their narratives, a result that might not have been predicted based on the existing literature.

Taken as a whole, the MDFT provides a window into social understanding in ASC that serves to complement, extend, and add nuance to previous research using film stimuli as a proxy for real-world social situations. Deficits in ASC performance on other film tasks, such as the Reading the Mind in Films task [Golan et al., 2006] or the Movie for the Assessment of Social Cognition [Dziobek et al., 2006], may be due in part to an overall decrease in the richness with which individuals with ASC spontaneously represent the minds of others from what they have seen. For example, in the current experiment, individuals with ASC attributed mental states to fewer characters overall, even though their narratives contained an average of 20 mental state terms across the four film clips, far exceeding the number required to attribute mental states to all eight film characters. If an individual's spontaneous representation of a scene only includes mental state attribution for some, but not all,

of the characters, that individual would be at a disadvantage if a test posed a specific question about the emotions of one of the characters to whom mental states were not spontaneously attributed. This difference has important implications given that real world social interactions often involve interacting with more than one person at once, and a deficit in forming multiple mentalistic representations of separate individuals could result in social impairment.

Further, an analysis of the data in this experiment shows parallels between the group differences in viewing strategies obtained in the *Virginia Woolf* eye-tracking study [Klin et al., 2002] and corresponding differences in the way that individuals with and without ASC spontaneously reference certain elements in their narratives of what they have seen. Individuals with ASC spent more time fixated on objects and less time fixated on the emotion-rich area of the face surrounding the eyes, and in the Moral Dilemmas Film Task, individuals with ASC show a smaller bias for referring to mental states compared to objects than controls. Further, Klin and colleagues found that individuals with ASC who fixated on the mouth region of the face when viewing social stimuli had lower levels of social impairment, and with the Moral Dilemmas Film Task, the degree to which individuals with ASC spontaneously produce mental state terms to describe film characters is strongly related to verbal ability. While this is in some ways unsurprising given that verbal ability is strongly related to social functioning in ASC [Lord & Paul, 1997] and that semantic knowledge, as well as pragmatic communication ability is related to children's performance on some ToM tasks [Happé, 1995], it does suggest that individuals with ASC may be relying more than controls on what is *said* than on more subtle emotion cues, such as facial expression [Baron-Cohen et al., 2001] and tone of voice [Rutherford et al., 2002].

Alternatively, it could be the case that this pattern of results reflects that *writing about mental states*, rather than drawing mental information from social scenes, is differentially verbally mediated in individuals with ASC and neurotypical controls. Under this view, while the two groups were matched for writing ability, there could be important group differences, for example, in mental state term vocabulary or the syntactic structures most conducive to communicating complex mental relations. To this end, it is worth noting both that previous research has revealed that at least with simple story retellings, individuals with and without ASC tend to produce mental states at similar rates [Capps et al., 2000] and that in this task, the correlation between Verbal IQ and mentalizing held even when the effect of writing ability was partialled out. Additionally, individuals with ASC produced second-order ToM, which arguably requires the most syntactically complex structures of all the mental

content examined here, at rates similar to those of neurotypical males. However, even if it is the case that it is retelling or summarizing mental content, and not drawing that content from films per se, that is differentially verbally mediated in autism, this seems to have similar implications. For example, if an individual is watching a social exchange between two peers and must later form conclusions based on what they saw, doing so may in some way require mentally recreating what they saw in a verbally mediated way. Further research is needed to fully distinguish between these possibilities.

In this experiment, a new test of advanced social cognition, the Moral Dilemmas Film Task, was developed using a paradigm similar to that used in investigation of narrative production in children with autism. The results showed important similarities and differences in the degree to which individuals with ASC and controls spontaneously attributed mental states to film characters in their retelling of what happened in the films. Specifically, the results support a theory in which individuals with ASC are broadly less biased towards mental content, even when viewing explicitly social scenes, and suggest that to the degree that they do succeed at viewing social scenes mentalistically, individuals with ASC may be using different strategies to do so. Future experiments could adapt the task to further examine these strategies; for example, by varying the amount of dialogue that individuals can hear during the course of the film scenes and examining the effects this has on the rate at which individuals with and without ASC reference mental states and objects in their narrative of what they have seen. Additionally, because there was a great deal of variation in the quality of ASC narratives, future research is needed to examine how variation on a task like this might be reflected in everyday social skills. Finally, because the Moral Dilemmas Film Task uses moral dilemmas to probe social understanding, it could be a valuable tool in assessing the ability of individuals on the autism spectrum and in other clinical populations to correctly draw inferences about and identify moral dilemmas and to explore the tendency with which they spontaneously render moral judgments.

Acknowledgment

Jennifer L. Barnes is now at Yale University. This research was supported by a Fulbright Fellowship to J. B., by funding from the MRC to S. B. C., and by the Shirley Foundation to M. L. Stimuli were taken from the following episodes in the first two seasons of the television show *House*: “Sports Medicine” © 2005 Universal Network Television LLC; “Histories” © 2005 Universal Network Television LLC; “Autopsy” © 2005 Universal Network Television LLC; “Need To Know” © 2006 MORATIM Produktions GmbH & Co. KG. Clips furnished

through the courtesy of Universal Network Television LLC. We are grateful to Ilona Roth and Johnny Lawson for valuable discussions, and to the participants for their generous cooperation.

Appendix A: Descriptions of the stimuli used in the Moral Dilemma Film Task. All clips were taken from the first two seasons of the television show “House.” Clips furnished through the courtesy of Universal Network Television LLC

Clip number	Episode	Description
1	Episode 2.02: “Autopsy”	A nine-year-old cancer patient who fears her condition might be terminal asks her 30-year-old doctor to kiss her
2	Episode 1.10: “Histories”	A homeless woman tries to talk her way into a house party
3	Episode 1.08: “Sports Medicine”	A doctor informs his patient that she is a match for organ donation, but cannot donate because she is pregnant
4	Episode 2.11: “Need To Know”	A man confronts a female colleague about her extramarital affair

“Sports Medicine” © 2005 Universal Network Television LLC. “Histories” © 2005 Universal Network Television LLC. “Autopsy” © 2005 Universal Network Television LLC. “Need To Know” © 2006 MORATIM Produktions GmbH & Co. KG.

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