

Responses to Wh-, Yes/No-, A-not-A, and choice questions in Taiwanese children with high-functioning autism spectrum disorder

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Abstract

The present study investigated the hypothesis that children with high-functioning autism spectrum disorder (HFASD) have a greater difficulty in responding to Wh- than Yes/No questions across languages. Conversations between Taiwanese children and their mothers were investigated and the children's response adequacy to maternal questions in a semi-structured setting were examined. Twelve Taiwanese children with HFASD, ranging in age from 7.1 to 14.9 years old, were compared with 12 typically developing (TD) children matched on age, sex, IQ and mean length of utterance in syllable (MLUs). Compared to TD children, HFASD children produced more inadequate or inappropriate responses to Wh- and Yes/No questions than to A-not-A and Choice questions. Taiwanese HFASD children share a greater difficulty in responding to maternal Wh-questions with their Japanese counterparts and do not show a relative ease in responding to Yes/No questions, while A-not-A and Choice questions were easier to respond to for the Taiwanese children.

Keywords: A-not-A questions, choice questions, high-functioning autism spectrum disorder, Taiwanese, Wh-questions, Yes/No questions

Wh-questions (Wh-Qs) are one of the most basic language structures that children need to acquire. However, researchers have given little attention to the acquisition process of Wh-Qs in children (Fletcher & MacWhinney, 2004). What has been studied thus far on this subject is the chronological order of acquisition during early childhood (Tyack & Ingram, 1977), the time when children have knowledge of long distance rules (De Villiers et al., 1990), and inversion errors in children's non-subject Wh-Qs (Ambridge et al., 2006). Regarding Wh-Qs in autism, Tager-Flusberg (1999) found that children with autism differed in producing Wh-Qs than children with Down's syndrome. As for response to Wh-Qs, Curcio, and Paccia (1987) were the first to indicate that English-speaking children with autism have greater difficulty in responding to Wh-Qs. They assumed that the cause could be a cognitive deficit and that while Yes/No questions (Y/N-Qs) might impose an external structure for responses, Wh-Qs might not impose such a structure. Children with autism have a greater need for external structure than typically developing (TD) children do (Clark & Rutter, 1981). This assumption is plausible, but could easily be replaced by a

simpler explanation: comprehension of Y/N-type close-ended questions develops far earlier than that of Wh-type open-ended questions in TD children (Tyack & Ingram, 1977). A recent study conducted on Japanese children found that children with high-functioning autism spectrum disorder (HFASD) had far greater difficulty responding to maternal Wh-Qs than Y/N-Qs when compared to TD children (Oi, 2010). In a significantly milder way, TD children also showed greater difficulty in responding to Wh-Qs than Y/N-Qs. These findings were later replicated using a larger sample (Oi & Tanaka, 2011a). Interestingly, non-echolalic English-speaking children with autism who were mildly developmentally retarded were also found to have more difficulty with Wh-Qs than Y/N-Qs (Curcio & Paccia, 1987). Japanese Wh-Qs and English Wh-Qs are different in grammatical construction, including factors such as the Wh-word appearing at the head of the sentence in English and the end in Japanese, inverted subject–verb order, and use of substitutive or auxiliary verbs. Additionally, the Japanese language has far more Wh-type question words compared to English. Despite these differences, in both languages children with HFASD showed relatively greater difficulty responding adequately to Wh-Qs than Y/N-Qs compared to TD children. These differences might also be observed across other languages. Testing the hypothesis in a language other than Japanese or English could provide findings on whether and how various lingua-cultural differences influence autism in terms of communication difficulties. Additionally, the findings might lead researchers to pay more attention to the greater difficulty in responding to Wh-Qs than Y/N-Qs in autism. If the difficulty also emerges in a language considerably different from either Japanese or English in terms of syntax and pragmatics of answering questions, it may be due to a reflection of the essential cognitive mechanisms underlying the communication problems seen in autism.

Hewitt (1998) conducted a study on how well autistic persons comprehend conversational questions. Hewitt demonstrated that in young adults with autism, who were native English speakers and functioning in the mild-to-borderline range of mental retardation, four types of questions showed a higher failure rate than the overall failure rate for responses to conversational questions. The four types were questions of more than seven words in length, multi-clause sentences, inferential requirements, and indirect requests for information. These results indicated that both language disability and pragmatic disability influenced response failure. Although the results had no direct relationship with the topic of this article, response failure with these types of questions may help explain the difference between Wh-Qs and Y/N-Qs.

The greater difficulty in responding to Wh-Qs might not only come from the question format but also from contextual demands imposed when Wh-Qs are casually given during conversations. Tanaka and Oi (2007) demonstrated this contextual demand in a preliminary study. They showed that children with HFASD responded adequately to virtually all Wh-Qs, which referred to contextual information presented in a cartoon. These Wh-Qs, which referred to the plots of the cartoon, were prepared before the cartoon was watched and were presented consecutively to the children in a written questionnaire after the children had discussed the cartoons with their mothers. While the Wh-Qs produced by the mothers seemed very similar to those asked in the questionnaire, children with HFASD failed to adequately respond to their mothers' inquiries, but successfully responded to the questionnaires. Although the effect of the time order of the maternal questions and the questionnaire cannot be ignored, it seems likely that the logical consecutiveness of Wh-Qs asked in the questionnaire following the plots of the cartoon helped the child respond to questions, whereas the incidental Wh-Qs asked by their mothers did not. In this respect, we could take as probable the problems seen in contextual information processing by children with autism. Loukusa et al. (2007a, b) have shown, from the viewpoint of relevance theory, that pragmatic errors produced by children with Asperger syndrome or high-functioning autism in responding to questions can be explained by utilization of irrelevant contextual factors, failure to address the focus of the question, or inability to stop processing after deriving the correct answer.

However, they did not distinguish between question formats, including Wh-Qs and Y/N-Qs. Oi and Tanaka (2011b) conducted a preliminary analysis in regard to influence of demand of contextual information processing on inadequacy in responding to maternal Wh-Qs in Japanese children with HFASD. Their study showed maternal requests for elaboration such as “What’s the story about?” were more difficult to respond to than context-relevant inquiries such as “Why did he drink it?” The former was considered more demanding than the latter in utilizing contextual information. Elaboration requests were rare compared to context-relevant questions in children with HFASD, so the contextual demand of a question could not be regarded as the sole source of the relative difficulty in responding to Wh-Qs. As previously described in Tanaka and Oi (2007), context-relevant Wh-Qs were reported to be accurately answered when given in a row to Japanese children with HFASD (Tanaka & Oi, 2007). Thus, this finding suggested a need for examining ways to apply the concepts of context or use of context in explaining failures in responding to questions.

Why, on the other hand, do Y/N-Qs seem easier for Japanese children with HFASD and non-echolalic English-speaking children to respond to compared to Wh-Qs? Because the child can respond by simply affirming or negating the information provided by the adult. This explanation matches the definition of questions proposed by Searle (1969). Questions were defined by Searle as attempts by a speaker to solicit information from a listener. In Y/N-Qs, since the speaker does not know whether the proposition is true, the listener is expected to give judgments on it. If his definition is valid, Y/N-Qs are simply easier than Wh-Qs to respond to as they are satisfied by just answering yes or no on the part of the listener. However, this definition is not sufficient in explaining the diversity seen in Y/N-Qs and responses. Some types of English Y/N-Qs cannot be answered by a plain yes or no (Kiefer, 1980). These are assumed to be a type of indirect act of speech (e.g. “Can you pass the salt?”) or rhetorical question (e.g. “Is this really a problem?”). Additionally, “Is John leaving for Stockholm tomorrow?” can be interpreted as “When is John leaving for Stockholm?” Kiefer has provided more types of Y/N-Qs that can be interpreted as Wh-Qs or could not be answered by yes or no. Sadock and Zwicky (1985) proposed classifications in linguistic typologies that group languages according to the way they minimally answer a polar or Y/N-Q that has the interrogative format. According to them (pp. 189–191), there are three basic alternatives: (1) Yes/no languages like English, which include a yes for a positive answer, and a no for a negative answer. (2) Agree-disagree systems like Japanese: There is a positive particle if the answer agrees with the polarity of the question, and a negative particle if the answer disagrees with the polarity of the question. (3) Echo systems, where there are no specific answer words but instead, prototypical minimal answers are given by repeating the verb of the question, possibly accompanied with additional units similar to adverbs. These languages would use partial repetition also as an answer to focused disjunctive questions. Hakulinen (2001) reported that answers to Y/N-Qs could range from a minimal answer to a full sentence answer in Finnish, which might include a wider range of features in the context such as Hakulinen (2001) reported that answers to Y/N-Qs could range from a minimal answer to a full sentence answer in Finnish, which might include a wider range of features in the context such as ‘hjoo kun sanot vaan että mitä siihen panna’. This answer is translated by Hakulinen into English as “hyeah when you just tell me what to put in”. Hakulinen noted that Y/N-Qs that receive full sentence answers can be roughly grouped into three types. The most frequent type was a genuine request for information. The second-largest type was formed by questions that listeners made in order to obtain clarification of something in an ongoing narrative. The final group consisted of questions that open up a presequence, projecting a request, invitation, or interrogation. It remains unclear whether this applies to Japanese, although Oi and Tanaka (2011b) showed Japanese children with HFASD responded frequently to Y/N-Qs with utterances consisting of several words rather than simple yes or no responses.

We can see other differences between Japanese and English, both of which show greater relative ease for responding to Y/N-Qs than Wh-Qs in children with autism. English Y/N-Qs are

simply ones starting with “Do you,” “Can you,” “Is it,” and the like, while tag questions or declaratives with questioning intonation also serve as Y/N-Qs. Japanese Y/N-Qs are more diverse than their English counterparts. A Japanese utterance with rising intonation is regarded as a Y/N-Q, as it is in English. Moreover, there are approximately 10 sentence-final particles that do not exist in English, which transform a Japanese sentence into an interrogative one. Additionally, functions of Japanese Y/N-Qs are ambiguous and not discrete (Tsuchihashi, 1983). Tsuchihashi demonstrated that Japanese sentence-final particles seemed to represent the lexicalization of a non-discrete speech act continuum between what has been traditionally labelled declarative versus interrogative. Tsuchihashi isolated several observable variables that reflect: (1) the speaker’s confidence in his or her knowledge or information; (2) the speaker’s willingness to admit challenge to his or her knowledge; and (3) the speaker’s solicitation of confirmatory or corrective responses. Furthermore, the analysis showed that the variables were mutually dependent. Thus, we regard responding to Y/N-Qs as more complicated than thought by Searle. Accordingly, we should suspend attributing the relative ease of response to Y/N-Qs seen in children with autism to the apparent simplicity of these questions. Thus, the final research question to be presently addressed is not just why Wh-Qs are relatively difficult to respond to compared with Y/N-Qs, but why Y/N-Qs are comparatively easier.

The first step to take is to clarify whether, in a language considerably different from Japanese and English, a similar relative difficulty could be seen in responding to Wh-Qs in children with HFASD than Y/N-Qs compared to TD children. We may then proceed to the next step in which we address why and how Wh-Qs are relatively more difficult to respond to for children with HFASD compared to TD children despite language differences.

The present study tested these hypotheses in Taiwanese, as it has some linguistic characteristics considerably different from Japanese and English. For Wh-Qs, Chinese resembles Japanese with respect to having no question word movement to the sentence head, no inversion of subject–verb order, or use of the substitutive or auxiliary verbs seen in English. Similar to Chinese dialects such as Mandarin or Cantonese, Taiwanese has unique question forms called A-not-A questions (ANA-Qs) (Gasde, 2004). A typical Taiwanese ANA-Q is an utterance where a verb is repeated twice, being conjoined by Chinese negation marker *bu*. An example of this question form is “*bing gan huei bu huei kai?* (Can you open or cannot you open the bag of cookies?)” This is expected to be answered only by “*huei* ([I] can)” or “*bu huei* ([I] can not).” No pragmatic examination of Chinese ANA-Qs was found in the literature, although it has been examined from a morphological and syntactic point of view (Gasde, 2004). Thus, we ask whether ANA-Qs make Taiwanese mother–child conversations different from those in Japanese or English. Taiwanese also differs from Japanese and English in the pragmatics of Y/N-Qs. Chinese Y/N-Qs mainly fall into two types, one of which ends with “*ma*” and the other ends with “*a*” (Tang, 1981). Chao (1968, p. 804) defined these two as confirmation questions and described them as follows: *a*-Qs are used for asking confirmation of a posed statement, with the effect of “Did I hear you right?” as in “*Jeyg a?* (This one, you mean?)” They should be translated to English in the straight order (S-V), with high intonation. On the other hand, *ma*-Qs should be translated to English in the inverted (V-S) order. These confirmation questions are concerned with the truth of the content (less than 50% probability that the content will be confirmed). According to a study on Mandarin Y/N-Q syntax (McCawley, 1994), a *ma*-Q is one such as “*Tamen dou xihuan kai che ma?* (Do they all like to drive?).” Probable answers to this can be “*Xihuan*” (literally means just “like” and implies “They do all like to drive”), “*Bu xihuan*” (literally just “Not like” and implies “None of them likes to drive”) or “*Bu*” (Literally just “not” and implies “Not all of them like to drive”). However, Tang (1981) noted that Taiwanese *ma*-type Y/N-Qs are often answered by not only affirmation/negation but are followed by repetition of the original proposition given by the questioner. An example of this is as follows. When a *ma*-Q such as “*Ni ming tian yau shang tai bei*

chiu ma?’’ (Are you going to Taipei tomorrow?) should be answered, in affirmation, by ‘‘Shr, wo ming tian yau shang tai bei chiu’’ (Yes, I am going to Taipei tomorrow), and in negation ‘‘Bu, wo ming tian bu yau shang tai bei chi’’ (No, I am not going to Taipei tomorrow). Speakers of Taiwanese who were recently interviewed by the authors, however, stated that the repetition of the proposition in question is not a strictly followed rule.

It seems unique to Chinese dialects including Mandarin and Taiwanese that the expectation of obtaining a positive response from the respondent of the ma-Q is less than 50% (Chao, 1968, p. 800); no known characterization for Y/N-Qs in either Japanese or English has been observed. This characteristic part of Taiwanese Y/N-Qs might suggest a different picture of responses to these from children with HFASD than that for Japanese or English.

Methods

Participants

Two groups of children and their mothers participated in the present study. One group included children diagnosed as HFASD by the children’s primary psychiatrists using *DSM-IV* criteria. The second group encompassed TD children. Both groups of children were from monolingual families where the parents spoke Chinese, resided in the Taipei area, Taiwan, and attended public schools. The two groups of children were matched for: (1) the expressive Intelligence Quotient (IQ) using the Wechsler Intelligence Scale-Third edition (WISC-III); (2) the chronological age (CA); (3) the sex of the children; (4) the mean length of utterance in syllable (MLUs), computed for syllable length according to the rules outlined in Cheung (1998); (5) the age of the mothers; (6) the mothers’ educational level from senior high school to college.

The participants with HFASD were 10 boys and 2 girls, 5 of whom were diagnosed with Asperger syndrome and 7 with high-functioning autism, ranging in age from 7.1 to 14.9 years ($M = 10.50$; $SD = 2.76$). All of them were assessed using the Wechsler Intelligence Scale, third edition (WISC-III) 6 months before the data were collected. Their scores ranged in full-scale IQ (FIQ) from 79 to 126 ($M = 94.25$; $SD = 13.44$), and in verbal IQ (VIQ) from 82 to 131 ($M = 99.83$, $SD = 12.35$), in MLUs from 5.24 to 10.50 ($M = 7.93$, $SD = 1.49$). They had no marked hearing or other major sensory or physical disabilities. They all lived at home, participated with their parents, and were recruited by a local non-profit organization for autism in New Taipei City. The TD participants were selected individually to match the participants with HFASD in terms of sex and age. They ranged in age from 7.0 to 15.0 years ($M = 10.60$; $SD = 2.81$), and their IQ scores ranged from 84 to 124 ($M = 94.92$; $SD = 10.97$) for FIQ, and 84 to 135 ($M = 100.50$, $SD = 12.82$) for VIQ. Their MLUs ranged from 6.78 to 10.56 ($M = 8.87$, $SD = 1.25$) and they all lived at home. The TD children were all offspring of the friends of the mothers of the HFASD children. The TD children had no marked physical, cognitive, behavioural, emotional, or social development disabilities.

Mann–Whitney U tests revealed no significant difference in CA ($U = 69.50$, $p > 0.05$), FIQ ($U = 67.00$, $p > 0.05$), VIQ ($U = 67.00$, $p > 0.05$) and MLUs ($U = 42.00$, $p > 0.05$) between the two groups. Additionally, the chronological age of the mothers did not differ significantly between the two groups.

Data collection

Fifteen-minute conversations with each participant and his/her mother were recorded by a video camera in a quiet room of the New Taipei City Autism Association in a semi-structured setting designed to facilitate mother–child conversations. Each child watched an 8-min animated cartoon without his/her mother present. We then asked the mother to maintain a 5-min conversation with

the child, initiated by asking, “Tell me, what cartoon you were watching?” We then switched to another 5-min conversation by asking, “What did you do yesterday?” Finally, there was free conversation for the last 5-min. For the first two parts of the conversation, the mothers were asked to initiate conversation and not to pursue the topic too intensively. They were also asked beforehand to end the topic when the child initiated a new one or kept answering no to the mother’s questions. After receiving training to transcribe 4 h of conversation between a dyad of mother and non-autistic child, a graduate student in the field of early childhood education transcribed the video-taped conversations. The student was not informed of the purpose of the study. The transcribed data were supplemented by viewing the videos as needed during later analyses.

Data analyses

The present study investigated responsiveness to questions within the context of meshing questions and responses. We used the coding schema for meshing devised by Bishop, Chan, Adams, Hartley, and Weir (2000) because it was the only scheme suitable for the present study, although with a few slight modifications. Bishop et al.’s coding system has a two-layer structure: the first layer defines the typological classification of responses as a basis for meshing analysis in the second layer, which codes question-response meshing. Thus, in the present study, we also started by coding the type of child response to the adult’s question and proceeded to code the meshing. The first layer of analysis provided information on the children’s verbal responsiveness to the questions. A graduate student transcribed the data in the following three ways: (a) type of maternal question; (b) type of child’s response; and (c) meshing of question and response.

Coding of maternal questions

Four types of questions were identified on the transcripts: Wh-Q, Y/N-Q, ANA-Qs, and choice questions (Ch-Qs). The definitions were based on standard Chinese linguistics (Tang, 1981). Wh-Qs were defined as those containing one of the Wh-words such as who, what, where, how, how much, or how many. Wh-Qs were followed by a sentence-final particle such as ne, a, na, and ya to oblige the responder to reply. An example of a Wh-Q in Taiwanese is “Ni shiang tauo shr mo?,” which could be translated into English as “What do you want to do?” Y/N-Qs were defined as those requiring a responder to directly indicate his/her affirmation or negation to the proposition given by the questioner by putting sentence final particles like ma, a, or ba and the like. An example of Y/N-Q in Taiwanese is “Ni shi huan gou ma?” which could be translated into English to “Do you like dogs?.” ANA-Qs were defined as those with a unique question-format, which collocate a verb or an adjective, auxiliary verb like bu or mei meaning negation, and the repeated verb or adjective. An example of ANA-Qs is “You mei you jie jyu?” which could be translated into English to “Does[n’t] it have an ending?” Such an ANA-Q asks the responder to choose either the affirmative part of the question (e.g. you) or the negation part (e.g. mei you) for the reply. Ch-Qs were defined as those that provide two or more options asking the responder to choose one of them. The most common pattern of an English translation of a Ch-Q would be “either...or”. An example of a Ch-Q in Taiwanese is “Ni shr jin tian chiu hai shr ming tian chiu?” which could be translated into English to “Are you leaving today or leaving tomorrow?”

Coding of responses

We started by coding the type of responses from the child to the maternal questions and proceeded to code the meshing. There were seven response categories: (a) ignoring, (b) no response, (c) non-verbal response, (d) prosodic response, (e) minimal verbal response, (f) extended verbal response,

and (g) other. Similar to Oi (2010), the authors of the present study added ignoring to separate this from the original no response category provided in Bishop et al. The original no response included two cases to be coded; in the first, the child took a turn after the adult's question but did not respond to it, and in the second, the child remained silent for more than a second as determined by a stopwatch or held the turn by uttering the response sound "Um" or something similar. In the present study, the first was categorized as ignoring and the second was categorized as no response. We considered the first to be pragmatically inappropriate and the second to be either pragmatically inappropriate or semantically inadequate. The other five categories were almost identical to those of Bishop et al. with slight modifications. The definitions of the seven categories are provided in Appendix 1.

Coding of meshing of questions and responses

The meshing procedures developed by Bishop et al. (2000) were adapted for coding, with the exception that Y/N-Qs were not sub-divided into acknowledgement versus information-soliciting questions. There were three meshing categories: (a) adequate, (b) inadequate, and (c) pragmatically inappropriate. The definitions and examples for coding the meshing are shown in Appendix 2. We did not modify the meshing procedure for Taiwanese-specific response adequacy to Y/N-Qs in terms of the addition of the original proposition to yes or no, as it was reported from several Taiwanese speakers that the addition is optional in modern usage. Examples are shown in Appendix 2.

Reliability

Inter-coder reliability was determined using a second coder who was a graduate student in the field of special education. Transcripts were supplemented by video information, including nonverbal communicative gestures like head nods as well as relevant events and objects from the environmental context to the conversation. All of the samples were coded in the second rating; the adult questions, types of child responses, and meshing of the questions and responses identified during the first coding were repeated during the second rating. The percentage of inter-coder agreement was computed by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Then kappa-coefficients κ (Cohen, 1960) were calculated. The reliability kappas were 0.84 for the types of adult questions, 0.86 for the types of child responses, and 0.89 for the meshing of questions and responses.

Results

Table 1 shows the total number of maternal Wh-Qs, Y/N-Qs, Ch-Qs and ANA-Qs. The means for total number of question-response pairs extracted from the transcripts were 123.00 (SD = 9.08) for the HFASD children and 115.00 (SD = 17.11) for the TD children. A Mann-Whitney U test revealed no significant difference in total number of maternal questions between the two groups. There were also no significant differences between the two groups with regards to the numbers of Wh-Qs, Y/N-Qs, Ch-Qs, and ANA-Qs. Kruskal-Wallis tests followed by Dunn's post-tests were conducted to examine group differences in the number of the four types of questions produced. For both groups of children with and without HFASD, significant differences were revealed between Wh-Qs, Y/N-Qs, Ch-Qs and ANA-Qs concerning the number of maternal questions (for both Kruskal-Wallis tests, $p < 0.001$). The proportions of Y/N-Qs (Dunn's post-test; $p < 0.01$ for

Table 1. The total number of maternal Wh-Qs, Y/N-Qs, Ch-Qs and ANA-Qs.

		Total no. questions	Wh-Qs①	Y/N-Qs②	Ch-Qs③	ANA-Qs④	Kruskal–Wallis test	Dunn's post-test
TD	M	115	38.92	24.67	25.5	25.92	$\chi^2(3) = 15.35^{***}$	① > ②**
	SD	17.11	8.68	9.15	6.17	9.41		① > ③*
	MED	119	40	23	25	25.2		① > ④*
HFASD	M	123	42.83	29.08	24.5	26.58	$\chi^2(3) = 27.62^{***}$	① > ②*
	SD	9.08	7.63	4.01	4.96	9.08		① > ③**
	MED	122	43	30	24	27		① > ④**

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

HFASD, $p < 0.05$ for TD), Ch-Qs (Dunn's post-test; $p < 0.01$ for HFASD, $p < 0.05$ for TD), and ANA-Qs (Dunn's test; $p < 0.01$ for HFASD, $p < 0.05$ for TD) were significantly lower than for Wh-Qs.

Proportions and the nature of responses to questions

The proportion of each type of response was calculated for each child by dividing the number of responses produced by the child by the number of Wh-Qs, Y/N-Qs, Ch-Qs and ANA-Q asked of the child. The proportions of the seven types of responses to each question type are shown in Table 2. For Wh-Qs, the HFASD children produced larger proportions of ignoring ($U = 37$, $p < 0.04$) and no response ($U = 35.50$, $p < 0.05$) compared to the TD children. This was true for Y/N-Qs also; the HFASD children produced larger proportions of ignoring ($U = 36.50$, $p < 0.05$) and no response ($U = 37.50$, $p < 0.05$) than the TD children. U-tests revealed no group difference for Ch-Qs and ANA-Qs.

For the children with HFASD, statistical tests revealed that the proportions of ignoring and no response were larger for Wh-Qs compared to the other three types of questions. The proportion of ignoring to Wh-Qs was significantly larger than to Y/N-Qs, Ch-Qs, and ANA-Qs (Dunn's post-test; $p < 0.05$; $p < 0.01$; $p < 0.01$, respectively). The proportions of no response to Wh-Qs were significantly larger than to Y/N-Qs, Ch-Qs and ANA-Qs (Dunn's post-test; $p < 0.05$ for all). Additionally, the proportion of extended verbal responses was significantly smaller for Wh-Qs compared to Y/N-Qs, Ch-Qs, and ANA-Qs (Dunn's post-test; $p < 0.01$ for all) in children with HFASD. Similar results were found for the TD children as the analyses revealed significantly larger proportions of ignoring and no responses to the Wh-Qs compared to the Y/N-Qs, Ch-Qs, and ANA-Qs (in all Dunn's post-test; $p < 0.05$). Additionally, the proportion of extended verbal responses to the Wh-Qs was significantly smaller than to the Y/N-Qs, Ch-Qs, and ANA-Qs (Dunn's post-test; $p < 0.01$; $p < 0.05$; $p < 0.05$, respectively).

Meshing of responses to questions

The proportions of adequate, inadequate, and pragmatically inappropriate responses to Wh-Qs, Y/N-Qs, Ch-Qs and ANA-Qs in children with and without HFASD are shown in Table 3. HFASD children produced significantly smaller proportions of adequate responses ($U = 13$, $p < 0.001$) and larger ones of inadequate ($U = 32$, $p < 0.05$) and pragmatically inappropriate responses ($U = 29$, $p < 0.05$) to the Wh-Qs compared to the TD children. Results were similar for the Y/N-Qs as the HFASD children produced a significantly smaller proportion of adequate responses ($U = 29.50$,

Table 2. Proportion of response types to Wh-, Y/N-, Ch-, and ANA-Qs.

	Wh-Qs①			Y/N-Qs②			Ch-Qs③			ANA-Qs④			TD		HFASD	
	TD M(SD)	HFAS DM(SD)		TD M(SD)	HFAS DM(SD)		TD M(SD)	HFAS DM(SD)		TD M(SD)	HFAS DM(SD)		Kruskal–Wallis test	Dunn's post-test	Kruskal–Wallis test	Dunn's post-test
Ignoring	0.24 (0.18)	0.36 ^a (0.09)		0.09 (0.10)	0.19 ^a (0.10)		0.10 (0.16)	0.13 (0.09)		0.11 (0.19)	0.12 (0.09)		$\chi^2(3) = 12.49^*$	① > ②* ① > ③** ① > ④**	$\chi^2(3) = 22.33^{***}$	① > ②* ① > ③** ① > ④**
No response	0.19 (0.08)	0.29 ^a (0.10)		0.11 (0.07)	0.20 ^a (0.11)		0.11 (0.12)	0.15 (0.06)		0.14 (0.17)	0.18 (0.11)		$\chi^2(3) = 13.42^*$	① > ②* ① > ③** ① > ④*	$\chi^2(3) = 17.65^*$	① > ②* ① > ③** ① > ④*
Nonverbal response	0.10 (0.08)	0.06 (0.05)		0.12 (0.07)	0.09 (0.06)		0.11 (0.05)	0.09 (0.05)		0.12 (0.08)	0.09 (0.06)					
Prosodic response	0.10 (0.08)	0.07 (0.05)		0.15 (0.07)	0.11 (0.05)		0.14 (0.09)	0.14 (0.13)		0.13 (0.08)	0.10 (0.05)					
Minimal verbal response	0.21 (0.12)	0.17 (0.10)		0.23 (0.08)	0.20 (0.07)		0.25 (0.07)	0.25 (0.11)		0.24 (0.09)	0.25 (0.09)					
Extended verbal response	0.09 (0.08)	0.06 (0.04)		0.27 (0.11)	0.22 (0.11)		0.26 (0.14)	0.24 (0.12)		0.23 (0.12)	0.25 (0.13)		$\chi^2(3) = 14.37^{**}$	① < ②** ① < ③** ① < ④**	$\chi^2(3) = 22.84^{**}$	① < ②** ① < ③** ① < ④**

^aMann–Whitney U test between HFASD and TD ($p < 0.05$).
Kruskal–Wallis test and Dunn's post-test; * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Table 3. Proportion of meshing types to Wh-, Y/N-, Ch-, and ANA-Qs.

	Wh-Qs①			Y/N-Qs②			Ch-Qs③			ANA-Qs④			TD			HFASD		
	TD M(SD)	HFAS DM(SD)		TD M(SD)	HFAS DM(SD)		TD M(SD)	HFAS DM(SD)		TD M(SD)	HFAS DM(SD)		Kruskal–Wallis test	Dunn's post-test		Kruskal–Wallis test	Dunn's post-test	
Proportion adequate responses	0.47 (0.08)	0.28 ^a (0.11)		0.67 (0.07)	0.50 ^b (0.18)		0.66 (0.11)	0.60 (0.24)		0.66 (0.10)	0.61 (0.13)		$\chi^2(3) = 18.89^{***}$	① < ②* ① < ③*** ① < ④***		$\chi^2(3) = 19.28^{***}$	① < ②** ① < ③*** ① < ④***	
Proportion inadequate responses	0.22 (0.08)	0.31 ^b (0.09)		0.10 (0.08)	0.20 ^b (0.13)		0.12 (0.07)	0.17 (0.10)		0.12 (0.07)	0.18 (0.14)		$\chi^2(3) = 12.65^{**}$	① > ②* ① > ③* ① > ④*		$\chi^2(3) = 11.23^*$	① > ②* ① > ③* ① > ④*	
Proportion pragmatically inappropriate responses	0.21 (0.07)	0.33 ^b (0.14)		0.12 (0.10)	0.23 ^b (0.15)		0.11 (0.07)	0.17 (0.09)		0.12 (0.05)	0.18 (0.15)		$\chi^2(3) = 11.40^{**}$	① > ②* ① > ③* ① > ④*		$\chi^2(3) = 10.75^*$	① > ②* ① > ③* ① > ④*	
Other	0.10 (0.09)	0.08 (0.10)		0.11 (0.09)	0.07 (0.08)		0.11 (0.12)	0.06 (0.09)		0.10 (0.14)	0.03 (0.08)							

^a($p < 0.01$)
^bMann–Whitney U test between HFASD and TD ($p < 0.05$).
Kruskal–Wallis test and Dunn's post-test; * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

$p < 0.05$) and larger ones of inadequate ($U = 35$, $p < 0.05$) and pragmatically inappropriate responses ($U = 35.50$, $p < 0.05$) than did the TD children. No group differences were found for Ch-Qs and ANA-Qs.

Intra-group comparisons among the four types of questions concerning response adequacy were conducted. For the children with HFASD, the proportion of adequate responses to the Wh-Qs was significantly smaller than to the Y/N-Qs, Ch-Qs and to the ANA-Qs (Dunn's post-test; $p < 0.05$; $p < 0.001$; $p < 0.01$, respectively). The proportions of inadequate responses to the Wh-Qs were significantly larger than to the Y/N-Qs, Ch-Qs, and ANA-Qs (Dunn's post-test; $p < 0.05$ for all). The proportions of pragmatically inappropriate responses to the Y/N-Qs, Ch-Qs and ANA-Qs were significantly smaller (Dunn's post-test; $p < 0.05$ for all) compared to the Wh-Qs. For the TD children, the pattern was similar. The proportion of adequate responses to the Wh-Qs was significantly smaller than to the Y/N-Qs, Ch-Qs, and ANA-Qs (Dunn's post-test; all $p < 0.01$). The proportion of inadequate responses to Y/N-Qs, Ch-Qs, and ANA-Qs were significantly smaller than to the Wh-Qs (Dunn's post-test; all $p < 0.05$). The proportions of pragmatically inappropriate responses to the Y/N-Qs, Ch-Qs and ANA-Qs (Dunn's post-test; $p < 0.05$ for all) were significantly lower than to the Wh-Qs.

Discussion

The present study tested whether there was a relative greater difficulty in responding to maternal Wh-Qs than to Y/N-Qs compared to TD children as is seen in Taiwanese children with HFASD, and in Japanese children with HFASD and English speaking non-echolalic children with autism. The results in part both affirmed and rejected the hypotheses. The rates of ignoring, no response, inadequate response, and pragmatically inappropriate response to maternal Wh-Qs were higher than Y/N-Qs, Ch-Qs, and ANA-Qs for both groups of children with and without HFASD. Additionally, the rates of extended verbal response and adequate response to the Wh-Qs were significantly lower than to Y/N-Qs, Ch-Qs, and ANA-Qs for both groups. Thus, relationships between Wh-Qs and the other three question types were similar for children with and without HFASD. However, increased rates of ignoring, no response, inadequate response, and inappropriate responses to the Wh- and Y/N-Qs were revealed in children with HFASD compared to TD children. Such group differences were not seen for Ch- and ANA-Qs.

These results indicated the following: (1) Taiwanese children with HFASD also showed greater difficulty than TD children in responding to Wh-Qs, as did Japanese children with HFASD and non-echolalic English-speaking children with autism and mild mental retardation. (2) The relative ease of response to Y/N-Qs, however, was not seen in Taiwanese children with HFASD, unlike their Japanese counterparts and non-echolalic English-speaking children with autism. (3) Instead, Taiwanese children with HFASD showed relative ease in responding to ANA-Qs and Ch-Qs. Thus, as hypothesized, greater difficulty in responding to Wh-Qs was seen across Japanese, English, and Taiwanese in children with HFASD or autism accompanying mild retardation. This leads to the question: Why is there no relative ease in responding to Y/N-Qs in Taiwanese? We assume that it is because ANA-Qs and Ch-Qs play a role similar to that of Y/N-Qs in Japanese and English in terms of ease of response. As demonstrated in the literature, ANA- and Ch-Qs in Taiwanese are both polar-type questions. Polarity is shared between Y/N-Qs in Japanese and English and ANA- and Ch-Qs in Taiwanese. The results suggested that polar-type questions, despite differences in question formats, were relatively easier to respond to than Wh-Qs across languages in children with HFASD compared to TD children. While examining such an assumption, however, we have to consider why Taiwanese children with HFASD did not show the same relative ease in responding to Y/N-Qs which were as syntactically polar as the ANA-Qs and Ch-Qs.

This unexpected relative greater difficulty in responding to Taiwanese Y/N-Qs in children with HFASD may be related to the tendency for these types of questions to be asked when the speaker has “a slight or considerable doubt about an affirmative answer, implying a probability was less than 50%” (Chao, 1968, p. 800). A *post-hoc* analysis on children’s responses (Huang & Oi, in press) revealed that more than half of the Y/N-Qs asked of the children with and without HFASD were ma-Qs. Taiwanese children with HFASD might have been confused when asked to give affirmation/negation or agreement/disagreement to a proposition during maternal ma-type Y/N-Qs when it seemed less probable to him/her. Individuals with autism are considered to be literalists to a much higher degree than individuals without autism (Lawson, 2003; Mitchell et al., 1997; Oi & Tanaka, 2011b). For example, the children with HFASD who participated in the study by Oi and Tanaka (2011b) were very similar to the participants of the present study with regards to IQ and chronological age, but did not prefer less probable interpretations of ambiguous language, while their TD counterparts did.

An additional tentative explanation for the relative greater difficulty in responding to Taiwanese Y/N-Qs might be that maternal questions tend to be used as directives at a far higher rate in Taiwanese than in Japanese, as was shown in a study of children with Down’s syndrome (Huang & Oi, 2001a, b). Question-directives have a two-fold meaning. In the case of Y/N-Q directives, affirmation/negation or agreement/disagreement are required, while obedience to the direction is expected tacitly on the part of responder. This characteristic of the questions might influence the responses from children with HFASD, as these children are believed to have difficulty handling ambiguous language (Ozonoff & Miller, 1996). To date, there have been no studies investigating the response patterns to question-directives in children with autism. Therefore, this merits further examination of the present data.

The third explanation could be a contradiction between Taiwanese and both Japanese and English. Both ma-Qs and a-Qs, which are two main types of Chinese Y/N-Qs, require the responder to not only negate/affirm a proposition given by the questioner (Tang, 1981), but to verbally state the proposition again (redundantly) in addition to saying yes or no, so that a Y/N-Q response lacking this repetition could be evaluated as irrelevant in Taiwanese. Further investigation is needed into whether Taiwanese children with HFASD were different from TD children in repeating their mothers’ propositions when answering with yes or no. They might have responded just yes or no from the viewpoint of logical correctness, but such a response without the redundancy might not be pragmatically appropriate in Taiwanese. Therefore, further investigation is necessary to clarify this.

Thus, the hypothesis tested in the present study could be revised to propose that children with HFASD have greater difficulty responding to Wh-Qs than polar-type questions. To address this, it would be beneficial to investigate a language considerably different from Japanese, English, and Taiwanese in terms of syntax and pragmatics of polar-type questions.

Examining the influence of procedural differences among studies conducted on children with HFASD answering these types of questions would be of use for further understanding the contrasts and greater difficulty of Wh-Qs compared to polar-type questions in children with HFASD. In this regard, findings from Loukusa et al. (2007a, b) are worth taking into account. Loukusa et al. (2007a, b) showed that irrelevant/incorrect answers produced by children with Asperger syndrome or high-functioning autism were more frequent than normally developing controls. Children were asked to respond to the same designated 41 questions on connected pictures, verbal scenarios, and/or a story presented in short chunks. The questions issued by the experimenter consisted of nine reference assignments, nine enrichments, nine basic implicature questions, nine routine questions, and five emotion questions in an experimental setting. In the present study and in Oi (2010), questions were not designated in this way and were asked by mothers incidentally during semi-natural conversations with their child. Although direct

comparisons could not be made due to procedural differences in calculating rate of incorrect or inadequate/inappropriate responses, rates of inadequate/inappropriate response greatly varied between the studies. For example, the rate of adequate responses to approximately 40 Wh-Qs given to each of the Taiwanese children in the present study was 28% for those with HFASD and 47% for TD, whereas the number of correct answers to 41 questions in the Finnish study by Loukusa et al. (2007b) went up to 35.1 for younger children (ranging in age 7–9 years), 37.5 for older children (ranging in age 10–12 years), and 39.0 for controls. These findings merit further investigation of differences in data collection methods and analyses of response adequacy rates.

On the other hand, Loukusa et al. (2007b) showed that younger AS/HFA children did more poorly when answering contextually demanding questions compared to older AS/HFA children and far more poorly than normally functioning children. This suggests that differences in age may play a role in the contrastive greater difficulty of Wh-Qs and ease of polar-type questions in children with HFASD in the current study. These differences also apply to Oi (2010). Both of the studies compared children with and without HFASD aged 7–14 years with no comparison between younger and older ones. Greater difficulty responding to Wh-Qs might differ between the two groups, but the sample size in our current study limits such a division.

Clinical implications

The present study may shed light on how to improve communication between a mother and her child with HFASD in regard to what types of questions mothers might choose to ask when communication breaks down. For Taiwanese mothers, it may be more fruitful to change their question types to ANA-Qs or Ch-Qs when their Wh- and Y/N-Qs fail to keep communication going. This finding was similar to Japanese mothers who experienced Wh-Q failures and Y/N-Q success in attaining adequate responses from their child with HFASD (Oi, 2010). However, no recommendations can be made until clear information is obtained from Taiwanese mothers who successfully attain responses by changing their question types to ANA- or Ch-Qs. However, a study by Curcio and Paccia (1987) showed that changing to Y/N-Qs from Wh-Qs on the part of the adult who failed to get an adequate response from non-echolalic English-speaking autistic children with mild mental retardation elicited more information. Therefore, future studies may want to investigate this further in terms of clinical significance. Thus, there is a need to investigate mother–child communication when the mother’s Wh- and Y/N-Qs failed and ANA- or Ch-Qs for Taiwanese, Y/N-Qs for Japanese and English were adopted instead.

Despite the above information, the mothers do not need to give up on asking children with HFASD Wh-Qs, although they seem challenging both for the mother and the child. We have both negative and positive suggestions in this respect. Jones and Schwartz (2009) provide a negative suggestion in their study which regarded questions from a mother or other family members to preschool children with autism who have almost normal expressive vocabulary as possibly sufficient to attain their attentional focus, but not to facilitate the social nature of communication. Numerous Wh-Qs seemed to be asked by family members at home in their 2009 study. An example of questions they investigated was “How was school today?” They indicated a discrete answer to a question from the child with autism often ends the interaction. Indeed, around 40% of these questions were ignored/rejected by the children while family comments were approximately 60%. Compared to the present study and Oi (2010), in which children aged 7–14 years participated, the rate of ignored/rejected questions shown by Jones and Schwartz seemed far higher. Direct comparisons could not be made, however, because definitions and classification of questions and responses were different between these studies.

We should examine where the difference arises among these studies. It might be due to cross-cultural differences between Taiwanese, Japanese, and Americans. American mothers seem to rely more on questions to communicate with their children compared to mothers of the other two when it comes to maternal interaction with young children with Down's syndrome (Huang, Kubota, and Oi, 2007). This might also apply to HFASD. In contrast, the difference might be due to age differences between participants with autism among the three studies. In that case, questioning children with autism, including with Wh-Qs, should not be regarded as insufficient in helping the children learn how to communicate. Oi and Tanaka (2011a) gave a positive suggestion for not refraining from Wh-Qs. They showed the rate of adequate response from Japanese children with HFASD to maternal Wh-Qs significantly increased while those of inadequate and inappropriate response significantly decreased when they were followed-up 1 or 2 years later. Finally, Wh-Qs requiring clarification, such as those seen in Oi (2008), would appear less frequently under the conditions the present study adopted. This might have lowered the rates of response failure, inadequate responses, and inappropriate responses to Wh-Qs in the HFASD children. Differences found between the two groups of children in the present study might not generalize to other, more low-structured, settings. Additionally, difference in response adequacy among maternal Wh-Q types should also be examined for clinical application. To clarify the clinical implications of the results obtained in the present study, we are required to also examine either how the difficulty in responding to Taiwanese Wh- and Y/N-Qs is related to the length or grammatical complexity of the question, or how that is related to the pragmatic demand the question imposes on children.

Declaration of interest

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Appendix 1

The definitions of child responses to questions

Ignoring

Child takes his/her turn by making a verbal response following the question, but does not answer the question.

No response

Child does not respond to the question, although there is at least a one-second pause after being asked, by being silent or making filler sounds like “ei” and “en”

Nonverbal response

Child responds to the question nonverbally (e.g. head nodding, pointing).

Prosodic response

Child responds using non-lexical verbal responses, including “en,” “ou,” and “ei.”

Minimal verbal response

Child responds with “yes,” “no,” or “I don’t know” to a yes/no question, or only provided the requested information without elaboration.

Extended verbal response

Child gives a relevant response that exceeded the minimal requested information or acknowledgement.

Other

Used when no coding applied; excluded from the meshing analysis. These responses were coded when the child responded to a question by challenging its presupposition, a response was unintelligible, or an overlap between the speakers occurred.

Appendix 2: Guidelines for coding meshing

“A” and “C” response options below refer to A = adult; C = child.

Adequate Response

This type of response was defined as one where the requested information or acknowledgement was either provided or where the child stated that it could not be provided with a response such as “I don’t know.”

Inadequate Response

That met one of the following six conditions:

- 1) A vague, overly general, or semantically underspecified response.
 - C: During the summer holidays, I’m going to X.
 - A: Where’s that?
 - C: A long way away
- 2) Semantic relation error where a related word was substituted.
 - A: What’s the doctor doing?
 - C: Testing the body with a telescope (referring to a stethoscope)
- 3) Response to only part of an alternative question, leaving the meaning unclear
 - A: And could he walk then, or did you have to carry him?
 - C: No.
- 4) Ignoring part of a complex question
 - A: What is your favourite thing to drink at a party?
 - C: Toffees.
- 5) Failure of literal comprehension
 - A: Where did you go on holiday?
 - C: In September.
- 6) “I don’t know” or equivalent where an adult would be expected to give an answer.
 - A: Are you going to the same place next year?
 - C: Yes.
 - A: What’s it called?
 - C: Can’t remember.

Pragmatically Inappropriate Response

A response that meets one of the following twelve conditions.

- 1) Overly literal response that does not appreciate speaker’s meaning
 - A: Can you tell me what sort of car your dad’s got?
 - C: (after a pause of more than 2 seconds) Yes.
- 2) Specific referent introduced without explanation
 - A: Who went with you on your holiday?
 - C: Li.
 - A: Who’s Li?
- 3) Scope of question misunderstood: different type of information supplied. This contrasts with inadequate responses, where the information provided is the right kind but is too vague, general, or underspecified.
 - A: So your dad drives to work every day. What sort of car has he got?
 - C: A brown one.

- 4) Hyperbolic or unbelievable response
A: (looking at photo of sick child) What do you think is wrong with him?
C: He has a heart attack.
- 5) Failure to consider prior conversation
A: Did you go to Taipei in your car?
C: Yes.
A: What about when you went to Taitung?
C: It was hot.
- 6) Failure to read social context. These are often but not invariably impolite. The child's response does not take the social status of the partner into account.
A: Who is your best friend? (child is unfamiliar with the adult)
C: You are.
- 7) Unexplained self-contradiction
A: Have you ever been to the seaside?
C: No.
A: So if you have not been to the seaside, where do you go on holiday?
C: To the seaside.
- 8) Apparently uncooperative use of "I don't know." Child says "don't know" in a context where even a young child should have no difficulty in answering the question
A: What is your brother's name?
C: Don't know.
- 9) Tangential response: the minimal response can be inferred, but only with some difficulty.
A: Have you ever been to the doctor?
C: I have an apple a day. (infer to mean no)
- 10) Extended response that contains additional details that are irrelevant, repetitive, or bizarre
A: What do you think is wrong with that boy?
C: I think he might have fallen into the water on January 6.
- 11) Child ignores adult and continues speaking
A: What do you think is wrong with that boy?
C: I am having my birthday party tomorrow.
- 12) Inappropriately exaggerated prosody.
A: Did you have a party this year?
C: Oh, no! (intonation suggests this is a comment on a major disaster; would be appropriate, for instance, if he had just spilled coffee on his trousers)