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**Role of Intonation and Sentence Final Particles in Comprehension of Irony
in Typically Developing Children and Children with ASD**

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**Role of Intonation and Sentence Final Particles in Comprehension of Irony
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Li Pui Wing

Abstract

This paper investigates the role of intonation cue and SFPs in the comprehension of verbal irony in Cantonese-speaking children with ASD and their typically developing (TD) peers. Thirteen children with ASD (8;3-12;9) were language-matched with 13 TD peers. By manipulating the two variables, 16 vignettes embedded with potentially ironic criticisms were constructed. The participants were asked to judge the *belief* and *intention* of the characters in the vignettes with reference to the remarks. Both groups performed similarly well in the judgement of the speaker's *belief*. For the speaker's *intent*, the clinical group performed significantly poorer and did not rely on either cue, whereas the control group depended more on SFPs than supra-segmental intonation cues. The differential patterns between the two groups were discussed in light of the literature on the theory of mind ability as well as the typological features of Cantonese.

Introduction

Irony is the use of words to convey a meaning that is the opposite of its literal meaning. There are various forms of irony, and the most common one is counterfactual statements (Wilson & Sperber, 1992). This form of verbal irony can be manifested as ironic criticism. When a man says “Tonight’s dinner was delicious!” to his girlfriend who had little culinary skills to speak of, and that the man had the intention of teasing his girlfriend, it is an example of ironic criticism, suggesting the dinner was unappealing. Another example would be calling someone “helpful” when he was so mean and had refused to offer any help when requested. In other words, ironic criticisms are an apparently positive statement intended to convey a negative underlying meaning. Ironic comments are a vital part of everyday communication. If these remarks are interpreted literally instead of figuratively, miscommunication could arise between the listener and speaker. At its worst, this misunderstanding could affect personal relationships and social development. Therefore, the ability to understand irony forms an important aspect of social interaction and is of particular interest to linguist (e.g., Wilson & Sperber, 1992), communication psychologist (e.g., Anolli, Ciceri, & Infantino, 2000) and speech language pathologist (e.g., Green & Tobin, 2009; Laval & Bert-Erboul, 2005).

Linguistic and Paralinguistic Cues for Irony Comprehension

From a bottom-up perspective, comprehension of irony involves the use of a combination of linguistic and paralinguistic information to infer a speaker’s communicative intent. Such information may include cues from the context and prosody of the utterance produced by the speaker. Contextual cues can be linguistic (e.g., words) or paralinguistic (e.g., facial expression) in nature and are picked up based on the discrepancy between reality and the utterance. Prosody cues are often in the form of intonation which can be operationally defined as the use of

supersegmental phonetic features to convey “postlexical” or “sentence-level” pragmatic meanings (Ladd, 1996). Intonation for conveying ironic intent is usually of lengthened rate of articulation, constantly greater intensity, shorter pauses and relatively varying pitch (Ackaman, 1986; Anolli et al., 2000; Laval & Bert-Erboul, 2005; Rockwell, 2000). For example, Brooke says, “I’ve had a great morning” to her colleague Julian. Without any knowledge about Brooke’s morning, Julian must rely on prosodic and contextual cues such as the presence of Brooke’s mocking tone, the grim look on her face, and a pair of muddy shoes to determine if Brooke is actually being ironic.

Unlike English, Cantonese is a tonal language in which a change in pitch contour alters the word meaning. There are nine lexical tones in Cantonese and their contour can be described with five tone levels indicating the relative height and contour of tones. In short, Tone 1 to Tone 9 are represented by 55 (high level tone), 35 (high rising), 33 (mid level tone), 23 (mid-low rising), 21 (mid-low falling), 22 (mid-low level), 5 (high stopped), 3 (mid stopped), and 2 (mid-low stopped). However, Cantonese speakers can also exploit intonation at a sentence level such that lexical tones are carried on the overall intonation contour (Yip, 2002). However, the variation of intonation in the utterance would not be sufficient enough to the extent that substitutes or modifies the lexical tone items. With this syllable-level lexical tone property, sentence-level intonation in Cantonese can be thought to be more restricted than nontonal languages. Therefore, the role of intonation in signifying ironic meaning in Cantonese may not be the same as that in English.

Another typological feature of Cantonese that may play an important role in conveying the ironic sense of a speaker is sentence-final particles (SFPs). They are an important class of particles in Cantonese which have no direct counterpart in English (Matthews & Yip, 1994).

Cantonese SFPs normally occur individually or in clusters of two or three at the end of an utterance (Chan, 2002). Syntactically, a sentence does not need any SFPs for it to be grammatically correct (Lee & Law, A., 2001). Functionally, they serve various pragmatic functions in terms of speech acts such as raising questions, conveying assertiveness, giving suggestions, making request as well as infusing emotional or affective flavouring to an utterance (Matthews & Yip, 1994). There are approximately thirty forms of SFPs commonly encountered in everyday speech (Kwok, 1984). Mandarin, which comprises of only four lexical tones and seven common SFPs (Kwok, 1984), can be considered somewhere in between Cantonese and English (Law, S.-P., 1990). It has been established from previous research (Lee, Wong, Leung et al, 1996) that SFPs are one of the earliest functional categories observed in Cantonese children, around the time when two-word combinations are produced.

Among the many SFPs, *zek55* has a highly affective value, occurring in contexts pertaining to being ‘cheeky, intimate’ (Matthews & Yip, 1994, p. 340). Chan (1996) found that this particle can be used in declaratives and interrogatives to convey a complex mixture of many different emotions, ranging from being complimentary to being impatient, exasperated and sarcastic. Consider the following example.

Nei21 zan55-hai22 zeon35-si23 zek55!

你真係準時 *zek55!*

You really punctual sfp

‘You are really punctual (sfp)!’

In the absence of *zek55*, this utterance is more likely to interpret as a passing comment with no hidden implication, whereas the use of *zek55* can express either complimentary or ironic meaning, depending on the context. On one hand, its presence intensifies the degree of the

speaker's appreciation of the addressee's punctuality or the intimacy between the speaker and the listener. In contrast, if the addressee is really late for the meeting, the speaker can also use the same SFP in a mocking manner to show his disapproval. In contemporary usage, however, the stereotypical 'positive' usage of this SFP has declined greatly; instead, the expression of impatience and dismay is more common, especially when used in conjunction with the intensifying adverb 真係 *zanhai* 'truly/really', marking a strong sense of contempt in the utterances (Fung, 2000). Previous studies of Cantonese SFPs were mainly descriptive in nature concerning their semantics, pragmatics and conversational functions (Fung, 2000; Lee & Law, A., 2001; Luke, 1990), syntactic properties (Law, S.-P., 1990, Law, A., 2002) and the developmental acquisition by children (Lee et al., 1996, Lee & Law, A., 2001). There is a nearly complete lack of experimental studies testing the functions of SFPs in testing the functions of SFPs in Cantonese speakers, let alone its role in the comprehension of verbal irony.

Requirement of Theory of Mind Skills in Irony Comprehension

Studies have shown that there are two stages of process for early irony comprehension (Ackerman, 1982; Hancock, Dunham, & Purdy, 2000). The first stage is identifying the nonliteral nature of the statement. The second stage is detecting the pragmatic intent of the speaker. Consider again the remark "Tonight's dinner was delicious!" To truly comprehend this remark as ironic, the listener first had to recognise that the speaker believed that the meal was unsavoury. This alone, however, is not sufficient for irony comprehension since this judgement does not distinguish an ironic remark from a lie which in this case, is a white lie where the speaker harboured good intentions of not hurting the listener's feeling. While both the ironic speaker and liar are using counterfactual language deliberately, the distinction between irony and lies involves the speaker's *intent* with respect to the listener's *belief* about the statement. The

ironic speaker intends the listener to perceive criticism for his remark while a liar wants to keep the truth from the listener.

An important prerequisite in comprehending verbal irony is a sound theory of mind. Primarily, the presence of theory of mind enables one to recognise and understand thoughts, beliefs, desires, and intentions of others to make sense of their behaviour (Baron-Cohen, Leslie & Frith, 1985). As mentioned above, there are two stages of processing in the comprehension of irony. Hancock et al. (2000) suggested that these two processes tap on two orders of mental state reasoning skills. Making a judgment on a speaker's *belief* utilizes first-order reasoning about belief states, while making a judgment on a speaker's *intent* calls for a second-order mental state reasoning. In first-order mental state reasoning, the participant simply has to infer the thoughts of another person while in the latter, the participant has to consider what one person thinks about another person's thoughts. Typically developing (TD) children pass first-order false belief tasks at about four years of age, while the second-order mental state reasoning emerges at a mental age of six (Winner & Perner, 1983). Children are therefore expected to comprehend the *belief* held in the mind of the speaker, which requires first-order reasoning, before they can comprehend the *intention* behind the speaker's actions or words, which requires second-order reasoning. An understanding of irony generally emerges at seven to eight years old in TD children and this sophisticated act is expected to improve and refine throughout adulthood (e.g., Ackerman, 1982; Creusere, 2000; Dews et al., 1996, Hancock et al., 2000; Winner & Leekam, 1991). For example, Imaizumi, Furuya, and Yamasaki (2009) reported the intention-reading ability through voice in 446 TD children. It was found that children younger than eight years of age were significantly poorer than older children in making intention judgments for incongruent sarcasm and banter phrases, but not praises and blames, since the former two communicative acts demand higher-

order reasoning skills than the latter two. The above findings imply that young children and individuals with an immature theory of mind would find it difficult to understand verbal irony. A lack of or a deficient theory of mind is a core cognitive feature of people with ASD. A large number of studies have demonstrated that in first-order false belief tasks, these children have difficulties in shifting their perspectives to judge what someone else might think. Instead they simply report what they themselves know from their own perspectives (e.g., Baron-Cohen et al., 1985; Leekam & Perner, 1991; Perner, Frith, Leslie & Leekam, 1989; Reed & Peterson, 1990; Swettenham, 1996; Swettenham, Baron-Cohen, Gomez & Walsh, 1996). The pioneer study on the development of the theory of mind made use of the well-known “Sally-Anne” test, in which the participants were requested to identify the false belief of the story character to investigate the first-order mental state reasoning in children (Baron-Cohen et al., 1985). In this study, it was found that only 20% of the participants with ASD, who had a mean chronological age of 9;3 and a verbal mental age of 5;5, were able to pass the “Sally-Anne” test. In contrast, 86% of children with Down Syndrome, who had a much lower mental age of 5;11 and a verbal age of 2;11, succeeded on the task. Given such a discrepancy in the performance between children with ASD and children with intellectual disability in the “Sally-Anne” test, the researchers claimed that failure in the first-order mental-state reasoning was not just a matter of intellectual disability in children with ASD. In a subsequent study, Happé (1995) investigated the role of age and verbal ability in the theory of mind task performance of children with ASD. By analyzing data pooled from previous studies on theory of mind studies, verbal ability was found to be a good predictor and a high correlate of theory of mind performance in TD and ASD children. The analysis also suggested that children with ASD required a higher verbal mental age to pass first-order false

belief tasks than TD children. They required an average verbal mental age of 9;2 to pass such tasks, about five years lagged behind the TD children.

As a result of a delay in acquiring first-order theory of mind competence, some children with ASD would be expected to have a delayed development of the second-order false belief reasoning skills. They would pass the second-order false belief tests at some point late in their teenage years. However, some may not acquire such advance mindreading skills at all (Bowler, 1992; Happé, 1993; Ozonoff, Pennington & Rogers, 1991). As such, metaphor, irony, and jokes are often poorly understood by these individuals (Dennis, et al., 2001; Happé, 1993; Martin & McDonald, 2004). Imaizumi et al. (2009) compared the ability in judging speaker's intent of three groups of children, including children with ASD, attention deficit/hyperactivity disorder and age-matched TD children. They reported that children with ASD performed significantly poorer than the other two groups. Besides behavioural data, evidence supporting the claim that children with ASD showing disproportionately poor performance in comprehension of figurative language also come from brain studies. In a recent study comparing TD children and ASD children on comprehension of verbal irony using functional MRI (Wang, Lee, Sigman, & Dapretto, 2006), children with ASD were found to be less accurate than TD children in comprehending irony. Significantly increased activation in the inferior frontal gyrus and bilateral temporal poles in children with ASD during the task was recorded, reflecting that verbal irony comprehension tasks taxed more brain resources in this population than their TD counterparts.

In terms of utilizing cues for comprehending irony, it was suggested that children with ASD faced difficulties in extracting meaning from voices from a very early age. Unlike their TD peers and those with learning disabilities, young children with ASD do not show a preference for listening to their mother's voice in infancy (Klin, 1991, 1992) and may even prefer a non-speech

analogue to motherese (Kuhl, Coffey-Corina, Padden, & Dawson, 2005). Older children with ASD, ranging from preschool to school-age, are unable to identify emotions expressed through the communication partner's tone of voice (Loveland, Tunali-Kotoski, Chen, Brelsford, & Ortegon, 1995). Given all the above findings, it is predicted that these deficits may persist in later years and manifested in difficulties in figurative language comprehension, including comprehending irony.

The Present Study

Building on previous studies on English-speaking children, the present study examined the role of intonation in the comprehension of irony in Cantonese-speaking children with ASD and their TD peers. Given the typological features of Cantonese, the present study also investigated if the SFP *zek55* has any facilitative effect on the comprehension of irony in these two groups of children in addition to intonation. In view of the close relationship between theory of mind abilities and the irony comprehension, it was predicted that children with ASD would be less accurate than TD children in comprehending verbal irony, in both areas of judging speaker's *belief* and *intent*. It was expected the presence of both intonation cue and SFP would be most facilitative in the comprehension of verbal irony in both groups of participants, while the absence of both cues would be least facilitative. Based on the existing evidence in the literature, it was unsure where the conditions of 'Intonation-only' and 'SFP-only' would stand in Cantonese.

Method

Participants

Given that TD children should be able to understand verbal irony by eight years old (Ackerman, 1982; Hancock, Dunham, & Purdy, 2000; Happé, 1995, Imaizumi et al., 2009; Winner & Leekam, 1991), the target age group to be examined was eight years or above.

Thirteen individuals with ASD were recruited from the Parent Association of Autistic Children in Mainstream Education. All participants were male and native Cantonese speakers, aged between 8;3 and 12;9. The language ability of the participants was determined using the Test of Hong Kong Cantonese Grammar (HKCG), a subtest of the Hong Kong Cantonese Oral Language Assessment Scale (HKCOLAS) (T'sou et al, 2006). All the children demonstrated age-appropriate language skills with a standard score above $-1.25SD$. These 13 children with ASD were then matched with 13 TD children according to their language performance in HKCG. Participants' characteristics, including chronological age, age range, mean age and language score are presented in Table 1.

Table 1.

Subject Characteristics

Group	Age range	Mean age (SD)	HKCG raw mean (SD)
TD (n=13)	8;05 – 12;9	10.42 (1.20)	55 (3.80)
ASD (n=13)	8;03 – 11;11	9.58 (1.20)	56 (4.70)

Materials

The variables of interest, i.e., intonation and SFP, were manipulated and resulted in four experimental conditions, (1) intonation only, (2) SFP only, (3) both intonation and SFP, and (4) neither. Four story scenarios were created. Each story scenario included two characters, engaged in events familiar to local children. Each story scenario was presented four times to include the four possible experimental conditions, yielding a total of 16 test vignettes. In the “Both” condition, both the sarcastic intonation, in the form of stronger stress and lengthening at the intensifier, and the SFP were available to aid in interpreting the speaker's communicative intent.

In the “Intonation-only” condition and “SFP-only” condition, only intonation cue and only the SFP were provided respectively. In the “Neither” condition, neither SFP nor intonation was embedded. Each vignette finished within four sentences, ending with a potentially ironic remark addressed by a speaker to a listener. Some changes were made to the names of the characters and setting of the stories to sustain participants’ interest.

The stimuli were verified perceptually by five native Cantonese adult speakers. They listened to the scenarios and ranked the four conditions from the most to the least ironic. Modifications on the comments in the story were made until all their rankings indicated that the “Both” condition’ was the most ironic and the “Neither” condition was the least ironic. Examples of the stimuli are presented in the Appendix. All the vignettes were read aloud and recorded onto a MP3 recorder to be presented to the participants in order to minimize any potential variation of the stimuli presented by the investigator. Drawings for the story scenarios were prepared to sustain the participants’ interest and provide contexts to support the children’s comprehension. In addition to the 16 vignettes with ironic remarks, five complimentary vignettes having story characters who were truly sincere were prepared. These served as distractors for the ironic vignettes and aimed to minimize the possibility of giving habitual responses to the second question concerning the speaker’s belief (see below).

Procedures

The procedures for assessing the comprehension of verbal irony in children were adapted from Ackerman (1983). The participants were tested individually. They listened to a total of 23 vignettes, consisting of two practice vignettes, 16 test vignettes and five vignettes ending with a compliment. The order of trials was randomized. The participants answered three questions after listening to each vignette. For example, the first question, “你認為 [人物1] 跳舞跳得好唔好?”

(Do you think that A was a good dancer?)”, was used to confirm whether participants understood the factual context of the story. The second question was “[人物2] 心裏面認為 [人物1] 跳得好唔好? (Did [B] believe that the [A] dance well?)”. This first-order false belief question assesses the child’s ability to judge the speaker’s belief. The third question was “[人物2] 同 [人物1] 講 ‘你跳得真係好咖啫, [人物2] 想 [人物1] 知道 [人物1] 跳得好定差呢? ’ (When [B] says to [A] ‘You danced beautifully’, did [B] intend for [A] to think that [A] was a good dancer or bad dancer?)”. This second-order false belief question assessed the child’s comprehension of speaker’s pragmatic intent. The order in which *good* or *bad* queries were presented was randomized.

The responses of the five complimentary vignettes were not included in the analysis. Each correct response scored one mark and the total scores for each type of question were used as the outcome measures.

Results

Identification of Factual Cues

All participants correctly answered this control question. No additional analyses were required on the results obtained.

Judgment of speaker’s belief

The majority of the participants from both groups were able to comprehend the speaker’s belief. Table 2 reveals the mean percentage and standard deviation of the correctly attributed speaker belief responses across the four experimental conditions and the two groups of participants. By observation, both groups of participants were able to comprehend the speaker’s belief with high accuracy across all four conditions. A 2 (group) x 4 (condition) two-way Analysis of Variance (ANOVA) with repeated measures was conducted, with group as the

between-group variable and condition as the within-group variable. Neither the main effects of condition ($F(3, 78) = 1.9, p = .14$), group ($F(1, 26) = 0.27, p = .61$) nor the interaction between group and condition ($F(3, 78) = 0.706, p = .55$) were significant. These results give rise to two implications. Firstly, both groups of participants gave similar judgment of speaker's belief in all conditions. Secondly, the various conditions of the potentially ironic remarks did not influence their judgment of speaker's belief, regardless of participants' group membership.

Table 2

Mean Proportions and Standard Deviations (SDs) of Correctly Attributed Speaker's Belief for Potentially Ironic Remarks

Group	Conditions			
	Both	SFP-only	Intonation-only	Neither
TD	0.83 (0.36)	0.82 (0.36)	0.77 (0.32)	0.78 (0.37)
ASD	0.86 (0.32)	0.88 (0.32)	0.84 (0.36)	0.86 (0.36)

Judgment of speaker's intent

Only the participants who correctly responded to the set of questions concerning the speaker's belief were required to answer the question on speaker's intent. A participant in the clinical group and another participant in the control group were not able to answer the set of questions concerning speaker's belief. As such, a total of 12 TD participants and 12 participants with ASD were included in this task. While the participants from both groups performed similarly in the judgment of speaker's *belief*, there was a more obvious difference between the two groups in the judgment of speaker's *intent*. Table 3 summarizes the mean results for this type of questions. The TD participants performed well above chance levels in the conditions of

“Both” and “SPF-only”; slightly above chance level for the condition of “Intonation-only” and below chance level for the “Neither” condition. In contrast, the clinical group performed below chance level in all conditions, and gave more correct responses in the conditions of “Both” and “SPF-only”.

Table 3

Mean Proportions and Standard Deviations (SDs) of Correctly Attributed Speaker’s Intent for Potentially Ironic Remarks

Group	Conditions			
	Both	SFP-only	Intonation-only	Neither
TD	0.96 (0.10)	0.95 (0.11)	0.51 (0.33)	0.19 (0.30)
ASD	0.38 (0.38)	0.42 (0.40)	0.29 (0.41)	0.23 (0.39)

Another two-way (group x condition) ANOVA with repeated measures was conducted to confirm the above difference. There was a significant main effect of group: TD group performed significantly better than the clinical group ($F(1, 22) = 7.57, p = .012, \text{partial } \eta^2 = .26$). There was also a significant main effect of the remark condition ($F(3, 66) = 40.9, p < .001, \text{partial } \eta^2 = .65$). This effect implied that ignoring the diagnosis of the participants, the presence or absence of intonation cue and/or SFP in the potentially ironic remarks affected their judgment of the speaker’s intent significantly. There was also a significant group x remark condition interaction ($F(3, 66) = 16.4, p < .001, \text{partial } \eta^2 = .43$), indicating that the judgment of speaker’s intent based on the different remark conditions significantly differed in the two groups as represented graphically in Figure 1. Contrast analyses with “Neither” condition as the reference group suggested that the significant interaction effect was due to the significantly better performances

of the TD group in conditions of “Both” ($F(1,22)=36.38, p<.001, \text{partial } \eta^2=.62$), “SFP-only” ($F(1,22)=30.13, p<.001, \text{partial } \eta^2=.58$) and “intonation-only” ($F(1,22)=7.55, p=.012, \text{partial } \eta^2=.26$). There was no significant differences between the two groups in “Neither” condition (see Figure 1).

Within the TD group, a follow-up one-way ANOVA and post-hoc analysis using Tukey tests were conducted. Results showed that the participants’ judgment of a speaker’s intent for the conditions of ‘Both’ and ‘SPF-only’ were not significantly different. The proportion of correct responses given under these two conditions were significantly higher from those given under the “Intonation-only” and “Neither” condition. Finally, the performance in “Intonation-only” condition was also significantly better than the “Neither” condition. As for the children with ASD, ANOVA confirmed that conditions do not impose any significant effect on their response.

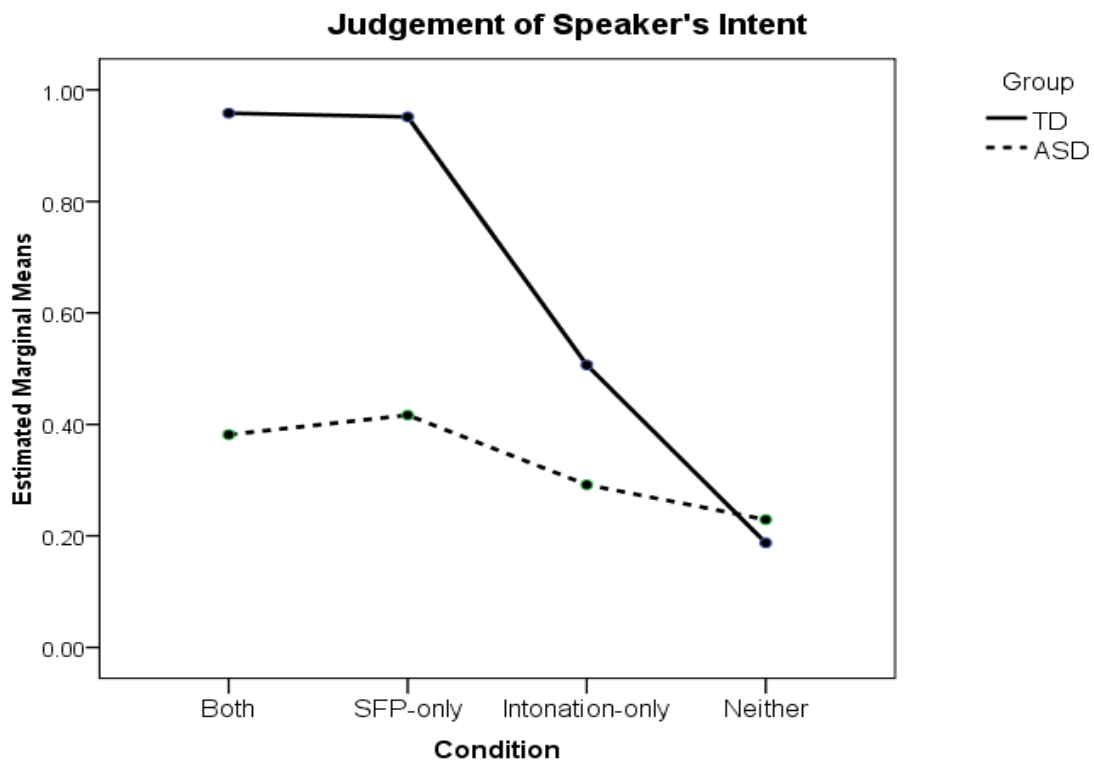


Fig 1. Group performance on the task of judging speaker’s intent.

Discussion

The study aimed to examine the role of intonation and the SFP *zek55* in the comprehension of verbal irony in Cantonese. Both TD children and children with ASD participated in this study.

Identification of Factual Cues

All participants were able to answer the control question correctly, demonstrating that they were able to comprehend the factual context of each story. The high accuracy attained was consistent with the fact that all the participants exhibited age-appropriate language ability as shown in the performance in the subtest of HKCG. This implied that their responses to the speaker's belief and speaker's intent questions would not be given randomly.

Judgment of Speaker's belief

The major finding regarding the judgement of speaker's belief indicated that children with ASD were as capable as the TD children in judging the speaker's belief from the story. That is, they understood that the character can have a thought which may not be congruent with the situation. By contrasting the factual context of the story with the ironic remark, both groups of participants were able to correctly attribute the speaker's belief. For example, the participant was able to infer that the story character believed that her friend was late even though she commented "How punctual you are!". It was anticipated that children with ASD would be less accurate than TD children in this task because it was evident in the past research that children with ASD often have a poorer theory of mind than their TD peers (e.g., Baron-Cohen et al., 1985; Reed & Peterson, 1990; Swettenham, 1996; Swettenham, Baron-Cohen, Gomez & Walsh, 1996). Apparently, the prediction was not supported by the results in the present study since children with ASD performed similarly well as their TD counterparts. One might be quick to point out that the results from this present study had diverted from the common belief of theory of mind

deficits in children with ASD, which is often described as universal across a range of age groups and IQ ability (Baron-Cohen, 1989; Frith & Happé, 1994; Happé, 1995). When the previous studies were examined in more details, it was found that there had been no reported cases of children with ASD passing the first order theory of mind tasks at the right mental age (Happé, 1995). Given that the language skills of all the participants had been controlled for by matching, the intellectual ability of the two groups was assumed to be close to each other. Therefore, the results here provided another line of evidence that even though some children with ASD can pass the first order theory of mind task at some point, their achievement in more advanced theory of mind still lagged behind the TD children (Happé, 1994).

Judgment of Speaker's intent

Previous research had showed that both contextual and prosodic cues were important in the comprehension of irony (Ackerman, 1982, 1986; Capelli et. al., 1990; Laval & Bert-Erboul, 2005; Winner & Leekman, 1991). However, the TD participants in this study did not make good use of the intonation cues to aid their comprehension of the intent of the ironic remarks. Instead, the conditions of “Both” and “SFP-only” were found to be more facilitative. This discrepant finding with previous studies may be attributed to the typological features in the tonal language of Cantonese. In English, the mood or meaning of an utterance can be modified by saying it in a different intonation. On the other hand, Cantonese, with a system of nine tones, has much less flexibility to use intonation variation to convey mood. This is because changing the pitch may result in changing the meaning of the syllables, and hence the word or even the entire utterance (Law, S.-P., 1990; Chan, 2002). Therefore, the prosodic difference between a sincere tone and a mocking tone may be more subtle in Cantonese.

In contrast to intonation, the presence of the SFP *zek55* at the end of the utterance was able to guide the TD participants in making an informed judgment of the speaker's intent. As previously mentioned, this SFP has a highly affective value, conveying a variety of emotions ranging from positive affects such as giving out compliments, to negative affects such as sarcasm and exasperation (Fung, 2000). With the incongruent contextual background knowledge, TD children can read the sarcastic undertone in the remark. According to Yau (1980) (cited in Law, S.-P., 1990), there is a mutual compensation between sentence particles and intonation. He suggested that "the more a language relies on the use of sentence particles in expressing sentential connotations, the less significant will be the role played by intonation patterns, and vice versa" (p. 51). English and Cantonese represent the two extremes in this continuum. This explained why the role of intonation in marking ironic undertone in Cantonese is less salient than English.

It is also noteworthy that the conditions of "Both" and "SPF-only" exerted a similar degree of facilitative effect on the comprehension of irony in the TD children. In other words, SFP alone may already be sufficient enough to bring about the facilitative effect to the children for ironic reading. This pattern was somewhat inconsistent with the original prediction that the "Both" condition could strengthen the explicitness of the ironic undertone when compared to the single-cue conditions. In order to understand this pattern, we can take a closer look at the mechanism of intonation at the sentence or utterance level in Cantonese or Chinese. Chao (1968) pointed out that intonation in Chinese are additive. He provided an example of imposing a rising intonation tone was added onto a final lexical falling tone, it would result in a lengthened syllable which was realized as a fall-rise sequence, giving rise to intonation variation. This example may suggest that the final syllable(s) of an utterance are crucial to bring about the

perception of intonation variation in Cantonese or Chinese. That means, syllables in other parts of a sentence would contribute to the overall intonation pattern of the sentence but may not be as salient as those in the utterance-final position. Moreover, since SFPs do not carry any semantic meaning, there is more room for intonation variation when using SFPs.

Among different languages around the world, instead of describing the relationship between the reliance on SFPs and intonation as a trade-off, it would be more appropriate to say that SFPs play a complementary role to the suprasegmental intonation in determining the overall prosodic feature of an utterance. Since the “Both”, “SPF-only”/ “Intonation-only” and “Neither” remarks had been judged by five native adult listeners as having increasing ironic sense, it may be possible that children at eight were not yet sensitive to the sole contribution of intonation in ironic reading. Their awareness in this area may improve with age, but such a speculation requires more systematic studies to support.

As for the participants with ASD, the accuracy for all the four conditions was below chance level with statistically insignificant differences across the conditions. Unlike the TD participants, they were unable to make use of the SFP *zek55* to infer the speaker’s intention of being ironic. From their perspective, they thought that the characters in the story were being nice by telling a white lie so as to make the listener feel better. It is of no surprise that the participants with ASD failed to pass this second-order false belief task. These participants may have shown to acquire the first-order mental state, as seen in their ability to judge the speaker’s belief; but to fully understand the speaker’s intention, these children must acquire the ‘meta-representation’ ability (Leslie, 1987, Happé, 1995; Papafragou, 1998), also known as the ‘mentalizing’ ability (Imaizumi et al., 2009). A child has to understand that the mental state of a speaker is not necessarily expressed literally in a straightforward manner. He/she has to correctly deduce the

affective value embedded in the SFP and integrate it with the literal meaning of the speech to understand the implicit but true intention of the speaker. Integrating incongruent properties in one's speech to make a sound interpretation of the speaker's intention is not easy. It takes years for TD children to develop this skill, let alone children with ASD. It can be concluded from the present study that children with ASD have difficulty in 'mentalizing' such advanced incongruent expressions.

It is also note-worthy that children in the ASD group tend to interpret the irony as "good-intent" white lies (as shown in their below-chance level responses in the judgment of speaker's intent task in all conditions). Such a "white-lie" inclination suggested that although both irony and white lie are classified as advanced figurative language (Happé, 1994), they actually belong to different levels of complexity. There is strong empirical evidence stating that among the different types of figurative language, comprehension of irony had been found to require higher order theory of mind skills, while that of metaphors require a lower level of such skills. On the contrary, the comprehension of similes required no theory of mind skills at all (Happé, 1993). This implies that comprehension of non-literal language taxes on different levels of mental state reasoning, of which may develop gradually and separately. For lies, the words are "deceptive" for which the speaker intentionally hid the truth from the listener with or without good intention. As for irony, the words are considered to be "fictional". The irony speaker does not deliberately hide the truth, but attempts to convey the message implicitly without compromising (Anolli et al., 2000). Based on these cognitive assumptions, it appears that the comprehension of white-lie would be easier than the comprehension of irony but more difficult than that of similes. Again, such a developmental hierarchy may require stronger acquisitional data to support.

Limitations and Future Direction

The present study identified that children with ASD were just as capable as the TD children in identifying the contextual cues when their language ability are controlled for. In this study, these vignettes were presented in an audio form, with the contextual cues mentioned explicitly. However, this mode of presentation is not a realistic replica of the ironic scenarios in our everyday lives. It would have been more naturalistic if the vignettes were videotaped, so that the contextual cues, including facial expressions, could be acted out. This is worth investigating because even with a sound theory of mind, a child would not be able to comprehend verbal irony if he/she was not able to decode the contextual cues in the first place. Past research had showed that children with ASD are poor in picking paralinguistic cues such as comprehending the body language of others (e.g., Atkinson, 2009; Hefter, Manoach, & Barton, 2005). Hence, it is believed that by presenting the story scenarios visually may be a better way to reflect the true ability of children with ASD in comprehending contextual cues.

Secondly, this present study revealed that intonation cues in Cantonese cues may not play an imperative role in the comprehension of verbal irony as in English. In this light, it would be worthwhile to replicate the study in other tonal languages such as Mandarin Chinese and Thai with a larger sample size.

Thirdly, only the SFP *zek55* was investigated in this study. Other SFPs in Cantonese such as *a55*, *aa55maa33*, *tim55* and *wo23* can be used to express irony but with various degree. As previous studies on Cantonese SFPs had been naturalistic studies investigating in their usage in adult speakers and their acquisition in young children, it would be interesting to conduct a well-controlled experimental study on the role of various SFPs in the comprehension of Cantonese verbal irony.

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Appendix- List of Test Vignettes**Story Scenario #1 punctuality (1-4)****1 Both condition**

美美約咗幾個朋友仔四點鐘去遊樂場玩。俊俊係最後一個去到遊樂場。美美見俊俊嘅時候，就同佢講：“你真係準時啱啱！”

Question 1: 你認為俊俊準唔準時？

Question 2: 咁美美認為俊俊準唔準時？

Question 3: 美美想要俊俊知道佢準時定遲到呢？

May and her friends had agreed to meet at the playground at 4pm. John was the last one to join the group. When May saw John, she said to him, “You are so (with stress and syllable lengthening) punctual (with SFP *zek55*)!”

Question 1: Do you think that John was punctual?

Question 2: So did May think that John was punctual?

Question 3: Did May want John to know that he was punctual or late?

2 SPF-only condition

彤彤逢星期三五點都去學畫畫。今日，彤彤係最後一個去到畫畫班。彤彤坐低嘅時候，佢隔離嘅同學仔就同佢講：“你真係準時啱啱！”

Question 1: 你認為彤彤準唔準時？

Question 2: 咁同學仔認為彤彤準唔準時？

Question 3: 同學仔想要彤彤知道佢遲到定準時呢？

Tong Tong attends an art class every Wednesday at 5pm. Today, Today, Tong Tong was the last one to arrive. When she sat down, her classmate said to her, “You are so (without stress and syllable lengthening) punctual (with SFP *zek55*)!”

Question 1: Do you think that Tong Tong was punctual?

Question 2: So did the classmate think that Tong Tong was punctual?

Question 3: Did the classmate want Tong Tong to know that she was late or punctual?

3 Intonation-only condition

放暑假嘅時候，老師安排成班同學去郊遊。佢叫大家朝頭早八點到學校集合。出發個日，小明係最後一個上車。小明上車嘅時候，班長就同佢講：“你真係準時！”

Question 1: 你認為小明準唔準時？

Question 2: 咁阿樂認為小明準唔準時？

Question 3: 班長想要小明知道佢準時定遲到呢？

During the summer holidays, the teacher arranged for her class to go on a field trip. She told the class to meet at school at 8am. On the day of the field trip, Ming was the last to get on the bus. The class monitor said to him, “You are so (with stress and syllable lengthening) punctual!”

Question 1: Do you think that Ming was punctual?

Question 2: So did the class monitor think that Ming was punctual?

Question 3: Did the class monitor want Ming to know that he was punctual or late?

4 Neither condition

今日係詠詠嘅生日，佢請咗成班同學一點鐘去佢屋企開生日會。志明係最後一個去到詠詠嘅屋企。志明去到嘅時候，詠詠對佢講：“你真係準時。”

- Question 1: 你認為志明準唔準時?
 Question 2: 咁詠詠認為志明準唔準時?
 Question 3: 詠詠想要志明知道佢遲到定準時呢?

Today is Wing's birthday. She invited the whole class to her house for her birthday party at 1pm. ZiMing was the last to arrive. When he arrived, Wing said to him, "You are so (without stress and syllable lengthening) punctual."

- Question 1: Do you think that ZiMing was punctual?
 Question 2: So did Wing think that ZiMing was punctual?
 Question 3: Did Wing want ZiMing to know that he was late or punctual?

Story Scenario #2 Cleaniness (5 – 8)**5 Both condition:**

東東打完波番屋企，成對鞋都是泥。爸爸叫佢刷一刷對鞋先替睇電視。第二日，爸爸見到有少少泥黏住喺對鞋度，就話：“你對鞋真係乾淨咖啫！”

- Question 1: 你認為東東對鞋乾唔乾淨?
 Question 2: 咁爸爸認為對鞋乾唔乾淨?
 Question 3: 爸爸想要東東知道佢對鞋污糟定乾淨呢?

Dong Dong went home wearing in a pair of muddy shoes after playing soccer. Dad asked him to clean it up before watching the television. The next day, Dad saw that there was still some mud stuck on the shoe, and said, "Your shoes are so (with stress and syllable lengthening) clean (with SFP *zek55*)!"

- Question 1: Do you think that Dong Dong's shoes were clean?
 Question 2: So did Dad think that Dong Dong's shoes were clean?
 Question 3: Did Dad want Dong Dong to know that his shoes were clean or dirty?

6 SPF-only condition

大雄交功課嘅時候，陳老師見到有少少茄汁喺本作業簿上面。陳老師就話：“你本作業簿真係乾淨咖啫！”

- Question 1: 你認為大雄本作業簿乾唔乾淨?
 Question 2: 咁陳老師認為本作業簿乾唔乾淨?
 Question 3: 陳老師想要大雄知道本作業簿乾淨定污糟呢?

When Hong handed in his assignment, his teacher Miss Chan saw some ketchup on his workbook. She said to him, "Your workbook is so (without stress and syllable lengthening) clean (with SFP *zek55*)!"

- Question 1: Do you think that Hong's workbook was clean?
 Question 2: So did Miss Chan think that Hong's workbook was clean?
 Question 3: Did Miss Chan want Hong to know that his workbook was dirty or clean?

7 Intonation-only condition

文文打完波番屋企，好污糟。媽媽叫佢沖完涼先食飯。食飯嘅時候，媽媽見到文文隻手有少少泥，就話：“你沖涼沖得真係乾淨！”

Question 1: 你認為文文乾唔乾淨？

Question 2: 咁媽媽認為文文乾唔乾淨？

Question 3: 媽媽想要文文知道佢隻手污糟定乾淨呢？

ManMan arrived home very dirty after playing football. Mum told him to take a bath before having dinner. During dinner, Mum saw that there was still some mud on ManMan's elbow, and said, "Your elbow is so (with stress and syllable lengthening) clean!"

Question 1: Do you think that ManMan's elbow was clean ?

Question 2: So did Mum think that ManMan's elbow was clean?

Question 3: Did Mum want ManMan to know that his elbow was clean or dirty?

8 Neither condition

放暑假嘅時候，爸爸叫哥哥幫手抹車。爸爸放工返嚟，見到車頂度有 D 雀屎，就同哥哥講：“你將架車抹得真係乾淨！”

Question 1: 你認為架車乾唔乾淨？

Question 2: 咁爸爸認為架車乾唔乾淨？

Question 3: 爸爸想要哥哥知道架車乾淨定污糟呢？

During the summer holidays, Dad asked Brother to clean the car. When Dad arrived home from work, he saw that there were still some bird droppings on the car. He said to Brother, "The car is so (without stress and syllable lengthening) clean."

Question 1: Do you think that the car was clean?

Question 2: So did Dad think that the car was clean?

Question 3: Did Dad want Brother to know that the car was dirty or clean?

Story Scenario #3 Naughty (9-12)**9 Both condition:**

婆婆今日帶弟弟出街玩。弟弟過馬路嘅時候唔肯拖住婆婆，仲周圍跑。媽媽夜晚放工去接弟弟嘅時候，婆婆就同媽媽講：“弟弟今日真係乖咖啫！”

Question 1: 你認為弟弟乖唔乖？

Question 2: 咁婆婆認為弟弟乖唔乖？

Question 3: 婆婆想要媽媽知道弟弟乖定曳呢？

Grandma took Little Brother out today. Little Brother had refused to hold Grandma's hand when they crossed the road, and had even run around. When Mum picked him up at night, Grandma said to her, "He was so (with stress and syllable lengthening) well-behaved (with SFP *zek55*)!"

Question 1: Do you think that Little Brother was well-behaved?

Question 2: So did Grandma think that Little Brother was well-behaved or naughty?

Question 3: Did Grandma want Mum to know that Little Brother was well-behaved?

10 SPF-only condition:

明仔今日喺學校發脾氣，仲打同學仔添。公公接明仔放學嘅時候，老師就同公公講：“明仔今日真係乖**啲**。”

Question 1: 你認為明仔乖唔乖？

Question 2: 咁老師認為明仔乖唔乖？

Question 3: 老師要公公知道明仔曳定乖呢？

Ming threw a tantrum in school today, and even hit his classmate. When Grandpa picked him up from school, the teacher said to him, “Ming was so (without stress and syllable lengthening) well-behaved (with SFP *zek55*)!”

Question 1: Do you think that Ming was well-behaved?

Question 2: So did the teacher think that Ming was well-behaved?

Question 3: Did the teacher want Grandpa to know that Ming was naughty or well-behaved?

11 Intonation-only condition:

哥哥今日喺屋企搶妹妹嘅玩具，整喊咗妹妹。爸爸放工返嚟，媽媽就同爸爸講：“哥哥今日真係乖！”

Question 1: 你認為哥哥乖唔乖？

Question 2: 咁媽媽認為哥哥乖唔乖？

Question 3: 婆婆想爸爸知道哥哥乖定曳呢？

Big Brother snatched Little Sister’s toys today, and made her cry. When Dad returned home from work, Mum said to him, “Big Brother was so (with stress and syllable lengthening) well-behaved!”

Question 1: Do you think that Big Brother was well-behaved?

Question 2: So did Mum think that Big Brother was well-behaved?

Question 3: Did Mum want Dad to know that Big Brother was well-behaved or naughty?

12 Neither condition:

弟弟今日同表哥去動物園玩。弟弟係動物園度唔聽表哥話，仲周圍跑添。媽媽夜晚去接弟弟嘅時候，表哥就同媽媽講：“弟弟今日真係乖”。

Question 1: 你認為弟弟乖唔乖？

Question 2: 咁表哥認為弟弟乖唔乖？

Question 3: 表哥想媽媽知道弟弟曳定乖呢？

Little Brother went with his cousin to the zoo today. He refused to listen to his cousin, and ran around, annoying other visitors. When Mum picked him up at night, the cousin said to her, “He was so (without stress and syllable lengthening) well-behaved.”

Question 1: Do you think that Little Brother was well-behaved?

Question 2: So did Cousin think that Little Brother was well-behaved?

Question 3: Did Cousin want Mum to know that Little Brother was naughty or well-behaved?

Story Scenario #4 Eating (13-16)**13 Both condition:**

姐姐今日係學校學整蛋糕。佢特登帶咗一塊蛋糕返屋企請爺爺食。爺爺食咗一啖，皺一皺眉頭，然後話，“塊蛋糕真係好吃咖啫！”

Question 1: 你認為姐姐塊蛋糕好唔好食？

Question 2: 咁爺爺認為塊蛋糕好唔好食？

Question 3: 爺爺想要姐姐知道塊蛋糕難食定好食呢？

Sister baked a cake in school today and brought a piece back home especially for Grandpa. Grandpa took a bite of the cake, twitched his eyebrows a little, and said, “The cake is so (with stress and syllable lengthening) delicious (with SFP *zek55*)!”

Question 1: Do you think that the cake was delicious?

Question 2: So did Grandpa think that the cake was delicious?

Question 3: Did Grandpa want Sister to know that the cake was delicious or unsavoury?

14 SPF-only condition:

媽媽今日病咗，所以晚餐就由爸爸負責。妹妹食咗一啖餸，皺一皺眉頭，然後話：“爸爸你煮嘅餸真係好吃咖啫！”

Question 1: 你認為爸爸煮嘅餸好唔好食？

Question 2: 咁妹妹認為爸爸煮嘅餸好唔好食？

Question 3: 妹妹想要爸爸知道 D 餸唔好食定難食呢？

Mum was sick today, so Dad was in-charged of cooking dinner. Little Sister took a bite of the meal, twitched her eyebrows a little, and said, “Today’s dinner is so (without stress and syllable lengthening) delicious (with SFP *zek55*)!”

Question 1: Do you think that the meal was delicious?

Question 2: So did Little Sister think that the meal was delicious?

Question 3: Did Little Sister want Dad to know that the meal was unsavoury or delicious?

15 Intonation-only condition:

黃大仙商場開咗一間新嘅茶餐廳。和仔就去買豬扒包嚟試吓。和仔食咗一啖豬扒包，皺一皺眉頭，然後話，“個豬扒包真係好吃！”

Question 1: 你認為個豬扒包好唔好食？

Question 2: 咁和仔認為個豬扒包好唔好食？

Question 3: 和仔想要老闆知道個豬扒包難食定好食呢？

A new fast food restaurant had opened up in Wong Tai Sin Shopping Centre. Ronald decided to try their pork chop burger. He took a bite of the burger, twitched his eyebrows a little, and said, “This pork chop burger is so (with stress and syllable lengthening) delicious!”

Question 1: Do you think that the pork chop burger was delicious?

Question 2: So did Ronald think that the pork chop burger was delicious?

Question 3: Did Ronald want others to know that the meal was delicious or unsavoury?

16 Neither condition:

就快過新年啦！姐姐想整曲奇餅請朋友食。姐姐整完第一批之後，就叫哥哥幫手試味。哥哥食咗一啖，皺一皺眉頭，然後話：“你 D 曲奇餅真係好吃！”

Question 1: 你認為姐姐 D 曲奇餅好唔好食？

Question 2: 咁哥哥認為 D 曲奇餅好唔好食？

Question 3: 哥哥想要姐姐知道 D 曲奇餅好食定難食呢？

Chinese New Year is coming! Sister wants to bake some cookies for her friends. She asked her brother to taste them when the first batch is ready. He took a bite of a cookie, twitched his eyebrows a little, and said, “This cookie is so (without stress and syllable lengthening) delicious.”

Question 1: Do you think that the cookie was delicious?

Question 2: So did Brother think that the cookie was delicious?

Question 3: Did Brother want Sister to know that the cookie was unsavoury or delicious?