Engaging young children in informal reasoning about the socio-scientific issue of climate

change by means of ironic sketches

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Abstract

Humorous ironic television sketches can be an approach to make children think about the socio-scientific issue of climate change. However it is not known whether children aged 8 to 12 can comprehend the irony in above mentioned sketches and whether they stimulate children to engage in informal reasoning to form their own opinion on a topic such as climate change. In this study 122 children aged 8/9 or 11/12 participated in a survey, and 16 in additional individual interviews to reach in depth insights by means of triangulation. It was found that 8/9 year-olds three to four times more often failed to comprehend irony, as they mostly pick up the literal text, whereas 11/12 year-olds rely on contextual factors. Both 8/9 and 11/12 year-olds appreciated the irony in the sketches, yet preferred action and logic humor respectively. After watching both sketches, 77% of children changed their initial opinion on climate change resulting in a small positive shift (climate change considered to be no problem) on group level. Children were found to engage in all steps of informal reasoning, by evaluating and incorporating arguments from sketch's characters into their own. All children used multiple arguments, mostly from Everyday life, Self-interest and Environmental perspectives in their argumentation. Humorous ironic sketches can be an excellent approach to engage children in informal reasoning about socio-scientific issues, especially when discussions are held afterwards to reflect on the sketch's (ironic) arguments presented.

Key words: irony comprehension, humor, socio-scientific issue, climate change, opinion forming, scientific literacy, primary education

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Scientific literacy is considered one of the principal goals of science education (Ananiadou & Claro, 2009; Arroio, 2010; Evagorou, 2011; Kolstø, 2001; Sadler, 2011; Sadler & Zeidler, 2005; Shaw & Dybdahl, 2000). Scientific literacy refers to the ability for every citizen – not just those who engage in science professionally – to be able to make judgements about science (Sadler, 2011, p. 2). This ability is required as science takes up an increasingly bigger part in modern society (Arroio, 2010) and as current science is often frontier science, on which the consensus is not yet reached (Kolstø, 2001).

Many of those debated frontier science topics, like climate change and genetic engineering, fall within the domain of socio-scientific issues. Socio-scientific issues (SSI) are complex and open-ended, debatable problems with multiple possible solutions that cannot be fully solved by pure science alone (Burns, O'Connor, & Stocklmayer, 2003; Sadler, 2011, pp. 2–4; Sadler & Zeidler, 2005). Yet, socio-scientific issues are – more than other science topics – strongly influenced by social factors like politics, economics and ethics (Sadler, 2011, p. 2). For this reason, addressing socio-scientific issues early in education is seen as the foremost solution to reach the scientific literacy that is highly needed in democratic societies (Arroio, 2010; Facione, 1990; Kolstø, 2001; Sadler, 2004, 2011; Sadler & Zeidler, 2005).

To make an informed judgement in a socio-scientific issue, a person must engage in the process of informal reasoning (Sadler, 2004). Informal reasoning involves the generation and evaluation of positions on socio-scientific issues, not based on rules of logic and mathematics (which is formal reasoning), but on rationalistic, emotive and/or intuitive arguments from multiple perspectives (Sadler, 2004; Sadler & Zeidler, 2005). It therefore deals with reasoning about causes and consequences, pros and cons and other attitude aspects (Zohar & Nemet, 2002).

The process of informal reasoning consists of three steps prior to making an informed judgement and one later step of argumentation: to voice the own constructed opinion or judgement, that are displayed in Figure 1 (Evagorou, 2011; Sadler, 2004; Sadler & Zeidler, 2005). A person first needs to recognize arguments from the different possible perspectives (e.g. scientific, political, and economic) in the heard or read text. The second step is to evaluate those for their trustworthiness or fit with own believes, that can be done on the level of the information or of the source (Kolstø, 2001; Sadler, 2004). After evaluation the arguments that are considered valid are incorporated into one's own opinion on the topic, leading to a formed judgement about the socio-scientific issue at hand, that can be communicated to others (argumentation). Practice of this process of informal reasoning leads to scientific literacy (Sadler & Zeidler, 2005).

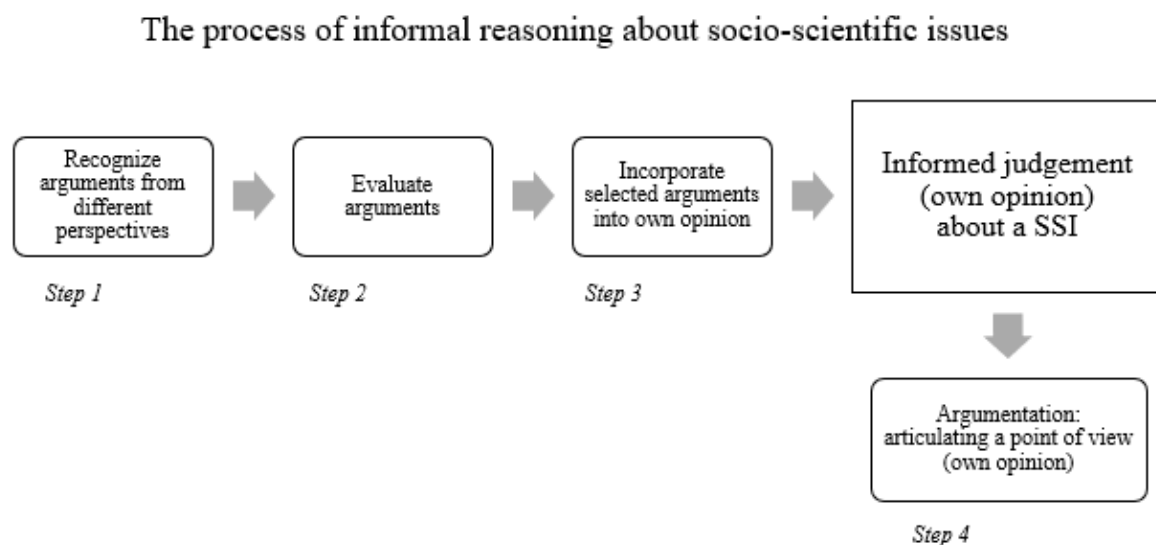*Figure 1: The process of informal reasoning about socio-scientific issues. Step 1 to 3 lead to an informed judgement about the socio-scientific issue at hand and step 4 deals with communicating that judgement or opinion. This figure was created by the researcher based on definitions and research (reviewed) by Evagorou (2011); Sadler (2004); and Sadler & Zeidler (2005). SSI = socio-scientific issue.*

While experts (e.g. Facione (1990); Hundal, Levin, & Keselman (2014); and Sadler (2004) agree that informal reasoning about socio-scientific issues needs to be stimulated early in education, little is known of how primary school children acquire and perform in this ability (Evagorou, 2011; Maloney & Simon, 2006; Sadler & Zeidler, 2005). This is due to research being predominantly focused on secondary and tertiary education only (Byrne, Ideland, Malmberg, & Grace, 2014). The limited studies on young children's informal reasoning show a promising view for that ability: A study with 10-12 year-olds found them able to recognize new pieces of evidence from different perspectives (e.g. financial, moral and environmental) and incorporate them in their opinion on the socio-scientific issue of a pig farm in their neighborhood (Evagorou, 2011). Similarly Byrne et al. (2014) found that 9-10 year-old children are willing to engage in a discussion about the socio-scientific issue of climate change, using arguments from different perspectives (Byrne et al., 2014). These studies indicate that primary school children recognize and evaluate the multiple perspectives of a socio-scientific issue, using them to change their own opinion based on evidence.

Although not many approaches to engage primary school children in informal reasoning about socio-scientific issues have been investigated, lessons can be learned from good practices with older students. Besides improving student's informal reasoning through explicit instruction on argumentation (e.g. Zohar & Nemet (2002), a month long intervention consisting of writing a plan for solving a socio-scientific issue (Patronis & Spiliotopoulou, 1999) and other positive interventions reviewed by Sadler (2004), Knippels, Severiens, & Klop (2009) found that movie clips about genomics had a positive influence on 16-year-old student's informal reasoning.

As schools – and therefore teachers – in the Netherlands have great freedom to choose approaches to address both socio-scientific issues and informal reasoning (Ananiadou & Claro, 2009) and television or short movies are often used in education (Thomson, Bridgstock, &

Willems, 2014), we investigate in this study whether movie clips will – similar to the findings of Knippels et al. (2009) – stimulate primary school children's informal reasoning.

Besides the approach, the socio-scientific issue itself influences children's engagement in informal reasoning. For informal reasoning children need a topic that is not too complex in terms of knowledge, that they can relate to their personal life and that is meaningful to them, allowing them to see multiple perspectives (Sadler & Zeidler, 2005). The socio-scientific issue of climate change fits this description, as it has a strong influence in children's (future) lives and is therefore meaningful (Arroio, 2010; Kolstø, 2001; Sadler, 2004) and 9/10 year-olds were already found to be able to reason about this topic using multiple possible perspectives (Byrne et al., 2014).

Clips about climate change were selected from the Dutch television program *Het Klokhuis* (NTR) as their target audience consists of primary school children (8-12 years-old) and they are a long-lasting source of educational video's that specifically aim to make children think about the world around them (Het Klokhuis, n.d.; Vink, 2002, p. 116). Episodes typically consist of a reportage about one topic, mixed with humorous sketches. These sketches function to display moral and emotional considerations on that topic, often in a playful, exaggerated manner. The combination should provoke children to think for themselves (Het Klokhuis, n.d.; Vink, 2002, p. 116).

Although the program aims to make children think, it remains unknown whether children are actually able to recognize and evaluate the arguments from the sketches and to incorporate them in their opinion. While humor can stimulate thinking about a topic (Cornett, 1986), it can also distract, especially when more difficult forms (such as irony) are concerned (Bryant & Zillmann, 1989; Zillmann et al., 1984). Therefore this research aims to find out how humorous and specifically ironic *Klokhuis* sketches influence 8 to 12 year-old children's opinions and informal reasoning about the socio-scientific issue of climate change.

Addressing socio-scientific issues with humorous drama

As Sadler advocated, socio-scientific issues and informal reasoning need to take up a major role in science education, that can be done in many ways (Sadler, 2011, p. 4; Sadler & Zeidler, 2005). However, one promising approach appears to be using drama, both live and recorded (Knippels et al., 2009; Verhoeff, 2017; Wieringa et al., 2011). Several studies report a positive influence of fiction such as movie clips on student's informal reasoning in socio-scientific issues (Knippels et al., 2009).

This effect may be due to (audiovisual) drama triggering the imagination, raising questions and stimulating the debate about the issue at hand (Wieringa et al., 2011). Drama can show perspectives and emotions of other people, which are critical to understand in order to form an opinion on a socio-scientific issue (Evagorou, 2011, p. 137; Wieringa et al., 2011). But not all drama works: Overacted or unrelatable characters may distract from the message and reduce attention and willingness to reflect on the topic (Wieringa et al., 2011). On the other hand, other features of drama, such as humor the audience can relate to, can actually result in higher engagement with the content (Wieringa et al., 2011). In this study we focus on drama in the form of sketches with characters providing perspectives and emotions that is intended to be humorous (Vink, 2002, p. 116).

Humor in children's educational television

Humor is often the primary reason for children to watch a television show, making it a powerful tool to keep them interested in content that is to be learned (Zillmann, Williams, Bryant, Boynton, & Wolf, 1980). Educational television programs are then made to yield effects on both cognitive and affective learning (Whittle, 1997). These learning effects are enhanced by characters that children can relate to and by humor that is tied to the educational content (Whittle, 1997; Zillmann et al., 1980).

Many different humor types can be distinguished, have different appeal to different audiences and other influences on learning (Buijzen & Valkenburg, 2004). Individual differences, like age, intelligence, and gender, play an important role in the appreciation and understanding of humor (Cornett, 1986). However, some trends can be seen across different ages, based on cognitive stage theories (Cornett, 1986): Babies from one week already smile during sleep and in response to tactile stimulation. Until children reach the age of six body noises, clowning, distorted words and exaggerated sizes become increasingly funny to them. Starting from the age of seven or eight, children become aware of linguistic ambiguity and realize that words cannot always be taken literally. In this phase children enjoy malicious pleasure and appreciate practical jokes that causes discomfort to others. For nine to twelve year-olds word plays, concrete puns and stunts, moron or knock-knock jokes are popular. These children find everything that deviates from the norm, that is taboo, or which adults disapprove of extremely funny. As children grow older, humor develops from a more visual to a more verbal focus. From an age of thirteen years onwards, children prefer a more good-natured humor such as sarcasm and self-ridicule instead of malicious pleasure. Children become more aware of their social environment, and forbidden topics are not laughed at in mixed company anymore. Furthermore tongue-in-cheek humor, social satire and irony become increasingly popular.

Irony comprehension

Irony is one of many humor techniques and is the one most closely investigated in this study. This is due to the fact that the appreciation and ability to comprehend irony are gradually emerging in the age range of the target audience of *Het Klokhuis*. Because irony allows one to convey something while saying something else, it is an appealing humor technique for the writers of the *Klokhuis* sketches.

Irony was traditionally defined as ''saying one thing and meaning the opposite'' (Wilson, 2013). However, reviewing the literature, Wilson (2013) concludes that in current experimental research the term irony is rightly used in a much broader sense to also include sarcasm, banter or interrogatives (1), imperatives (2) and hyperboles (3) such as (examples from Wilson (2013)):

1) (to an obsessively cautious driver): Did you remember to check the rear-view mirror?

2) (to someone who has dropped a plate of food): Go ahead and ruin my carpet.

3) (after a boring lecture): I was on the edge of my seat.

And while these three examples can be considered ironic, it is not to say that all hyperboles, banter and sarcastic utterances automatically are ironic (Wilson, 2013). To solve the problems in defining irony, Wilson calls for an adequate definition of irony based on the three distinctive features of irony, which will be explained below. As Wilson does not provide a definition of irony, in this study the definition for verbal irony[1] of Dews et al. (1996) is used: ''irony is a form of nonliteral language characterized by opposition or difference between the sentence (literal) meaning and the speaker (conveyed) meaning''. For utterances to be qualified as ironic in this study, they also have to contain the three distinctive features of irony (Wilson, 2013):

• It expresses a mocking, scornful or contemptuous attitude to an echoed thought;

• A normative bias is present (something does not live up to some norm-based expectation); and

• There is a possibility of using the regular ironical tone of voice.

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[1] Verbal irony is the only form of irony investigated in this study. This irony is called verbal to distinguish it from other loosely related non-verbal phenomena that sometimes are called irony as well, such as situational irony (rain on your wedding day) and irony of fate (Wilson, 2013). In this paper every incident of irony (unless stated otherwise) refers to verbal irony only.

Consider the food dropping example again (2). It has normative bias (people are *supposed* to be neat/careful), a mocking attitude (towards the spiller) and could be said with ironical tone of voice. The humorous effect of irony is caused by noticing this discrepancy between literal (you are allowed to ruin my carpet) and conveyed (be careful/you have to clean it/you idiot/…) meaning (Dews et al., 1996). Cornett (1986) states that irony is mostly appreciated from 13 years on, but it can be recognized, comprehended, and appreciated by much younger children already (Capelli, Nakagawa, & Madden, 1990; Dews et al., 1996; Glenwright & Pexman, 2010; Pexman & Glenwright, 2007).

To comprehend irony, a child needs to be able to notice discrepancies between the literal and the conveyed meaning of a speaker (Dews et al., 1996). Several studies (e.g. Capelli et al. (1990); Creusere (2000); Dews et al. (1996); and Pexman & Glenwright (2007)) found that the ability to comprehend simple ironic utterances emerges abruptly between five and six years of age. However, irony is not always comprehended after that age. Research indicates that this ability is still developing at the age of twelve and thirteen and even adults can struggle with it (Creusere, 1999; Dews et al., 1996).

Thanks to the broad definition of irony, plenty of different utterances could qualify as ironic and it is not easy to predict which ironic utterances are harder to comprehend. However, certain aspects that can influence the comprehension of irony are pointed out by research. Firstly, comprehension is influenced by the degree of indirection (Dews et al., 1996): The speaker's meaning can be the exact opposite of what is meant (direct irony; in case of the food dropper (2): 'you are such a neat person') or only follows from that (indirect irony; 'you should become a waitress'). Dews et al. (1996) found that indirect irony is more subtle, leading to failure of comprehension by five and six year-olds. Secondly, the difficulty of irony is affected by intonation. The characteristic ironic tone of voice (mocking, sarcastic with slow speaking rate and nasalization), does not have to be present (Wilson, 2013), but if it is, it helps young

children's comprehension by alerting them to the irony (Capelli et al., 1990; Wilson, 2013). Thirdly, irony is easier to detect when a prior statement (for example the plate dropper boasting about her neatness) is echoed in the ironic statement ('you really are neat') (Creusere, 2000; Dews et al., 1996; Wilson, 2013). Lastly, the context, such as previous statements or personal characteristics, can give important clues on irony (Mulken & Burgers, 2013; Zillmann et al., 1984). Obvious cases of irony (direct, echoing a prior-statement, with intonation) are comprehended and appreciated more by young children as opposed to subtle irony (Dews et al., 1996).

Concludingly, literature suggests differences in comprehension and appreciation of irony across the target audience of Het Klokhuis (age eight to twelve). As irony is a major component of human interaction (Wilson, 2013) and *Het Klokhuis* shows the world as it is (Vink, 2002, p. 116), it is not surprising that many cases of irony can be found in its sketches. The makers of the program pointed out to the researcher that they use irony intentionally to make the sketches appealing for older children and adults. However, whether irony is indeed better comprehended and appreciated by older instead of younger children is not yet investigated. Therefore, this study aims to explore how the humorous and ironic sketches of *Het Klokhuis* are understood and appreciated by children at both ends of the age spectrum of *Het Klokhuis*. Furthermore, we aim to investigate a possible relationship between the comprehension and appreciation of the sketches, and children's opinion and informal reasoning about the socio-scientific issue of climate change, as irony was found to distort young children's judgements about the properties of a topic the humor was related to (Zillmann et al., 1984). To this goal, the following research (sub)questions will be answered:

RQ: What is the difference between eight and twelve year-olds' comprehension and appreciation of ironic sketches and their informal reasoning about climate change when confronted with sketches about this socio-scientific issue?

SQ1: To what extent do 8 and 12 year-olds understand and appreciate ironic sketches?

SQ2: To what extent do 8 and 12 year-olds engage in informal reasoning about climate change when confronted with sketches about this socio-scientific issue?

To address these research questions, children filled out a survey measuring character understanding, irony comprehension and change in climate change opinion before, during and after watching two ironic sketches, followed by individual interviews to get insight in children's argumentation which is considered a valid way to measure the extent of informal reasoning (Sadler & Zeidler, 2005).

This research can contribute to current understanding of training children with humorous television or video drama to recognize and evaluate perspectives in a socio-scientific issue. Besides that, teachers can use this research to design socio-scientific opinion-forming activities in primary school classes. Ultimately makers of educational television programs, specifically *Het Klokhuis*, could use these findings to better accustom their (ironic) humor to specific age groups.

Methods

To address the research questions we selected two ironic Klokhuis sketches about climate change. The irony, humor and character's opinions in the sketches were analyzed and compared with results from the survey and the coded interviews. As irony is extremely dependent from the context (Burgers & van Mulken, 2017; Glenwright & Pexman, 2010), we describe the methods (and later the results) in a rather specific and extensive way.

Participants

122 children (female 54%, male 43,5%, would or could not say 2,5%) participated in this study. Children were attending grades K-3 (Dutch: *groep* 5) or K-6 (Dutch: *groep* 8) at one of two primary schools. Both schools are part of a catholic collective of primary schools in different neighborhoods in Hengelo (OV), The Netherlands. In total, 45 children of grade K-3

(aged 8-10; $M = 8.76; SD = 0.57$) and 77 children of K-6 (aged 11-13; $M = 11.64; SD = 0.56$) were included in this study[2].

Design

  All children viewed two ironic *Klokhuis* sketches about climate change and answered to a survey about their comprehension and appreciation of segments of those sketches (SQ1) and their opinion on climate change (SQ2). Shortly sixteen children participated in an individual interview elaborating on their survey answers to reach a fuller picture due to triangulation (Denscombe, 2010, p. 347). With a combination of the quantitative and qualitative data, the research questions could be answered.

  Ironic sketches

  To select sketches for this study the database of the program[3] and the Dutch platform for educational television *Schooltv*[4] were searched for all *Klokhuis* episodes concerning the climate (over a 100 results; nine specifically about climate change). All climate episodes were screened for sketches that met all of the following essential criteria:

The sketch must….

- Address an alternative perspective to the topic of climate change, hereby inviting the viewers to think critically.;

- Have human characters taking a stand and providing arguments concerning climate change in spoken dialogue, in order to design a questionnaire about character's opinions.;

- Contain verbal irony.;

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[2] In this paper, the K-3 children will be referred to as 8/9 year-olds and the K-6 children as 11/12 year-olds as in both groups there were no more than three children aged 10 or 13 respectively. For clarity reasons, everywhere in this paper ages are noted in numbers instead of words.

[3] www.hetklokhuis.nl/tv-uitzendingen

[4] www.schooltv.nl

- Appear in a *Klokhuis* episode where reportages and sketches are alternating, as opposed to the format of *Het Klokhuis – Kantoor* (the office)[5], to ensure that the sketch was intended to provide moral or emotional considerations to the topic of the reportage.;

- Not be broadcasted recently. To minimize the chance that older children have already seen the sketch, sketches from before 2015 are preferred.; and

- Fit current times cinematics, language and discourse, in order to match nowadays children's interests and knowledge.

This screening resulted in three sketches that met all criteria. However, one sketch about a family of primeval people 'sensing' global freezing (2015/2017)[6] was ultimately discarded as the goal to make children think was less explicit, the sketch was relatively recently broadcasted (and could thus already be seen by most children) and the characters did not explicitly voice their opinions.

The resulting two sketches scored extremely well on all criteria and were highly comparable in the sense that they both include two familiar characters (teenagers) that voice their opinion explicitly in a discussion using dialogue that fits children's knowledge frame. In both sketches the characters provide multiple perspectives trying to convince each other, making the sketches suitable to stimulate children's thinking about climate change (SQ2). Both sketches contain irony in different ways to be able to answer SQ1. These two sketches are described below. The actual storyline of both sketches can be found in Appendix A.

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[5] In *Het Klokhuis – Kantoor* the regular *Klokhuisformat* is changed: Drama is the base in this format and multiple informative clips are shown in between. As opposed to regular episodes, *Het Kantoor* episodes do not deal with one central topic and were therefore excluded from this research.

[6] Episode *Het Klokhuis – Zuidpool* (28-12-2017); time 3:17 - 4:52; accessed from: https://www.hetklokhuis.nl/tv-uitzending/3712/Zuidpool

In sketch 1[7] Said thinks and argues that climate change is very bad, as he studies the topic for an upcoming test. His street friend Jonathan is indifferent at first, as he ironically exclaims that climate change is *very bad*. Both boys hold this opinion until they realize the benefits of The Netherlands getting hotter: to wear t-shirts all day and that Said's dad will feel at home once again. Convinced they will fail their test if they exclaim that climate change is no problem, they come up with a plan to lie to their teacher that climate change is indeed *very bad*, practicing saying this with exaggerated facial expressions and intonation. The sketch ends with the boys walking towards school, as to say 'climate change is *very bad*' is everything they claim to need to pass the test.

In sketch 2[8] Malika expresses her worries about upcoming dangers to the environment and climate change using ice cubes in their bar drinks to illustrate melting polar sheets. Her friend Beckie is not at all worried and mocks her friend for thinking about this instead of enjoying their night out. Beckie is not even worried when Malika rants about possible tsunamis and she ultimately distracts Malika from her worries by introducing her to a passing guy who happens to know how to rescue swim. Malika and the guy start dancing and Beckie is left with the melting ice cubes in the drinks, leading her to wonder if there was some truth in Malika's worries after all.

Both sketches were segmented by the researcher following the example of Juckel, Bellman, & Varan (2016) for segmenting sitcoms into scenes-by-topic. For this research, segments were defined in which one topic (a single argument) was dealt with and in which both characters had a single opinion throughout the segment. The characters' opinions were

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[7] Episode *Het Klokhuis – Zoek het uit – Klimaat* (09-10-2013); time 2:35 – 4:50; accessed from: https://www.hetklokhuis.nl/tv-uitzending/2433/Zoek%20het%20uit%21%20Klimaat
[8] Episode *Het Klokhuis – Klimaatgeschiedenis deel 2* (25-03-2009); time 3:30 – 5:09; accessed from: https://www.hetklokhuis.nl/tv-uitzending/496/Klimaatgeschiedenis%20%28deel%202%29

described by the researcher and verified with a member check by the writers of the sketches (Denscombe, 2010, p. 174). This approach resulted in 10 segments for Said and Jonathan (duration 7.80 – 24.56 seconds; *M* = 13.53 *; SD* = 5.70*)* and 6 segments for Beckie and Malika (duration 10.63 – 27.57 seconds; *M* = 16.65 *; SD* = 7.18*).*

Data collection

The data collection took place in a classroom environment at school. The introduction and quantitative survey, including the viewing of the sketches, occurred with all children simultaneously, whereas the qualitative interviews afterwards were individual. Additionally all teachers gave evidence about the extent to which climate change had been addressed in class, noticing sharp differences between K-3 (little to none) and K-6 (moderately to extensively).

Introduction on research procedure and climate change

The researcher started with introducing herself and explaining the research procedures. The children were asked to provide honest answers in the survey, to not look at other's forms, to keep silent and ask questions only when the researcher approved. These 'rules' were violated occasionally in some classes with children peaking at other's answers or verbally responding to the survey questions. The researcher took care to minimize these violations by explaining why the rules were important for reliable research results. No major disturbances occurred.

To ensure that all children had the same base level of understanding of climate change, the researcher gave a five-minute introduction on the topic of climate change. Climate was explained as the average weather over a long time span, and climate change as a change in this average weather. It was explained how this average weather currently gets increasingly warmer, which can have consequences for the environment and everything that lives in the world. The researcher pointed out that the greenhouse gas effect is one of the major causes for climate

change. In addition an informative short fragment of a *Klokhuis* episode[9] explaining the relationship between the greenhouse gas effect and climate change was shown. The researcher's text was build up with terms and lines extracted from other *Klokhuis* episodes[10] to ensure the right language for that age and mimicking a real episode where a sketch is preceded by the reportage. The researcher did not voice her own opinion about climate change, nor did the Klokhuis presenter in this fragment, to minimize the influence on the children's own opinions.

After data collection at the first school was completed, adaptations to the introduction were made, following design research practice (Bakker & van Eerde, 2015). The reason for this adaptation was an interview with one of the first children of K-3 that indicated there was a misconception about climate change being the same as regular seasonal changes. The introduction was expanded with extra information about this difference.

Quantitative survey

After the introduction the pre viewing questions of the survey were filled in individually in silence, with the researcher reading out the questions to minimize the number of missing answers, to help when misunderstanding occurred, to explain the Likert scale answer possibilities, and to keep speed. During the entire survey, the researcher continued reading the questions and the children answered in paper booklets. After completing the pre viewing questions containing the climate change attitude pretest, sketch 1 (Said and Jonathan) was viewed for the full duration. Shortly after that, the sketch was watched again, but this time in segments whereby questions followed every segment. This procedure was repeated for sketch

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[9] Episode *Het Klokhuis – Klimaatverandering* (16-07-2009); time: 00:45 – 1:50; accessed from: https://schooltv.nl/video/het-klokhuis-klimaatsverandering/#q=klimaatverandering

[10] Eg. *Het Klokhuis – Klimaatgeschiedenis 2* (25-03-2009); accessed from: https://www.hetklokhuis.nl/tv-uitzending/496/Klimaatgeschiedenis%20%28deel%202%29

2 (Beckie and Malika). After viewing and answering to questions of both sketches, the post viewing questions of the survey containing the climate change attitude posttest were answered. The entire survey took 30 minutes to complete in the K-6 classes and 45 minutes for the K-3 classes, including for the latter a small diversion (a game or dance) in between the two sketches to increase attention for the remaining of the survey.

Qualitative interviews

Shortly after the survey 16 one on one interviews were held in neighboring rooms with children that were put forward by their teacher, that signed up themselves or were invited because of their answers in the survey. The reasons for inviting those 16 children can be found in Appendix B. Four 11/12 year-olds were interviewed one or two days after filling out the survey due to limited time availability of that class. This was found to be no problem, as stimulated recall (rewatching segments during the interview) allows for a delay between the first and second data collection (McConnell, 1985).

The researcher stressed that the interviews were confidential, to invite the participants to give detailed and honest answers. The sound of the interviews was recorded with the explicit permission of every student involved. In total 16 interviews of 10-20 minutes were conducted, recorded and analyzed afterwards.

Instruments

Pilots

All instruments were designed by the researcher using information gathered during two pilots. In the first pilot the researcher viewed and discussed a variety of *Klokhuis* sketches with six children aged 7 to 13 years, gathering experience with interviewing young children and getting a grasp on their reasoning about sketches' storylines. It was found that children can reflect on character's opinions and the happenings in such a sketch, but also that younger children face more difficulties in putting that into words. Because of that the researcher opted

for solely closed questions in the survey and extra summarization to check young children's answers during the interview. This pilot also showed that some language humor, such as sarcasm and ridicule, was not recognized by some of the younger participants, suggesting differences in irony comprehension for the two selected sketches. Before data collection the instruments were tested and found to be suitable in another pilot with one 13 year-old.

Survey

All children filled in a paper survey that consisted of 5 parts with (N) questions:

- Sociodemographic and personal questions (5), such as age, gender and frequency of watching and liking of *Het Klokhuis;*

- Questions measuring their attitude towards climate change (3) as a pre-viewing test;

- Questions relating to the sketch Said and Jonathan, both as a whole (4), such as familiarity of this sketch and its characters, and in segments (20; asking to name the opinion of both characters and the funniness of this segment);

- The same questions as named above, but then for the sketch Beckie and Malika (16); and

- Concluding questions (4), including which sketch they liked best and the same three questions measuring their attitude as a post-viewing test.

Questions relating to a character's opinion or children's own attitude towards climate change were measured on a 5-point pictorial Likert scale (see Figure 2). For questions relating funniness the five degrees of happiness - scale by Hall, Hume, & Tazzyman (2016) was adopted and expanded with two negative options (see Figure 3). This new scale included 'in between' (positive) options of which the need was shown in the pilots and indicated in literature (Hall et al., 2016; Read & MacFarlane, 2006). Literature namely showed that young children answer extremely positive when evaluating a product (Hall et al., 2016; van Dijk, Lingnau, &

Kockelkorn, 2012). Thus, a regularly balanced 5-point Likert scale proved to be insufficient for an evaluative question with young children as negative options were never chosen, even if the product at hand was of obvious poor quality (Hall et al., 2016). Only when solely positive options were provided, variety in answers was reached.

We chose to follow the approach of Hall et al. (2016) to increase answer variety, however we added the possibility for the children to answer that they found a segment boring, although such a negative answer was not to be expected (Hall et al., 2016; Read & MacFarlane, 2006). This lead to the out-of-balance 7-point scale as a compromise between a scale with maximum variety in (positive) answers (Hall et al., 2016), the possibility of negative answers and a scale that did not exceed the reasonable number of seven answer possibilities (Cox, 1980; Hall et al., 2016; Leung, 2011; Mellor & Moore, 2014).

Figure 2: Example of the used 5-point pictorial Likert scale measuring attitude or opinion, adopted from the Smileyometer firstly created by Read & MacFarlane (2006). *The Dutch words mean (left to right): very bad – bad – neutral – not bad – not bad at all.*
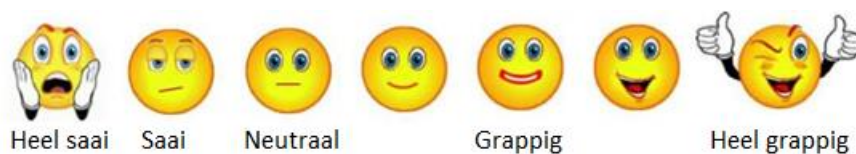

Figure 3: The 7-point Likert scale for funniness as used in the survey, adapted from (Hall et al., 2016). *The Dutch words mean (left to right) very boring – boring – neutral – funny – very funny.*

Interviews

Interviews were held with individual children that were selected for various reasons (see Appendix B) to maximize a diverse sample. Due to the age of the participants, the

interviews were strongly lead by the researcher, with a semi-structured set up to ensure the gathering of the data aimed for and the possibility to illuminate creative ideas and opinions (Denscombe, 2010, p. 175).

The interview scheme was set up to be used with stimulated recall (McConnell, 1985) to discuss their given answers upon reviewing a segment to reach a fuller picture by means of triangulation (Denscombe, 2010, p. 347). Both character opinions and funniness were discussed. Depending on the survey answers, some segments were not attained to when no new or relevant information was to be expected. The researcher was careful not to change children's initial believes about character opinions in her questioning.

Children that marked different answers in the pre- and post-viewing questions about climate change attitude were asked to explain whether these video's and what moments in particular made them reconsider climate change. Those children were also invited to elaborate on their own opinion on climate change.

Sketch description

A description and analysis of the sketches on the levels of character's opinions, irony and other humor types was a major tool for the creation of the instruments and interpretation of the results.

Character's opinions and arguments

The character's opinions were interpreted by the researcher and verified with the writers of the sketches. Agreement was reached on all points. The characterization of characters opinions for every segment can be found in Appendix A. Based on this agreed character's opinions we defined correct, false and near-correct answers for all opinions in each segment.

Near-correct answers were defined as the two options on both sides of the scale next to the correct answer. For Jonathan's opinion in segment 1 and 2 (ironic utterance), all answers different from his literal exclamation *very bad* were considered correct, as the researcher and

the writer agreed that his actual opinion could not be deduced from the context of the sketch. For the opinions of Malika in segment 4 and Beckie in segment 6 all three middle options were considered correct and both extremes considered wrong, as the interviews showed that children were not able to discriminate between the three middle options.

Besides the analysis of character's opinions, we analyzed the individual arguments given by the characters and coded them using the coding scheme for perspectives in reasoning about a socio-scientific issue by Byrne et al. (2014) (see results section of this paper).

Irony classification

As previously described, irony can be highly diverse and can be less difficult to comprehend when it is direct instead of indirect, the ironic tone of voice is present, prior statements are echoed and the context alerts the viewer to the irony (Capelli et al., 1990; Creusere, 2000; Dews et al., 1996; Mulken & Burgers, 2013; Wilson, 2013; Zillmann et al., 1984). For all character's utterances that met the definition by Dews et al. (1996) and the distinctive features of irony (Wilson, 2013) we described the irony type as a result of those difficulty influencers (Table 1). In both sketches echoing of prior statements was found, that influencer was therefore left out of the table.

As irony is perceived differently for different characters and situations (Mulken & Burgers, 2013) – for example more irony is expected from males than females – similar irony in the two sketches cannot be considered equally difficult. Due to large differences in irony in the Beckie and Malika sketch, all ironic cases in that sketch are discussed individually. For Said and Jonathan a distinction is made between direct non-contextual cases (SJ-1 and SJ-2) and direct contextual cases (SJ-8, SJ-9 and SJ-10). SJ-1 and SJ-2 differ in the presence of the ironic tone of voice, that is taken into account separately.

Table 1

A characterization of the different ironic utterances based on the difficulty influencers degree

of indirection, presence of the ironic tone of voice and preceding context alerting the viewer

Segment number	Character utterance	Other humor types	Degree of indirection	Ironic tone of voice	Context (pretext)
SJ-1	J: oh yeah man, yes that is really very bad	Imitation Exaggeration Peculiar face	Direct	Yes	No
SJ-2	J: Yes man, that is super bad	Exaggeration Repetition	Direct	No	No
SJ-8	S: Furthermore, I will just say 'It is very bad'	Deceitful behavior Peculiar face	Direct	Yes	Yes
SJ-9	J: Haha yes, use that sad face, it is really very bad; S: Yes it is very bad	Peculiar face Repetition	Direct	Yes	Yes
SJ-10	J: It is very bad; S: We have to do something, it is truly horrific	Exaggeration Peculiar face Repetition	Direct	Yes	Yes
BM-1	B: Malika, can you look any more happy?	Sarcasm	Indirect	Yes	No
	M: I am a little bit worried	Understatement	Direct	No	No
BM-3	B: Should I be worried about that now?!	Sarcasm	Indirect	Yes	Yes

Note: The presence of other humor types than irony for that utterance are also given, as

humor is typically caused by a combination of humor types (Buijzen & Valkenburg, 2004).

The ironic tone of voice is treated as the humor technique Peculiar face in this study.

Humor classification

All humor in the segments was coded using a combination of the typology of humor in

sitcoms by Juckel et al. (2016) and the typology of humor in television advertisements by

Buijzen & Valkenburg (2004). The resulting typology had 50 humor techniques divided over

four categories (action, identity, language, and logic), combining the benefits of Juckel's

(dramatic storyline and dialogue humor) and Buijzen and Valkenburg's (children's and more

diverse types of humor) into a workable new typology that can be found in Appendix C.

Using the new typology the researcher coded all segments for the presence of the humor techniques, labeling utterances or situations with the applicable humor technique(s). 23 out of the 50 humor techniques were found in these two sketches. This coding was corrected by a second coder and discussions were held until agreement was reached on all points. All segments with the corresponding humor types can be found in appendix A.

Data analysis

Quantitative survey

Minimal statistics were used to handle the quantitative data, as the aim of this research was to find qualitative patterns. Given the diversity of survey questions and the small number of children per age group, this report presents primarily descriptive statistics. Hence any reported differences should be treated as such.

To be able to compare the performances in character understanding of the two age groups, we awarded a correct answer one point, a near-correct answer half a point and a wrong answer zero points in order to calculate mean scores for every segment. To be able to compare humor appreciation for the two age groups, we transformed the 7-point scale to a balanced 5-point scale using half numbers to be able to calculate means (Leung, 2011).

Qualitative interviews

The interviews were transcribed and coded to find reasons for character understanding, irony comprehension, humor appreciation and opinion change. For all of those four topics different coding schemes were used. Character understanding and irony comprehension were open coded to find categories of reasons for comprehension (Denscombe, 2010, p. 115).

For humor appreciation children's utterances were coded with the humor types from the typology (Appendix C). A few utterances were coded as a new code Contrast (placed under the Identity category) as they could not be matched to any code from the humor typology yet were often mentioned.

For climate change opinion and opinion change, we used the coding scheme of the six perspectives used by children in a climate change discussion, described by Byrne et al. (2014), that can be found in Appendix D.

Results

In the following section the results for every sub question will be given separately, beginning with results from the quantitative survey and followed by the qualitative interviews.

Comprehension and appreciation of irony

The first sub question *To what extent do 8 and 12 year-olds understand and appreciate ironic sketches?* is answered below on both a quantitative and qualitative level. First, we describe to what extent the children understand the characters in both sketches, with particular attention to irony comprehension and arguments used by children in reasoning about character's (ironic) opinions. Second, we describe what segments of the sketches were most appreciated by children of both age groups and which humor techniques, among which irony, are responsible for that. Last, we describe how understanding and appreciation of sketch segments correlate.

Understanding character's opinions

Character understanding was measured in the survey by asking about the opinions of the characters after every segment. To compare the understanding of the sketches in total for both age groups, the mean scores on both sketches were calculated (Table 2). The Beckie and Malika sketch was better understood than the Said and Jonathan sketch, as seen from higher mean scores for both 8/9 and 11/12 year-olds: 9.55 and 10.16 out of a possible 12, compared to 12.76 and 15.03 out of a possible 20. Age differences for understanding the Beckie and Malika sketch were not significant, but for understanding the Said and Jonathan sketch 11/12 year-olds significantly outperformed the 8/9 year-olds ($U = 777$, $p < .001$). Overall, 11/12 year-

olds outperformed the 8/9 year-olds in terms of character understanding, having higher means

for both sketches.

Table 2

Mean scores for character understanding in ironic and non-ironic segments in both sketches

across the different age groups

Sketch	Type of irony	Number of Questions	Age group	Lowest score	Highest score	Mean	SD	*p*
Said and Jonathan	**Total**	20	8/9	4.0	17.0	12.76	3.06	<.001
			11/12	9.5	18.5	15.03	1.93	
	Direct non-contextual irony	2	8/9	0.0	2.0	1.29	0.84	.002
			11/12	0.0	2.0	1.73	0.55	
	Direct contextual irony	5	8/9	0.0	5.0	3.67	1.85	.027
			11/12	0.0	5.0	4.38	1.38	
	No irony	13	8/9	3.0	11.0	7.70	1.56	<.001
			11/12	6.5	11.5	8.92	1.21	
Beckie and Malika	**Total**	12	8/9	2.0	12.0	9.55	2.14	.296
			11/12	7.0	12.0	10.16	1.18	
	Indirect non-contextual irony	1	8/9	0.0	1.0	0.87	0.31	.218
			11/12	0.0	1.0	0.94	0.20	
	Direct non-contextual irony	1	8/9	0.0	1.0	0.81	0.32	.442
			11/12	0.5	1.0	0.88	0.22	
	Indirect contextual irony	1	8/9	0.0	1.0	0.83	0.32	.459
			11/12	0.0	1.0	0.88	0.26	
	No irony	9	8/9	2.0	9.0	7.01	1.62	.294
			11/12	5.0	9.0	7.45	1.01	

Note: For every question about a character's opinion we awarded one point for a

correct answer, a half point for a near-correct answer and zero points for a wrong answer. In

the last column *p* presents the statistical significance of the difference in mean scores of both

age groups.

Amount of irony comprehension

In accordance with the results in the beforementioned section, 11/12 year-olds had higher scores for understanding character opinions in all ironic segments than the 8/9 year-olds, as can be seen from the means in Table 2. This difference was significant and especially large for the direct non-contextual segments (*Mean*-difference = 0.44; p = .002) and the direct contextual segments (*Mean*-difference = 0.77; p =.027) in the Said and Jonathan sketch, but not significant nor large for the segments of the Beckie and Malika sketch.

However, higher scores are not the only evidence for a higher level of irony comprehension in 11/12 year-olds. In comprehending irony one needs to pick the conveyed instead of the literal meaning (Dews et al., 1996). For all ironic utterances except for Beckie in BM-1 and BM-3, the survey was designed in such a way that the literal meaning was one of the answering possibilities. Table 3 shows for all ironic utterances what percentage of children in both age groups answered the literal meaning on the question of the character's opinion and therefore did not comprehend the irony in that utterance.

Irony was not comprehended by three to four times more 8/9 year-olds than 11/12 year-olds, although the irony in BM-1 (Malika) forms an exception to this. Irony without the peculiar voice (the ironic tone of voice) was poorer comprehended by 11/12 year-olds compared to other cases of irony. Direct contextual irony was best comprehended compared to other types of irony by both age groups. One exception to this forms Said in SJ-10, whose irony was comprehended poorly by 8/9 year-olds.

Table 3

The percentage of children that failed to comprehend the irony in the segments with the

different types of irony

Type of irony	Segment number	Character utterance	Other humor types	Age group	% of children that answered the literal meaning, therefore do not comprehend irony
Direct non-contextual	SJ-1	J: oh yeah man, yes that is really very bad	Imitation Exaggeration Peculiar face Peculiar voice	8/9 11/12	35.6 10.4
	SJ-2	J: Yes man, that is super bad	Exaggeration Repetition	8/9 11/12	35.6 16.9
Direct contextual	SJ-8	S: Furthermore, I will just say 'It is very bad'	Deceitful behavior Peculiar face Peculiar voice	8/9 11/12	9.1 2.6
	SJ-9	J: Haha yes, use that sad face, it is really very bad; S: Yes it is very bad	Peculiar face Peculiar voice Repetition	8/9 11/12	15.6 (J)/ 13.3 (S) 3.9 (J)/ 5.2 (S)
	SJ-10	J: It is very bad; S: We have to do something, it is truly horrific	Exaggeration Peculiar face Peculiar voice Repetition	8/9 11/12	11.4 (J)/ 22.7 (S) 5.2 (J)/ 5.2 (S)
Indirect non-contextual	BM-1	B: Malika, can you look any more happy?	Peculiar voice Sarcasm	8/9 11/12	n.a. n.a.
Direct non-contextual	BM-1	M: I am a little bit worried	Understatement	8/9 11/12	20.0 24.7
Indirect contextual	BM-3	B: Should I be worried about that now?!	Peculiar voice Sarcasm	8/9 11/12	n.a. n.a.

Note: In the case of SJ-9 and SJ-10, the letter after the percentage refers to the

character's utterance (either Said (S) or Jonathan (J)) that percentage applies to.

Reasons for character understanding and irony comprehension

To find out what factors are taken into account by children explaining about character's opinions, open coding was used for a qualitative indication (Denscombe, 2010, p. 115). See Table 4 for the arguments that were used by children of different ages to argue why a character had a certain opinion. The three most used arguments by 8/9 year-olds fell in the categories Text (53), Voice (29) and Emotions (21), whereas 11/12 year-olds used Storyline segment (29), Behavior (22) and Face (22) mostly.

Table 4

The amount of mentions in all argument categories by children of the two age groups while explaining character's ironic and non-ironic opinions

Argument category	Description	Example from this study	Total mentions of argument[a]	
			8/9 year-olds	11/12 year-olds
Behavior	Actions undertaken by one or more characters	''When she looked at the ice cubes''	8	**22**
Emotions	States of being of one or more characters	''He is shocked after that''	**21**	15
Face	Facial expressions or looks a character gives or has	''They do not look like they are serious''; ''When they pulled those faces''	19	**22**
Intended meaning	What a character means when he/she says or does something	''He actually means it a little sarcastic''	6	10
Miscellaneous arguments	Arguments that did not fit in other categories or referred to other information than from the sketch	''I don't think he likes it to have thick blankets on his bed''	4	1
Social	Social behavior or socially accepted norms	''He only says it because his friend does''	3	3
Storyline entire sketch	Actions, utterances, incidents or other information from previous or later segments in the sketch	''I think that Jonathan loses interest later''	9	12

Argument category	Description	Example from this study	Total mentions of argument[a]	
			8/9 year-olds	11/12 year-olds
Storyline segment	Describing the global happenings in that segment (as opposed to specific behavior, text, faces etc. that are coded separately)	'He is comparing Sahara and Rif Mountains and he does ….''	13	**29**
Text	Character utterances literally copied or referring to the fact that a character said something	''It is weekend''; ''Because he says it is very bad''	**53**	8
Thinking	Thoughts a character is expected to have, without voicing them	''I got the impression that she now was thinking it through''	9	19
Voice	Tone of voice and the way of talking[b]	''How he says it''; ''You can hear it from the voice''	**29**	16

Note: [a]Not all character's opinions were discussed with all children and children differed in the number of arguments mentioned for every segment. The researcher succeeded to interview approximately the same number of children in both age groups for all segments. This column with total mentions for every argument category combines data from the Said and Jonathan sketch (on average nine children per segment) and the Beckie and Malika sketch (on average four children per segment). [b]Children that copied an ironic utterance explicitly using the ironic tone of voice (such as this 11/12 year-old: ''***veeeeeeeeery baaaaad***, with those voices'') were coded at the 'voice'-argument instead of the 'text'-argument, as from context was understood that they referred to the tone of voice rather than the actual text.

Table 4 shows how in total, children of the two different age groups use other arguments to decide on a character's opinion. Consequently, large differences were found for the arguments that were used in non-ironic or ironic segments and whether that argument was provided by a child that was right or wrong in the interpretation of the character in that segment (see Figure 4ab). Arguments provided by children that were right are counted as

understanding/comprehension promoting arguments, similarly arguments from children that were wrong are hampering arguments. The main results are summarized below.

Character understanding was …

- Promoted by:

  o 8/9 year-olds: Text (26), Emotions (13) and Thinking (9)

  o 11/12 year-olds: Storyline segment (13), Behavior (12) and Thinking (11)

- Hampered by:

  o 8/9 year-olds: Text (6), Emotions (2) and Face (2)

  o 11/12 year-olds: Behavior (3), Emotions (3) and Thinking (3)

Irony comprehension was …

- Promoted by:

  o 8/9 year-olds: Voice (19), Face (9) and Storyline entire sketch (7)

  o 11/12 year-olds: Storyline segment (11), Face (10) and Intended meaning (9)

- Hampered by:

  o 8/9 year-olds: Text (24), Voice (6) and Face (6)

  o 11/12 year-olds: Storyline segment (5), Thinking (3) and Behavior/Face (2)
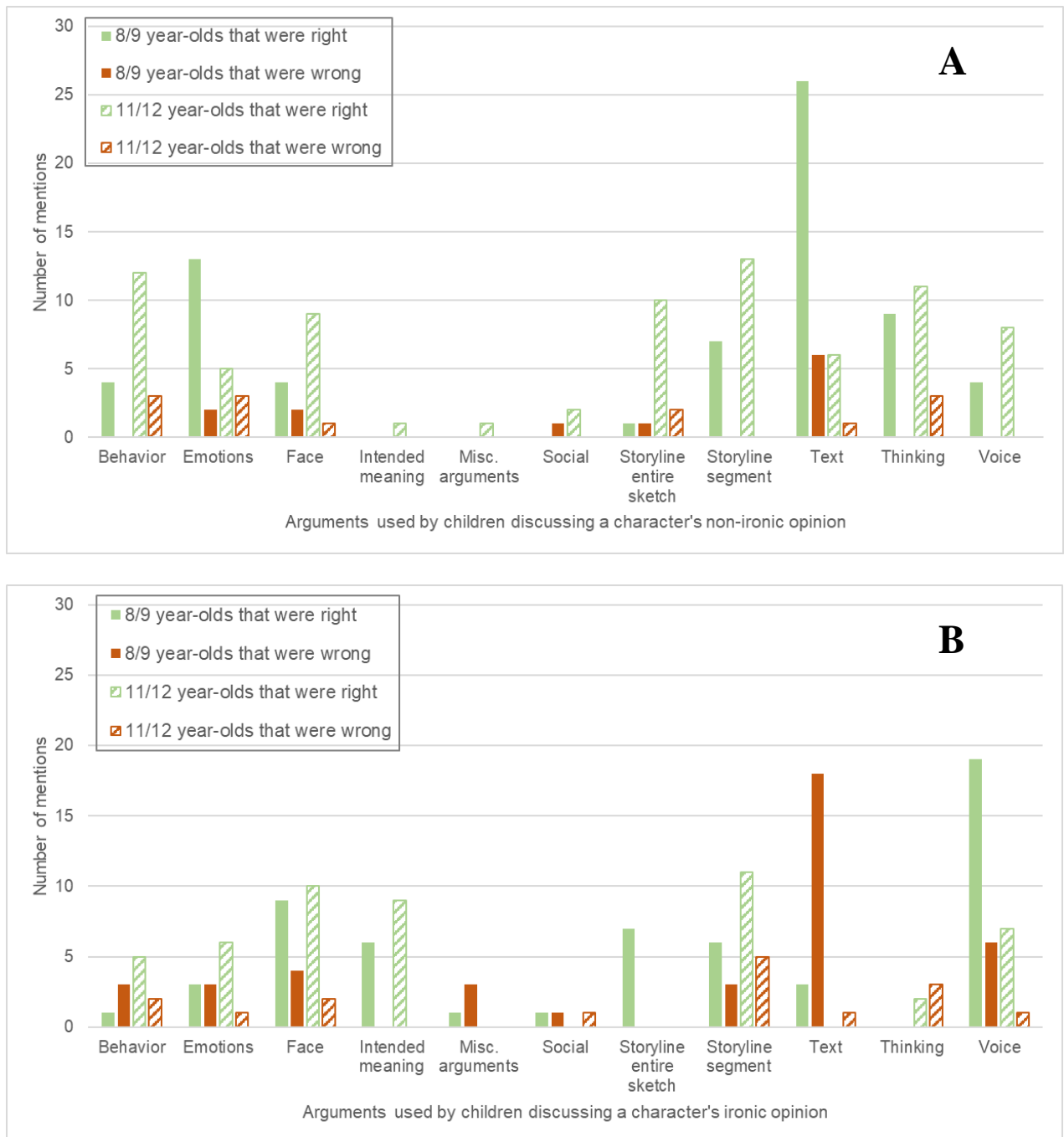
Figure 4: The number of mentions for each argument by the two age groups, separated for whether it was given by a child that was right or wrong with that argument. The graph in A represents the arguments given for non-ironic character utterances in the two sketches. The graph in B represents the arguments given for ironic character utterances in the two sketches.

Humor and irony appreciation

The appreciation of humor and irony was measured by the 16 survey questions: *how funny did you find this segment*? and the results are displayed in Figure 5. On average children found the Beckie and Malika sketch funnier (8/9 year-olds: $M = 3.36$; $SD = 0.90$; 11/12 year-olds: $M = 3.24$; $SD = 1.09$) than the Said and Jonathan sketch (8/9 year-olds: $M = 3.10$; $SD = 0.78$; 11/12 year-olds: $M = 2.92$; $SD = 0.90$), although the last two segments of Said and Jonathan were the most appreciated over all. On average 8/9 year-olds appreciated the humor in all segments more than 11/12 year-olds. SJ-4 and BM-3 are the only segments that were more appreciated by 11/12 year-olds than 8/9 year-olds.

As can be seen from Figure 5, all ironic segments (except BM-3) were more appreciated by 8/9 year-olds, although the margins can be slim. In the Said and Jonathan sketch direct non-contextual irony was much more appreciated by 8/9 year-olds than 11/12 year-olds (*Mean-difference* $= 0.41$). With the exception of segment SJ10 (higher appreciation by 8/9 year-olds; *Mean-difference* $= 0.67$) no other segments that give indications for a preferred irony type for children of different ages were found.

A Spearman's correlation was calculated to investigate a correlation between appreciation of a segment and understanding the characters in that segment. For most segments no significant correlation between appreciation and understanding was found.

Reasons for humor and irony appreciation

When asked what they found funny in all segments, children gave answers represented in Table 5. For all four humor categories the number of mentions by the two age groups are given, along with the number of mentions for the most often mentioned humor techniques in that category.

From Table 5 becomes clear that 8/9 year-olds perceive a segment as funny due to the presence of action (peculiar face and voice) and language humor (exaggeration) mostly. Logic

humor is not appreciated much by the youngest in our research. Contrary, 11/12 year-olds can appreciate most humor techniques and referred to many different humor techniques in the interviews. However logic humor is their primary cause of humor in these two sketches.

In terms of irony appreciation, the two age groups referred to this humor technique approximately equally often, taken into account that 8/9 year-olds in general referred to lesser humor techniques. There is however a difference for the age groups in which segments irony and the related peculiar face and voice were mentioned as a cause of humor: 8/9 year-olds only mentioned those techniques in the last two segments of the Said and Jonathan sketch, whereas 11/12 year-olds mentioned all those techniques in all irony-containing segments of Said and Jonathan. Irony as cause of humor was never mentioned for the Beckie and Malika sketch, however one 11/12 year-old mentioned sarcasm instead for the first segment.
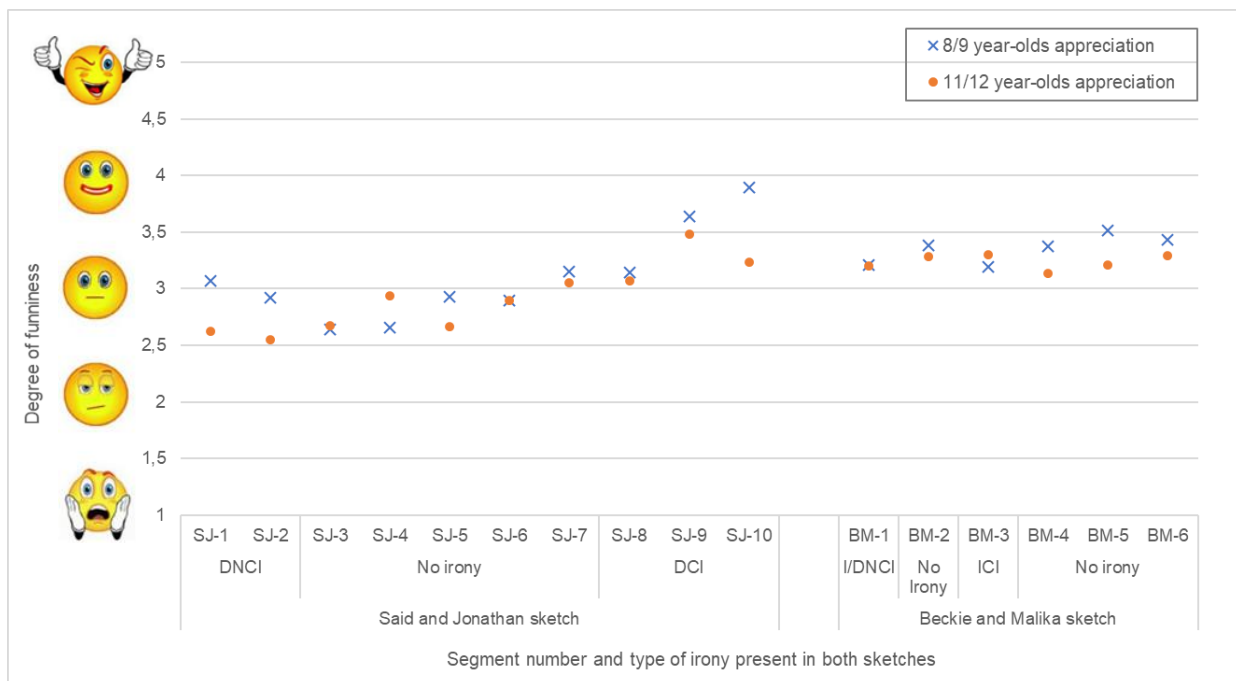
Figure 5: The average degree of funniness for every segment in the two sketches for the different age groups. On the y-axis the degree of funniness is represented by the transformed 5-point Likert scale for funniness (from low to high (1-5): very boring – boring – neutral – funny – very funny). For both sketches the types of irony in that segment are given by their abbreviation: Direct non-contextual irony (DNCI), direct contextual irony (DCI), indirect and direct non-contextual irony (I/DNCI) and indirect contextual irony (ICI).

Table 5

Most popular humor techniques in every humor category as measured by the number of

mentions by children in both age groups

Humor category	8/9 year-olds		11/12 year-olds	
	Most popular humor techniques	Number of mentions	Most popular humor techniques	Number of mentions
Action		**35**		**32**
	Peculiar face	15	Peculiar face	17
	Peculiar voice	14	Peculiar voice	10
	Clownish behavior	3	Clownish behavior	3
Identity		**22**		**35**
	Transformation	6	Transformation	8
	Deceitful behavior	5	Contrast	6
	Contrast	3	Irreverent behavior	5
			Stereotype	5
Language		**35**		**41**
	Exaggeration	20	Exaggeration	15
	Irony	7	Ridicule	11
	Ridicule	4	Irony	10
Logic		**18**		**57**
	Conceptual surprise	6	Conceptual surprise	16
	Repetition	5	Misunderstanding	13
	Absurdity	3	Absurdity	9
			Outwitting	9

Note: Most children mentioned more than one humor technique per segment and humor

techniques mentioned again by the same child in another segment were also counted. These

techniques are taken from the combined humor typology that can be found in Appendix C

(Buijzen & Valkenburg, 2004; Juckel et al., 2016). One extra humor technique (Contrast) was

added by the researcher, as this referred to these specific videos and those utterances could not

be coded with techniques from the typology. The description of Contrast is as follows: A

difference in opinion or behavior of two or more characters.

Informal reasoning and opinion about climate change

The second sub question *To what extent do 8 and 12 year-olds engage in informal reasoning about climate change when confronted with sketches about this socio-scientific issue?* is answered below on both a quantitative and qualitative level. First we describe to what extent the children changed their opinion on climate change as measured by a difference in answers on the post-viewing questions compared to pre-viewing questions, to give indications on the occurrence of informal reasoning. Second we describe the arguments and perspectives used by children in the argumentation of their (formed) opinion (step 4 in the process of informal reasoning, see Figure 1). Last we describe whether it were arguments from the sketches that were responsible for a change in opinion (steps 1-3 of informal reasoning).

Change in opinion on climate change

Three questions about the severity of climate change were asked to all children before and after watching the sketches. These three questions showed high internal reliability both in the pretest ($\alpha = .839$) and the posttest ($\alpha = .892$), convincingly measuring children's opinion on the severity of climate change. About 78% of all children changed their opinion on at least one of the three questions (Table 6), suggesting that the sketches made them think. More changes were seen among the 8/9 year-olds ($M = 1.62$, $SD = 1.35$) than among the 11/12 year-olds ($M = 1.26$, $SD = 1.06$).

In addition to the degree of change in climate change opinion, the direction of change indicates how the sketches influenced children's opinion. In Figure 6 the net individual opinion change is given, which is the average change for an individual on all three questions. For these questions, a negative score means they came to consider climate change as more problematic and a positive score means they came to consider climate change as less of a problem. 11/12 year-olds show less big changes than 8/9 year-olds. Due to an almost equal spread in positive and negative scores, the mean changes in attitude are small, however

positive for both 8/9 year-olds ($M = .022$; $SD = 0.63$) and 11/12 year-olds ($M = .004$; $SD = 0.40$). Table 7 shows the differences on the three pre- and post-viewing questions for both age groups, showing that after watching the sketches the children came to think of climate change as less bad, whereas they considered the warming of the Netherlands as a little worse and were more worried about climate change than before. Furthermore the table shows higher initial scores for the 8/9 year-olds as compared to the 11/12 year-olds, indicating that the youngest children did not consider climate change a big problem at the start.

Table 6

The degree of change in climate change opinion across both age groups as measured by the number of changes an individual made

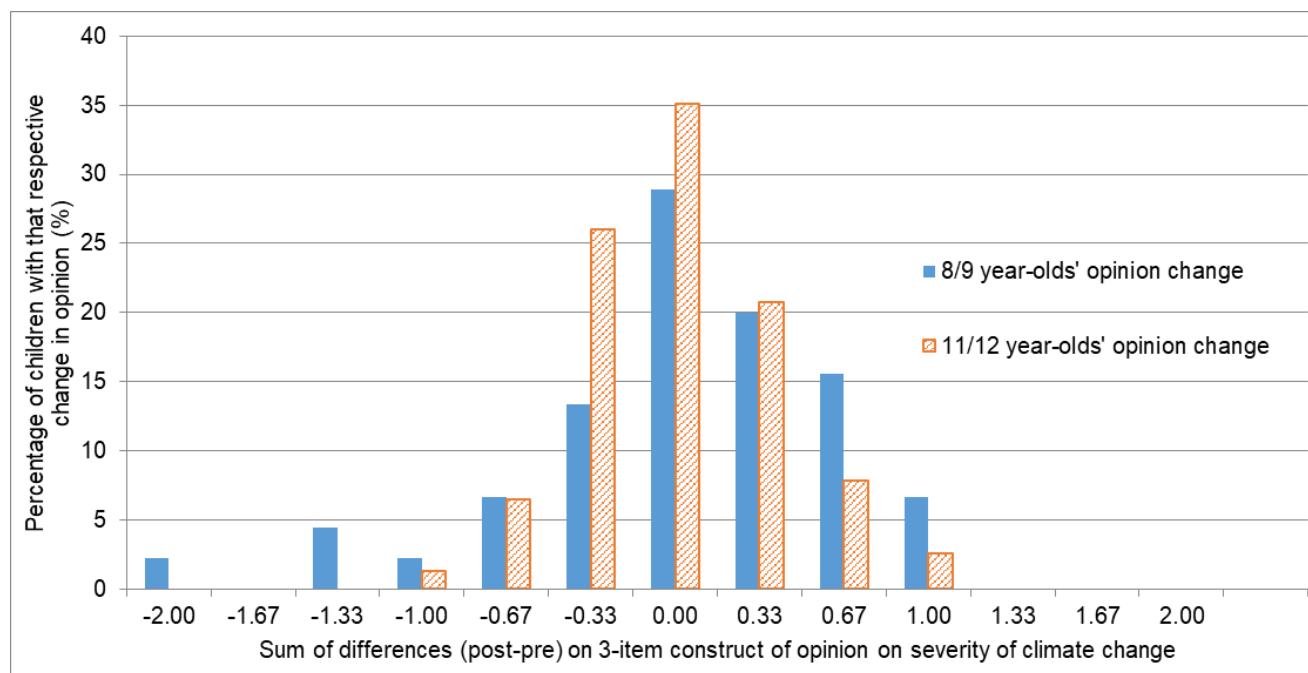| Age group	Number of changes	Frequency	Percent	Cumulative percent
8/9	0	10	22.2	22.2
	1	13	28.9	51.1
	2	12	26.7	77.8
	3	6	13.3	91.1
	4	3	6.7	97.8
	5	0	0	97.8
	6	1	2.2	100
	Total	45	100	
11/12	0	17	22.1	22.1
	1	34	44.2	66.3
	2	20	26	92.3
	3	3	3.9	96.2
	4	1	1.3	97.4
	5	2	2.6	100
	6	0	0	
	Total	77	100	

Figure 6: Net individual change in opinion on the 3-question construct of severity of climate change for the two age groups. The y-axis represents the percentage of children that showed a certain net change in opinion. A positive score corresponds to a consideration of climate change as less of a problem than before watching the sketches and a negative score to a consideration of it being more of a problem.

Table 7

Mean answers on the three pre- and post-viewing questions on climate change opinion

Survey question	8/9 year-olds		11/12 year-olds	
	Pre-viewing	Post-viewing	Pre-viewing	Post-viewing
1) How bad is climate change?	3.73	4.02	2.48	2.69
2) How bad would it be if the Netherlands became warmer?	4.09	4.02	3.17	3.13
3) To what extent are you worried about climate change?	4.22	4.07	3.34	3.18

Note: These three questions were measured on a 5-point Likert scale with answer possibilities low (1) to high (5): very bad – bad – neutral – not bad (Q1 and Q2) and very much – a lot – neutral – a little – not at all (Q3). Consequently, a mean above three indicates the opinion of climate change as no problem, whereas a mean below three indicates the opinion of climate change as problematic.

Argumentation of own opinion on climate change

In Table 8 the arguments are presented that the children used to describe their own opinion on the severity of climate change and a possible change herein. The children made most use of the Self-interest (28), Everyday life (17) and Environment (15) perspectives that were described by Byrne et al. (2014). Differences between the age groups were found in the use of the Science and Technology perspective, that was especially often used by 8/9 year-olds as pros to explain why they considered climate change non-problematic, such as this 8/9 year-old: ''There probably will be a new planet [for people to live on when earth does not exist anymore]''. The justice perspective was only used by one 11/12 year-old that said to be extremely concerned with climate change.

Table 8

Perspectives used by children in the two age groups to argue about their own opinion on the severity of climate change

Perspective	Characterized by …	Example in this study	8/9 year-olds		11/12 year-olds	
			Cons	Pros	Cons	Pros
Everyday Life (EL)	Everyday habits and activities and relating to matters close to students' everyday lives.	''I mean, I also still want good winters, with snow and everything''	4	4	4	5
Science and Technology (ST)	Attempted scientific reasoning and references to science and technology.	''It is not possible that the water from the north pole will reach us [The Netherlands]''	0	5	1	2
Society (SO)	Concerns the structure, organization or functioning of society and media reporting.	n.a.	0	0	0	0
Justice (J)	Talk about 'fairness' and ethical perspectives.	''When it rains and they do not live far from the supermarket, that they then go by car''	0	0	2	0

Perspective	Characterized by …	Example in this study	8/9 year-olds		11/12 year-olds	
			Cons	Pros	Cons	Pros
Environment (E)	Concerned with the 'right' thing to do in relation to sustaining our world for the future.	''When I think about it that maybe in a million years the earth will not exist anymore due to humans''	6	0	7	2
Self-interest (SI)	Concerned with students' own interests and welfare.	''I am not worried; by the time the climate has changed entirely we will all be dead''	6	7	7	8

Note: The first two columns of this table were copied from the coding scheme proposed by Byrne et al. (2014). For clarity reasons we summarized the descriptions in this table and changed their wording (repertoire) to ours (perspective), the full coding scheme by Byrne et al. (2014) can be found in Appendix D. The examples in the third column are representative arguments given by children in this study. This table is comprised based on data from four 8/9 year-olds and seven 11/12 year-olds. All individual arguments were coded. On average 8/9 year-olds provided seven arguments, whereas 11/12 year-olds provided five arguments. Within a single child's argumentation pros and cons could go side by side.

Influence of the sketches on informal reasoning

During the interviews, 11 children were found to have at least one difference in their answers on pre- and post-viewing questions. When asked why their opinion had changed, four of them (one 8/9 year-old, three 11/12 year-olds) said the sketches had not made them think per se, instead their different answers could be explained by them doubting on two answer possibilities to begin with or their already excessive knowledge on climate change. The seven others (three 8/9 year-olds, four 11/12 year-olds) explained that the sketches indeed had made them rethink their opinion on climate change, as illustrated by the following quote from an 11/12 year-old that changed from very bad to neutral on the issue of the Netherlands heating

up: ''Yes [I see it as less of a problem], because how I saw that movie, how you can sit in short pants for a long time and only during exercise it may be less comfortable, so that is it.''

However, self-reported effects are not the sole evidence for the influence of the sketches on their opinion. The characters in both sketches provided numerous pros and cons for climate change, that we coded for perspective (Byrne et al., 2014). Most arguments were literally used or reflected on by at least one child (see Table 9). 11/12 year-olds were found to use 1.3 times more character's arguments in their argumentation than 8/9 year-olds.

Table 9

The arguments provided by one of the characters that were used in or reflected on in children's

own argumentation about the severity of climate change

Sketch	Value	Arguments	Perspective	Number of mentions by	
				8/9 year-olds	11/12 year-olds
Said and Jonathan	Con	Water levels are rising	E	1	0
		No winters anymore	E	1	4
		Sun is shining longer and brighter (all day)	E	0	0
		Increasingly getting hotter	E	3	4
		Just wear t-shirts	EL	0	2
		All day sweating	EL/SI	0	1
		The Netherlands will be dry like a dessert	E	1	0
	Pro	Just wear t-shirts	SI/EL	0	2
		Said's dad will feel at home in a dessert	SI	0	0
Beckie and Malika	Con	Polar sheets are melting	E	2	1
		Polar ice breaking off into the see	E	0	1
		This will cause a tsunami that will drown us all	SI	2	5
		A tsunami is extremely high	ST	0	2
	Pro	We are far away from the dunes	SI	0	1

Note: Value refers to whether the argument was used by the characters as a pro or as a con for considering climate change <u>less of a problem</u>.

Discussion

Although *Het Klokhuis* is often watched by children aged 8-12, used in lessons, and its sketches are made to make children think (Vink, 2002, p. 116), it was not yet known whether children at both ends of the age spectrum understood the characters in such a sketch and whether character's arguments made the children think about a socio-scientific topic. Using a survey about children's opinion on climate change and character's opinions and funniness of two ironic *Klokhuis* sketches, followed by interviews, we were able to answer the research questions.

We found that children of both 8/9 and 11/12 years of age can comprehend irony and character's opinions in ironic sketches, however the older children outperformed the younger ones on all questions. Especially in irony comprehension 11/12 year-olds were three to four times less often wrong than 8/9 year-olds[11]. This was explained by the latter relying on textual information mostly, leading them to choose the literal instead of the conveyed meaning in case of irony. Younger children appreciated the sketches more, both non-ironic as ironic segments, although irony was not their main reason for finding something funny.

Furthermore, we found that 78% of all children changed their own opinion on climate change as a result of watching the sketches, interpreted as the first sign of informal reason. A small positive change (climate change was judged as less of a problem) was found on group level for both ages, whereas large individual differences in the degree and direction of the opinion change and interview answers indicate informal reasoning about the topic at personal level. Children of both ages were found to argue about their climate opinion (change) using Self-interest, Everyday life and Environment repertoires (Byrne et al., 2014), corresponding to

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[11] One exemption to this formed the results for the direct non-contextual irony spoken by Beckie in BM-1, where 11/12 year-olds were in fact 5% more wrong than 8/9 year-olds. This unexpected finding will be discussed below.

the repertoires and arguments used by the characters in the sketches. The results indicate that older children were more inclined to incorporate arguments from the sketches into their own opinion, as half of their arguments were based on character's arguments from the sketches, compared to a third in 8/9 year-olds arguments. This suggests a higher level of informal reasoning in 11/12 year-olds.

Irony comprehension

In terms of irony comprehension by children of different ages large differences were found within segments both within a sketch and between the sketches. Due to the fact that irony in different contexts (e.g. a different sketch) cannot immediately be compared, we will discuss the findings of both sketches separately to provide more detailed insights. The type of irony was described in terms of factors that are known to influence comprehension difficulty (Capelli et al., 1990; Creusere, 2000; Dews et al., 1996; Mulken & Burgers, 2013; Wilson, 2013; Zillmann et al., 1984) that allowed for some comparison within segments of the Said and Jonathan sketch.

Said and Jonathan sketch

For all ironic segments the 11/12 year-olds significantly outperformed the 8/9 year-olds in irony comprehension, but both age groups performed better or worse on certain segments. An analysis of the arguments used in the interviews suggests explanations for these differences.

We found that 8/9 year-olds reason extremely often based on Text arguments (53 mentions), leading them to pick the wrong literal meaning of an utterance, instead of the literal. 8/9 year-olds also heavily relied on Voice (29 mentions) and to a lesser extent on Face and Storyline entire sketch. The latter three helped them to understand the direct contextual segments at the end of the sketch much better (+- 15% wrong) than the non-contextual segments at the beginning (36% wrong). Their preferred arguments also explain why 8/9 year-olds perform worse on the utterances of Said in SJ-10 (23% wrong): in that segment the

characteristic face and voice are less obvious when he repeats ''it is very bad'', in addition he exclaims a new utterance ''It is very bad, sir, it is truly horrific […] We have to do something'' with sincere intonation. For 8/9 year-olds relying on text mostly, this might already be enough to suddenly fail to comprehend the irony.

We found that 11/12 mostly reason with Storyline segment (29 mentions), Behavior and Face (both 22 mentions). These arguments result in a good comprehension of irony, but are also responsible for the increased percentage 11/12 year-olds that fail to comprehend the irony in SJ-2 (17% wrong; compare with 10% wrong in SJ-1) where Jonathan's ironic face and voice are less prominent and he behaves in a slightly more considerate way. This lead some 11/12 year-olds to conclude that he now found it indeed very bad, reasoning the following: ''Said was calling out stuff and then he might be thinking, well, that is what we will have when it gets increasingly warmer''. Opposite the 8/9 year-olds, 11/12 year-olds barely reasoned with Text arguments (8 mentions). This improved their irony comprehension, yet caused them to misinterpret Jonathan's opinion in SJ-3, where he – after being indifferent and ironic about that – actually briefly considers and exclaims climate change as bad. This might further be explained by findings of Mulken & Burgers (2013) that upon encountering irony, more irony is expected in the rest of the story. Fact is, that this utterance was the only one where 8/9 year-olds – that do use the Text argument – outperform the 11/12 year-olds in understanding a character's opinion.

The notion that irony is better comprehended when it is direct, presented in cases with rich context and with the ironical tone of voice, is by no means a new finding (Capelli et al., 1990; Creusere, 2000; Dews et al., 1996; Mulken & Burgers, 2013; Wilson, 2013; Zillmann et al., 1984). Similar for the notion that older children comprehend irony better than younger children (Capelli et al., 1990; Dews et al., 1996; Wilson, 2013). New in this study was the choice of irony source: a television program specifically produced for children aged 8-12,

aiming to make them think. We found that the irony in sketches of that program was not comprehended by all children of the program's target audience, and the character's opinions were not always correctly understood. Whether this is problematic or actually beneficial as a challenging program further stimulates thinking skills, we leave up for discussion.

Beckie and Malika sketch

In terms of irony comprehension or character understanding no extra insights are gathered from the Beckie and Malika sketch, as differences between the age groups were very small, non-significant and not different from scores for the non-ironic segments. These unexpected findings might be due to lesser and longer segments, lesser opinion changes in both character's and/or other humor techniques compared with the Said and Jonathan sketch. Children might performed better on questions about character opinion as the ironic utterances were not immediately related to the answering possibilities or because the terminology in the 5-point Likert scale (e.g. very much – a little) forced them towards the more extreme options. Although the cause of the differences in performance with the Said and Jonathan sketch cannot be identified from this data, the results itself may still be valuable for people creating products containing irony (especially understatement), exaggeration and other humor for young children and are therefore presented as descriptive statistics in this paper.

Irony appreciation

The results point out that the ironic segments were more appreciated by the 8/9 year-olds, just as the non-ironic segments. However, interview information showed that both age groups mention irony as a cause of humor equally often and those differences are explained by the presence of Action humor in those segments, which is especially appreciated by the youngest children. Segments containing more Logic humor were more appreciated by 11/12 year-olds instead. Besides a preference for a type of humor (e.g. Action or Logic), our findings point out certain humor techniques from these sketches that better resonated with children from

the different age groups (e.g. a preference for Deceitful behavior (8/9 year-olds) versus Irreverent behavior (11/12 year-olds), both from the Identity category). Educational program makers and others concerned with using humor in communicating to children are advised to take these preferences into account.

No correlation between irony appreciation and character understanding has been found. While it seems obvious to expect a correlation to be present – one rarely finds something funny that he does not understand – the presence and large influence of other humor types in ironic segments makes this question unanswerable with this study.

Informal reasoning as a result of ironic sketches

The results indicate that both age groups engaged in the process of informal reasoning (see Figure 1), as they both recognized (and understood) character's arguments and opinions (step 1), evaluated them (step 2) as indicated by reflections given on the arguments and opinions in the interviews and incorporated them into their own opinion (step 3) to make their own informed judgement about climate change, which was seen from the argumentations (step 4).

The percentage of 78% of all children that changed their opinion on some level, indicates a high level of engagement with informal reasoning about the topic and supports the claim by *Het Klokhuis* that their sketches make children think (Het Klokhuis, n.d.; Vink, 2002, p. 116). We must remark that four out of 11 children self-reported that their opinions had not changed as a result of watching the sketches, even though a change was seen in the survey. On the other hand, seven others did report that the sketches made them think, which was supported by the fact that all interviewed children used arguments that were at least based on the arguments provided by the characters in the sketch. Our personal believe based on interviews with 16 children, is that almost all students were engaged in the topic of climate change and the process of informal reasoning, even though their own opinion did not change as a result of

that. This is consistent with findings from several researchers, that children like to participate in informal reasoning tasks, as they are pleased to be considered as opinion-bearing people in those cases (Byrne et al., 2014; Hundal et al., 2014; Sadler, 2004).

Besides the degree (or the presence of) change in climate change opinion, we looked into the way the sketches influenced children's own opinions. On population level a small positive shift towards considering climate change less bad was measured (post-pre viewing questions). This was caused by two small negative shifts of approximately -0.05 for the Netherlands becoming warmer, and -0.15 for their worries about climate change, that were balanced by a relatively large approximate 0.25 shift for considering climate change as a whole less bad.

Because the three questions consist of one reliable scale as measured by Cronbach's alpha ($\alpha > .830$), it appears odd that the shifts are not in the same direction or of equal size. One possible explanation is offered by Zillmann et al. (1984), who found that certain humorous distortions in educational programs can confuse students. They and others specifically found that when irony was used to reverse properties off a topic, it lead to an underperception of these properties in children from 3 up to 14 year-old. Opposite, when exaggeration was used to overproject properties, the children were inclined to overpercept those properties. As the Said and Jonathan sketch was filled with ironic exclaims that climate change was *so bad*, it might have lead the children to underpercept the real dangers in climate change, causing the positive shift in opinion (climate change is less of a problem). As Beckie was exaggerating how worried she was and everybody else had to be about climate change, this might have lead children to overpercept the need for worrying, leading to the negative shift (more of a problem). In the Said and Jonathan sketch the boys exaggerated many cons and one pro (see Table 9) of the Netherlands heating up, that might have lead to the minor negative shift. From this data these

suspicions cannot be verified, yet it indicates the possibility that irony and other humor techniques influence processes like informal reasoning to a large extent.

Children reasoned about climate change using all but one perspectives described by Byrne et al. (2014). Everyday life and Self-interest were most often used, equally as pro or con of climate change. The high usage of the Everyday life perspective is not surprising and corresponds to Byrne et al. (2014) own findings, as children are most comfortable reasoning from their personal experiences (Byrne et al., 2014; Sadler & Zeidler, 2005). In this study many children used this perspective to discuss temperature, how that would impair them from daily activities (such as sleeping well) or provide advantages to their life (such as being able to swim a lot or wear short pants). The interviews were held in one of the first weeks of summer temperatures in the Netherlands, which students often referred to in positive or negative terms. We have to provide caution in interpreting these results, as the Everyday life perspective is extremely vulnerable to every influence in their current daily lives.

The Self-interest perspective was often used to express threats climate change could be to themselves, such as not being able to go to cold countries on holiday or the dangers of tsunami's *in the Netherlands*. It was found that children of both ages primarily considered climate change in local terms – The Netherlands or their place of residence, in other words their own life – as they struggle to see socio-scientific issues in a global perspective. This is similar to findings by Shepardson, Niyogi, Choi, & Charusombat (2009), that grade seven students never considered regional (within USA) or global differences in the effects of climate change. We also found that many students lacked the conceptual knowledge to grasp the consequences of socio-scientific issues, yet attempted to reason about it using fallacious Science and Technology (ST) arguments (Byrne et al., 2014; Sadler & Zeidler, 2005). Both the local reasoning and attempted ST arguments are best illustrated by the following quote of a 11/12 year-old:

P: ''I am not worried. […] It will take a while before it [climate change] reaches the Netherlands.''

I: ''What would be the worst thing that can happen then?''

P: ''Not so much. There could be a second North sea flood. But back then a few people in fact did survive, so……''

Concept knowledge is important in informal reasoning about socio-scientific issues (Sadler & Fowler, 2006). Teachers provided information on the extent to which climate change was addressed in class in the months preceding data collection. For the 8/9 year-olds this was little to none and for the 11/12 year-olds moderately to extensively. No remarkable differences within age groups were found that could be attributed to a higher attention for climate change in class. It is possible that a different level of concept knowledge accounts for the differences between the two age groups (e.g. a higher resorting to fallacious Science and Technology arguments and the initially and finally more positive opinion on how bad climate change is), but due to the limited scope this cannot be confirmed nor ruled out.

Further research

To follow up on the beforementioned limitations of this study and the questions it raises, we propose the following directions for further research. As it was found that not all children in the target audience were able to understand all character's opinions and the socio-scientific issue content, and the sketches made children consider climate change less of a problem, it raises the question whether different opinion changes had been found if all children had been able to understand character's opinions and comprehend and see the humorous intention of the irony. A follow-up study investigating the effects of understanding climate change on informal reasoning based on arguments delivered in sketches, would add to the knowledge in this field.

As far as we are aware, no other study has provided reasons for irony comprehension by young children in a manner similar to ours. As we found major differences in the type of

arguments used by children – Text (8/9 year-olds) versus Context (11/12 year-olds), we recommend follow-up studies to possibly replicate these findings on a larger scale and in-depth studies focusing on further implications of this difference in approach.

Lastly, sketches containing ironic utterances were found to engage children in the full process of informal reasoning about climate change, yet ironic and non-ironic arguments were not associated with same effects on the children's opinions. Further research with these or similar sketches could provide evidence for whether irony, such as exclaimed by Said and Jonathan, indeed can lead to an underperception of the dangers of climate change (Zillmann et al., 1984).

Conclusion

Using a combination of quantitative survey questions and qualitative interviews we were able to find evidence that watching two ironic sketches can engage both 8/9 year-olds and 11/12 year-olds in the full process of informal reasoning, of which the first step is recognizing arguments (Evagorou, 2011). Arguments and opinions of the sketch's characters were better understood by the older children, especially in the case of ironic utterances that younger children failed to recognize three to four times more often. Similar to previous research, the presence of an ironic tone of voice and clarifying context stimulated comprehension (Capelli et al., 1990; Creusere, 2000; Dews et al., 1996; Mulken & Burgers, 2013; Wilson, 2013; Zillmann et al., 1984). Reasons for differences in irony comprehension were found from children's reasoning about the opinions: 11/12 year-olds relied on contextual cues, such as Behavior and Storyline, whereas 8/9 year-olds almost entirely relied on textual cues, leading them to choose the literal instead of the conveyed meaning of an ironic utterance (Dews et al., 1996).

The successive steps in informal reasoning (evaluating arguments, incorporating them into own opinion and argumentation; see Figure 1) were shown to be completed by nearly all

students, as it was found that all children used arguments provided by the sketch's characters into their own opinion argumentation (step 3) and/or reflected on them in the interviews (step 2). 78% of all children demonstrated a change in opinion on the construct of climate change severity, leading to a minor positive (came to think of climate change as less problematic) change in opinions for both age groups. In argumentation of their own opinion (step 4) children made use of different perspectives: Everyday Life, Self-interest and Environmental mostly, corresponding to other research findings (Byrne et al., 2014).

This research shows that it is possible to engage children in informal reasoning about a socio-scientific topic by means of humorous ironic sketches, even though not all children comprehend all irony, character's opinions and climate change content. We conclude with recommendations for practice. First we recommend to *Het Klokhuis* to keep on engaging children to think about the world around them by means of the ironic sketches in the program (Vink, 2002), yet we want to encourage them to use the ironic tone of voice and clarifying context as that increases both comprehension and understanding in the children of their target audience. To *Het Klokhuis* and other educational movie makers, we want to point out the data on humor appreciation (mainly Table 5) to tie their humor use to the preferences of their viewers. Lastly we want to encourage primary school teachers to engage their students in informal reasoning about socio-scientific issues, stimulating their progress by discussing the sketch's arguments in class (Arroio, 2010; Sadler & Zeidler, 2005; Zohar & Nemet, 2002). A small request, as this research shows a fun movie clip and a discussion about arguments can already be the first stepping stone to ultimately reach scientific literacy (Byrne et al., 2014; Evagorou, 2011; Kolstø, 2001; Sadler, 2011).

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Appendix A

Description of storyline, humor technique and -types and character opinions for the two

sketches used in this study

Table A1 and A2 contain a transcript of the spoken text in both sketches, as well as

humor techniques and corresponding humor categories for every utterance and the character's

opinions agreed upon by the researcher and the writers of the sketches. A plus-sign (+) indicates

a strong code. The translation is made by the researcher based on the video's referred to by the

URLs mentioned below. Lines are added to increase clarity and individual segments in the

sketches are visually separated by the thick black bars.

Table A1

Detailed description and analysis of the Saïd and Jonathan sketch about climate change

Content	***Said and Jonathan*** *would not mind the Netherlands heating up, however decide to lie about that on an exam.*
Part of episodes	Zoek het uit - Klimaat – SKETCH 1 (*Find it out – Climate*) Klimaatgeschiedenis deel 1 – SKETCH 1 (*Climate history part 1*)
Broadcasted in	2009 & 2013
URL	https://www.hetklokhuis.nl/tv-uitzending/2433/Zoek%20het%20uit%21%20Klimaat
Time in the URL	2:35 – 4:50
Length	2 minutes 15 seconds
Characters	Saïd (S) Jonathan (J)
Goal sketch	To make children think using the following perspective: If the Netherlands heat up due to climate change, that would not be too bad. Therefore climate change is no problem.

Transcript	Humor techniques	Humor categories	Opinion of Said and Jonathan on the question *How bad is climate change?*
----Saïd and Jonathan leader------	Stereotype Repetition (same leader for every SJ sketch)	Identity Logic	
J: Hé Saïd, hé what are you learning?	Clumsiness (Jonathan arrives and appears to fall)	Action	
S: About climate. Test coming up.			
S: Jay, this is all really bad, this	Stereotype	Identity	S: Very bad
J: What?	Ignorance	Identity	
S: Well, climate change and everything			
J: Oh yeah man, yes that is truly veeeery bad	Peculiar face Peculiar voice + Imitation Exaggeration + Irony	Action Action Identity Language Language	J: Indifferent
J: Hé, why actually?	Ignorance	Identity	
S: Dude, the water is rising, we almost have no winters anymore, and the sun is shining brighter and longer and it is getting hotter and warmer here	Stereotype	Identity	S: Very bad
J: Yes man, that's really very bad.	Irony + Exaggeration + Repetition	Language Language Logic	J: Indifferent
S: Yes dude, soon you will only be able to walk in t-shirts and it will be sunny all day and you will be sweating all day.	Exaggeration Stereotype	Language Identity	S: Very bad
J: Yes man that's bad man, that's…	Repetition	Logic	J: Bad
J: Eey, but that is actually relaxed isn't it, all day in shirts?	Outwitting Conceptual change	Logic Logic	J: Not bad
S: Yes that is actually… You are right dude, it's relaxed			S: Not bad
S: Hé what's the problem dude, with these people actually?	Irreverent behavior + Ridicule	Identity Language	
J: Like I know much	Ignorance	Identity	
S: Here, here, here, here, this is it, dude.	Stereotype	Identity	

S: Soon in ten years it will be so scorched and dry here, then it is really almost a dessert here.	Analogy + Exaggeration	Logic Language	S: Bad
J: Ah man that's surely just like the Sahara	Analogy Exaggeration	Logic Language	J: Not bad
S: Yes, but is that bad dude? Look, my dad, he has long been used to a Sahara, you know, to a dessert	Conceptual change	Logic	J: Not bad
S: He, look, he is from Titua			
J: No man that's no Sahara, that's reef mountain	Outwitting + Embarassment + Misunderstanding	Logic Identity Logic	
S: Well Sahara, reef mountain, joh potato potato	Misunderstanding	Logic	
S: I intend to say, it is scorched and dry over there you know.			
S: Look and when it will be dessert in here as well in ten years, my father will feel at home again dude	Analogy + Stereotype	Logic Identity	S: Not bad
S: Completely at home, then it will be just like his village of birth			
J: So, what's the problem then?	Stereotype	Identity	
S: There is no problem at all dude	Exaggeration + Stereotype	Language Identity	S: Not bad at all
J: No man	Exaggeration +	Language	J: Not bad at all
S: Those people are whining man,	Irreverent behavior + Exaggeration	Identity Language	
S: climate change is really fantastic	Exaggeration +	Language	
J: They are real big whiners man	Ridicule + Irreverent behavior	Language Identity	
J: Ee, but you really should not say that dude when in class in a minute	Conceptual surprise + Stereotype	Logic Identity	S: Not bad at all J: Not bad at all
J: That will result in a fail immediately	Exaggeration + Absurdity	Language Logic	
S: No, you are right dude, we keep this a secret	Deceitful behavior +	Identity	
S: More than that dude, I will just say:	Deceitful behavior Stereotype	Identity Identity	
S: 'It is really bad'	Irony + Peculiar face Peculiar voice	Language Action Action	
J: Haha yes with that sad face	Peculiar face +	Action	

J: Ah teacher it is really very bad	Irony + Peculiar face + Peculiar voice + Repetition	Language Action Action Logic	S: Not bad at all J: Not bad at all
S: Yes yes with that lip like that, it is very bad	Irony + Peculiar face + Peculiar voice + Repetition +	Language Action Action Logic	
J: Yes dude seriously, if you do it like that you will have a 7.5 immediately, I swear	Exaggeration + Absurdity Misunderstanding Stereotype	Language Logic Logic Identity	
S: Cool dude, a 7.5	Ignorance Stereotype	Identity Identity	
S: Yes, it is very bad	Irony + Peculiar face + Peculiar voice + Repetition +	Language Action Action Logic	
S: I'm all set dude, come on, let's go dude	Ignorance + Stereotype Misunderstanding +	Identity Identity Logic	
J: Okay, all set, come on man			
S: It is very bad	Irony + Peculiar face + Peculiar voice + Repetition +	Language Action Action Logic	
J: Hé Saïd. Saïd is my buddy	Peculiar voice Repetition + (same sentence for every SJ sketch) Stereotype	Action Logic Identity	
S: Yes it is really very bad, teacher, it is truly horrific	Irony + Repetition Exaggeration	Language Logic Language	S: Not bad at all J: Not bad at all
J: It is very bad	Irony Repetition +	Language Logic	
S: We have to do something teacher	Irony +	Language	
J: Do it like that, yes, say it again			
S: It is very bad	Irony + Peculiar face Peculiar voice Repetition +	Language Action Action Logic	

Table A2

Detailed description and analysis of the Beckie and Malika sketch about climate change

Content	**Malika** is worried about melting polar caps and tsunamis, **Beckie** has a very creative way of reassuring her
Part of episodes	Klimaatverandering (presenter: Bart) – SKETCH 1 (C*limate change*) Klimaatgeschiedenis deel 2 – SKETCH 1 (*Climate history part 2*)
Broadcasted in	2009 & 2009
URL	https://www.hetklokhuis.nl/tv-uitzending/496/Klimaatgeschiedenis%20%28deel%202%29
Time in the URL	3:30 – 5:09
Length	1 minute 39 seconds
Characters	Beckie (B) Malika (M) Michael
Goal sketch	To make children think about the perspective: Everybody should be thinking about the consequences and therefore be worrying about the dangers of climate change.

Transcript	**Humor technique**	**Humor category**	**How much are Beckie and Malika worried about climate change?**
---Leader Beckie & Malika---	Repetition (same leader) Stereotype	Identity Logic	
B: Malika, can you look a little happier?	Irony Sarcasm +	Language Language	
M: I am a little bit worried	Irony Exaggeration + (factually an understatement)	Language Language	M: Very much
B: About what?			
M: About the environment			
B: Well, whatever	Ridicule + Exaggeration Stereotype	Language Language Identity	B: Not at all
B: It is weekend, we are enjoying a night out don't we?!	Condescension	Identity	
B: There she is, worrying about the panda	Ridicule + Misunderstanding	Language Logic	
M: No way about the panda			

B: Then what?			
M: Look to my ice cubes Beckie, they are melting just like that			
B: Then you ask for new ones	Outwitting +	Logic	
M: That's not the point Beckie, that's also happening with the polar ice	Analogy +	Logic	M: Very much
B: Oh, please	Exaggeration Condescension + Ridicule Stereotype	Language Identity Language Identity	B: Not at all
M: Yes indeed Beckie, as we speak as we speak	Exaggeration +	Language	
B: Should I be worried about that now?	Sarcasm +	Language	B: Not at all
M: Well, I would if I were you, because while we are sitting here, a big chunk of polar ice out there might collapse in sea as of tonight.			M: Very much
B: So what	Ignorance +	Identity	
M: So what so what, then we might get a tsunami that will drown us all	Exaggeration + Ridicule +	Language Logic	
B: Okay, assume that that happens, then we are a long distance from the dunes	Outwitting	Logic	
M: And how would I know whether they have been maintained properly?			
M: Do you know how high that can be, such a tsunami?	Rigidity	Identity	
B: Snap out of it Malika, relax!	Exaggeration +	Language	
M: How can I be relaxed when a flood could come here any minute?	Exaggeration Rigidity +	Identity Identity	
B: Hé you guy, come on over here	Conceptual surprise +	Logic	B: Not at all
B: What's your name?			
Michael: Michael			
B: Are you able to rescue swim?	Conceptual surprise +	Logic	
Michael: Eeuh yes	Coincidence +	Logic	
B: Good.	Outwitting	Logic	
B: Michael this is Malika, Malika this is Michael			
B: Michael is able to rescue swim			
M: Really?	Transformation	Identity	M: Almost none
Michael: Yes			
Michael: Are you in for a dance?	Conceptual surprise +	Logic	
M: Okay	Sexual allusion (look from Beckie)	Language	M: Not at all
M: You don't mind, do you, Becks?			
B: What are friends for?!	Exaggeration +	Language	B: Not at all

B: Aaaaaaaaah	Exaggeration + Peculiar voice + Peculiar face Clownish behavior Ignorance + Stereotype	Language Action Action Action Identity Identity	
Beckie looks at and drinks from glass; thinking about ice cubes and the environment	Conceptual surprise + Peculiar face	Logic Action	B: A little worried

Appendix B

List of reasons why children were selected to participate in the interviews

This appendix provides an overview of the reasons why children were invited to participate in the individual interviews.

8/9 year-olds

- Chosen by teacher by motives of excellent answering capability (3x)

- Profound understanding of Said and Jonathan sketch and high variance in humor appreciation

- Strong degree of opinion change from neutral to not bad at all

- Limited understanding of Said and Jonathan sketch an high variance in humor appreciation

- Irony comprehension for direct non-contextual irony, yet not for (easier) direct contextual irony

- High variance in humor appreciation

11/12 year-olds

- Chosen at random from all children that volunteered to participate (3x)

- Chosen by teacher by motives of excellent answering capability

- High variance in humor appreciation

- Increased worrying about climate change, profound understanding of Said and Jonathan sketch, limited understanding of Beckie and Malika sketch (unusual)

- Major changes in own opinion about climate change (both directions), limited understanding of direct non-contextual irony

- Changes in own opinion about climate change (both directions), limited understanding of Said and Jonathan's irony

Appendix C

New typology of humor used in this study.

This typology is based on the typology of humor in sitcoms by Juckel et al. (2016) and the typology of humor in television advertisements by Buijzen & Valkenburg (2004). The resulting typology had 50 humor techniques divided over four categories (action, identity, language, and logic), combining the benefits of Juckel's (dramatic storyline and dialogue humor) and Buijzen and Valkenburg's (children's and more diverse types of humor) into a workable new typology.

Table C1

New typology of humor used in this study

	Humor technique	**Description technique**	**Humor category** (Berger, 1997)	
			Predominant category	**Alternative category**
A1	Chase	A pursuit or chase of someone or something	Action	
A2	Clownish behavior	Making vigorous arm and leg movements or demonstrating exaggerated irregular physical behavior	Action	
A3	Peculiar face	Making a funny face, grimace	Action	
A4	Peculiar music	Funny, unusual music	Action	
A5	Peculiar voice	Funny, unusual voice	Action	Identity
A6	Clumsiness	Lacking dexterity or grace	Action	
A7	Slapstick	Physical pie-in-the-face humor often involving degradation of someone's status	Action	
A8	Speed	Talking or moving very fast or in slow motion	Action	
A9	Repulsive behavior	Offensive, aversive, disgusting behavior	Action	
I1	Anthropomorphism	Objects or animals with human features	Identity	
I2	Deceitful behavior	Being deliberately misleading, concealing or distorting the truth	Identity	

I3	Eccentricity	Someone who deviates from the norms, an odd character	Identity	
I4	Grotesque appearance	Someone who has a bizarre or monstrous appearance with striking features	Identity	
I5	Imitation	Mimicking or copying someone's appearance or movements while keeping one's own identity at the same time	Identity	
I6	Impersonation	Taking on the identity of another person, intentionally or unintentionally	Identity	
I7	Embarrassment	An awkward situation in which someone gets a sense of discomfort, uneasiness, or shame	Identity	
I8	Malicious pleasure	Taking pleasure in other people's misfortune; victim humor	Identity	
I9	Condescension	Displaying arrogance by patronizing those considered inferior	Identity	
I10	Irreverent behavior	Lacking proper respect for authority or the prevailing standards	Identity	Language
I11	Ignorance	Someone acts or behaves in a foolish, naive, gullible, or childish manner	Identity	Logic
I12	Parody	Imitating a style or a genre of literature or other media	Identity	
I13	Stereotype	Stereotyped or generalized way of depicting members of a certain nation, gender, or other group	Identity	
I14	Rigidity	Someone who thinks along straight lines, who is conservative and inflexible	Identity	Logic
I15	Transformation	Someone or something takes on another form or undergoes a metamorphosis; before/after	Identity	
I16	Self-depreciation	Expressing something negative about oneself	Identity	
L1	Ridicule	Making a fool of someone, verbally or nonverbally	Language	
L2	Wit	Ingenious humor	Language	
L3	Bombast	Talking in a high-flown, grandiloquent, or rhetorical manner	Language	
L4	Infantilism	Playing with the sound of words	Language	
L5	Irony	Saying one thing and meaning something else or exactly the opposite of what you're saying	Language	
L6	Exaggeration	Making an exaggeration or overstatement; reacting in an exaggerated way; exaggerating the qualities of a person or product	Language	Identity
L7	Sarcasm	Biting remark made with a hostile tone; sarcasm is always a verbal put-down	Language	
L8	Satire	Making a fool of or poking fun at well-known things, situations, or public figures	Language	
L9	Sexual allusion	Making a reference or insinuation to sexual or naughty matters	Language	
L10	Repartee	Verbal banter, usually in a witty dialogue	Language	
L11	Puns	Playing with the meaning of words	Language	

L12	Allusion	Indirect reference	Language	
C1	Absurdity	Nonsense, a situation that goes against all logical rules	Logic	
C2	Analogy	Comparisons based on a shared characteristic often involving insult or ridicule (p.8)	Logic	
C3	Caught out	Unexpectedly getting caught while wrongdoing or saying something reprehensible	Logic	
C4	Conceptual surprise	Misleading the audience by means of a sudden unexpected change of concept	Logic	
C5	Sound effects/peculiar sound	Funny sound, unexpected sound, as in cartoons	Logic	
C6	Repetition	Repetition or replay of the same situation	Logic	
C7	Misunderstanding	Misinterpreting a situation	Logic	
C8	Unmasking	To disclose the character of someone	Logic	
C9	Outwitting	Outsmarting someone or the establishment by retort, response, or comeback	Logic	Language
C10	Disappointment	A situation that leads to (minor) disappointment	Logic	
C11	Coincidence	A coincidental and unexpected occurrence	Logic	
C12	Scale	Very large or small sizes of objects that surpass people's logical expectations	Logic	Identity
C13	Visual surprise	A sudden unexpected visual/physical change	Logic	

Appendix D

The coding scheme developed by Byrne et al. (2014) describes six repertoires used by children in their study. For the word repertoires perspectives can be read in this study.

Table D1

The repertoires employed by students (copied from Byrne et al. (2014)*)*

Repertoires	Characterized by …
Everyday Life (EL)	Everyday habits and activities and relating to matters close to students' everyday lives. Often includes the threat of some kind of sacrifice for them and therefore students may try to legitimize their normal behavior by reaffirming normal modes and expectations of their lives
Science and Technology (ST)	Attempted scientific reasoning and references to science and technology (e.g. to explain why two cars emit more carbon dioxide than one)
Society (SO)	Concerns the structure, organization or functioning of society and media reporting. Students may, for example, refer to an authority (e.g. the Environment Minister). Also includes discussion of how to collectively organize people and discuss how to regulate imports, etc.
Justice (J)	Talk about 'fairness' and ethical perspectives. It concerns the administration of the law according to prescribed and accepted principles. Students may use the repertoire to argue for the right for everyone to have the same opportunity to visit family abroad and to travel by car if they live far away from school
Environment (E)	Concerned with the 'right' thing to do in relation to sustaining our world for the future. Students may use environmental discourse, such as 'save the planet', 'do not pollute' or public discourse about global warming/ climate change
Self-interest (SI)	Concerned with students' own interests and welfare. Can be used to take advantage of opportunities without regard for the consequences it may have on others or on the environment; retaining normal expectations (e.g. travelling abroad two or three times a year); having a convenient lifestyle (e.g. eating what one loves to eat such as exotic fruits)