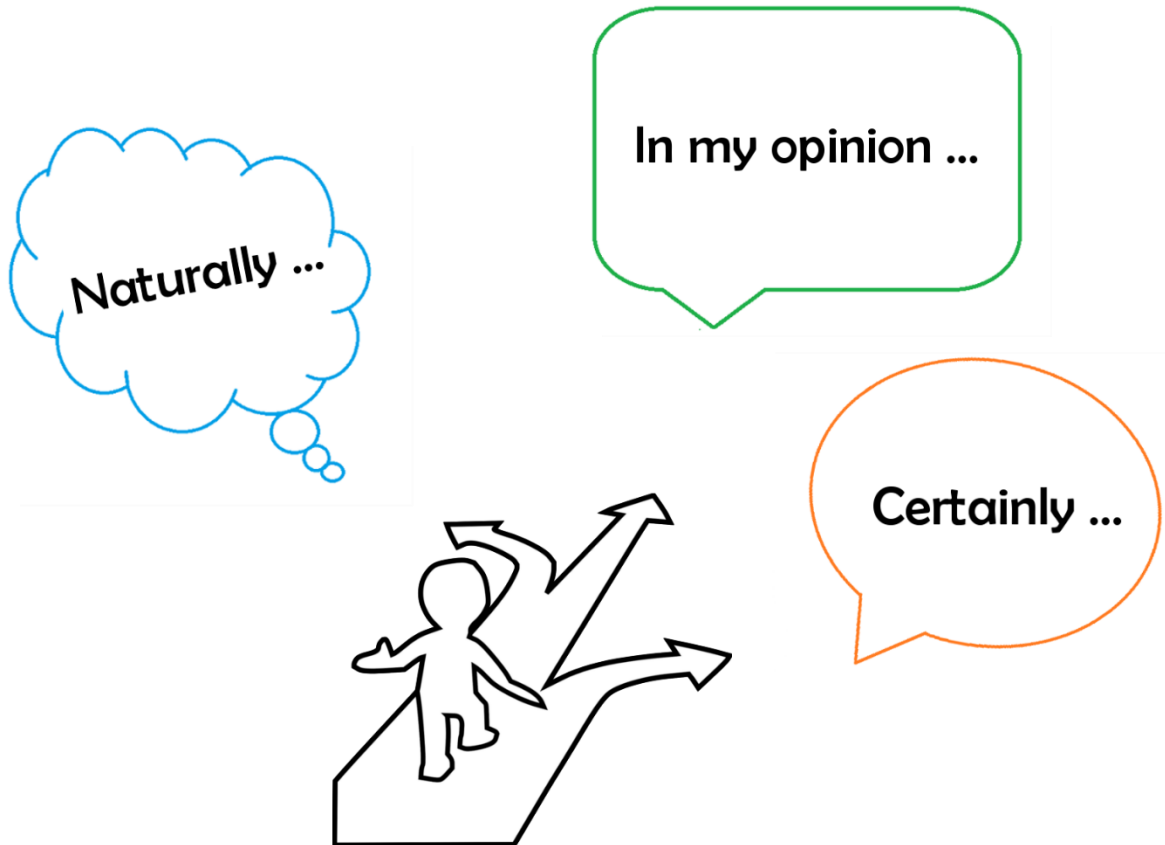


# Fact or Opinion?

Critical Information Assessment by Adolescents



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## Abstract

This study investigates the information assessment abilities of secondary school students in terms of their use of reading strategies in goal-oriented reading and their ability to identify facts and opinions. A first experiment had adolescents tell objective and subjective information apart in texts through a selection task. Here, we find that adolescents can find and distinguish subjective from objective information. Adolescents are also seen to notice and utilise stance markers cueing subjectivity. In a second experiment, eye tracking demonstrated that adolescents' reading behaviour is subject to task instructions. When instructed to find weak reasoning and read critically, adolescents are seen to adjust their reading behaviour to spend more time looking at subjective information. The findings of the study yield a positive outlook on the information assessment abilities of adolescents.

*Keywords:* Adolescents' Information Literacy, Critical Information Assessment, Subjective and Objective Information, Cues for Subjectivity, Subject of Consciousness, Stance Marking, Reading Strategies, Critical Reading

## Fact or Opinion?

## Critical Information Assessment by Adolescents

The rapid digitalisation of our world has introduced an impactful new information channel into society. Through the internet, information retrieval has become more accessible and faster than ever. New media forms enable digital news publishers, opinion makers, and bloggers to publish pieces with relatively little cost or quality control (Abdulla, Garrison, Salwen, Driscoll, & Casey, 2002). The great appeal and accessibility of new media also makes it very attractive to sponsors and commercial advertisers (Bruce, 2000). Altogether, these factors allow for biased information and do not guarantee or motivate new media to factually and objectively present information. These new information dynamics necessitate that information consumers be more critical and competent in assessing the information they read, specifically in telling biased from objective information.

This topic has raised the interest of researchers, and a large body of research is popping up that investigates the information literacy of youth and adults in digital media (e.g., Sharit, Hernández, Czaja, & Pirolli, 2008; Wineburg, McGrew, Breakstone, & Ortega, 2016). The importance of information assessment is also reflected in the research agendas of international organisations such as the European Union (Carretero, Vuorikari, & Punie, 2017; Vuorikari, Punie, Gomez, & Van Den Brande, 2016) and organisations for national educational curriculum development such as SLO (Thijs, Fisser, & van der Hoeven, 2014). For example, the DigComp 2.0 framework stresses that the citizens of tomorrow must be able to “analyse, compare and critically evaluate the credibility and reliability of sources of data, information and digital content [and] to analyse, interpret and critically evaluate the information” (Vuorikari et al., 2016, p. 8).

In the light of these aims, it is necessary to educate adolescents adequately and stimulate their development of information assessment competencies. Especially so because

adolescents are found to be “among the most extensive consumers of digital information” (Eshet, 2002, p. 5), but less information literate than adults (Eshet, 2002; Hargittai 2002a; 2002b). This paints a troublesome picture for adolescents as information consumers, and consequently their development into the new generation of critical thinkers.

Recent research has jumped to investigating youth’s digital literacy, but has overlooked youth’s general information evaluation abilities, making it difficult to understand shortcomings in their digital literacy (Madden, Ford, & Miller 2007, p. 342). In tackling the low digital literacy challenge, it is crucial to look at the state of adolescents’ fundamental information assessment competencies first. One such competency is their ability to identify and distinguish subjective and objective information. Another is their ability and inclination to employ special critical reading strategies when consciously evaluating the credibility of information. It remains unclear how well adolescents can tell subjective from objective information, and whether this may be a root cause for information evaluation problems.

In this paper, we first discuss empirical research on information assessment by youth. Then, we discuss information assessment in the context of discourse theories. Finally, we study adolescents’ ability to identify subjective and objective information, facts and opinions, whether they are helped by cues of subjectivity, and whether they employ special reading strategies when instructed to read critically.

### **Information Assessment by Adolescents**

Studies find that the information assessment abilities of youth are wanting (Britt & Aglinskias, 2002; Julien & Barker, 2009; Scott & O’Sullivan, 2005). It has been argued that more time should be spent on teaching information literacy at secondary school or earlier, and that it is unwise to leave the development of these abilities to be resolved in post-secondary education environments, where it is uncertain that such development will take place at all (Julien & Barker, 2009). However, there is a consensus that teachers also lack know-how, instruments,

and time in efficiently teaching information literacy (Julien & Barker, 2009; Ladbrook & Probert, 2011; Scott & O'Sullivan, 2005; Shenton, 2009; Shenton & Jackson, 2008). A better understanding of what adolescents include and miss in their information assessment will enable teachers and curricula to answer the shortcomings in the development of these crucial abilities.

Information assessment by adolescents has been found to be naïve and rushed, where speed and ease of information retrieval forego quality assurance (Brill, Falk, & Yarden, 2004; Eagleton, 2001; Heinström, 2006; Jones, 1999). Julien and Barker (2009) found that adolescents are relatively unaware of their information searching processes and focus on quickly obtaining a product to their information searches (p. 4). Rieh and Hilligoss (2008) argue adolescents are not as naïve as believed but may prioritise certain information processes over others in their information search (p. 64). In this way, adolescents may pay less attention to the source and subjectivity of information in their information search, as seen in research by Agosto (2002) and Fidel et al. (1999). Research that studied information evaluation has often done so through surveys or in setups where adolescents may not have focussed only on credibility evaluation in their information search (e.g., Flanagin & Metzger, 2007; Liu, 2004; Metzger, Flanagin, & Zwarun, 2003). As of yet, no research has looked specifically at adolescents' conscious ability and performance in identifying and distinguishing objective and subjective information, and thereby directed and prioritised credibility assessment.

Naivety and haste are unlikely to dominate goal-oriented information searching. McCrudden and Schraw (2007) have set out the role of relevance in text processing, 'where specific instructions explicitly prompt a reader to focus on particular text segments' (p. 116). The importance of such instructions for students in goal-oriented tasks is highlighted by Britt and Rouet (2012), where instructions support the creation of task models and subsequent

approaches to task completion. Other research corroborates the effect of instruction on the product and processes of reading. For example, undergraduates' source memory is found to be increased as a factor of task instructions that have them evaluate source knowledge (Saux, Ros, Britt, Stadtler, Burin, & Rouet, 2018). However, even with goal-oriented instructions, adolescents may not have goal related reading strategies available for every purpose. In this way, adolescents instructed to focus on credibility assessment may not realise that increased attention to cues of credibility in their reading would be more efficient in both terms of time and the quality of their assessment. Even if they are aware of the value of such strategies, it is possible these reading strategy processes may not be fruitfully realised in their actual reading. Research has already shown that adolescents can employ reading strategies, as adolescents may skim or scan information in information searching (Agosto, 2002). It remains unclear whether adolescents have available critical reading strategies, and as such pay more attention to subjective text segments in critical reading, either consciously or unconsciously, when given instructions to read critically and time to do so.

### **Fundamentals of Information Assessment**

Whether presented digitally, in print, or through speech, an initial step in information assessment is the construction of an internal representation. In any form of language comprehension, information is processed and stored in a repeatedly updated model of representation, a *situation model* (e.g., O'Brien, Rizzella, Albrecht, & Halleran, 1998; Van Dijk & Kintsch, 1983; Zwaan, Langston, & Graesser, 1995). With our current inquiry in mind, it has been argued that "[information] literacy acts as a filter: it identifies false, irrelevant, or biased information, and avoids its penetration into the learner's cognition" (Eshet, 2002, p. 5). Ideally, the filter thus serves to exclude undesired information from our situation models.

One explanation for the lower information literacy of adolescents may be an inability

to judge information impartially. In distinguishing facts from opinions, one's own world view and perspective relating to the information to be assessed must first be set aside. Because a biased information filter clouds proper and objective judgement when assessing information on controversial topics. In this way, a flawed filter allows for biased information to add to the situation model without proper evaluation, simply because the information may align with the assessor's world view.

Another cause for shortcomings in their information literacy could be that adolescents do not acknowledge the role of subjective sources in information assessment. Recall that biased or false information is undesired in the mind of a critical information consumer. When considering sources of subjectivity, a critical reader would realise that information from subjective sources could be biased or false. As such, a critical reader would more likely believe the opinion presented in (1a) than that in (1b), because he or she can more easily identify the subjective source in (1b).

- (1) a. A global currency facilitates international cooperation.
- b. I think a global currency facilitates international cooperation.

The information in (1a) is presented more factually, as it feigns to describe a true real-world situation. Although the truth-conditional information presented in both sentences is essentially identical in the interpretation that disregards the propositional attitude semantics in (1b), the addition of the stance marking 'I think' in (1b) cues subjectivity. Sentence (1b) saliently introduces the personal reasoning and perspective of a person or entity, also known as the *Subject of Consciousness* (SoC) (see Pander Maat & Sanders, 2001). The presence of a SoC makes information more subjective because it presents the relative view of the SoC. Consequently, in distinguishing opinions from facts, it is crucial for information consumers to identify the presence of a SoC and realise that the presented information has already been evaluated, even if the SoC is not saliently introduced.

Even if adolescents recognise the value of a SoC in information assessment, and pay attention to SoC marking, they may be unable to detect these sources of subjectivity in different types of SoC marking. Linguistic marking such as ‘I think’ assists information consumers in their identification of a SoC through the explicit mentioning of a belief using a first-person pronoun. However, linguistic marking without such explicit reference to a subjective person or entity may serve to conceal subjective intent, present subjective information as factual or logical, and ultimately persuade people to interpret opinions as facts. Examples are linguistic extremity (Craig & Blankenship, 2011), powerful and powerless markers (Areni & Sparks, 2005; Blankenship & Holtgraves, 2005; Holtgraves & Lasky, 1999), which may alter the persuasive strength of messages in speech and print. Importantly, this type of marking often conceals the presence of a SoC and presents information as straightforwardly true or false, such as in attitude markers like ‘naturally’ or the necessity modal ‘should’. Although it can be inferred that these markers express subjective information, and present a SoC, they do not explicitly signal or mention the SoC or the subjectivity of the information. An example is shown in (2ab).

- (2) a.     I think trade tariffs harm economic welfare.  
      b.     Naturally, trade tariffs harm economic welfare.

The statements in (2) are subjective as economists are likely to disagree over the truth evaluation. In (2a), the SoC explicitly introduces this statement as a personal belief. In (2b) no explicit reference to the SoC is made and the content of the statement is unchanged. There is no direct reference to a person, via for example a pronoun, but there is an indirect inclusion of a SoC who has judged it self-explanatory trade tariffs harm economic welfare. The decreased saliency of the SoC and strong persuasive strength that ‘naturally’ adds as a linguistic marker disguises the statement in (2b) as a fact. Critical information consumers need to be aware of the concealed persuasive intent present, and that the SoC is still present.



Moreover, there should be awareness that, although relatively implicit, these stance markers still introduce the subjective perspective of the SoC. Adults have been found to be forewarned by similar subjective marking (Kamalski, Lentz, Sanders, Zwaan, 2008), and can thereby be aided by them in their information assessment. It remains unclear whether adolescents also notice implicit SoCs and whether this translates to their ability to distinguish facts from opinions.

### **Research Questions & Hypotheses**

Research has found that adolescents are less information literate than adults. In remedying the shortcomings in their information literacy, it is key to study the general information assessment competencies of adolescents. As a first step in this endeavour, we look to answer two questions.

First, in Experiment 1, we want to find out whether adolescents can identify facts and opinions in texts when instructed to do so. In addition, we want to see how the presence or absence of additional SoC marking in opinions will affect judgements regarding subjectivity. Our main hypothesis is that adolescents will be able to recognise facts better than opinions, as we expect opinions to be mistaken for facts, but not facts for opinions. Because adults have been found to be forewarned by markers of subjectivity (Kamalski et al., 2008), we also expect adolescents to be forewarned by such markers, and as such identify marked opinions better than unmarked opinions.

Second, in Experiment 2, we want to find out whether adolescents employ a custom critical reading strategy when asked to read critically and given a goal-oriented task. To investigate this, we will conduct an eye tracking study with a task instruction to read texts in a summarising or critical manner. Here, we are interested in their reading behaviour per

reading modality, specifically regarding markers of subjectivity and sentences containing opinions. Testing summarising reading allows for drawing a comparison and contrasting possible effects of task instructions. We expect adolescents to adhere to the task instruction and pay more attention to opinions and SoC markers when reading critically, as prior research argues that specific instructions can direct attention to relevant text segments (McCrudden & Schraw, 2007) and increase performance related to task goals (Saux et al., 2018).

### **Experiment 1**

Experiment 1 serves to investigate whether adolescents can identify and distinguish facts from opinions in texts when asked to do so explicitly. Additionally, the experiment sets out to find out what effect additional markers of subjectivity in opinions have on the information assessment by adolescents. A critical reader must be able to distinguish and identify what segments of information are subjective, and which are objective or framed by a SoC to look objective. We test adolescents' ability to do so through a fact and opinion identification task that includes sentences containing facts, opinions, and opinions with additional SoC marking.

### **Method**

**Participants.** Two hundred and fifty-five Dutch students (146 female, 109 male) participated in the experiment during classroom sessions. Participants were in their third (38.4%), fourth (27.5%), and fifth (34.1%) year of secondary school following either general secondary (HAVO, 37.6%), pre-university (VWO, 49.0%), or gymnasium (GYM, 13.3%) education. They were aged 13 to 18 years old ( $M = 15.64$ ,  $SD = 1.15$ ). All participants were included in the data analysis.

Exercising information evaluation abilities fitted the curriculum of Dutch as a subject. The study was conducted with permission of and in cooperation with the school director and

the teachers. Nevertheless, students were to participate in the study on a voluntary basis and were not granted compensation such as bonus points.

**Materials.** The experiment featured an identification task in which participants had to identify and select facts and opinions in texts. Two texts were constructed on current and controversial topics: one on organ donation and the other on gun control. The texts were created with facts and opinions gathered from various sources such as internet articles and newspapers and supplemented with a neutral author's byline.

Each text featured eight objective and twelve subjective sentences. Factual sentences presented truth-verifiable or quantifiable information. Sentences presenting opinions featured claims that were subjective in nature, where the truth-conditionality of the content depended on either the subjective perspective of the SoC or even the perspective of the reader, the information assessor.

In the experiment the distinction was made between implicit and explicit opinions. As such, six of the twelve subjective sentences in each text appeared in an implicitly subjective form, and the other six in an explicitly subjective form. We construed implicit opinions to be statements without additional marking of an SoC, and explicit opinions with such marking. The explicit opinions featured both SoC markers that explicitly and implicitly introduced a SoC, where an explicit introduction mentioned a person through a pronoun. Examples of a fact and an implicit opinion are shown in (3ab), and explicit opinions with implicit and explicit SoC marking are shown in (3cd) respectively.

A second version of each text was made in which all implicitly subjective statements in one version of a text were presented as explicitly subjective statements in the other and vice versa. Altogether, four stimuli were made, which can be found in appendix A.

- (3) a. Er overlijden bijna 150 mensen per jaar omdat er geen orgaan voor hen beschikbaar is.  
'Nearly 150 people die each year because there is no organ is available to them.'
- b. Het systeem dat we nu hebben is niet goed genoeg.  
'The system we currently have is not good enough.'
- c. Vanzelfsprekend is het systeem dat we nu hebben niet goed genoeg.  
'Self-evidently, the system we currently have is not good enough.'
- d. Ik ben ervan overtuigd dat het nieuwe systeem eerlijker en makkelijker is voor iedereen.  
'I am convinced that the new system is more fair and easier for everyone.'

**Design.** Experiment 1 was part of a larger study and was preceded by a forced choice decision task on facts and opinions. (see Veenhof, 2018). All participants were distributed over four lists, each list featuring only one of the four experimental texts.

**Apparatus.** The experiment was conducted on iPads provided by the school. These iPads ran a software program called ZuluDesk, which allowed us to set restrictions to iPad usage and push our experimental tasks to all active iPads. The tasks were hosted on a customised LimeSurvey environment, an instrument for conducting online questionnaires or tasks. This environment was accessed via a website address that would distribute participants over the different experimental lists automatically.

**Procedure.** The experiment was conducted in 50-minute classroom sessions. The sessions included a forced decision task on facts and opinions, and the current information identification experiment. Students were informed beforehand that a researcher would

conduct an experiment on language during a special lesson. All sessions took place during regular class hours in the usual classrooms and in the presence of the class teacher.

Each lesson opened with the teacher briefly introducing the experimenter. The experimenter would take over the instruction and set out what the lesson would entail. Students were instructed that they were to complete two tasks on iPads about distinguishing facts from opinions and that they would receive a personal score based on their performance at the end of the session. This score provided them with general insight into their ability to distinguish facts from opinions and encouraged active participation.

Participants first entered their age, class, and gender on the iPads. Having entered these details, they were presented two practice items on the distinction between facts and opinions with immediate textual feedback on their responses. After the practice trials, the students first completed the forced decision task, taking approximately 20 minutes. All participants proceeded to the identification task simultaneously, averaging 15 minutes. When all had finished, the participants could see their scores and submit the data automatically. Students could then take a moment to talk and discuss their scores and findings with their classmates. Once the class discussion and score sharing had subsided, the experimenter called the class to attention a final time to take measure of their thoughts on the tasks. The discussion that followed concluded the lesson and thereby the experiment.

## **Results**

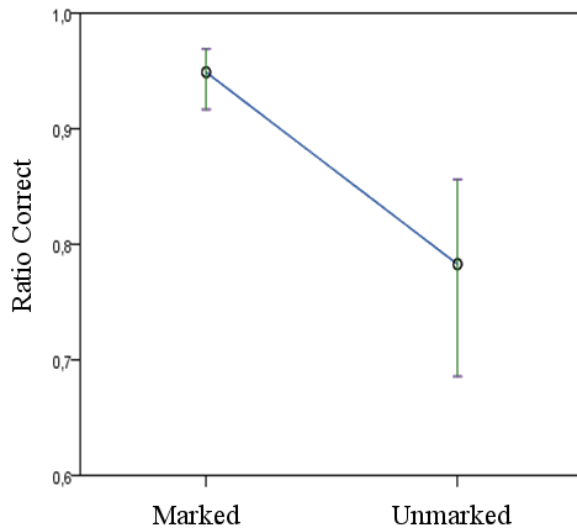
Factual sentences were selected as facts correctly 1913 out of 2040 times, making up a 93,8% identification rate for facts. A Pearson Chi-Square test showed no effect of text on the rate of correct fact recognition, ( $\chi^2(1) = 1.11, p = .292$ ), with a correct response rate of 94,3% on the organ donation text and 93,2% on the weapon text. Sentences containing opinions were selected as opinions correctly 2484 out of 3060 times, resulting in a correct response rate of

81,2%. Here, there was an effect of text, ( $\chi^2(1) = 97.25, p < .001$ ), where opinions were correctly selected 88,2% of the time in the organ text, compared to 74,3% in the weapon text. A significant difference was observed when comparing the correct response rates on fact and opinion selection, ( $\chi^2(1) = 163.46, p < .001$ ), where facts were recognised better.

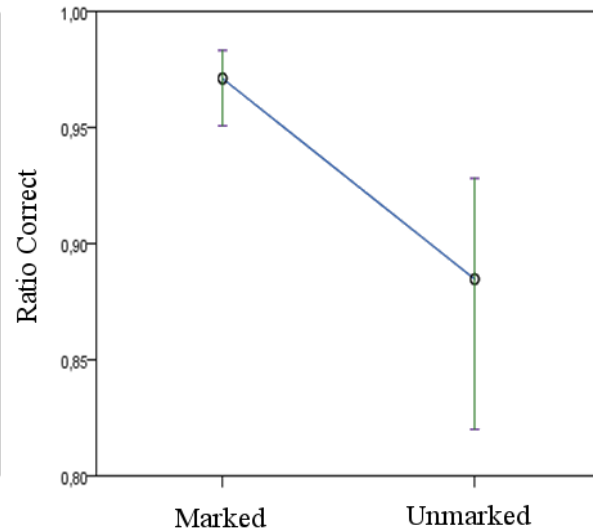
Looking at the effect of extra SoC-marking on opinion recognition, opinions were correctly identified 1101 out of 1530 times (72.0%) in their unmarked form, as opposed to 1383 out of 1530 (90.4%) when in their marked form. A generalised linear mixed model (GLMM) with participants and items as random effects, shown in Table 1, found a fixed effect of marking on responses in the selection of opinions in the opinion selection question. The observed effect predicts that when asked to select opinions, participants more often correctly recognise marked opinions as compared to unmarked opinions. The corresponding estimated means of the effect are shown in Figure 1.

Table 1.  
*GLMM on Responses to Opinions in the Opinion Selection Question per Factor of Marking over Participants and Items.*

<b>Fixed Effects</b>							
Source	Numerator df		Denominator df		F	Sig.	
Marking	1		3.058		178.166	<.001	
<b>Fixed Coefficients</b>							
Model Term	Coefficient		Sig.				
Intercept	1.284		<.001				
Marking	1.645		<.001				
<b>Random Effects</b>							
Parameter	Estimate	Std. Error	Z	Sig.	95% Conf. Int.		
					Lower Bound	Upper Bound	
Intercept(Participant)	1.281	0.192	6.675	<.001	0.955	1.718	
Intercept(Item)	1.322	0.422	3.129	.002	0.706	2.473	



*Figure 1.* Estimated means for the significant effect on ratios of correct responses to opinions in the select opinions question per marking condition.



*Figure 2.* Estimated means for the significant effect on ratios of correct responses to opinions in the select facts question per marking condition.

We also looked at whether the presence of additional SoC marking can prevent opinions to be mistaken for facts in the fact selection question. The GLMM presented in Table 2 and Figure 2 found that opinions in the fact selection question were more often mistaken for facts when they appeared in their unmarked form.

A closer inspection of the data on the selected unmarked opinions in the fact selection question allows for a qualitative exploration into the root cause. Looking at the selection counts on individual opinions in the fact selection question, the effect of marking on the rates of correct selection is seen to differ per item. Marking is shown to have a significant effect on the rate of misidentification only on certain items. Table 3 sets out the selection counts per opinion in the fact selection question, thus the number of times each opinion was mistaken for a fact.

Table 2.  
*GLMM on Responses to Opinions in the Fact Selection Question per Factor of Marking over Participants and Items.*

<b>Fixed Effects</b>						
Source	Numerator df		Denominator df		F	Sig.
Marking	1		3.058		96.459	<.001
<b>Fixed Coefficients</b>						
Model Term	Coefficient		Sig.			
Intercept	2.040		<.001			
Marking	1.481		<.001			
<b>Random Effects</b>						
Parameter	Estimate	Std. Error	Z	Sig.	95% Conf. Int.	
					Lower Bound	Upper Bound
Intercept(Participant)	1.555	0.240	6.476	<.001	1.149	2.104
Intercept(Item)	1.341	0.434	3.091	.002	0.711	2.529

Table 3.  
*Selection Counts per Opinion on the Fact Selection Question per Condition.*

Item	Unmarked		Marked	
Item 2	3/63	(4.8%)	2/63	(3.2%)
Item 3*	34/63	(54.0%)	3/63	(4.8%)
Item 6	1/63	(1.6%)	3/63	(4.8%)
Item 7	3/63	(4.8%)	2/63	(3.2%)
Item 9	3/63	(4.8%)	2/63	(3.2%)
Item 11	4/63	(6.3%)	1/63	(1.6%)
Item 13	3/63	(4.8%)	3/63	(4.8%)
Item 15	2/63	(3.2%)	3/63	(4.8%)
Item 16	8/63	(12.7%)	3/63	(4.8%)
Item 17	7/63	(11.1%)	4/63	(6.3%)
Item 19	8/63	(12.7%)	6/63	(9.5%)
Item 20	3/63	(4.8%)	4/63	(6.3%)
Item 23	6/62	(9.7%)	2/67	(3.0%)
Item 24	3/62	(4.8%)	2/67	(3.0%)
Item 25*	47/67	(70.1%)	8/62	(12.9%)
Item 26*	46/67	(68.7%)	10/62	(16.1%)
Item 29	2/62	(3.2%)	2/67	(3.0%)
Item 31*	50/67	(74.6%)	2/62	(3.2%)
Item 32	5/62	(8.1%)	2/67	(3.0%)
Item 35*	21/62	(33.9%)	13/67	(19.4%)
Item 36*	32/67	(47.8%)	3/62	(4.8%)
Item 37	10/62	(16.1%)	5/67	(7.5%)
Item 38	6/67	(9.0%)	2/62	(3.2%)
Item 40	6/67	(9.0%)	2/62	(3.2%)

Note. \*  $p < .001$  on  $\chi^2$  test.

Items 1-20 appeared in the Organ text. Items 20-40 appeared in the Weapon text.



## Discussion

The results of Experiment 1 show that adolescents can identify facts and opinions in running texts successfully. As expected, adolescents were better at recognising facts overall. We argue that adolescents can identify facts more easily due to the high saliency of features defining factual information, such as quantifiable and truth-verifiable information. In contrast, opinions are not always as saliently subjective, making them appear factual.

When looking at the effect of SoC markers, the results show that opinions that are supplemented with SoC marking are more easily identified as opinions than their unmarked counterparts. The data suggest that adolescents can identify a SoC through subjective marking and that such marking alerts them of subjectivity, thereby aiding them in their information assessment.

This finding is supported by items on which participants scored at chance when unmarked, but near ceiling when marked, such as items 3 and 36 in Table 3. Item 36, presented in its unmarked and marked forms in (4), exemplifies the disambiguating effect of SoC marking.

- (4) a. De wensen van de wapenlobby kosten onschuldige scholieren hun leven.  
'The wishes of the gun lobby are costing innocent students their lives.'
- b. Het is overduidelijk dat de wensen van de wapenlobby onschuldige scholieren hun leven kosten.  
'It is clearly so that the wishes of the gun lobby are costing innocent students their lives.'

The opinion presented in (4a) was misidentified as a fact 47.8% of the time, compared to a 4.8% misidentification rate for (4b).

Importantly, the marking *it is clearly so* in (4b) only implicitly introduces the prior judgement and involvement of the SoC. Nevertheless, it is seen to aid adolescents in

disambiguating the subjectivity of information. A similar effect is observed for item 31, presented in (5), where the marked form is misidentified as a fact only 3.2% of the time, compared to 74.6% when unmarked. The marking in this item explicitly mentions the SoC through the pronoun *I* in *I believe*.

- (5) a. Een strikter wapenbeleid heeft minder schietpartijen tot gevolg.  
'A stricter gun policy leads to fewer shootings.'
- b. Ik geloof dat een strikter wapenbeleid minder schietpartijen tot gevolg heeft.  
'I believe that a stricter gun policy leads to fewer shootings.'

A distinction was made in the explicitness of SoC marking, and the question was raised whether adolescents could benefit from both straightforward explicit, and more complex implicit, SoC marking. Crucially, from (4) and (5) it is seen that adolescents can do so from both types of marking, as both explicit and implicit SoC markers are noticed and utilised by adolescents in their information assessment.

The data also found an effect of text on opinion identification, where opinions were identified less well in the weapon text. One cause may be that misidentified opinions in the weapon text expressed content that must have aligned to the world views of the adolescents, who therefore evaluate them as factual. A more likely cause of this effect is that opinions in the weapon text are not as saliently subjective as those in the organ text, and therefore mistaken for facts more frequently. In this way, a critical reader may have noticed that (5a) is ambiguously subjective, as the cause-consequence can be factual when supported by independent real-world data. This ambiguity may explain for the high misidentification rate for this and other items. Such items were more frequent in the weapon text, explaining for the effect of text. Importantly, the ambiguity in these items supports the effect of SoC marking ever more strongly, as it shows that when information can be perceived as either subjective or objective, it is disambiguated entirely through SoC marking.

## Experiment 2

Experiment 1 has found that adolescents can identify facts and opinions in texts. Moreover, the findings suggest that adolescents notice markers of subjectivity and utilise them in their information assessment. Experiment 2 serves to supplement these findings with insights into the online reading processes in adolescents' information assessment.

Experiment 2 employs an eye tracking experiment aiming to find out how adolescents distribute their attention towards subjective information when given task instructions that orient attention towards sources of subjectivity. We will look at their attention distribution over subjective and objective information given goals that do and do not relate to the subjectivity of information. One type of instruction, henceforth referred to as the critical reading instruction, will put emphasis on the evaluation of argumentation of information, which will ideally direct adolescents' focus towards identifying SoCs and subjectivity. The other type of instruction serves as a measure of comparison and does not direct attention to the subjectivity or reasoning of information, this is the summarising reading instruction.

In their critical reading we expect adolescents to look specifically for cues of subjectivity and weak reasoning, such as attitude markers and subjective sentences. Increased attention towards such information in the critical reading modality would provide evidence in support of the idea that adolescents are able to recognise subjective information, and that they are aware of the value of SoC markers when consciously assessing the quality of information. Finding such evidence would co-align with the findings of Experiment 1.

In their summarising reading we expect adolescents to look specifically for important information that conveys the main gist of the piece, such as factual or quantifiable information. While we still expect them to read and look at the subjective information, we hypothesise that they pay less attention to markers of subjectivity and subjective information

in comparison to the attention distribution given the critical reading instructions.

## Method

**Participants.** Thirty-six Dutch students (18 female, 18 male) participated in the eye tracking experiment. Although they came from the same school, participants in the eye tracking experiment had not participated in the classroom sessions of Experiment 1. Participants were third year general secondary students (50.0%) and fourth year pre-university students (50.0%). They were aged 14 to 17 years old ( $M = 15.00$ ,  $SD = .894$ ). Six participants were excluded from the data analysis due unstable registration of their eye movements. The study was conducted with permission of the school and students participated in the study on a voluntary basis without compensation such as bonus points.

**Materials.** The current eye tracking experiment used the two texts from Experiment 1. The choice of specific text version per text was motivated by the results on the identification task, where we selected the versions that adolescents most successfully identified opinions and facts for. The texts were too long to present on one screen and were therefore split across two screens each. The spacing between lines was set to 25 pixels. The locations of line breaks were manipulated to occur at natural positions, while ensuring markers of subjectivity never appeared the beginning or end of a line to avoid possible effects of return sweeps on these markers.

**Task Instruction.** The task instruction served to elicit a reading modality from the participants and therefore constituted our independent measure. Before reading a text, participants were either instructed to read a text carefully as to summarise it afterwards, or to read a text critically as to indicate which arguments were the weakest afterwards. The instructions are set out in Table 4.

Table 4.  
*Task Instructions per Reading Modality.*

<b>Summarising Reading</b>	
Dutch	Free Translation
Voor Taak 1 ga je een tekst lezen over Orgaandonatie. Het is de bedoeling dat je deze tekst zorgvuldig leest.	For Task 1 you will read a text on Organ Donation. You are supposed to read the text carefully.
Na het lezen van de tekst moet je samenvatten wat er in de tekst werd geschreven.	After having read the text you will need to summarise what was written in the text.
<b>Critical Reading</b>	
Dutch	Free Translation
Voor Taak 2 ga je een tekst lezen over Wapenbezit. Het is de bedoeling dat je deze tekst kritisch leest.	For Task 2 you will read a text on Gun Possession. You are supposed to read the text critically.
Na het lezen van de tekst moet je aangeven welke argumenten je zwak vond.	After having read the text you will need to indicate which arguments you found weak.

Although the qualitative data produced by the participants was not our main interest, we had participants fill out their answers on task forms. After checking these answers, we had no reason to suspect participants did not actively participate or read in the desired modalities.

**Design.** Participants read both texts, but in different reading modalities. The texts were presented across four lists that crossed the order of text presentation and order of task instruction.

**Apparatus.** Participants' eye movements were recorded using a mobile eye-tracker, the SMI RED250 mobile eye tracker mounted to a laptop with a 1920x1080 resolution. This eye tracker recorded using infrared video at an approximate distance of 60cm and with a gaze position accuracy of 0.4 degrees. A chinrest helped participants to maintain a

stable relative position to the eye tracker. The experiment was conducted using ZEP software running on Windows 8.

**Procedure.** Testing took part in a private room at the participants' school. Each session took approximately 25 minutes. The participants were instructed that they would read texts with special equipment that could track their eye movements. Participants were seated on a stable chair in front of a desk. They were asked to find the most comfortable position on the chair while resting their chin on a chinrest.

Participants were instructed that they were to read texts with specific tasks. A calibration procedure first took place followed by a practice trial that exemplified what the experiment entailed. After the practice trial, a recalibration took place and participants would read the task instructions of the first trial before starting it. After having read the first text, they would fill out the corresponding exercise on paper. Once ready, participants would shift back to the reading position with their head in the chinrest. Another calibration took place and the process repeated with a different text and task for the second trial.

**Measures.** Total fixation counts on each SoC marker were calculated by summing up all fixations on them. Per marker, total fixation durations were calculated by summing up all the durations of fixations belonging to the marker. We measured overall reading times by summing up all total fixation durations per text, including those on non-target regions. In preparing the measures for analyses we performed log-transformations on the overall reading times and fixation durations measures.

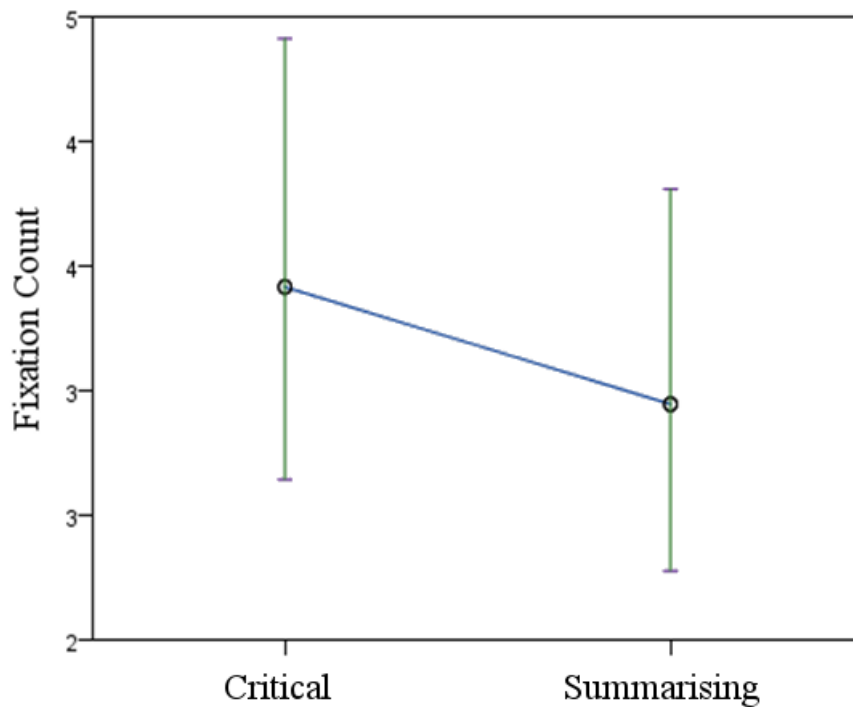
**Analysis.** The overall reading times per text and the total fixation durations on SoC-markers were analysed using linear mixed effect modelling. Fixation counts on SoC-markers were analysed using generalised linear mixed effect modelling. Participants and items were included in the models as crossed random factors.

## Results

The effect of the reading instructions is first measured through analyses of reading times. A Mixed Model (MM) found no effect of reading instructions on the total reading times per text ( $p = .961$ ). Similarly, a MM showed no overall effect of reading instructions on the total fixation durations towards subjective markers of a SoC ( $p = .522$ ). However, a GLMM found an effect of reading instructions on the fixation counts on these markers, as Table 5 and Figure 3 illustrate, where there were more fixation counts on markers of subjectivity in the critical reading condition.

Table 5.  
*GLMM on Fixation Counts towards Markers of Subjectivity per Factor of Reading Instruction over Participants and Items.*

<b>Fixed Effects</b>						
Source	Numerator df	Denominator df	F	Sig.		
Instruction	1	368	6.776	.010		
<b>Fixed Coefficients</b>						
Model Term	Coefficient	Sig.				
Intercept	1.081	<.001				
Critical	0.148	.010				
<b>Random Effects</b>						
Parameter	Estimate	Std. Error	Z	Sig.	95% Conf. Int.	
					Lower Bound	Upper Bound
Intercept(Participant)	0.057	0.021	2.709	.007	0.028	0.118
Intercept(Item)	0.162	0.074	2.194	.028	0.066	0.396



*Figure 3.* Estimated means for the significant effect on fixation counts towards markers of subjectivity per reading instruction.

We explored the data further in a post-hoc manner through different levels of measurement, as we believed the measures could yield more insights given a different scope to our target regions. As such, we looked at the same measures on a sentence level, where sentences were coded as target regions, and categorised by subjectivity. Performing the same measures on this level, the MM in Table 6 shows an overall effect of reading instruction on the total fixation durations on sentences containing an opinion. The total fixation durations on opinions were longer given critical reading instruction. The mixed models in Tables 7 and 8 show that this overall effect of reading instruction on total fixation durations extends to both unmarked and marked opinions. Interestingly, no such effect was observed for fixation durations towards factual sentences, ( $F(1, 435.105) = 0.317, p = .574$ ).



Table 6.

*Mixed Model on Log Total Fixation Durations towards Sentences containing Opinions per Factor of Reading Instruction.*

<b>Fixed Effects</b>					
Source	Numerator df	Denominator df	F	Sig.	
Intercept	1	44.525	10730.907	<.001	
Instruction	1	666.177	14.831	<.001	

<b>Estimates of Fixed Effects</b>							
Parameter	Estimate	Std. Error	df	t	Sig.	95% Conf. Int.	
						Lower Bound	Upper Bound
Intercept	3.465	0.034	47.642	101.153	<.001	3.397	3.534
Critical	0.048	0.012	666.177	3.851	<.001	0.024	0.072

<b>Random Effects</b>			
Parameter	Estimate	Std. Error	
Residual	0.028	0.002	
Intercept(Participant)	0.012	0.004	
Intercept(Item)	0.016	0.005	

Table 7.

*Mixed Model on Log Total Fixation Durations towards Sentences containing Marked Opinions per Factor of Reading Instruction.*

<b>Fixed Effects</b>					
Source	Numerator df	Denominator df	F	Sig.	
Intercept	1	25.251	7807.839	<.001	
Instruction	1	317.726	4.964	.027	

<b>Estimates of Fixed Effects</b>							
Parameter	Estimate	Std. Error	df	t	Sig.	95% Conf. Int.	
						Lower Bound	Upper Bound
Intercept	3.542	0.041	27.739	85.839	<.001	3.457	3.627
Critical	0.039	0.018	317.726	2.228	.027	0.005	0.074

<b>Random Effects</b>			
Parameter	Estimate	Std. Error	
Residual	0.028	0.002	
Intercept(Participant)	0.018	0.005	
Intercept(Item)	0.011	0.005	

Table 8.

*Mixed Model on Log Total Fixation Durations towards Sentences containing Unmarked Opinions per Factor of Reading Instruction.*

<b>Fixed Effects</b>							
Source	Numerator df		Denominator df		F	Sig.	
Intercept	1		18.834		8979.428	<.001	
Instruction	1		319.089		11.383	.001	

<b>Estimates of Fixed Effects</b>							
Parameter	Estimate	Std. Error	df	t	Sig.	95% Conf. Int.	
						Lower Bound	Upper Bound
Intercept	3.388	0.037	21.011	91.429	<.001	3.311	3.465
Critical	0.058	0.017	319.089	3.374	.001	0.024	0.091

<b>Random Effects</b>			
Parameter	Estimate	Std. Error	
Residual	0.026	0.002	
Intercept(Participant)	0.009	0.003	
Intercept(Item)	0.011	0.005	

A GLMM showed an overall effect of reading instruction on fixation counts per sentence, ( $F(1, 1.318) = 20.241, p < .001$ ), where the counts were higher given the critical reading instruction. Recall that this was also seen for SoC markers. Looking closer, here also, no effect of reading instruction is observed on the fixation counts towards factual sentences, ( $F(1, 478) = 3.659, p = .056$ ), although marginally. The GLMMs in Tables 9 and 10 show significant effects of reading instruction on fixation counts for sentences with unmarked and marked opinions respectively. There were more fixations on sentences containing opinions in the critical reading as compared to the summarising reading condition, as further illustrated by Figures 4 and 5.

Table 9.

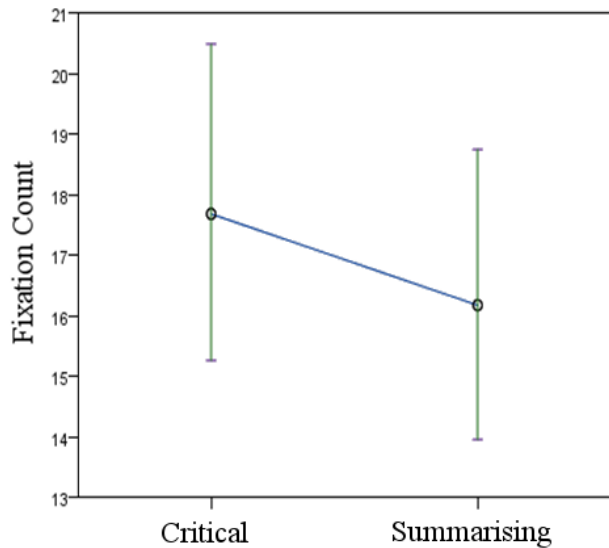
*GLMM on Fixation Counts towards Sentences Presenting Marked Opinions per Factor of Reading Instruction.*

<b>Fixed Effects</b>						
Source	Numerator df	Denominator df	F	Sig.		
Instruction	1	358	12.334	.001		
<b>Fixed Coefficients</b>						
Model Term	Coefficient	Sig.				
Intercept	2.784	<.001				
Critical	0.089	.001				
<b>Random Effects</b>						
Parameter	Estimate	Std. Error	Z	Sig.	95% Conf. Int.	
					Lower Bound	Upper Bound
Intercept(Participant)	0.037	0.011	3.309	.001	0.021	0.068
Intercept(Item)	0.049	0.021	2.257	.024	0.020	0.116

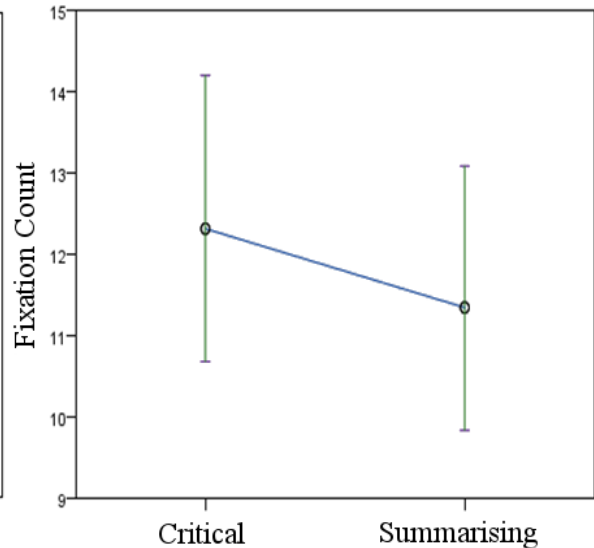
Table 10.

*GLMM on Fixation Counts towards Sentences Presenting Unmarked Opinions per Factor of Reading Instruction.*

<b>Fixed Effects</b>						
Source	Numerator df	Denominator df	F	Sig.		
Instruction	1	358	7.334	.007		
<b>Fixed Coefficients</b>						
Model Term	Coefficient	Sig.				
Intercept	2.429	<.001				
Critical	0.082	.007				
<b>Random Effects</b>						
Parameter	Estimate	Std. Error	Z	Sig.	95% Conf. Int.	
					Lower Bound	Upper Bound
Intercept(Participant)	0.023	0.008	2.941	.003	0.012	0.044
Intercept(Item)	0.048	0.022	2.214	.027	0.020	0.117



*Figure 4.* Estimated means for the significant effect on fixation counts per reading instruction towards sentences presenting marked opinions.



*Figure 5.* Estimated means for the significant effect on fixation counts per reading instruction towards sentences presenting unmarked opinions.

## Discussion

As in Experiment 1, the data in Experiment 2 show that adolescents pay attention to linguistic material expressing subjectivity, as they look towards SoC marking. Primarily, we wanted to find out whether adolescents distribute their attention differently over information when reading critically and given a task, by comparing it to their reading in a summarising modality.

The data show that overall reading times of texts were not subject to whether adolescents were reading critically or in a summarising manner. Expecting that adolescents utilise SoC markers in their information assessment during critical reading, we predicted that looking times towards these markers would be longer in critical reading. However, no such effect of reading modality was found. Interestingly, despite the absence of this effect, the data show that the SoC markers are looked at more frequently during critical reading, suggesting that they are actively seen and utilised by adolescents.

A natural assumption would be that higher fixation counts on material are paired with longer total looking times towards that material, but this does not hold in our data on SoC markers. Looking times on SoC markers may not be significantly longer in critical reading as processing during reading is not necessarily locally bound. One example of non-local processing is that initial processing of encountered linguistic material may occur further down a sentence and therefore be asynchronous with the fixation location, a common confound carefully considered in self-paced reading research. Non-local processing can also occur as linguistic material is stored in the mind of the reader, added to the situation model, and possibly the phonological loop, where the reader can later reflect on encountered material asynchronously to their fixation location. In our current setup, the processing of SoC marking may therefore be caught by our sentence level measurements but missed by local SoC-marker measurements.

Exploring the data on a sentence level, sentences containing opinions are looked at longer when adolescents are reading critically. This effect is observed for both sentences containing SoC marking and sentences that do not. In addition, these sentences are also paired with higher fixation counts in the critical reading condition. These observations suggest that adolescents process and incorporate subjective information more actively in their information assessment during critical as compared to summarising reading.

The data show no effect of reading instruction on the attention towards factual information. Neither looking times nor fixation counts towards facts differed per reading modality. As such, there is no immediate evidence for adolescents' reading strategies differing between summarising and critical reading with regards to information that is factual. In this light, the finding that more attention is paid to opinions in critical reading suggests that adolescents are primarily focussed on seeking out subjective information during critical reading, paying no increased attention to saliently objective information.

### General Discussion

This study looked at adolescents' information literacy in two experiments. Previous research found that the information assessment abilities of adolescents are lacking, expressing concern given the necessity of information literacy that the rise of the digital age introduces. In experiments conducted at a Dutch secondary school, we investigated whether adolescents can identify and distinguish subjective from objective information in texts, whether they utilise linguistic cues of subjectivity, and whether they employ a reading strategy in goal-oriented critical reading.

Experiment 1 looked at adolescents' ability to identify and distinguish facts from opinions. The results show that adolescents can successfully identify facts, and most opinions also. Looking at the saliency of subjectivity in opinions, manipulated in our study through marking that directs attention to the presence of a *Subject of Consciousness* (SoC), it is seen that adolescents find it more difficult to identify opinions that are implicitly subjective. Opinions that are supplemented with markers that explicitly mention a SoC, such as *I believe*, are easier for adolescents to identify. Interestingly, adolescents are also helped by markers that implicitly introduce a SoC, such as *it is certainly so*. The increased success in identifying marked opinions shows that adolescents notice these linguistic cues of subjectivity and that they are alerted by them in their information assessment. These findings are in line with research by Kamalski et al. (2008) who found adults to be forewarned of persuasive intent by subjective marking.

In Experiment 2 we studied whether adolescents adjust their reading behaviour to focus more towards subjective information in goal-oriented critical reading. We compared the reading behaviour of adolescents as they read texts given critical and summarising reading goals. Attention towards factual information did not differ between reading modalities, but more attention was paid to opinions given the critical reading instruction, in terms of both

looks and fixation durations. Additionally, adolescents looked at SoC markers more often when reading critically. Collectively, these findings corroborate the idea that adolescents employ a special reading strategy in goal-oriented reading, where they more actively seek out and process relevant information, following the role of relevance as put forward by McCrudden and Schraw (2007). In terms of subjectivity and source credibility, these findings also pair well with those of Saux et al. (2018), who found task instructions can affect the towards information sources positively. The increased attention towards markers of subjectivity also further support the findings of Experiment 1, which suggest that adolescents understand the value of linguistic cues of subjectivity and utilise them in their information assessment.

### **Conclusion**

This study is one of the few that finds adolescents successfully identify sources of subjectivity. Importantly, it has found that they can do so, and that they utilise and have available a specific approach to reading critically, without prior training. We looked at adolescents' conscious information assessment, where they were explicitly directed to distinguish facts from opinions or read critically in a goal-oriented setting. Our findings suggest that adolescents can identify sources of subjectivity and put their focus on them when directed to do so. Future research should investigate whether these competencies are also translated to the spontaneous information assessment by adolescents.

**Acknowledgements**

The author would like to thank his supervisors T. Sanders and S. Kleijn for the many delightful meetings, their valuable insights, and selfless guidance. He would also like to thank I. Mulders, M. Duijndam, J. van Elst, and the rest of the UiL-OTS lab team for their help, trust, and patience. Finally, many thanks to the wonderful teachers and students at the secondary school that helped realise the study.



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## Appendix A

**Text 1: version A (257 words)****Orgaandonatie**

Op 13 februari is er in de Eerste Kamer gestemd voor een nieuw donorregistratiesysteem. Vanzelfsprekend is het systeem dat we nu hebben niet goed genoeg. Nederland doet het in vergelijking met andere Europese landen niet goed als het om orgaandonatie gaat. Volgens officiële organisaties zijn er meer orgaandonaties in andere Europese landen, zoals Spanje. In 2015 telde Spanje 40,2 donoren per miljoen inwoners, terwijl Nederland er 15,8 per miljoen had. Naar mijn idee is het fijn dat de knoop over orgaandonatie nu is doorgehakt. De discussie over wat het beste systeem zou zijn heeft al veel te lang geduurd. In het nieuwe systeem is iedereen automatisch donor, tenzij ze daar bezwaar tegen maken.

Uiteraard is orgaandonatie een belangrijk onderwerp. Er overlijden bijna 150 mensen per jaar omdat er geen orgaan voor hen beschikbaar is. Dat mensen doodgaan door een gebrek aan orgaandonaties is onacceptabel. 88 procent van de Nederlanders wil graag een donororgaan hebben als dat nodig is. Ik vind dat mensen die organen willen ontvangen zelf ook orgaandonors zouden moeten zijn. Van alle Nederlanders is 24 procent geregistreerd als donor. Het is niet eerlijk dat mensen die zelf geen donor zijn wel orgaandonaties kunnen ontvangen.

Ik ben ervan overtuigd dat het nieuwe systeem eerlijker en makkelijker is voor iedereen. Het is zeker zo dat de keuze voor orgaandonatie vrijwillig moet blijven. Het blijft voor iedereen mogelijk om orgaandonatie te weigeren. Uiteindelijk gaan we dankzij de wet in Nederland eerlijker met elkaar om. Iedereen zal blij zijn dat er geen orgaantekort meer is.

Door: Thijs Visser

**Text 1: version B (254 words)****Orgaandonatie**

Op 13 februari is er in de Eerste Kamer gestemd voor een nieuw donorregistratiesysteem. Het systeem dat we nu hebben is niet goed genoeg. Ik ben ervan overtuigd dat Nederland het in vergelijking met andere Europese landen niet goed doet als het om orgaandonatie gaat. Volgens officiële organisaties zijn er meer orgaandonaties in andere Europese landen, zoals Spanje. In 2015 telde Spanje 40,2 donoren per miljoen inwoners, terwijl Nederland er 15,8 per miljoen had. Het is fijn dat de knoop over orgaandonatie nu is doorgehakt. Naar mijn idee heeft de discussie over wat het beste systeem zou zijn al veel te lang geduurd. In het nieuwe systeem is iedereen automatisch donor, tenzij ze daar bezwaar tegen maken.

Orgaandonatie is een belangrijk onderwerp. Er overlijden bijna 150 mensen per jaar omdat er geen orgaan voor hen beschikbaar is. Vanzelfsprekend is het onacceptabel dat mensen doodgaan door een gebrek aan orgaandonaties. 88 procent van de Nederlanders wil graag een donororgaan hebben als dat nodig is. Mensen die organen willen ontvangen zouden zelf ook orgaandonors moeten zijn. Van alle Nederlanders is 24 procent geregistreerd als donor. Ik vind het niet eerlijk dat mensen die zelf geen donor zijn wel orgaandonaties kunnen ontvangen.

Het nieuwe systeem is eerlijker en makkelijker voor iedereen. De keuze voor orgaandonatie moet vrijwillig blijven. Het blijft voor iedereen mogelijk om orgaandonatie te weigeren. Het is zeker zo dat we dankzij de wet in Nederland eerlijker met elkaar omgaan. Uiteraard zal iedereen blij zijn dat er geen orgaantekort meer is.

Door: Thijs Visser

**Text 2: version A (229 words)****Wapenbezit en Schietpartijen**

Op een school in Amerika zijn in een schietpartij zeventien doden gevallen. In Amerika zijn er gemiddeld 40 schietpartijen op scholen per jaar. Er is al enkele jaren een nutteloze discussie over de oorzaak van de schietpartijen. Het is tijd dat Amerika de wapenverkoop beperkt.

Natuurlijk zijn er zoveel schietpartijen doordat de Amerikaanse grondwet burgers toestaat vuurwapens te hebben. Vanzelfsprekend zorgen minder wapens bij burgers voor minder schietpartijen op scholen. Meer dan een derde van de Amerikaanse gezinnen heeft thuis een wapen liggen. Amerikanen mogen vanaf hun achttiende een wapen kopen. Achttien jaar is veel te jong om een wapen te mogen bezitten. In Nederland is de regelgeving voor wapenbezit strikter dan in Amerika. Ik geloof dat een strikter wapenbeleid minder schietpartijen tot gevolg heeft. Om schietpartijen tegen te gaan moet Amerika wapenbezit beperken zoals in Nederland. Amerikaanse staten met minder wapenbezit tellen minder doden door wapens.

De Amerikaanse wapenlobby wil de verkoop van wapens zo min mogelijk beperken. De wapenverkopers verkiezen geld boven mensenlevens. Het is overduidelijk dat de wensen van de wapenlobby onschuldige scholieren hun leven kost.

Het gevaar van vrij wapenbezit wordt onderschat. Volgens mij zouden alleen het leger en de politie wapens mogen hebben. Amerika telt 42 procent van al het burgerlijk wapenbezit op de wereld. Ik vind Trumps voorstel om leraren nu ook te bewapenen niet de oplossing.

Door: Mark Tegels



**Text 2: version B (224 words)****Wapenbezit en Schietpartijen**

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De schietpartijen zijn te wijten aan burgerlijk wapenbezit. Minder wapens bij burgers zorgt voor minder schietpartijen op scholen. Meer dan een derde van de Amerikaanse gezinnen heeft thuis een wapen liggen. Amerikanen mogen vanaf hun achttiende een wapen kopen. Volgens mij is achttien jaar veel te jong om een wapen te mogen bezitten. In Nederland is de regelgeving voor wapenbezit strikter dan in Amerika. Een strikter wapenbeleid heeft minder schietpartijen tot gevolg. Vanzelfsprekend moet Amerika wapenbezit beperken zoals in Nederland om schietpartijen tegen te gaan. Amerikaanse staten met minder wapenbezit tellen minder doden door wapens.

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Het is overduidelijk dat het gevaar van vrij wapenbezit wordt onderschat. Alleen het leger en de politie zouden wapens mogen hebben. Amerika telt 42 procent van al het burgerlijk wapenbezit op de wereld. Trumps voorstel om leraren nu ook te bewapenen is niet de oplossing.

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