Thinking Dispositions Moderate Adolescent Readers' Mental Models of Conflicting Sport Information

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Abstract

Readers' prior beliefs can slant their mental models of conflicting information in favour of perspectives and standpoints that support them. Previous research suggests that reader's (meta-)cognitive resources might protect them from belief biases in the mental representation of controversial textual information. Since critical thinking dispositions involve the willingness to analyze evidence independently of beliefs and are associated with the propensity to seek new evidence, they are likely to protect readers from the biasing effects of beliefs. This study, therefore, investigated how critical thinking dispositions mediate belief biases in adolescents' mental models of controversial information. Eighty-five adolescent readers read two documents that presented arguments for and against their favourite football teams. The strength of their situation-model and text-base representations were measured by a recognition task. The results revealed that adolescents' mental models of the controversial sport information were slanted towards the text that communicated belief-congruent information. The results further revealed that critical thinking dispositions moderated the effects of prior beliefs on the mental models that adolescent readers constructed of the conflicting information. The findings provide support for the 2-stage model of processing conflicting information, according to which critical thinking dispositions can prevent belief biases by fostering elaborative processing of belief-inconsistent information.

Keywords: adolescent reader , critical thinking dispositions, mental models, prior beliefs

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1. Introduction

Abundance and easy accessibility of information are the hallmarks of the 21st information society. Such ready accessibility has been brought about by the advent of technological advances—most notably the World Wide Web—that have facilitated greater diffusion of information and, at the same time, provided instant access to numerous documents that provide information on a wide array of social, academic, and medical issues (Magliano et al., 2018, Kammerer, et al., 2018). These information documents often provide discrepant perspectives on a single issue, which can make it difficult for the readers to build a balanced and coherent representation of the issue (Karimi & Richter, 2021a). To build a coherent representation, readers would need to objectively scrutinize the truth value, cogency and strength of the arguments and assemble a mental model of each document, which, in turn, provides a basis for a comprehensive "documents model" of the issue discussed across a multitude of documents. Ideally, the documents model would include equally strong mental models of both sides of a controversial issue (Abendroth & Richter, 2020). Previous research, however, provides evidence that the bias from readers' pre-existing beliefs prevents them from constructing balanced mental models of such controversies (Author & Co-Author, 2021a; 2021b; Knobloch-Westerwick & Meng, 2011; Wiley, 2005).

Although the default image of a reader that we often have in mind is that of an adult individual reading academic texts, a major group of readers are adolescents reading non-academic information. Despite declines in the motivation for and frequency of engaging in reading among adolescents (Wilkinson, et al., 2020), they often widely read certain types of information, particularly on the Internet, which has become a major source of information for them (Kammerer, et al., 2019). For example, adolescents often passionately read the news, reports, commentaries, and texts about the fields of sport that interest them (e.g., reading

news or commentaries about their favourite football teams). Iranian adolescents are no exception to this general rule. Although wrestling is considered the traditional sport for older generations in Iran, over the past half a century, love of football has crept into the Iranian society, especially among the adolescents. As in many other countries, discrepancies and clashes of opinions on various aspects of this sport are clearly observed among adolescents in Iran as well. Such discrepancies are also reflected in sport sources, which present themselves as favourite reading sources to the adolescents. Given the controversial nature of such information, it may be consistent with or oppose readers' pre-existing beliefs in different degrees. Therefore, sport is a field that is highly suitable to examine belief biases in mental models of textual information among adolescents.

In what follows, we present a theoretical and empirical overview of the effects of prior beliefs on mental models controversial information and discuss the role of critical thinking dispositions in this context. This discussion forms the background for the hypotheses tested in this study.

2. Effects of Prior Beliefs on Mental Models of Controversial Texts

The effects of prior beliefs that readers bring to (a) text(s) and the way they interact with the mental models that they construct of textual information has been explained in a number of models of (multiple) text comprehension. As discussed above, readers are inclined to judge the textual information that supports their beliefs as highly plausible but tend to disprove evidence and information that refutes them. This effect, which is referred to as *text-belief consistency effect* in the literature (e.g., Maier & Richter, 2013; Richter & Maier, 2017) is in line with the notions of confirmation bias (Jonas, et al., 2001; Nickerson, 1998), selective exposure effect (Festinger, 1957) and congeniality bias (Eagly & Chaiken, 2005). Based on these notions, people tend to seek congenial evidence and actively resist evidence that contradicts their beliefs to "feel validated" (Hart, et al., 2009, p. 556). In contrast to other

forms of confirmation bias, the text-belief consistency effect occurs in a relatively early stage of information processing, already as a result of regular comprehension processes, which will be explained in more detail below.

One theoretical model that recognizes the role of readers' pre-existing beliefs in their representations of textual information is Multiple Documents–Task-Based Relevance Assessment and Content Extraction (MD-TRACE) developed by Rouet and Britt (2011). The model recognizes a key role for readers' diverse cognitive resources, including their schematic knowledge and prior beliefs on the topic, in how they evaluate the informational requirements of an initial task model that they build for successful comprehension of the textual information. More specifically, the model assumes that readers' prior knowledge and beliefs on the topic of the texts inform their evaluations of the appropriacy and pertinency of the information that is selected to fulfil the requirements of the task.

In the RESOLV (REading as problem SOLVing) model (Rouet et al., 2017), which is a subsequent extension of the MD-TRACE model, also the role of readers' internal resources, including their prior knowledge and beliefs in comprehension is highlighted. A basic assumption in the model relates to the readers' propensity to optimize their processing of textual information in the light of a benefit-cost ratio analysis (Rouet et al., 2017). This optimization of processing coheres with the mechanism underlying the text-belief consistency effect in terms of readers' inclination to efficiently manage their cognitive costs during reading by expending less cognitive resources on the information that contradicts their prior beliefs (Karimi & Richter, 2021a).

A clear account of how readers' prior beliefs interact with comprehending controversial textual information comes from the Two-Step Model of Validation (Richter & Maier, 2017). The model assumes a dual stage for processing such information: a default non-strategic stage and an optional strategic stage. Depending on whether readers choose to

engage in only the first stage or both of the stages, the eventual mental model that they construct of the textual information would vary. In the first default stage, labelled *validation,* readers implicitly assess the plausibility of textual information, i.e. the consistency of this information with prior knowledge and beliefs, which are automatically activated (Gilead et al., 2019; Isberner & Richter, 2014; Singer, 2013; Wertgen, et al., 2021). The implicit plausibility judgments generated by the validation mechanism help readers to efficiently allocate their cognitive resources, directing these resources preferably to information that accords with readers' pre-existing beliefs. As a consequence, the readers' mental models of the text(s) would be distorted by a one-sided emphasis on the information that is consistent with their beliefs, thus resulting in a text-belief consistency effect (Richter & Maier, 2017).

The second stage in the model is described as a goal-driven resource-intensive stage, by which readers detect and resolve the incompatibilities between their beliefs and the textual information (Karimi & Richter, 2021a). Only readers with specific reading goals, epistemic motivations, or a tendency to defend their standpoints in the face of opposing perspectives would engage in this second step (Kruglanski & Webster, 1996; Richter & Maier, 2018). The consequence of engaging in this second step would be an all-encompassing mental representation of the information containing both overlapping and conflicting arguments.

The text-belief consistency effect has been empirically supported in several lines of research. For example, the effect has been indirectly supported by research on argument evaluation. Wolfe and Williams (2017), for instance, found that after exposure to a one-sided document, participants judged the accompanying reasons in single-sentence arguments more favourably when they were consistent with their beliefs than when they contradicted their beliefs. Similar findings have been reported in McCrudden and Barnes (2016). Evidence for the text-belief consistency effect is also provided in studies that examine information synthesis across documents that present divergent perspectives on a single topic. For

example, van Strien et al. (2014) and van Strien et al. (2016) found that readers' essays written based on a number of nonlinear documents on controversial topics were strongly biased towards their prior topic-related attitudes.

Another line of research, which provides more direct support for the effect, is based Kintsch's (1998) two-level model of comprehension composed of text-base and situation-model representations. In the first study within this line of research, Maier and Richter (2013) found that university students built stronger situation-model representations based on documents that presented belief-consistent information compared with the documents that provided belief-inconsistent information. Additionally, arguing that the text-belief consistency effect is likely to serve to protect the readers' identity and minimize the cognitive dissonance stemming from exposure to belief-incongruent evidence, Maier et al. (2018) investigated how readers' beliefs and their social group identification influence their mental models of controversial information. The findings disclosed the protecting function of the text-belief consistency effect such that readers tend to expose themselves to and select or process information that accords with their pre-existing beliefs more favourably. The results further showed that the motivation to protect personal beliefs was far stronger than avoiding evidence that presented a threat to the readers' social identity. The effect has also been replicated in contexts where beliefs have been experimentally induced (Abendroth & Richter, 2021b) and in contexts where the readers have read information in a language other than their first language (Karimi & Richter, 2021a; 2021b).

Several conditions have been documented to moderate the belief-driven representations of conflicting textual information. For example, based on the predictions of the Two-Step Model of Validation, prior knowledge is assumed to guard against the effect of pre-existing beliefs on readers' mental models of conflicting documents (Richter & Maier, 2017). Learner characteristics such as cognitive flexibility, open-mindedness, and accuracy

vs. defence motivation have also been documented to reduce the more general phenomenon of confirmation bias (Hart et al., 2009; Kessler et al., 2019; Stanovich & West, 1997; Wolfe et al., 2013). Additionally, readers' epistemic dispositions have been shown to modulate the text-belief consistency effect (Karimi & Richter, 2021b). In a similar vein, critical thinking dispositions might guard against belief biases during comprehension, a possibility that will be discussed next.

3.   Critical Thinking Dispositions

Critical thinking refers to "a metacognitive process that, through purposeful, reflective judgment, increases the chances of producing a logical conclusion to an argument or solution to a problem" (Dwyer, Hogan, & Stewart, 2014, p. 43). A wide consensus in the literature points to the existence of two major dimensions to the construct: cognitive and dispositional (Bravo, et al., 2020; Macpherson & Stanovich, 2007; Quinn, et al., 2020; Sosu, 2012). The cognitive dimension includes such key sub-skills as recognition of the underlying assumptions, analysis, inference, evaluation, and synthesis of arguments (Cheng & Wan, 2017; Ren, et al., 2020; Sosu, 2012). The dispositional dimension, on the other hand, covers such attitudinal aspects as truth-seeking, open-mindedness, analyticity (the ability to apply evidence-based reasoning to solving problems), systematicity (the propensity to engage in organized and orderly inquiry), inquisitiveness, engagement (the inclination to anticipate situations that call for reasoning), innovativeness (the propensity to seek new evidence), and cognitive maturity (the tendency to see problems as complex and multi-dimensional and also recognize one's and others' biases) (Bell & Loon, 2015; Qiang, et al., 2020; Ren, et al., 2020).

The cognitive dimension of critical thinking has a longer history compared with the dispositional dimension. It concerns a person's *ability* to apply appropriate cognitive strategies to come up with desirable outcomes (Tunjungsari & Takwin, 2021). However, the

same person is only likely to use this ability since utilizing critical thinking abilities and skills hinges upon pertinent dispositions (Bell & Moon, 2015). In essence, a critical thinking disposition concerns the social-emotional dimension of such thinking and is defined as "a consistent internal motivation" (Bell & Moon, 2015, p. 120) and a propensity or habit to utilize critical thinking skills and reasoning processes in dealing with problems and in judging arguments (Ren, et al., 2020; Wang, et al, 2020). Therefore, dispositions provide the prerequisites for an activity that calls for critical thinking skills (Bell & Moon, 2015).

As an impactful construct, critical thinking has been widely investigated in diverse professional and educational settings. Critical thinking has also been recognized as a "fundamental educational objective" (Bravo, et al., 2020, p. 2) and has, thus, been documented to be associated with students' performance in academic contexts (Ren, et al., 2020). It has also been acknowledged as a key to the rigorous analysis of the information that we encounter on a daily basis and a protective mechanism against the influence of prior beliefs and knowledge in appraising such information (Bravo, et al., 2020). The construct has also been reported to guard against beliefs that have "no epistemic warrant" (Lobato, et al., 2020, p. 617) such as pseudo-scientific and paranormal beliefs (Dyer & Hall, 2019; Wilson, 2018). Protection against bias from the beliefs has also been reported to be predicted by critical thinking disposition. For example, West, et al. (2008) found that critical thinking dispositions predicted the avoidance of bias by prior beliefs when completing reasoning tasks.

4. Rationale for the Present Study

The text-belief consistency effect is an established effect in previous research (e.g., Bohn-Gettler & McCrudden, 2018; Maier & Richter, 2013; Abendroth & Richter, 2020; 2021a; Wiley, 2005). This line of research has, however, been followed in specific contexts and among specific populations (e.g., psychology undergraduates in German and North

American contexts). The topics investigated have also been mostly socio-scientific controversies (e.g., global warming, vaccination, medical potential of spider silk). Investigating the effect among other populations and other topic domains would add to the generalizability of the findings. Therefore, the present study investigated the effect among L1-Persian adolescent readers reading controversial sport information about their favorite football clubs, Esteghlal and Perspolis. These two clubs are old football archrivals in the Persian Gulf Pro League with a clear two-way split in the sport-loving population in their love for and beliefs regarding the superiority of the two teams. Consistent with the evidence provided in previous research, we hypothesized that adolescents' mental models of controversial sport information would be biased towards the textual information that aligns with their pre-existing beliefs (Hypothesis 1). As Hypothesis 2, we predicted that critical thinking dispositions would alleviate the biasing effect of prior beliefs on mental models of conflicting information by adolescent readers. The hypothesis is based on the assumption that critical thinking dispositions involve the willingness to rigorously analyze evidence and propositions independently of pre-existing beliefs and opinions and to seek new evidence (Bell & Moon, 2015), which is key to constructing balanced mental models of controversial information (according to the Two-Step Model of Validation, Richter & Maier, 2017).

As exploratory research questions, we also investigated whether the participants' propositional text base of the conflicting texts are slanted towards their prior beliefs and if so, whether such biases are moderated by critical thinking dispositions.

5. Method

5.1. Participants

An initial sample of adolescent readers ($N = 106$) responded to a prior beliefs questionnaire that assessed their Pro-Esteghlal and Pro-Perspolis stances (See the section on Prior Beliefs Measure). Based on their performance on the measure, participants whose

agreement to the Pro-Esteghlal stance was higher and whose Pro-Perspolis stance scores were lower than the theoretical midpoint (3.00) of the response scale were categorized as Pro-Esteghlal participants ($n = 29$; Pro-Esteghlal Stance: $M = 4.90$, $SD = 0.31$; Pro-Perspolis Stance: $M = 1.21$, $SD = 0.41$; $t(28) = 36.70$, $p < .001$, $d = 6.81$). On the other hand, participants whose agreement to the Pro-Perspolis stance was higher and whose Pro-Esteghlal stance scores were lower than the theoretical midpoint of the response scale were categorized as Pro-Perspolis participants ($n = 34$; Pro-Esteghlal Stance: $M = 1.47$, $SD = 0.51$; Pro-Perspolis Stance: $M = 4.88$, $SD = 0.33$; $t(33) = -28.36$, $p < .001$, $d = 4.86$). Finally, participants whose scores on the two stances were equal were categorized as Neutral participants ($n = 22$; Pro-Esteghlal and Pro-Perspolis stances: $M = 2.77$, $SD = 0.69$). In addition, the three groups' fanhood status was also checked by an open-ended question. The selected participants' mean age was 16.44 ($SD = 1.33$) and included 39 males and 46 females. A closer inspection of the data revealed that 17 participants did not meet the inclusion into the target participants. These participants had mentioned a different team in response to the open-ended question, or their Pro-Esteghlal and pro-Perspolis scores were both higher/lower than the theoretical midpoint. Four participants also did not take part in the main phase of the experiment. Therefore, the final sample included in the analyses was 85.

We conducted a sensitivity analysis based on this sample size. Assuming a power $(1-\beta)$ of .90, a type I error probability (α) of .05, and medium correlations ($\rho = .5$) between repeated measures, the design was sensitive enough to detect an effect of f = .197 (sensitivity analysis performed with G*Power 3.1.9.4 software, Faul et al., 2007).

5.2. Materials and Measures

5.2.1. Text Material

As pointed out earlier, there is a clear two-way split in the Iranian society in the fanbase for two Tehran-based football archrivals in the Persian Gulf Pro League, Esteghlal

and Perspolis, and they are almost equally loved and hated. The derby between the two teams is considered the most important derby in Asia with "100,000 supporters chanting inside Azadi Stadium during the derby between *Abi-ha* (Blues) and *Ghermez-ha* (Reds), meanwhile 20,000 people will be waiting outside because of sold-out" (http://www.mondofutbol.com/en/tehran-derby/).

The two experimental texts used in the present study presented opposing standpoints on the superiority of either team. The texts were assembled from various sources including excepts from publicly available sport sites and the clubs' own introductions on their websites. One text presented viewpoints that clearly supported the major position that Esteghlal is superior to Perspolis (Pro-Esteghlal position, consistent with Pro-Esteghlal participants' beliefs), and the other text provided arguments that Perspolis is the superior team (Pro-Perspolis position, consistent with Pro-Perspolis participants' beliefs). Each text included an introduction that framed the controversy and stated the controlling idea of the text, followed by a historical account about the team. Subsequently, five central paragraphs provided arguments for the superiority of the team drawing on aspects including the associated color (and how it has come to characterize the team), the fanbase (statistics and demographics), domestic and continental honors, foreign head coaches, and history of the club's name(s). Each central paragraph presented a basic claim backed by supporting evidence that cumulatively supported the text's basic claim. The text concluded with a sentential clincher that served as a reference to the controlling idea at the beginning of the text.

The mean length of the two texts was 1241 words and their mean readability was 36.19 (based on the Flesch Reading Ease formula; Flesch, 1948) indicating that the texts were moderately difficult for the adolescent readers. Further, the texts were also compared with regard to perceived level of understandability, interestingness, argument plausibility, stance clarity and the number of supporting arguments based on ratings from an independent sample

of adolescent participants ($N = 11$) (see Table 1). A series of paired-samples t-tests were run to discern any likely differences between the two texts with regard to the aforementioned characteristics. No significant differences were found between the texts.

5.2.2. Comprehension Measure

To assess the participants' strength of the situation-model and text-base representations of the two texts, a recognition task was used. The task was modelled after Schmalhofer and Glavanov (1986) and included twenty four items of three different types (i.e., inferences, paraphrases, and distractors; eight per item type). An inference item targeted information that was not directly stated in the text but needed to be inferred to build a coherent situation model of the text. A paraphrase item, on the other hand, targeted information that was explicitly stated in the text. To construct such items, specific statements from the text were selected and changed with regard to syntactic arrangement and lexical choice while trying to maintain their semantic similarity to the original statements. Finally, the distractor items expressed information that was neither explicitly stated in the text nor could be induced from the information in the text. However, the items bore a superficial informational resemblance with the content of the text.

The participants' text-base strength was assessed based on their responses to paraphrases by judging the correspondence between the information expressed in the item and the information in the text. In contrast, the participants' situation-model strength was assessed based on judging the correspondence between information expressed in the item and mental model constructed based on the content of the text. More specifically, measurement of the text-base strength was based on the difference of proportions of correct responses to paraphrase items (referred to as hits) and incorrect responses to distractor items (referred to as false alarms). The proportions were first probit-transformed to normalize their distributions and avoid negative values (Cohen, et al., 2003). Subsequently, the probit-transformed

proportions of incorrect responses to distractor items were subsequently subtracted from the probit-transformed proportions of correct responses to paraphrase items. The measurement of the situation-model strength was based on the difference of proportions of correct responses to inference items (referred to as hits) and incorrect responses to distractor items (referred to as false alarms). Similarly to the measurement of text-base strength, the probit-transformed proportions of distractor items were subtracted from the probit-transformed proportions of inference items.

5.2.3. Prior Beliefs Measure

Participants' prior beliefs about their favourite team were assessed by a three-item measure. One item assessed their agreement with the Pro-Esteghlal position ('I am a fan of Esteghlal and believe this team is the best team in Iran') whereas another item assessed their agreement with the Pro-Perspolis position ('I am a fan of Perspolis and believe this team is the best team in Iran'). To cross-check the participants' answers to the first two items, an open-ended item was also included in the measure, which asked them to name the best team in the Iranian football league. Response categories for the items on the scale ranged from 1 *(strongly disagree)* to 5 *(strongly agree)*. The internal consistency of the measure was high (Cronbach's α = .92).

5.2.3. Critical Thinking Dispositions Scale

Participants' thinking dispositions were measured by the Critical Thinking Dispositions Scale (Sosu, 2012). The measure included 11 items which assessed two sub-constructs. Seven items assessed participants' Critical Openness dispositions (e.g., 'It's important to understand other people's viewpoint on an issue') and four items assessed their Reflective Scepticism dispositions. (e.g., 'I usually think about the wider implications of a decision before taking action'). The participants were required to indicate their agreement to each item on five-point Likert scale with response categories ranging from 1 *(strongly*

disagree) to 5 *(strongly agree)*. The internal consistencies for the two sets of items were acceptable (items measuring Critical Openness: Cronbach's α = .82; items measuring Reflective Scepticism: Cronbach's α = .81). We also formed a composite scale that reached an internal consistency of Cronbach's α = .88.

5.3. Procedure

The prior beliefs measure was administered to the participants six weeks prior the main phase of the experiment. The reason for this time interval was to prevent likely carry-over effects from the assessment of beliefs to the main experiment. For the main phase of the experiment, the participants were instructed to read the two texts and respond to the comprehension items that followed each text. Text presentation order varied across the participants. More specifically, half the participants read the Pro-Esteghlal text first and then the Pro-Perspolis text, and the other half of the participants read the texts in the opposite order. The time allocated to reading the texts and taking the comprehension test was 50 min.

5.4. Design

The basic design of the study was a 2 (text stance: Pro-Esteghlal vs. Pro-Perspolis; varied within-subjects) × 2 (participant stance: Pro-Esteghlal vs. Pro-Perspolis; varied between-subjects) split-plot design. In addition, text presentation order was counterbalanced across the participants. Critical thinking dispositions as a composite score (z-standardized) and the two subcomponents including critical openness (z-standardized) and reflective scepticism (z-standardized) were included as covariates.

5.4. Availability of Data and Materials

Data and syntax for the analyses reported in the present paper and English translations of the experimental texts are available at the repository of the Open Science Framework (https://osf.io/g6zb8/?view_only=d82d5ee17d334ed091709d4fd351e25f).

6. **Results**

This study examined adolescents' mental models of controversial sport information and how critical thinking dispositions moderate such mental models. Table 2 presents the descriptive statistics and the matrix of correlations between the variables of the study. The mean proportions of responses to the items on the comprehension measure are also presented in Table 3. All hypothesis tests in the study were based on a Type I error probability of .05 (two-tailed). Since text presentation order did not exert a significant influence on the strength of the mental models of the texts, it was not included in the analyses.

Hypothesis 1 predicted that adolescents' mental models of controversial sport information at the situation-model level would be biased towards the textual information that aligns with their pre-existing beliefs. The results of a General Linear Model analysis showed a significant interactive effect of text stance and participant stance on the participants' mental models, $F(2, 76) = 10.58$, $p < .001$, $\eta_p^2 = .22$. Consistent with Hypothesis 1, the mental models were found to be stronger for the text that communicated belief-consistent sport information. More specifically, for the Pro-Esteghlal group, the mental model for the Pro-Esteghlal text was stronger ($M = 1.34$, $SE = 0.16$) than the mental model for the Pro-Perspolis text ($M = 0.74$, $SE = 0.11$; $t(28) = 3.91$, $p < .001$, Cohen's $d = 0.73$). In contrast, for the Pro-Perspolis group, the mental model for the Pro-Perspolis text was stronger ($M = 1.13$, $SE = 0.16$) than the mental model for the Pro-Esteghlal text ($M = 0.73$, $SE = 0.16$; $t(28) = -2.51$, $p = .017$, Cohen's $d = 0.43$). Finally, for the Neutral group, the results revealed no significant difference in the strength of the mental model for the Pro-Esteghlal text ($M = 0.69$, $SE = 0.24$) and the Pro-Perspolis text ($M = 0.84$, $SE = 0.18$; $t(28) = -0.84$, $p = .410$) (Figure 1).

Hypothesis 2 predicted that critical thinking dispositions would moderate the effect of prior beliefs on mental models of conflicting information by adolescent readers. In line with the hypothesis, critical thinking disposition (as a composite score) was found to moderate the participants' belief-biased mental models of the conflicting texts, $F(2, 79) = 14.21$, $p < .001$,

$\eta_p^2 = .27$. Follow-up analyses with the two sub-components of critical thinking dispositions showed that critical openness also moderated the biased mental representation of the conflicting information, $F(2, 76) = 4.94$, $p < .05$, $\eta_p^2 = .12$. However, reflective scepticism was not found to exert a moderating effect on the participants' mental models of the conflicting information, $F(2, 76) = 0.11$, $p = .896$.

To interpret the interactions for Hypothesis 2, the conditional effects of belief-biased mental models of the conflicting texts for participants with higher levels (+1 *SD*) and lower levels (–1 *SD*) of critical thinking dispositions (as a composite score) were computed (Aiken & West, 1991). Participants with lower levels of critical thinking dispositions in the two groups equipped with biased prior beliefs were found to construct stronger mental models for the text that communicated information compatible with their beliefs, compared with the mental models for the text that communicated information incompatible with their beliefs (Pro-Esteghlal Group: Pro-Exteghlal text: $M = 1.59$, $SE = 0.19$; Pro-Perspolis text: $M = 0.65$, $SE = 0.16$, $F(1, 79) = 33.71$, $p < .001$, $\eta_p^2 = 0.30$; Pro-Perspolis Group: Pro-Esteghlal text: $M = 0.68$, $SE = 0.27$; Pro-Perspolis text: $M = 1.72$, $SE = 0.22$, $F(1, 79) = 20.81$, $p < .001$, $\eta_p^2 = 0.21$) (Figure 2). In contrast, the mental models for the two texts in participants with higher levels of critical thinking dispositions in the two groups equipped with biased prior beliefs were on par (Pro-Esteghlal Group: Pro-Exteghlal text: $M = 0.81$, $SE = 0.26$; Pro-Perspolis text: $M = 0.93$, $SE = 0.22$, $F(1, 79) = 0.31$, $p = .578$; Pro-Perspolis Group: Pro-Esteghlal text: $M = 0.75$, $SE = 0.21$; Pro-Perspolis text: $M = 0.76$, $SE = 0.17$, $F(1, 79) = 0.000$, $p = .989$). (See Figure 2).

The conditional effects were also computed for participants with higher levels (+1 *SD*) and lower levels (–1 *SD*) of critical openness dispositions. Participants with lower levels of this disposition in the two groups equipped with biased prior beliefs were found to build stronger mental models for the text that communicated belief-compatible information

compared with the mental models for the text that communicated belief-incompatible information (Pro-Esteghlal Group: Pro-Exteghlal text: $M = 1.19$, $SE = 0.28$; Pro-Perspolis text: $M = 0.40$, $SE = 0.23$, $F(1, 76) = 10.57$, $p < .05$, $\eta_p^2 = 0.12$; Pro-Perspolis Group: Pro-Esteghlal text: $M = 0.86$, $SE = 0.31$; Pro-Perspolis text: $M = 1.96$, $SE = 0.25$, $F(1, 76) = 16.51$, $p < .001$, $\eta_p^2 = 0.18$). In contrast, the mental models for the two texts in participants with higher levels of this disposition in the two groups equipped with biased prior beliefs were on par (Pro-Esteghlal Group: Pro-Exteghlal text: $M = 1.24$, $SE = 0.33$; Pro-Perspolis text: $M = 1.21$, $SE = 0.27$, $F(1, 76) = 0.12$, $p = .912$; Pro-Perspolis Group: Pro-Esteghlal text: $M = 0.56$, $SE = 0.27$; Pro-Perspolis text: $M = 0.53$, $SE = 0.22$, $F(1, 76) = 0.013$, $p = .908$).

At the text-base level, the participants' representations were not significantly different across the texts that communicated belief-compatible and belief-incompatible information, $F(1, 76) = 0.72$, $p = .492$. The participants were found to construct similarly strong text-base representations for the Pro-Esteghlal text (Pro-Esteghlal Group: $M = 1.27$, $SE = 0.12$; Neutral Group: $M = 1.27$, $SE = 0.22$; Pro-Perspolis Group: $M = 1.14$, $SE = 0.13$) and the Pro-Perspolis text: (Pro-Esteghlal Group: $M = 0.74$, $SE = 0.11$; Neutral Group: $M = 0.84$, $SE = 0.18$; Pro-Perspolis Group: $M = 1.13$, $SE = 0.16$). The text-base representations were also not found to be moderated by critical thinking dispositions (as a composite score), $F(1, 79) = 2.92$, $p = .060$, or any of the two subcomponents: Critical Openness, $F(1, 76) = 2.83$, $p = .066$; Reflective Scepticism: $F(1, 76) = 0.51$, $p = .606$.

7. Discussion

The present study examined the interaction of prior beliefs with the mental representations of conflicting information in the domain of sports among adolescent readers and whether such mental representations are moderated by critical thinking dispositions. The results revealed that adolescents' mental models of the controversial information slanted towards the text that communicated information supporting their pre-existing beliefs at the

situation-model level but not at the text-base level of representation. The results further revealed that critical thinking dispositions moderated the effects of prior beliefs on the mental models that adolescent readers constructed of the conflicting information.

The belief-biased mental representations of conflicting information in readers is supported by the assumption that readers often use their prior beliefs as yardsticks to "judge whether the information communicated by the various texts is true or plausible" (Richter, 2011, p.126). Such belief-based plausibility judgments are often fast and implicit and are commonly achieved with little conscious contemplation over the inherent truth value of the propositions communicated in the texts and serve as a basis for the allocation of cognitive resources to information (Abendroth & Richter, 2021a). More often than not, information that aligns with readers' pre-existing beliefs is judged as more plausible (i.e., more truthful or more acceptable) with minimal cognitive effort and is more readily integrated into the readers' mental models than belief-incongruent information (Abendroth & Richter, 2021a; Ferreira et al., 2002). Such preference for belief-compatible information leads to a biased and distorted representation of controversial information at the situation-model. This is clearly manifested in the mental models of the two groups in the study who are equipped with strong prior beliefs (e.g., Pro-Esteghlal and Peo-Perspolis groups). The balanced mental representations of the textual information by the Neutral group add further support to this assumption. The results, however, did not support a belief bias in the representations of textual information at the at the text-based level. This is because this level of representation is text-bound and less belief-driven by default (Abendroth & Richter, 2021a).

The findings of the study further provided evidence for the moderating effect of critical thinking dispositions on the belief-biased mental models of controversial information. According to Two-Step Model of Validation, readers are, by default, predisposed to engage in the non-strategic epistemic processing stage of comprehension, which is in line with

Kahneman's (2011) System I processing mode (Karimi & Richter, 2021b) that calls upon fast, automatic and spontaneous validation of controversial information. Mere reliance on this mode of processing leads to stronger representations of the content that coheres with a reader's prior beliefs. As the results of this study reveal, participants with lower levels of critical thinking dispositions appear to rely more on this mode of processing and, accordingly, construct stronger mental models for the information compatible with their beliefs.

To counteract such biased representations, readers would need to engage in more strategic elaboration of belief-information incompatibilities that increase perceptions of the plausibility of the inconsistent information (Lombardi et al., 2016). The inclination to engage in such strategic plausibility judgements depends on person-specific and task-specific conditions such as sophisticated epistemic dispositions, prior knowledge, task instructions, and sophisticated metacognitive skills (Richter & Maier, 2017). According to Abendroth and Richter (2021b), "strategic judgements about plausibility are [also] inherent in critical thinking" (p. 2). Critical thinking corresponds to Kahneman's (2011) System II mode of thinking, which hinges upon "rational, slow, analytical and logical" thinking and encourages belief-independent appraisal of information (Bravo, et al., 2020, p. 3). Therefore, critical thinking aligns with thinking that is characteristic of elaborative processing component of the Two-Step Model of Validation, which is believed to protect against belief-biased representations of controversial information. This is clearly supported by the patterns of findings in the conditional effects computed for participants with high and low levels of critical thinking dispositions (as a composite score). As the results show, the mental models for the belief-consistent and belief-inconsistent texts in participants with higher levels of critical thinking dispositions in the two groups equipped with biased prior beliefs were basically similar. The same pattern was also observed in conditional effects for participants

with higher lower levels of critical openness dispositions, which adds further support to the role of critical thinking dispositions in protecting against belief biases in mental representations.

7. Limitations

In this study, only two experimental texts were used that presented sport information. Including a higher number of experimental texts would have enhanced the generalizability of the findings. Additionally, beliefs about sport information constitute a specific set of beliefs, which are often associated with strong passion. It would have been appropriate to include texts about other socioscientific controversies and investigate how critical thinking dispositions are likely to moderate belief-biased representations in other domains. Including more socioscientific issues would allow comparing the moderating effects of critical thinking dispositions across text topics.

8. Conclusion

This study extends research on the belief-biased representation of information to sport controversies, which are often associated with passionate beliefs. Iranian adolescent readers were shown to rely on their belief profiles as epistemic background to interpret the controversial information with the concomitant belief-skewed mental models of the controversies. Such belief-driven representations are rooted in the readers' default tendency to opt for information that endorses their viewpoints and dismiss information that can potentially invalidate their pre-existing beliefs (Abendroth & Richter, 2021a; Knobloch-Westerwick & Meng, 2011). Mental models that readers develop of information serves as a basis for situated action; therefore, it is essential that readers represent the controversial information independently of their beliefs (Schroeder, et al., 2008). This is particularly important for adolescents who are at the formative years of their reading habits. Therefore, to

guard against the adverse effects of prior beliefs, adolescents in the Iranian context and, by extension, in other contexts would need to develop awareness of prior beliefs and their role in constructing mental models of textual information. In this light, it is recommended that reading instructional programs for adolescents aim at promoting such awareness and cultivating effective belief-resistant reading habits in them.

The findings further present empirical evidence that critical thinking dispositions affect the mental models that adolescent readers develop based on information from multiple controversial documents. More specifically, critical thinking dispositions protect readers against the adverse effects of pre-existing beliefs on the mental models that they construct of multiple controversial information sources. Fostering such dispositions encourage "a form of language analysis that does not take the given text at face value, but involves a deeper examination of the claims put forth, as well as the supporting points, and possible counterarguments" (Goertel, 2018, p. 1). As best expressed by Wilson (2018), "teaching critical thinking skills provides students with the tools necessary to question and investigate claims in relation to known facts (p. 206). In this light, we strongly advise that raising readers' critical thinking dispositions should be part of any reading instructional program. Additionally, providing multi-perspective textual content is also likely to encourage critical thinking dispositions since readers, particularly adolescent readers who are still shaping their reading habits, would be encouraged to pit divergent perspectives and standpoints against each other and evaluate their evidentiary value.

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Table 1

Characteristics of the Two Experimental Texts

Text No.	Argumentative Position	Length[a]	Readability[a]	Plausibility[c] $M(SE_M)$	Understandability[c] $M(SE_M)$	Number of arguments[c] $M(SE_M)$	Clarity of stance[c] $M(SE_M)$	Interestingness[c] $M(SE_M)$
Text 1	Pro-Esteghlal	1250	36.19	4.33 (.16)	4.26 (.15)	4.82 (.18)	4.73 (.19)	4.27 (.30)
Text 2	Pro-Perspolis	1233	36.18	4.52 (.13)	4.53 (.14)	4.73 (.27)	4.64 (.24)	4.09 (.28)
—	—	—	—	$r = .71$	$r = .47$	$r = .08$	$r = .56$	$r = .71$

Note 1. [a]Number of words per text. [b]Computed based on the Flesch Reading Ease Formula. [c]Computed based on ratings by an independent sample of participants ($N = 11$); text plausibility and text understandability were assessed by six and nine items, respectively (Plausibility scale: Cronbach's α = .83/.64; Understandability scale: Cronbach's α = .75/.74); number of arguments was measured by an open-ended question, stance clarity and text interestingness were each measured by a single item. The response categories for all measures (except for the number of arguments) ranged from 1 to 6.

Note 2. Plausibility: $t(10) = 1.60$, $p = .140$; Understandability: $t(10) = 1.81$, $p = .101$; Number of Arguments: $t(10) = -0.29$, $p = .779$; Clarity of Stance: $t(10) = -0.43$, $p = .676$; Interestingness: $t(10) = -0.80$, $p = .441$

Table 2

Descriptive Statistics and Intercorrelations of the Variables in the Study

Variable	M	SD	1	2	3	4	5	6	7
1 Situation-model Strength (Pro-Esteghlal)	0.93	0.99	1						
2 Situation-model Strength (Pro-Perspolis)	0.92	0.81	.43**	1					
3 Text-base Strength (Pro-Esteghlal)	1.17	0.80	.66**	.48**	1				
4 Text-base Strength (Pro-Perspolis)	1.30	0.84	.41**	.65**	-.50	1			
5 Critical Thinking Dispositions (Composite; z-Standardized)[a]	41.94	9.26	-.36**	-.15	-.22	-.08	1		
6 Critical Openness (z-Standardized)[a]	26.21	6.21	-.32**	-.15	-.23*	-.12	97**	1	
7 Reflective Scepticism (z-Standardized)[a]	15.73	3.62	-.36**	-.12	-.17	.010	.90**	.76**	1

Note. $N = 85$. Situation-model strength: Probit-transformed proportion of yes-responses to inference items; Text-base strength: Probit-transformed proportions of yes responses to paraphrase items. [a]M and SD for Critical Thinking Dispositions (Composite), Critical Openness and Reflective Scepticism are based on raw scores. [*]$p < .05$ (two-tailed), [**]$p < .01$ (two-tailed).

Table 3

Mean Proportions (with Standard Errors) of Yes Responses for the Three Item Types in the Comprehension Measure

Measure	Inference Items	Paraphrase Items	Distractor Items
Pro-Esteghlal Text			
Pro-Esteghlal Group[a]	.73 (.03)	.70 (.03)	.27 (.03)
Neutral Group[b]	.60 (.04)	.73 (.03)	.37 (.05)
Pro-Perspolis Group[c]	.61 (.03)	75 (.02)	.36 (.04)
Total	.65 (.02)	.73 (.02)	.33 (.02)
Pro-Perspolis Text			
Pro-Esteghlal Group[a]	.56 (.03)	.76 (.04)	.30 (.03)
Neutral Group[b]	.65 (.03)	.72 (.05)	.36 (.05)
Pro-Perspolis Group[c]	.68 (.03)	.76 (.03)	.31 (.04)
Total	.63 (.02)	.75 (.02)	.32 (.02)

Note. [a] $n = 29$, [b] $n = 22$, [c] $n = 34$

Figure 1. Mental-model strength and text-base strength of Pro-Esteghlal and Pro-Perspolis texts across the three participant groups. Error bars represent standard error of the mean.
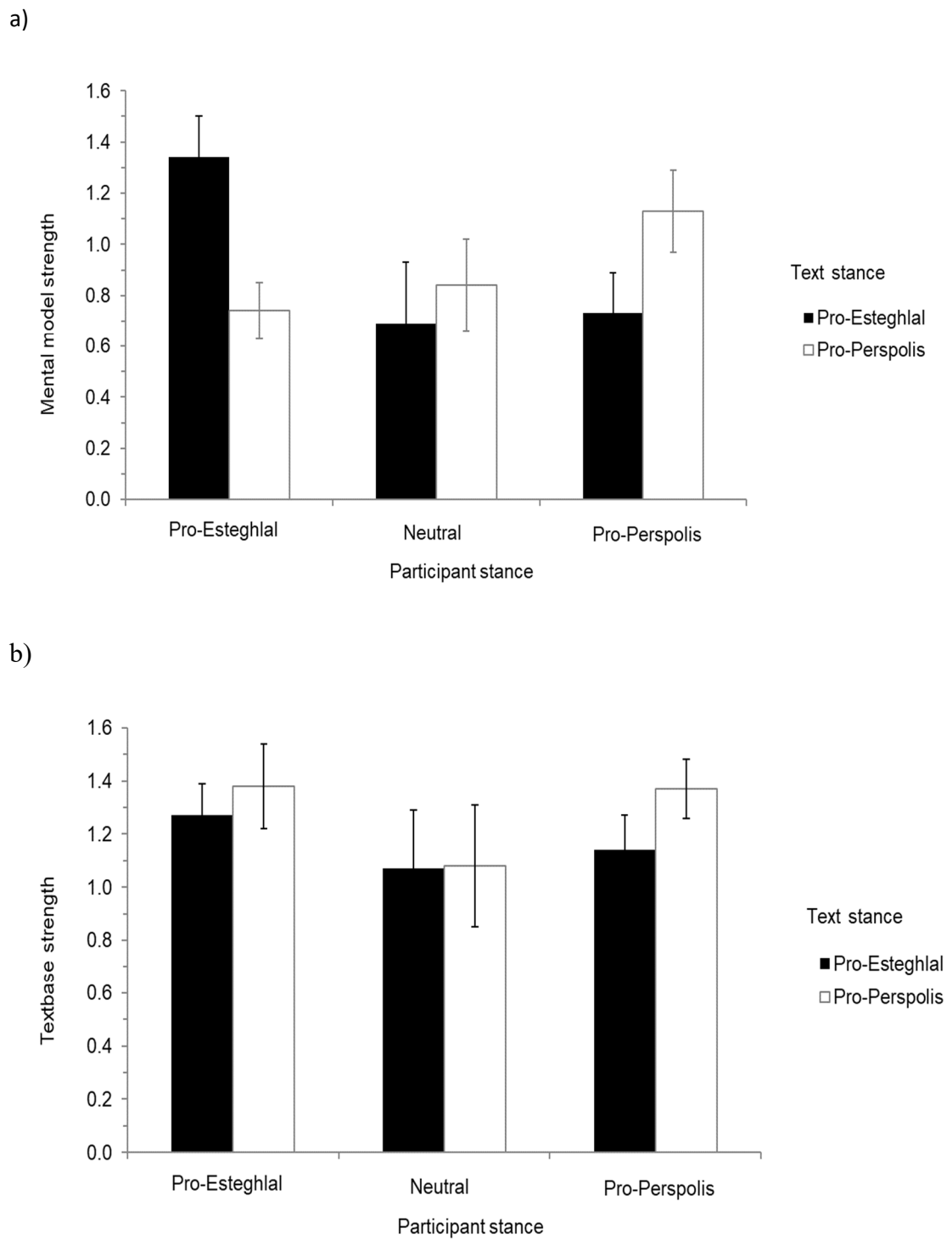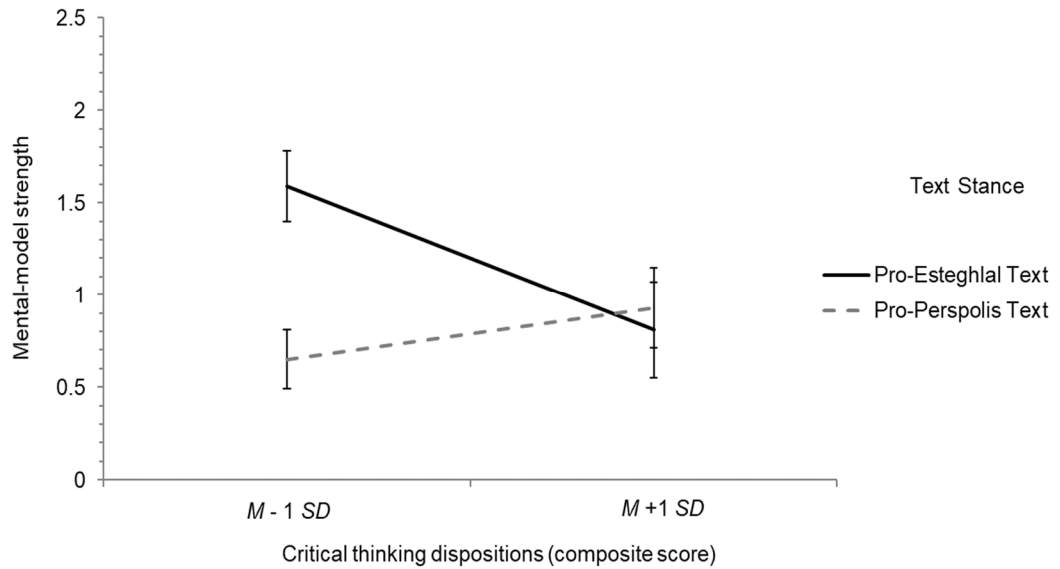
a)

b)

Figure 2. Simple slopes for (a) Pro-Esteghlal Group and (b) Pro-Perspolis Group, with standard errors for the point estimates at a high (+ 1 SD) and low (– 1 SD) level Critical Thinking Dispositions (Composite Score).
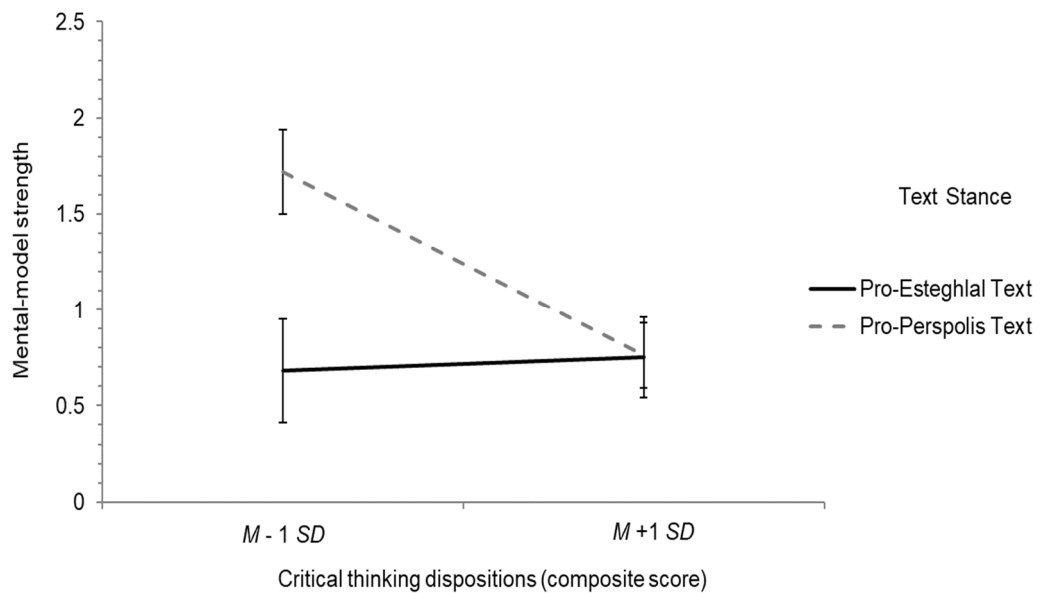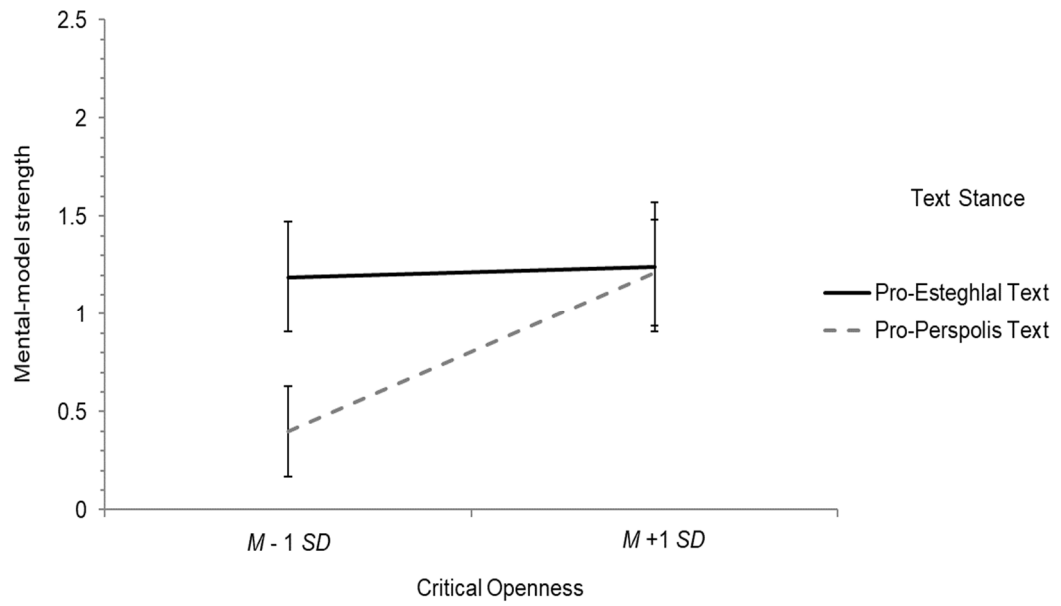
a)

b)

Figure 3. Simple slopes for (a) Pro-Esteghlal Group and (b) Pro-Perspolis Group, with standard errors for the point estimates at a high (+ 1 SD) and low (– 1 SD) level Critical Openness disposition.

a)

b)