

Dubbing versus subtitling in young and older adults: cognitive and evaluative aspects

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Empirical evidence on the cognitive and evaluative effects of viewing a dubbed versus a subtitled film is limited, theoretical views on the subject are mainly speculative, and age-related differences have not been investigated in this sphere. To fill these gaps, we carried out two studies contrasting the effects of viewing a dubbed versus subtitled version of the same film excerpt in young and older adults, using a comprehensive array of verbal and visual measures. The findings clearly show that dubbing does not provide a cognitive or evaluative advantage over subtitling. Moreover, subtitling seems to be more effective than dubbing in supporting the lexical aspects of performance. Finally, although older adults always performed worse than young adults on all cognitive measures, they did not show a specific impairment in the subtitling condition. The results support the view that subtitled films are processed effectively and appreciated equally by both young and older adults.

Keywords: dubbing; subtitling; cognitive aging; individual differences; audiovisual processing

Introduction

Does subtitling affect comprehension and memory of a film? Is dubbing associated with a more fluent viewing experience that leads to greater final satisfaction and enjoyment? Does subtitling specifically affect older adults' comprehension and memory? These questions have been debated in the audiovisual and cognitive literature but, unfortunately, existing evidence is limited and fails to offer definitive answers. Not only does answering these questions have clear relevance in light of the real-world applications of dubbing and subtitling, but it also has theoretical value, because the answers could corroborate or undermine differing views on audiovisual processing and enjoyment that have been provided on a primarily speculative basis. The first aim of the two studies reported in this paper is to assess the cognitive and evaluative effects of viewing a dubbed versus subtitled version of the same film excerpt. In so doing, we will attempt to answer the first two questions and to resolve the related theoretical disagreements by providing critical empirical evidence. The second aim is to answer the third question, shedding light on

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age-related aspects of audiovisual processing and appreciation, and providing a further contribution to the theoretical debate.

Opposing stances on the cognitive load and effectiveness of subtitles have been advanced. According to some scholars, watching a subtitled film is more cognitively demanding and less effective in terms of content understanding and memory performance than viewing the same film in a dubbed version (Díaz Cintas, 2001; Gottlieb, 1994; Grillo & Kawin, 1981; Koolstra, Peeters, & Spinhof, 2002; Maihac, 2000; Marleau, 1982; Mera, 1998). This is ascribed to the need to simultaneously process and integrate information coming from different sources. The same idea seems to be rooted in lay people's opinions (Kilborn, 1993; Luyken, 1987; Luyken, Herbst, Langham-Brown, Reid, & Spinhof, 1991; Spinhof & Peeters, 1999). However, this position is not firmly based on empirical evidence, and studies on subtitle processing seem to support a different theoretical stance. According to this alternative view, reading subtitles (just as ordinary reading and visual processing, e.g. d'Ydewalle, Praet, Verfaillie, & Van Rensbergen, 1991; LaBerge & Samuels, 1974; Lang, 2000, 2001; Lang, Potter, & Bolls, 1999; Logan, 1997) is a semiautomatic task that does not pose high processing demands on the film viewer, at least when rather simple and moderately redundant information is presented at standard rates (d'Ydewalle & De Bruycker, 2007; d'Ydewalle & Gielen, 1992; d'Ydewalle, Van Rensbergen, & Pollet, 1987). Moreover, subtitled materials are usually processed effectively: In experimental studies, viewers display overall good levels of general film content understanding, good performance in both dialogue and visual scene recognition (e.g. Bairstow, 2011; Lavaur & Bairstow, 2011; Perego, Del Missier, Porta, & Mosconi, 2010), and flexibility in distributing attention over the relevant stimuli (Bairstow, 2011; d'Ydewalle, 2002; d'Ydewalle et al., 1987; d'Ydewalle, Warlop, & Van Rensbergen, 1989; Guichon & McLornan, 2008; Marian, 2009; Van de Poel & d'Ydewalle, 2001).

Surprisingly, very few studies have contrasted dubbing and subtitling. Koolstra et al. (2002; see also Koolstra, van der Voort, & d'Ydewalle, 1999) discuss three non-English studies aimed at assessing how effectively dubbed and subtitled materials are processed. A Swedish study, conducted on 7–11-year-old children, showed that subtitled television is more difficult to understand than dubbed television (von Feilitzen, Filipson, & Schyller, 1979). However, according to Koolstra et al. (2002), this result can be ascribed to the poor quality of TV subtitling three decades ago and not necessarily to the translation method itself. A Dutch experiment, carried out on 6–12-year-old children, showed that pictorial and verbal details are remembered better with dubbed television programmes and that subtitled programmes are less easily understood (Peeters, Scherpenzeel, & Zantinge, 1988). This study also observed that young children (Grade 2), who are non-proficient readers, benefit more from dubbing than subtitling. However, Peeters et al. (1988) attribute these results to the children's low proficiency in reading and, again, not to the translation method itself. Moreover, another study observed that children aged 10–12 seem to benefit equally from subtitling and dubbing (d'Ydewalle & De Bruycker, 2007). A further Dutch experiment (Mangnus, Hoeken, & van Driel, 1994), conducted on adult viewers, compared information recall for a dubbed (actually, voiced-over) and a subtitled television programme, showing no significant difference in the recall of information delivered through dialogues and images.

Another point of theoretical disagreement among scholars encompasses the subjective enjoyment of viewing a dubbed versus subtitled film. Indeed, the hedonic aspects of a film experience, i.e. those aspects relating to pleasure, are very important (Koolstra et al., 2002; Wissmath, Weibel, & Groner, 2009). In this regard, some researchers assume that

dubbing can provide more satisfaction than subtitling and they claim that this is possibly due to the less disrupted and more involving nature of the hedonic experience itself (Díaz Cintas, 2001; Jankowska, 2009; Maihac, 2000; Marleau, 1982). Other scholars hypothesize that people appreciate a subtitled film equally or to an even greater extent because subtitled films maintain the original atmosphere and spirit in the dialogues (Mera, 1998). We are aware of two studies that compared the two translation methods and the hedonic aspects of film watching. In the study conducted by Peeters et al. (1988), the subtitled programme was preferred to the dubbed programme even by the youngest Dutch children, possibly because of their familiarity with subtitles (the Netherlands is a subtitling country). In a recent Swiss study, Wissmath et al. (2009) investigated the effects of dubbing versus subtitling on psychological immersion, assessed through the four measures of presence, transportation, flow, and enjoyment.¹ They found that the translation method does not have a significant influence on the participants' evaluation of the film experience. The results corroborate the hypothesis that dubbing results in the highest levels of presence, transportation, and flow, but that the translation method has no major effect on enjoyment, irrespective of film genre. The authors conclude that the potential differences in the evaluative effects of the two translation methods have been overstated. Wissmath et al. (2009), however, did not investigate the cognitive effects of the two translation methods.

A further gap in the literature on audiovisual translation is due to the scarcity of studies on age-specific groups (e.g. children and older adults). Aside from a few studies focusing on children (d'Ydewalle & De Bruycker, 2007; d'Ydewalle & Van Rensbergen, 1989; von Feilitzen et al., 1979; Koolstra, van der Voort, & van der Kamp, 1997; Koolstra et al., 1999; Peeters et al., 1988), researchers have failed to consider age-related differences and actually ignored older adults. Because older adults experience a decline in performance in various aspects of cognitive functioning, such as fluid intelligence, processing speed, episodic memory processes, and comprehension (e.g. Dixon, Small, MacDonald, & McArdle, 2012; Light, 1988, 1990, 2000; Salthouse, 2004; Salthouse, Atkinson, & Berish, 2003; Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, 2003), they will be able to understand and remember film materials worse than young adults do, regardless of the translation method. Indeed, some evidence shows that young adults outperform older adults in audiovisual text-related activities (Depp, Schkade, Thompson, & Jeste, 2010; Frieske & Park, 1999; Stine, Wingfield, & Myers, 1990). If processing subtitled audiovisuals is more cognitively taxing than processing dubbed audiovisuals, older adults should perform less well with subtitles, especially if they are not familiar with subtitles. This prediction would also be consistent with surveys that highlight older adults' self-reported problems with subtitle reading (Spinhof & Peeters, 1999; Tonla Briquet, 1979) and with a study that shows that older adults spend less time reading subtitles and more time watching the visuals than young adults (d'Ydewalle et al., 1989). However, as we have already pointed out, the assumption that subtitle processing is cognitively taxing is not supported by empirical studies, and existing research suggests, instead, that subtitle processing is semiautomatic and effective (e.g. d'Ydewalle & De Bruycker, 2007). Moreover, there is some ERP² evidence on the perception of audiovisual versus auditory speech that seems to show that, 'unlike other areas of human condition, the ability to integrate [audiovisual] events [...] remains intact in old age' (Winneke & Phillips, 2009). According to the authors, the combined processing of redundant stimuli is more efficient and requires less effort than processing non-redundant information (e.g. speech accompanied by a visual cue rather than speech only). Following this view, we might assume that the cognitive decline of older adults may not specifically affect the processing of subtitled

audiovisuals; furthermore, we might expect to observe no significant differences between young and older adults' understanding and memory of subtitled materials, aside from the general negative effect related to cognitive and sensory decline.

To summarize, there are opposing stances on the cognitive load and effectiveness of subtitling. Some scholars assume, on a speculative basis, that processing subtitled audiovisuals can require more effort and be less effective than processing dubbed materials. Other scholars underline the effectiveness of subtitle processing. Existing research seems to support the latter view in adult samples, although the available evidence seems rather limited and not conclusive. Moreover, some scholars believe that dubbing can provide greater enjoyment than subtitling. Other researchers stress that the preservation of the original soundtrack and voices in subtitled audiovisuals can make the viewing experience more authentic and natural. The most comprehensive study comparing the hedonic experiences associated with the two translation methods in an adult sample did not find significant differences. Finally, the existing studies on the effects of aging suggest that older adults could perform worse in memory and comprehension of the information presented (also in a TV format), which can be ascribed to their cognitive and sensory decline. However, no previous research investigated the cognitive and evaluative effects of dubbing versus subtitling in older adults, and, as we have pointed out, different hypotheses can be proffered, starting from diverse theoretical assumptions.

To tackle empirically the debated issues, we carried out an experiment (Study 1), in which we contrasted the two audiovisual translation methods in a sample of young adults. To do so we used a comprehensive array of measures, covering all the main aspects of performance and the evaluation of the hedonic experience. Such measures included general comprehension, dialogue recognition, visual scene recognition, name–face association, and self-report evaluations of processing effort and film appreciation. To the best of our knowledge, this is the first study comparing dubbing and subtitling in all of these respects (for a multi-dimensional assessment of subtitling see also Perego et al., 2010). From a theoretical perspective, we were also interested in understanding whether dubbing and subtitling produce different cognitive effects in young and in older adults, as suggested by the third opening question. Starting from the theoretical assumption that processing a subtitled film requires significantly more cognitive resources than watching its dubbed version, a stronger age-related performance decline in memory and comprehension measures should be observed in the subtitling condition (versus the dubbing condition), because the greater demands of the task will be handled less effectively due to the reduced cognitive resources of older adults. On the contrary, if one assumes that subtitle processing is effective and it implies no major additional cognitive demands, then older adults should not be more impaired in the subtitling condition than in the dubbing condition, in spite of their cognitive decline. In order to put these two alternative hypotheses – related to rival theoretical stances – to empirical test and in order to check the robustness of the findings obtained in Study 1, Study 2 replicated the dubbing versus subtitling comparison in a sample of young and older adults. To the best of our knowledge, Study 2 is the first quasi-experimental study that compares dubbing and subtitling across these two populations.

Study 1

In Study 1 we tried to answer the first two questions: Does subtitling affect comprehension and memory of a film? Is dubbing associated with greater satisfaction and enjoyment? We compared dubbing and subtitling's cognitive and evaluative effects in

a sample of undergraduates, putting forward two alternative hypotheses derived from the literature. If subtitling is really more cognitively taxing than dubbing, as some scholars assume (see previous section), then we should expect that viewers exposed to dubbing will outperform viewers exposed to subtitling on all the cognitive measures (H1a) and that they will also find the film experience more pleasant (H2a). If subtitling is not more cognitively taxing than dubbing, as other scholars assume and as some empirical evidence suggests (see previous section), then the alternative translation methods should not yield significant differences in performance (H1b) and evaluation (H2b).

Method

Participants

Fifty-five undergraduates and postgraduates (45 females and 10 males, age range 18–30 years, $M = 23.55$, $SD = 2.52$) from an Italian university took part in the experiment, receiving course credits for participation. They were all Italian native speakers who reported being habitual viewers of dubbed films but occasional viewers of subtitled films. In particular, 85.5% of participants stated that they see dubbed films from *fairly often* to *always*, whereas 43.7% reported the same for subtitled films. No participant had any knowledge of the original language of the film fragment used in the experiment.

Design

Two types of audiovisual translation methods (dubbing and subtitling), applied to the same video excerpt, were presented to participants. They were randomly assigned to two experimental conditions (Sub: $n = 25$, Dub: $n = 30$), according to a two-group between-subjects design. Subtitle-reading checks were administered to participants who were exposed to the subtitled excerpt (see ‘Materials’ section).

The main dependent variables were measures of cognitive performance as well as evaluative measures. Cognitive performance was assessed through measures of general comprehension, dialogue recognition, face–name association, and visual scene recognition, thus encompassing both visual and verbal aspects of performance. Evaluative measures included film appreciation, self-reported effort related to the film vision, and metacognitive judgments of memory. These measures concern the evaluation of the hedonic aspect and subjective judgments of facets of performance that can be related to cognitive and evaluative effects.

Procedures and measures followed previous research on subtitled audiovisual processing (Perego et al., 2010; Wissmath et al., 2009).

Materials

Video

A 26-minute video fragment was used in the experiment. The video was taken from *Sukkar banat*, also known as *Caramel*, a 2007 Lebanese comedy/light drama directed by Nadine Labaki, and it was shown in its dubbed or subtitled version, according to the experimental design. The translated versions of the film used in the study, both in the form of dubbing and subtitling, were made by professionals for the Italian DVD released by Checchi Gori Home Video. The translations are therefore in line with Italian standards. The verbal strand of the video (Lebanese Arabic) had been deliberately chosen, as it was unknown to all participants (as in Perego et al., 2010), to make sure that the comprehension of the subtitled

version of the video depended entirely on the subtitles (versus spoken dialogues). In the case of the presentation of the subtitled excerpt, the only comprehensible audio information came from the paralinguistic and extralinguistic elements of spoken communication. For our study, we chose a narratively conventional and medium paced³ video excerpt. In fact, in this study we were interested in testing the most common viewing situation and not extreme and rare (i.e. very fast/slow and narratively difficult/easy) cases.

Subtitle-reading checks

A questionnaire on subtitle reading was administered to all participants exposed to the subtitled excerpt. The questionnaire had the aim of verifying whether viewers actually paid attention to the subtitles and remembered their permanence on screen, and it enabled us to collect the viewers' opinions on the ease of subtitle reading. Two self-report questions on a seven-point scale asked how frequently these participants used subtitles to help their understanding of the film and how difficult they found reading subtitles. A question on a five-point scale asked whether the subtitles remained on the screen for an appropriate amount of time. In addition, using two multiple-choice questions, we checked whether participants were able to remember subtitles position (i.e. centred) and colour (i.e. white without background).

Questionnaire on dubbing and on subtitling

Participants were administered a questionnaire appraising their viewing habits and their appreciation of either audiovisual translation mode. Five seven-point Likert scale questions asked how frequently participants watch subtitled and dubbed films, whether subtitling had (or could have) been useful to understand the film plot and to appreciate the film scenes, and how they judge subtitled film characters speaking in their native language.

Cognitive measures⁴

General comprehension questionnaire. A 20-question multiple-choice questionnaire on the general content of the video was designed to appraise whether participants understood the main conceptual aspects of the film fragment. For each question, participants were asked to complete a statement by selecting one item from a list including a correct response and two distracters.

Dialogue recognition questionnaire. This 20-item questionnaire appraised the ability to recognize specific words or short phrases presented in the film. Participants had to recognize a series of statements by selecting the correct response among three possible options.

Face-name association test. Respondents were shown eight freeze-frames of the film characters and they were asked to select the name of each among eight alternative names.

Visual scene recognition test. Sixty freeze-frames were presented in a random order on a questionnaire and participants had to decide whether each one was part of the video or not. Only half of the frames had been actually presented, the remaining frames were foils.

Evaluative measures

Evaluative questionnaire. Several questions on a seven-point Likert scale appraised the degree of film appreciation (five items) and self-reported effort during film viewing (three items). Metacognitive judgments of memory and comprehension (three items), referring

to general comprehension, dialogue recognition, and visual scene recognition, were also collected.

Procedure

Two separate viewing sessions were arranged for the subtitling and dubbing conditions. Once each group was gathered in a special cinema room, participants were given instructions and a general introduction. No mention of the film language or translation method was made. After viewing the video, participants were given a booklet containing the questionnaires and they were asked to fill them out in a specific order: (1) evaluative questionnaire; (2) face–name association test; (3) general comprehension; (4) visual scene recognition; (5) dialogue recognition; (6) subtitle-reading checks; (7) questionnaire on dubbing and subtitling. Filling in the questionnaires was a self-paced task and it took approximately 60 minutes (for more details about procedure and materials see Perego et al., 2010).

Results

Subtitle-reading checks

Ninety-six percent of the sample in the subtitling group correctly remembered the alignment of subtitles and 88% of the sample correctly remembered their colour. All of the participants in this group reported having used subtitles *often* or *always* to help their understanding of the film. As for the difficulty in reading subtitles, 80% of the group provided judgments ranging from *neither easy nor difficult* to *very easy*. Finally, 84% of the group stated that subtitles remained on the screen at least for a *fair amount of time*. These findings indicate that participants read subtitles with apparent ease and seemed to rely on them to understand the film.

Questionnaire on dubbing and subtitling

No differences were found between groups in a general enquiry of how disturbing watching a film in a foreign language is (Sub: $M = 4.92$, $SD = 1.82$; Dub: $M = 4.30$, $SD = 1.86$; $t(51.57) = 1.24$, $p = 0.22$) and of how often participants see subtitled films (Sub: $M = 4.08$, $SD = 2.20$; Dub: $M = 3.40$, $SD = 2.18$; $t(51.04) = 1.15$, $p = 0.26$) or dubbed films (Sub: $M = 5.52$, $SD = 1.58$; Dub: $M = 5.73$, $SD = 1.28$; $t(46.06) = 0.54$, $p = 0.59$). Compared to the dubbing group, the subtitling group considered the subtitles more helpful for both film understanding (Sub: $M = 5.84$, $SD = 1.34$; Dub: $M = 3.83$, $SD = 1.86$; $t(52.05) = 4.64$, $p < 0.001$, $\omega^2 = 0.04$) and visual scene recognition (Sub: $M = 4.56$, $SD = 1.47$; Dub: $M = 3.47$, $SD = 1.81$; $t(52.98) = 2.47$, $p < 0.05$, $\omega^2 = 0.01$). According to these results, participants did not differ in their viewing habits and being exposed to the subtitling translation method led to a greater consideration of the functional role of subtitles in understanding. Vice versa, being exposed to the dubbing translation method leads to a lower consideration of the potential role of subtitles in understanding a film.

Cognitive measures

Data analysis was carried out on summative performance scores for each cognitive test: general comprehension, dialogue recognition, face–name association, and visual scene recognition. Internal consistency for these measures (Cronbach's α) was low to moderate,

Table 1. Descriptive statistics for the dependent variables as a function of translation methods in Study 1.

	Dub		Sub	
	M	(SD)	M	(SD)
<i>Cognitive measures</i>				
General comprehension	16.00	(2.17)	17.20	(2.38)
Dialogue recognition	12.63	(2.47)	16.08	(2.53)
Face–name association	1.90	(1.49)	3.64	(0.95)
Visual scene recognition	47.77	(4.37)	46.92	(5.49)
<i>Evaluative measures</i>				
Film appreciation	20.26	(6.00)	21.28	(5.75)
Self-reported effort	16.10	(2.26)	16.16	(1.91)
Judgments of memory	13.13	(2.85)	13.76	(2.15)

Note: Ranges of scores for cognitive measures were: 0–20 for general comprehension and dialogue recognition, 0–8 for face–name association, and 0–60 for visual scene recognition. Ranges of scores for evaluative measures were: 5–35 for film appreciation and 3–21 for self-reported effort and judgments of memory.

probably due to the complexity of the tasks: general comprehension ($\alpha = 0.35$), dialogue recognition ($\alpha = 0.65$), face–name association ($\alpha = 0.50$), and visual scene recognition ($\alpha = 0.64$).

As shown in Table 1, the subtitling group performed better than their dubbing counterpart in face–name association ($t(49.86) = 5.23, p < 0.001, \omega^2 = 0.08$) and dialogue recognition, ($t(53) = 5.09, p < 0.001, \omega^2 = 0.01$). The difference between groups was close to statistical significance for general comprehension ($t(53) = 1.96, p = 0.056$), with an advantage for the subtitling group. The two groups did not differ on the visual scene recognition measure ($t(53) = 0.64, p = 0.53$).

Evaluative measures

Data were analysed using three main summative indices: film appreciation, self-reported effort during film vision, and judgments of memory. Internal consistency was moderate to high for these measures (film appreciation $\alpha = 0.81$; self-reported effort $\alpha = 0.68$; judgments of memory $\alpha = 0.80$). As evident in Table 1, results did not show significant differences between the two groups on film appreciation ($t(53) = 0.64, p = 0.53$), self-reported effort ($t(53) = 0.11, p = 0.92$), and judgments of memory ($t(53) = 0.91, p = 0.37$).

Discussion

In Study 1, we assessed the cognitive and evaluative effects of viewing a dubbed versus a subtitled film. Although our results on cognitive measures are at odds with H1a, they did not completely support H1b. In fact, some surprising advantages of subtitling versus dubbing emerged, in particular in regard to the lexical aspects of performance (i.e. the ability to remember face–name associations and specific expressions of dialogues), which benefited from the written presentation. A marginally significant difference between conditions was also observed for general comprehension. Thus, not only do our findings show that dubbing does not provide any cognitive advantage over subtitling, but they also indicate that subtitling can enhance certain aspects of cognitive performance. As for the evaluative aspects, the two groups did not differ, thus supporting H2b. Film appreciation

and perceived effort were similar in the two conditions, as well as the participants' metacognitive judgments about their cognitive performance. To conclude, subtitling does not lead to a lower satisfaction with the viewing experience (see also Wissmath et al., 2009).

Study 2

A secondary aim of Study 2 was to replicate Study 1 with a different sample. However, this study was primarily designed to understand whether subtitling specifically affects older adults' comprehension and memory of a film, and whether this can lead to lower satisfaction with the viewing experience. Following this previously-discussed view, it can be hypothesized that older adults' performance (H1a) and evaluation (H2a) should be specifically low in the subtitling condition (i.e. age X translation method interactions are expected, with the worst performance in older adults in the subtitling condition). However, starting from the different theoretical perspective that processing subtitled materials is not particularly demanding, older adults' performance (H1b) and evaluation (H2b) should be less effective than that of young adults, but no specific performance or evaluation decrease in the subtitling condition should be observed (i.e. main effects of age and – sometimes – translation method are expected, but no specific age X translation method interactions). As for the difference between subtitling and dubbing, we expect to replicate the results of Study 1 and to observe significant differences in the lexical aspects of performance, but no differences in other measures. In Study 2, participants were also administered a battery of cognitive tests. These were unrelated to the viewing experience and were used to exert statistical control over participants' individual and age-related differences in some preexisting cognitive abilities (i.e. fluid intelligence, processing speed, and vocabulary) that may be related to cognitive performance and evaluative measures in our audiovisual context. Finally, we analysed the relationships between our cognitive and evaluative measures by carrying out a series of correlational analyses.⁵

Method

Participants

Participants were 88 young adults (58 females and 30 males, age range 18–26 years, $M = 19.93$, $SD = 1.77$) and 67 older adults (48 females and 19 males, age range 60–78 years, $M = 66.88$, $SD = 4.12$). Young adults were undergraduates and postgraduates from an Italian university and received course credits for their participation. Older adults were volunteers recruited at a local University of the Third Age. Young ($M = 12.82$, $SD = 1.21$) and older adult ($M = 12.27$, $SD = 3.95$) groups did not differ in years of education ($t(150) = 1.22$, $p = 0.22$). All participants were Italian native speakers who reported being habitual viewers of dubbed films but occasional viewers of subtitled films. In particular, 71.5% of young participants and 58.2% of older adults stated that they see dubbed films from *fairly often* to *always*, whereas 45.5% of young adult participants and 6% of older adults reported the same for subtitled films. No participant had any knowledge of the original language of the film fragment used in the experiment.

Design, materials, and procedure

Young and older adults were randomly assigned to the two translation method groups, according to a 2×2 between-subjects quasi-experimental design (Sub/young adults:

$n = 45$, Sub/older adults: $n = 34$; Dub/young adults: $n = 43$, Dub/older adults: $n = 33$). Subtitle-reading checks were administered to participants who had been exposed to the subtitled excerpt. Participants were tested in groups in a specifically equipped cinema room. Stimuli and apparatus were as in Study 1. After the viewing experience and the administration of film-related tests and questionnaires, participants also underwent the battery of cognitive tests.

Cognitive tests

Raven's Coloured Progressive Matrices (CPM; Raven, 1995). This nonverbal test was used as a measure of fluid intelligence, which is a complex human ability that allows us to adapt our thinking to a new cognitive problem or situation (Carpenter, Just, & Shell, 1990). CPM comprises three series of 12 items of increasing difficulty (A, Ab, and B). Each item is a diagrammatic puzzle arrayed and organized according to certain rules, with a missing part that needs to be selected from six options. In each test item, the participant is asked to identify the missing element that completes a pattern. CPM was administered in groups, with participants answering on their own record form. No time limit was set and all subjects were allowed to complete the test. The maximum score of the test is 36.

Letter and Pattern Comparison Tasks (Salthouse & Babcock, 1991). These tasks were used as indicators of processing speed. They require participants to compare pairs of letters (Letter Comparison) or line patterns (Pattern Comparison) and decide if the stimuli are the same or different. Each task comprises a total of 42 and 60 items (for the Letter and Pattern versions, respectively). The test score is the number of items correctly completed within the time limit.

Vocabulary Test (Thurstone & Thurstone, 1963). This 50-item vocabulary test requires participants to identify synonyms of a target word within an eight-minute timespan.

Results

Subtitle-reading checks

Young adults were more able than older adults to remember both the colour (75.6% versus 32.4%; $\chi^2(1, n = 78) = 13.91, p < 0.001$) and the text presentation (100% versus 79.4%; $\chi^2(1, n = 78) = 8.86, p < 0.01$) of subtitles. The majority of participants reported having used subtitles *often* or *always* to help their understanding of the film (86.7% of young adults versus 52.9% of older adults). Regarding the difficulty of reading subtitles, almost all participants of both samples provided judgments ranging from *neither easy nor difficult* to *very easy* (91.1% versus 91.2%). Finally, the majority of participants stated that subtitles remained on the screen at least for a *fair amount of time* (68.9% young adults versus 76.5% older adults). In sum, participants in the subtitling groups read subtitles with apparent ease and they seemed to rely on them to understand the film.

Questionnaire on dubbing and subtitling

A series of separate 2×2 (age X translation method) Analyses of Variance (ANOVAs) were carried out in order to evaluate differences across groups in the considered dependent variables, as reported below. The analysis of the reported frequency of subtitled film vision revealed a main effect of age ($F(1, 144) = 46.11, p < 0.001, \eta^2 = 0.24$), with young adults reported to be more familiar with this method of translation than older adults ($M = 3.95, SD = 1.90$ versus $M = 2.11, SD = 1.61$). The main effect of the

translation method ($F(1, 144) = 1.84, p = 0.18$) and the age X translation method interaction were not significant ($F(1, 144) = 0.13, p = 0.72$). An ANOVA on the reported frequency of dubbed film vision did not highlight any effect of age and translation methods, or their interaction. A general enquiry on how disturbing/pleasant it is to watch a film in a foreign language revealed main effects of age ($F(1, 143) = 10.89, p < 0.005, \eta^2 = 0.07$) and translation method ($F(1, 143) = 7.32, p < 0.01, \eta^2 = 0.05$), with more positive evaluations for young adults ($M = 4.50, SD = 1.36$) than older adults ($M = 3.84, SD = 1.21$) and for the subtitling group ($M = 4.46, SD = 1.21$) than the dubbing group ($M = 3.96, SD = 1.43$). Again, the age X translation method interaction was non-significant ($F(1, 143) = 1.41, p = 0.24$). As for the questions on the role of subtitling in helping film understanding and visual scene recognition, analyses revealed main effects of age ($F(1, 144) = 8.32, p < 0.01, \eta^2 = 0.05$, and $F(1, 144) = 7.38, p < 0.01, \eta^2 = 0.05$) and of the translation method ($F(1, 144) = 48.54, p < 0.001, \eta^2 = 0.25$, and $F(1, 144) = 14.01, p < 0.001, \eta^2 = 0.09$). Young adults ($M = 5.26, SD = 1.68$ and $M = 4.63, SD = 1.36$) considered subtitles more helpful for understanding the film and for recognizing the scenes than older adults did ($M = 4.60, SD = 1.72$ and $M = 4.05, SD = 1.49$). In addition, as in Study 1, the subtitling group ($M = 5.79, SD = 1.33$ and $M = 4.77, SD = 1.35$) considered subtitles more helpful to understand the film than the dubbing group ($M = 4.07, SD = 1.66$ and $M = 3.96, SD = 1.42$), when referred to the potential situation of seeing a subtitled film. The age X translation method interactions were non-significant ($F(1, 144) = 2.0, p = 0.16$) ($F(1, 144) = 0.15, p = 0.70$).

Cognitive measures

As in Study 1, data were analysed by creating a summative performance score for general comprehension, dialogue recognition, face-name association, and visual scene recognition. Internal consistency for these measures was moderate (general comprehension: $\alpha = 0.43$; dialogue recognition: $\alpha = 0.69$; face-name association: $\alpha = 0.55$; visual scene recognition: $\alpha = 0.86$). Descriptive statistics for cognitive measures as a function of age groups and translation methods are reported in [Table 2](#).

Regarding general comprehension, a 2×2 ANOVA (age X translation method) showed that only the main effect of age was significant ($F(1, 151) = 11.88, p = 0.001, \eta^2 = 0.07$), with young adults ($M = 15.11, SD = 2.27$) obtaining a better performance than older adults ($M = 13.88, SD = 2.13$). The main effect of the translation method ($F(1, 151) = 1.73, p = 0.19$) and the age X translation method interaction ($F(1, 151) = 0.48, p = 0.49$) were not significant. Similarly, the ANOVA highlighted a significant main effect of age for scene recognition ($F(1, 151) = 44.12, p < 0.001, \eta^2 = 0.23$), with young adults ($M = 45.33, SD = 4.93$) performing better than older adults ($M = 37.54, SD = 9.40$). Again, the main effect of the translation method ($F(1, 151) = 0.10, p = 0.75$) and the age X translation method interaction ($F(1, 151) = 0.34, p = 0.56$) were not significant. For face-name associations and dialogue recognition, ANOVAs showed main effects of age ($F(1, 151) = 37.39, p < 0.001, \eta^2 = 0.20$ and $F(1, 151) = 23.07, p < 0.001, \eta^2 = 0.13$) and translation method ($F(1, 151) = 42.23, p < 0.001, \eta^2 = 0.22$ and $F(1, 151) = 22.13, p < 0.001, \eta^2 = 0.13$), but the age X translation method interactions were not significant ($F(1, 151) = 0.09, p = 0.77$ and $F(1, 151) = 0.31, p = 0.58$). For both face-name association and dialogue recognition, young adults ($M = 3.59, SD = 1.52$ and $M = 14.32, SD = 3.10$) obtained better results than older adults ($M = 2.30, SD = 1.38$ and $M = 11.91, SD = 3.51$), and participants in the subtitling group ($M = 3.71, SD = 1.42$ and $M = 14.42,$

$SD = 2.99$) performed better than participants in the dubbing group ($M = 2.33$, $SD = 1.46$ and $M = 12.09$, $SD = 3.58$).

In order to take account of the potential influence of individual differences in different aspects of cognitive functioning (fluid intelligence, perceptual speed, and vocabulary), we carried out a series of separate Analyses of Covariance (ANCOVAs) on the same dependent variables.⁶ The main effect of age ($F(1, 148) = 12.88$, $p < 0.001$, $\eta^2 = 0.08$) continued to be significant for general comprehension, whereas the main effect of translation method ($F(1, 148) = 1.55$, $p = 0.22$) and the age X translation method interaction ($F(1, 148) = 0.002$, $p = 0.96$) were non-significant. Only the effect of the vocabulary covariate was significant ($F(1, 148) = 6.50$, $p = 0.01$, $\eta^2 = 0.04$). Considering visual scene recognition, the main effect of age continued to be significant ($F(1, 148) = 19.94$, $p < 0.001$, $\eta^2 = 0.12$), whereas the main effect of translation method ($F(1, 148) = 0.04$, $p = 0.85$) and the age X translation method interaction ($F(1, 148) = 0.57$, $p = 0.45$) were non-significant. Only the effect of the processing speed covariate was significant in this case ($F(1, 148) = 10.87$, $p = 0.001$, $\eta^2 = 0.07$). The ANCOVA for face-name association confirmed the main effects of age ($F(1, 148) = 14.04$, $p < 0.001$, $\eta^2 = 0.09$) and translation method ($F(1, 148) = 41.45$, $p < 0.001$, $\eta^2 = 0.22$), whereas the interaction was still non-significant ($F(1, 148) = 0.19$, $p = 0.67$). None of the covariates showed significant effects for this variable. Finally, the ANCOVA for dialogue recognition confirmed the main effects of age ($F(1, 148) = 17.67$, $p < 0.001$, $\eta^2 = 0.11$) and translation method ($F(1, 148) = 19.75$, $p < 0.001$, $\eta^2 = 0.12$), whereas the age X translation method interaction was still non-significant ($F(1, 148) = 0.005$, $p = 0.94$). Only the vocabulary measure was a significant covariate in this case ($F(1, 148) = 5.87$, $p < 0.05$, $\eta^2 = 0.04$). In summary, the ANCOVAs confirmed the ANOVA results: age-related differences were evident in all the cognitive measures, and the findings of Study 1 were fully replicated.

Evaluative measures

We took into consideration the same summative indices of Study 1 (i.e. film appreciation, self-reported effort, judgments of memory) and computed a 2×2 ANOVA (age X translation method) for each of these variables. Internal consistency was moderate to high

Table 2. Descriptive statistics for the dependent variables as a function of age groups and translation methods in Study 2.

	Dub				Sub			
	Young adult		Old adult		Young adult		Old adult	
	M	(SD)	M	(SD)	M	(SD)	M	(SD)
<i>Cognitive measures</i>								
General comprehension	15.00	(2.64)	13.52	(2.40)	15.22	(1.87)	14.24	(1.79)
Dialogue recognition	13.26	(3.27)	10.58	(3.44)	15.33	(2.58)	13.21	(3.10)
Face-name association	2.86	(1.36)	1.64	(1.32)	4.29	(1.34)	2.94	(1.13)
Visual scene recognition	45.49	(4.44)	37.00	(10.51)	45.18	(5.40)	38.06	(8.31)
<i>Evaluative measures</i>								
Film appreciation	15.73	(7.26)	17.12	(5.79)	18.45	(5.00)	20.33	(6.66)
Self-reported effort	14.98	(3.22)	15.03	(1.80)	15.91	(2.60)	14.92	(2.25)
Judgments of memory	12.63	(2.92)	12.97	(2.18)	13.18	(2.50)	13.42	(2.58)

Note: Ranges of scores for cognitive measures and evaluative measures were the same as Study 1.

(film appreciation: $\alpha = 0.81$; self-reported effort: $\alpha = 0.77$; judgments of memory: $\alpha = 0.82$). Descriptive statistics for evaluative measures as a function of age groups and translation methods are reported in Table 2.

Only for film appreciation did the subtitling group ($M = 19.16$, $SD = 5.74$) report slightly more enjoyment in watching the film than its dubbing counterpart ($M = 16.29$, $SD = 6.70$; $F(1, 142) = 7.94$, $p < 0.01$, $\eta^2 = 0.05$). The main effect of age ($F(1, 142) = 2.42$, $p = 0.12$) and the age X translation method interaction ($F(1, 142) = 0.05$, $p = 0.82$) were non-significant. No other significant differences related to age or translation method were observed. The same pattern was found after computing ANCOVAs on the same dependent variables (including as covariates vocabulary, fluid intelligence, and perceptual speed). Only the effect of the translation method was still significant for the film appreciation measure ($F(1, 139) = 7.33$, $p < 0.01$, $\eta^2 = 0.05$).

Correlations between measures

We assessed the relationships between different aspects of performance by carrying out bivariate Pearson's correlations on the dependent variables. We first computed correlations between cognitive measures, and then between cognitive and evaluative variables. All the aspects of cognitive performance were positively related (for general comprehension $r_{\text{dialogue recognition}}(210) = 0.44$, $p < 0.01$; $r_{\text{face-name association}}(210) = 0.29$, $p < 0.01$; $r_{\text{visual scene recognition}}(210) = 0.34$, $p < 0.01$; for dialogue recognition $r_{\text{face-name association}}(210) = 0.48$, $p < 0.01$; $r_{\text{visual scene recognition}}(210) = 0.21$, $p < 0.01$; and for face-name association $r_{\text{visual scene recognition}}(210) = 0.21$, $p < 0.01$). This shows that participants who had a better performance on measures that partly depend on language processing ability also had a better performance in image-related tasks. In other words, no sign of trade-offs between dialogue processing and visual processing emerged (cf. Perego et al., 2010), but positive associations were observed.⁷ In addition, only some evaluative variables were positively related to the cognitive variables. In particular, the participants who reported having experienced more effort in following the film were also those reaching higher levels of performance ($r_{\text{general comprehension}}(210) = 0.29$, $p < 0.01$; $r_{\text{dialogue recognition}}(210) = 0.25$, $p < 0.01$; $r_{\text{face-name association}}(210) = 0.16$, $p < 0.05$; $r_{\text{visual scene recognition}}(210) = 0.17$, $p < 0.05$). However, as we have shown, perceived effort did not differ between the subtitling and dubbing conditions. Moreover, a better performance was also positively (but weakly) associated with higher metacognitive judgments (with the exception of visual scene recognition; $r_{\text{general comprehension}}(210) = 0.21$, $p < 0.01$; $r_{\text{dialogue recognition}}(210) = 0.15$, $p < 0.05$; $r_{\text{face-name association}}(210) = 0.14$, $p < 0.05$), highlighting some degree of metacognitive ability in this particular domain. Finally, film appreciation was positively related only to the general comprehension measure ($r_{\text{general comprehension}}(210) = 0.15$, $p < 0.05$), but not to the more specific cognitive measures, suggesting that film appreciation may be specifically related to higher-level aspects of film understanding.

Discussion

The results obtained in Study 2 on the cognitive measures are at odds with H1a and in agreement with H2a: We observed only main effects of age and, in some cases, of the translation method, but we did not observe any significant interaction.⁸ Young adults obtained better results than their older counterparts on all cognitive measures, and this pattern of results remained significant also when checking for the influence of individual

differences in cognitive abilities. Interestingly, we fully replicated and extended to older adults the findings of Study 1, showing some advantages of subtitling versus dubbing in the ability to remember face–name associations and the specific expressions used in the dialogues. These results suggest that such lexical aspects of performance probably benefitted from the written presentation. Thus, as for the cognitive effects, not only did our findings show that dubbing does not provide any advantage over subtitling, but they also suggest that subtitling can enhance certain aspects of performance. As for the evaluative aspects, no significant age-related differences were observed between young and older adults. In addition, as opposed to Study 1, the translation method slightly affected film appreciation, while the perceived cognitive effort continued to be similar in the two translation method conditions, as well as the metacognitive judgments.

General discussion

The three questions raised in the introduction about the relative merits of dubbing versus subtitling asked whether subtitling affects comprehension and memory of a film, whether dubbing allows for a more fluent viewing experience that leads to a greater satisfaction and final enjoyment, and whether subtitling specifically affects older adults' comprehension and memory of a film. These are theoretically interesting questions, because the answers can corroborate or weaken different views of audiovisual processing and appreciation. Moreover, they have major applied significance, considering the real-world spread of dubbing and subtitling. Our review of the audiovisual literature on the dubbing versus subtitling debate showed the lack of clear empirical evidence on the cognitive and evaluative effects of viewing dubbed or subtitled products and on age-related differences. Thus, we decided to fill these gaps by carrying out two new studies.

In Study 1, we contrasted dubbing and subtitling to compare their cognitive and evaluative effects in a sample of undergraduates. The results we obtained showed that general comprehension of film content and visual scene recognition are achieved equally with both translation methods, and that subtitling is more effective than dubbing when some lexical aspects of performance are considered. These results were fully replicated in Study 2. Accordingly, the answer to our first question is negative: Subtitling does not impede, but in some respects helps, film comprehension and memory.

Furthermore, Study 1 was designed to assess the evaluative dimension of the film experience. The results show that there are no significant differences between dubbing and subtitling: Participants in both groups reported having appreciated the film to the same extent, and they showed no differences in self-reported cognitive effort or metacognitive judgments of memory. In Study 2, we obtained a slightly different pattern of results, with participants appreciating the subtitled version of the film more than its dubbed equivalent. Overall, the findings of our studies suggest that dubbing is not associated with greater appreciation of the film.

In Study 2, we also contrasted the performance of young and older adults in order to appraise whether the subtitling condition is especially taxing for older adults. Moreover, we appraised the role of potential cognitive correlates. The results we obtained show that, although older adults' performance declines with both translation methods, differences between age groups are not especially evident in a particular condition (dubbing or subtitling). In other words, older adults' performance is consistently lower but similar to the one found in young adults: No difference between translation methods was observed in general comprehension or visual scene recognition, and an advantage of subtitling over dubbing was observed in lexical tasks. Thus, the answer to our third question is also

negative: Subtitling does not specifically affect the viewing experience of older adults. In regard to the role of cognitive covariates, it is interesting to note that the abilities to understand core aspects of the film and to recognize specific dialogue items are selectively related to vocabulary skills, while the ability to recognize film scenes is selectively related to processing speed. However, the ANCOVA results show that the differences between age and translation method groups are still significant after controlling for the influence of covariates. Thus, these differences cannot be completely traced back to group-related or individual differences in the three general cognitive abilities considered in our study.

From the theoretical point of view, the results of our studies undermine the perspective assuming that processing subtitled film is cognitively demanding and that it negatively affects film enjoyment and viewers' appreciation (as in Díaz Cintas, 2001; Gottlieb, 1994; Grillo & Kawin, 1981; Koolstra et al., 2002; Maihac, 2000; Marleau, 1982; Mera, 1998). Our findings are generally consistent with the view that subtitle processing is cognitively effective (d'Ydewalle & De Bruycker, 2007; Perego et al., 2010) and does not negatively affect film evaluation (Wissmath et al., 2009). Another theoretically interesting consideration relates to the positive effects of subtitling on the lexical aspects of performance. These results offer converging empirical evidence supporting the theoretical arguments usually expressed about the advantages of subtitles for second language acquisition (e.g. Díaz Cintas & Fernández Cruz, 2008; O'Connell, 2011; Incalcaterra McLoughlin & Lertola, 2011). They also corroborate previous empirical findings on the beneficial role of subtitles in lexical acquisition and syntactic accuracy (d'Ydewalle & Pavakanun, 1995, 1997; d'Ydewalle & Van de Poel, 1999; Ghia, 2011; Koolstra & Beentjes, 1999; Kuppens, 2010; Van de Poel & d'Ydewalle, 2001; Van Lommel, Laenen, & d'Ydewalle, 2006).

From an applied point of view, our results support the role of subtitles as boosters for lexical acquisition. Given the benefits provided by subtitles in enabling viewers (irrespective of their age) to remember specific lexical items read on the screen, and given their positive impact on reading proficiency (Gottlieb, 2004; Koolstra et al., 1997), a more systematic use should be considered, especially in dubbing countries. Indeed, subtitles can function well, both as an enjoyable and motivating learning tool to be used consistently in formal learning environments, and as an incidental foreign language acquisition device. Secondly, given the overall positive characteristics of subtitles, and without rejecting dubbing (which may be especially useful to, for example, small children or anyone with low reading proficiency, and also sight impaired or illiterate people), subtitles should be used more extensively to cater for the weaker segments of the population. Deaf and hard-of-hearing, older adults with presbycusis (i.e. age-related progressive hearing loss), viewers in a noisy environment, and immigrants might in fact benefit in several ways from reading written material on screen, as reported in the literature (Kothari, 2000; Kothari & Takeda, 2000; Matamala & Orero, 2012; Nir, 1984). In particular, our results support the idea that subtitles could be used as an accessible and stimulating way for aging individuals to remain adept at reading, and as a means for them to fully enjoy (less and more selected) television contents. This would contribute to making them feel less isolated and to limit the frustrating effects of the age-related inability to hear and understand television speech. Although an alternative to television as entertainment is much needed today for older adults (Depp et al., 2010), as is the acknowledgement and the treatment of hearing loss in adults, knowing that subtitle reading is effective also in older populations opens the way to access television more effectively and to use it as an aid to improve the conditions of older users. This is

particularly important today, as subtitles included in films or TV shows can be played on special mobile devices used as hearing assistive technology (HAT) (Fligor, 2007; Ross, 2004). Moreover, the coexistence of dubbing and subtitling as mutually nonexclusive translation methods would enable more audiovisual products to be imported and distributed in dubbing countries, thanks to a cheaper but equally effective and appreciated translation option, thus providing more space on the market to a more varied palette of audiovisual products, including niche material, and granting the spread or preservation of multilingualism and cultural diversity (e.g. Gottlieb, 2004).

Before concluding, some limitations of the present research need to be discussed. First, although our studies considered a wide array of different cognitive and evaluative measures, a more comprehensive picture could result from the continuous monitoring of cognitive and emotional processes during film viewing (e.g. Schulte-Mecklenbeck, Kühberger, & Ranyard, 2010). For instance, the use of eye tracking methods has already provided valuable insights (e.g. Perego et al., 2010). A second limitation of the research pertains to the particular sample that took part in the experiments: All participants were citizens of a dubbing country. Although this points to the need to generalize our results to different populations, it seems reasonable that the extension of the research to participants who are more familiar with subtitling (e.g. Scandinavian people) would confirm our findings or show even stronger benefits of subtitling over dubbing. A third limitation of our studies is related to the use of a single film excerpt. Although our findings are generally consistent with existing psychological literature on subtitle processing (see introductory section), and Wissmath et al. (2009) found no main effect of film genre in their analysis, we think that future research should consider the possibility of manipulating the film redundancy and structural complexity (Lang, Geiger, Strickwerda, & Sumner, 1993; Lang, Zhou, Schwartz, Bolls, & Potter, 2000) over an array of very different levels. In fact, it has been hypothesized that the processing strategies applied to audiovisual information depend on the type of material (Lang, 2000), on its redundancy and relative importance (Fox, Park, & Lang, 2007; Grimes, 1991; Lang, 1995, 2001), and on the cognitive characteristics of the viewer. The film excerpt we used in our study was selected to be moderately complex from the narrative and structural point of view, in order to represent the typical properties of ordinary films, but the boundaries of the cognitive effectiveness of subtitle processing may emerge only when redundancy is very low, the material to be processed is very complex and potentially interfering, and the rate of delivery is faster than normal.

Our investigation provided a first piece of knowledge on the cognitive and evaluative effects of watching a film in a dubbed versus subtitled version in different segments of the adult population. The clear pattern of findings we obtained has the significant theoretical and applied implications that we have discussed. However, future studies might explore more difficult and less common semiotic environments, which may offer further valuable insights into subtitle processing and multi-channel communication.

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Notes

1. Psychological immersion is a mental state experienced by people caught up in a pleasant and involving activity. In mediated environments, immersion is frequently accompanied with:

presence, i.e. the feeling of media users being spatially located in the mediated environment; transportation, i.e. the feeling of media users of being mentally drawn away from the actual physical environment into the world of a narrative; flow, i.e. the feeling of media users being intensely involved in and focused on a given activity to the extent of losing self-consciousness; enjoyment, i.e. the feeling of appreciation, attraction, preference, and liking experienced by media users (Csikszentmihalyi, 1988).

2. Event-related brain potentials, i.e. a non-invasive method of measuring brain activity during cognitive processing.
3. Pacing has been operationalized by counting the number of camera changes (i.e. cuts and edits) per minute. Such procedure results in four levels of edit: slow (zero to seven per minute), medium (eight to 15), fast (16–23), and very fast (> 24) (cf. Lang, Bolls, Potter, & Kawahara, 1999; Lang et al., 2000). In our video excerpt, the average number of edits per minute is 11. Moreover, as shown by the descriptive statistics in Tables 1 and 2, the film information was not too easy or too difficult to understand and remember.
4. The performance score for all the cognitive measures was the number of correct responses. The general comprehension and dialogue recognition questionnaires, the face–name association, and visual scene recognition tests included items covering the whole film excerpt.
5. The data of Study 1 and Study 2 have been aggregated to increase the power of the statistical tests related to these correlational analyses.
6. The ANCOVA (analysis of covariance) is an extension of the ANOVA that allows us to appraise the influence of covariate variables. Like the ANOVA, the ANCOVA is used to determine whether there are any significant differences between the means of the dependent variables (i.e., general comprehension, dialogue recognition, face-name association, and visual scene recognition) related to the effects of independent variables (translation method and age). However, the ANCOVA has the additional benefit of exerting statistical control over the potential effects of other variables (covariates), which may affect the dependent variables (i.e., fluid intelligence, vocabulary, and processing speed).
7. A similar pattern of results is also obtained when considering the subtitling condition only. We do not report the detailed results due to lack of space, but they are available on request.
8. This conclusion, although based on the absence of significant age X translation method interactions, is convincingly supported by the data. First, the absence of a significant interaction was consistently observed in all the tests carried out in Study 2. Then, the combined probability of the interaction effect in the tests carried out on the four main cognitive measures of Study 2, computed with Fisher's (1948) method, was still non-significant [$\chi^2(8) = 4.20, p = 0.84$]. Finally, the means of the different groups, reported in Table 2, show no trace of potential interactions.

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References

- Bairstow, D. (2011). Audiovisual processing while watching subtitled films: A cognitive approach. In A. Şerban, A. Matamala, & J.-M. Lavour (Eds.), *Audiovisual translation in close-up: Practical and theoretical approaches* (pp. 205–219). Bern: Peter Lang.

- Carpenter, P. A., Just, M. A., & Shell, P. (1990). What one intelligence test measures: A theoretical account of the processing in the Raven Progressive Matrices test. *Psychological Review*, *97*, 404–431. doi:10.1037/0033-295X.97.3.404
- Csikszentmihalyi, M. (1988). The flow experience and its significance for human psychology. In M. Csikszentmihalyi & I. Csikszentmihalyi (Eds.), *Optimal experience: Psychological studies of flow in consciousness* (pp. 15–35). Cambridge: Cambridge University Press.
- Depp, C. A., Schkade, D. A., Thompson, W. K., & Jeste, D.W. (2010). Age, affective experience, and television use. *American Journal of Preventive Medicine*, *39*, 173–178. doi:10.1016/j.amepre.2010.03.020
- Díaz Cintas, J. (2001). *La traducción audiovisual: El subtítulado* [Audiovisual translation: Subtitling]. Salamanca: Ediciones Almar.
- Díaz Cintas, J., & Fernández Cruz, M. (2008). Using subtitled video materials for foreign language instruction. In J. Díaz Cintas (Ed.), *The didactics of audiovisual translation* (pp. 201–214). Amsterdam: John Benjamins.
- Dixon, R. A., Small, B. J., MacDonald, S. W. S., & McArdle, J. J. (2012). Yes, memory declines with aging – But when, how, and why? In M. Naveh-Benjamin (Ed.), *Memory and aging: Current issues and future directions* (pp. 325–347). New York, NY: Psychology Press.
- d'Ydewalle, G. (2002). The mind at the crossroad of multiple ongoing activities: A challenge to cognitive psychology. In L. Bäckman & C. von Hofsten (Eds.), *Psychology at the turn of the millennium, Vol. 1: Cognitive, biological, and health perspectives* (pp. 153–178). Hove: Psychology Press.
- d'Ydewalle, G., & De Bruycker, W. (2007). Eye movements of children and adults while reading television subtitles. *European Psychologist*, *12*, 196–205. doi:10.1027/1016-9040.12.3.196
- d'Ydewalle, G., & Gielen, I. (1992). Attention allocation with overlapping sound, image, and text. In K. Rayner (Ed.), *Eye movements and visual cognition: Scene perception and reading* (pp. 415–427). New York, NY: Springer-Verlag.
- d'Ydewalle, G., & Pavakanun, U. (1995). Acquisition of a second/foreign language by viewing a television program. In P. Winterhoff-Spurk (Ed.), *Psychology of media in Europe: The state of the art, perspectives for the future* (pp. 51–64). Opladen: Westdeutscher Verlag GmbH.
- d'Ydewalle, G., & Pavakanun, U. (1997). Could enjoying a movie lead to language acquisition? In P. Winterhoff-Spurk & T. Van der Voort (Eds.), *New horizons in media psychology* (pp. 145–155). Opladen: Westdeutscher Verlag GmbH.
- d'Ydewalle, G., & Van de Poel, M. (1999). Incidental foreign language acquisition by children watching subtitled television programs. *Journal of Psycholinguistic Research*, *28*, 227–244. doi:10.1023/A:1023202130625
- d'Ydewalle, G., & Van Rensbergen, J. (1989). Developmental studies of text-picture interactions in the perception of animated cartoons with text. In H. Mandl & J. R. Levin (Eds.), *Knowledge acquisition from text and pictures* (pp. 233–248). Amsterdam: Elsevier Science Publishers B.V.
- d'Ydewalle, G., Praet, C., Verfaillie, K., & Van Rensbergen, J. (1991). Watching subtitled television. Automatic reading behaviour. *Communication Research*, *18*, 650–666. doi:10.1177/009365091018005005
- d'Ydewalle, G., Van Rensbergen, J., & Pollet, J. (1987). Reading a message when the same message is available auditorily in another language: The case of subtitling. In J. K. O'Regan & A. Lévy-Schoen (Eds.), *Eye movements: From psychology to cognition* (pp. 313–321). Amsterdam: Elsevier Science Publishers B.V.
- d'Ydewalle, G., Warlop, L., & Van Rensbergen, J. (1989). Television and attention: Differences between young and older adults in the division of attention over different sources of TV information. *Medienpsychologie: Zeitschrift für Individual- und Massenkommunikation*, *1*, 42–57.
- Fisher, R. A. (1948). Combining independent tests of significance. *American Statistician*, *2*, 30.
- Fligor, B. J. (2007). Hearing loss and iPods: What happens when you turn them to 11? *Hearing Journal*, *60*(10), 10–16. doi:10.1097/01.HJ.0000295441.16133.0c
- Fox, J. R., Park, B., & Lang, A. (2007). When available resources become negative resources: The effects of cognitive overload on memory sensitivity and criterion bias. *Communication Research*, *34*, 277–296. doi:10.1177/0093650207300429
- Frieske, D. A., & Park, D. C. (1999). Memory for news in young and old adults. *Psychology and Aging*, *14*(1), 90–98. doi:10.1037/0882-7974.14.1.90
- Ghia, E. (2011). The acquisition of L2 syntax through audiovisual translation. In A. Şerban, A. Matamala, & J.-M. Lavaur (Eds.), *Audiovisual translation in close-up: Practical and theoretical approaches* (pp. 95–112). Bern: Peter Lang.

- Gottlieb, H. (1994). Subtitling: People translating people. In C. Dollerup & A. Lindegaard (Eds.), *Teaching translation and interpreting 2: Insights, aims, visions* (pp. 261–274). Amsterdam: John Benjamins.
- Gottlieb, H. (2004). Language-political implications of subtitling. In P. Orero (Ed.), *Topics in audiovisual translation* (pp.83–100). Amsterdam: John Benjamins.
- Grillo, V., & Kawin, B. (1981). Reading at the movies: Subtitles, silence and the structure of the brain. *Post Script: Essays in Film and Humanities, 1*, 25–32.
- Grimes, T. (1991). Mild auditory-visual dissonance in television news may exceed viewer attentional capacity. *Human Communication Research, 18*, 268–298. doi:10.1111/j.1468-2958.1991.tb00546.x
- Guichon, N., & McLornan, S. (2008). The effects of multimodality on L2 learners: Implications for CALL resource design. *System, 36*(1), 85–93. doi:10.1016/j.system.2007.11.005
- Incalcaterra Mc McLoughlin, L., & Lertola, J. (2011). Learn through subtitling: Subtitling as an aid to language learning. In L. Incalcaterra McLoughlin, M. Biscio, & M. Á. Ni Mhainnín (Eds.), *Audiovisual translation. Subtitles and subtitling* (pp. 243–263). Bern: Peter Lang.
- Jankowska, A. (2009). Translating humor in dubbing and subtitling. *Translation Journal, 13*. Retrieved from <http://www.bokorlang.com/journal/48humor.htm>
- Kilborn, R. (1993). ‘Speak my language’. Current attitudes to television subtitling and dubbing. *Media, Culture and Society, 15*, 641–660. doi:10.1177/016344393015004007
- Koolstra, C. M., & Beentjes, J. W. J. (1999). Children’s vocabulary acquisition in a foreign language through watching subtitled TV programs at home. *Educational Technology Research and Development, 47*(1), 51–60. doi:10.1007/BF02299476
- Koolstra, C. M., Peeters, A. L., & Spinhof, H. (2002). The pros and cons of dubbing and subtitling. *European Journal of Communication, 17*, 325–354. doi:10.1177/0267323102017003694
- Koolstra, C. M., van der Voort, T. H. A., & d’Ydewalle, G. (1999). Lengthening the presentation of subtitles on television: Effects on children’s reading time and recognition. *Communications, 24*, 407–422. doi:10.1515/comm.1999.24.4.407
- Koolstra, C. M., van der Voort, T. H. A., & van der Kamp, L. J. (1997). Television’s impact on children’s reading comprehension and decoding skills: A 3-year panel study. *Reading Research Quarterly, 32*(2), 128–152. doi:10.1598/RRQ.32.2.1
- Kothari, B. (2000). Same language subtitling on Indian television: Harnessing the power of popular culture for literacy. In K. Wilkins (Ed.), *Redeveloping communication for social change: Theory, practice and power* (pp. 135–146). New York, NY: Rowman & Littlefield.
- Kothari, B., & Takeda, J. (2000). Same language subtitling for literacy: Small change for colossal gains. In S. C. Bhatnagar & R. Schware (Eds.), *Information and communication technology in development* (pp. 176–186). New Delhi: Sage.
- Kuppens, A. H. (2010). Incidental foreign language acquisition from media exposure. *Learning, Media and Technology, 35*, 65–86. doi:10.1080/17439880903561876
- LaBerge, D., & Samuels, S. J. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology, 6*, 293–323. doi:10.1016/0010-0285(74)90015-2
- Lang, A. (1995). Defining audio/video redundancy from a limited- capacity information processing perspective. *Communication Research, 22*(1), 86–115. doi:10.1177/009365095022001004
- Lang, A. (2000). The limited capacity model of mediated message processing. *Journal of Communication, 50*(1), 46–70. doi:10.1111/j.1460-2466.2000.tb02833.x
- Lang, A. (2001). Defining audio/video redundancy from a limited-capacity information processing perspective. *Communication Research, 22*, 86–115. doi:10.1177/009365095022001004
- Lang, A., Bolls, P., Potter, R., & Kawahara, K. (1999). The effects of production pacing and arousing content on the information processing of television messages. *Journal of Broadcasting & Electronic Media, 43*, 451–475. doi:10.1080/08838159909364504
- Lang, A., Geiger, S., Strickwerda, M., & Sumner, J. (1993). The effects of related and unrelated cuts on television viewers’ attention, processing capacity, and memory. *Communication Research, 20*(1), 4–29. doi:10.1177/009365093020001001
- Lang, A., Potter, R., & Bolls, P. (1999). Something for nothing: Is visual encoding automatic? *Media Psychology, 1*, 145–164. doi:10.1207/s1532785xmep0102_4
- Lang, A., Zhou, S., Schwartz, N., Bolls, P. D., & Potter, R. F. (2000). The effects of edits on arousal, attention, and memory for television messages. *Journal of Broadcasting & Electronic Media, 44*(1), 94–109. doi:10.1207/s15506878jobem4401_7

- Lavaur, J. M., & Bairstow, D. (2011). Languages on the screen: Is film comprehension related to viewers' fluency level and to the language in the subtitles? *International Journal of Psychology*, 46, 455–462. doi:10.1080/00207594.2011.565343
- Light, L. L. (1988). Language and aging: Competence versus performance. In J. E. Birren & V. L. Bengtson (Eds.), *Emergent theories of aging* (pp. 177–213). New York, NY: Springer.
- Light, L. L. (1990). Interactions between language and memory in old age. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (3rd ed., pp. 275–290). New York, NY: Academic Press.
- Light, L. L. (2000). Memory changes in adulthood. In S. H. Qualls & N. Abeles (Eds.), *Psychology and the aging revolution: How we adapt to longer life* (pp. 73–97). Washington, DC: American Psychological Association.
- Logan, G. (1997). Automaticity and reading: Perspectives from the instance theory of automatization. *Reading & Writing Quarterly*, 13(2), 123–146. doi:10.1080/1057356970130203
- Luyken, G. (1987). In other words. (Part 2). *Cable and Satellite Europe*, 6, 57–61.
- Luyken, G. M., Herbst, T., Langham-Brown, J., Reid, H., & Spinhof, H. (1991). *Overcoming language barriers in television. Dubbing and subtitling for the European audience*. Manchester: The European Institute for the Media.
- Maihac, J. P. (2000, October). *Subtitling and dubbing, for better or for worse? The English version of Gazon Maudit*. Paper presented at the Third International Conference and Exhibition on Converging Markets and Multimedia. Berlin, Germany.
- Mangnus, J., Hoeken, H., & van Driel, H. (1994). De schaar van Wember en ondertiteling: Experimenteel onderzoek naar de informatie-overdracht van ondertitelde en Nederlands gesproken documentaires' [The scissors of Wember and subtitling: Experimental research on information processing of subtitled and Dutch spoken documentaries]. *Communicatie*, 24, 1–11.
- Marian, V. (2009). Audiovisual integration during bilingual language processing. In A. Pavlenko (Ed.), *The bilingual mental lexicon* (pp. 52–78). Clevedon: Multilingual Matters.
- Marleau, L. (1982). Les sous-titres: Un mal nécessaire. [Subtitling: A necessary evil]. *Meta*, 27, 271–285. doi:10.7202/003577ar
- Matamala, A., & Orero, P. (Eds.). (2012). *Listening to subtitles. Subtitling for the deaf and hard of hearing*. Bern: Peter Lang.
- Mera, M. (1998). Read my lips: Re-evaluating subtitling and dubbing in Europe. *Links & Letters*, 6, 73–85.
- Nir, R. (1984). Linguistic and sociolinguistic problems in the translation of imported TV films in Israel. *International Journal of the Sociology of Language*, 48, 81–97.
- O'Connel, E. (2011). Formal and casual language learning: What subtitles have to offer minority languages like Irish. In L. Incalcaterra McLoughlin, M. Biscio, & M. Á. Ní Mhainín (Eds.), *Audiovisual translation. Subtitles and subtitling* (pp. 157–175). Bern: Peter Lang.
- Peeters, A. L., Scherpenzeel, A. C., & Zantinge, J.H. (1988). *Ondertiteling of nasynchronisatie van kinderprogramma's* [Subtitling or dubbing of children's programs] (Report No. R88–425). Hilversum: NOS.
- Perego, E., Del Missier, F., Porta, M., & Mosconi, M. (2010). The cognitive effectiveness of subtitle processing. *Media Psychology*, 13, 243–272. doi:10.1080/15213269.2010.502873
- Raven, J. C. (1995). *Manual for the coloured progressive matrices* (revised). Windsor: NFER-Nelson.
- Ross, M. (2004). Hearing assistance technology: Making a world of difference. *The Hearing Journal*, 57, 12–17. doi:10.1097/01.HJ.0000324402.49520.53
- Salthouse, T. A. (2004). What and when of cognitive aging. *Current Directions in Psychological Science*, 13(4), 140–144. doi:10.1111/j.0963-7214.2004.00293.x
- Salthouse, T. A., & Babcock, R. L. (1991). Decomposing adult age differences in working memory. *Developmental Psychology*, 27, 763–776. doi:10.1037/0012-1649.27.5.763
- Salthouse, T. A., Atkinson, T. M., & Berish, D. E. (2003). Executive functioning as a potential mediator of age-related cognitive decline in normal adults. *Journal of Experimental Psychology: General*, 132, 566–594. doi:10.1037/0096-3445.132.4.566
- Schulte-Mecklenbeck, M., Kühberger, A., & Ranyard, R. (Eds.). (2010). *A Handbook of process tracing methods for decision research: A critical review and user's guide*. New York, NY: Taylor & Francis.

- Singer, T., Verhaeghen, P., Ghisletta, P., Lindenberger, U., & Baltes, P. B. (2003). The fate of cognition in very old age: Six-year longitudinal findings in the Berlin Aging Study (BASE). *Psychology and Aging, 18*, 318–331. doi:10.1037/0882-7974.18.2.318
- Spinhof, H., & Peeters, A. L. (1999). *Opinies over nasynchroniseren en ondertitelen* [Opinions about dubbing and subtitling]. (Report No. P99–160). Hilversum: NOS.
- Stine, E. A., Wingfield, A., & Myers, S. D. (1990). Age differences in processing information from television news: The effects of bisensory augmentation. *Journal of Gerontology, 45*, 1–8. doi:10.1093/geronj/45.1.P1
- Thurstone, T. G., & Thurstone, L. L. (1963). *Primary mental ability*. Chicago, IL: Science Research Associates.
- Tonla Briquet, G. (1979). *Investigation into the subtitling of film and TV* (Unpublished thesis). Higher Governments Institute for Translators and Interpreters, Brussels, Belgium.
- Van de Poel, M., & d'Ydewalle, G. (2001). Incidental foreign-language acquisition by children watching subtitled television programs. In Y. Gambier & H. Gottlieb (Eds.), *(Multi)media translation. Concepts, practices, and research* (pp. 259–273). Amsterdam: John Benjamins.
- Van Lommel, S., Laenen, A., & d'Ydewalle, G. (2006). Foreign-grammar acquisition while watching subtitled television programmes. *British Journal of Educational Psychology, 76*, 243–258. doi:10.1348/000709905X38946
- von Feilitzen, C., Filipson, L., & Schyller, I. (1979). *Open your eyes to children's viewing*. Stockholm: Sveriges Radios Förlag.
- Winneke, A. H., & Phillips, N. A. (2009, September). *Older and younger adults use fewer neural resources during audiovisual than during auditory speech perception*. Paper presented at the International Conference on Audiovisual Speech Processing. University of East Anglia, Norwich, UK.
- Wissmath, B., Weibel, D., & Groner, R. (2009). Dubbing or subtitling? Effects on spatial presence, transportation, flow, and enjoyment. *Journal of Media Psychology, 21*, 114–125. doi:10.1027/1864-1105.21.3.114