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Using humour as an extrinsic source of emotion regulation in young and older adults

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It has been suggested that intrinsic abilities for regulating emotions remain stable or improve with ageing, but, to date, no studies have examined age-related differences in extrinsic emotion regulation. Since humour has been found to be an effective form of emotion regulation, we used a paradigm similar to that of Strick and colleagues (2009) with two objectives: to compare extrinsic humorous emotion regulation in young and older adults and to test whether the potential beneficial effect of humour on negative emotion is better explained by the cognitive distraction hypothesis or by the positive affect elicitation hypothesis. To this end, neutral, moderately, and strongly negative pictures followed by humorous, simply positive, or weird cartoons, controlled for both their funniness and cognitive demands, were presented to 26 young and 25 older adults with the instruction to report their negative feelings. When induced to feel moderately negative emotions, both young and older adults reported a lower negative feeling after viewing the humorous cartoons than after the other ones. This indicates that the extrinsic humorous emotion regulation skill remains stable with ageing and suggests that the beneficial effect of humour on emotional feeling cannot be seen as a purely cognitive distraction.

Keywords: Extrinsic emotion regulation; Humour; Ageing; Cognitive distraction.

Emotion regulation and ageing

At first sight, people may think that old age is not a very funny period of life, especially because older adults are frequently faced with loneliness and death of loved ones and are particularly vulnerable to health problems. Paradoxically, a number of studies have established that normal ageing is associated with an enhancement of positive affect (e.g., Consedine & Magai, 2006; Gross et al., 1997; Lawton, 2001; Mroczek & Kolarz, 1998). For instance, older adults generally describe their lives as characterized by a reduction in the daily experience of negative emotions (e.g., Charles, Reynolds, & Gatz, 2001; Mroczek & Kolarz, 1998) and show an overall increase in reported well-being compared to young and middle-aged adults (Consedine & Magai, 2006). Furthermore, whereas young and middle-aged adults tend to preferentially process negative stimuli over positive ones (called "negativity bias", Rozin & Royzman, 2001), there is empirical evidence for a reversal phenomenon in older adults, who show a reduced negativity effect, especially in memory tasks (see Murphy & Isaacowitz, 2008, for a meta-analysis).

The most common theory used to explain these findings is known as the socioemotional selectivity theory (SST; Charles & Carstensen, 2009). According to this theoretical model, the affective changes observed in late life-span development would be the result of a motivational shift

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towards emotionally meaningful goals due to an increased awareness of the limited perspective of time. As a result, older adults would be more focused than young adults on emotion-directed goals such as the search for positive emotions, which would represent a potential emotion regulation strategy to maintain high levels of well-being. The idea that emotion regulation improves with age has recently begun to be tested, providing a small amount of data predominantly focused on the abilities to *intrinsically* regulate emotions elicited by visual stimuli (Kunzmann & Richter, 2009; Opitz, Rauch, Terry, & Urry, 2012; Phillips, Henry, Hosie, & Milne, 2008; Shiota & Levenson, 2009). These data paint a mixed picture, emphasizing the existence of different age-related differences on the abilities to implement different strategies for emotion regulation. When compared to young adults, older adults show preserved abilities to suppress their emotion-expressive behaviour (Kunzmann, Kupperbusch, & Levenson, 2005; Magai, Consedine, Krivoshekova, Kudadjie-Gyamfi, & McPherson, 2006; Phillips et al., 2008; Shiota & Levenson, 2009), but are not always successful in using cognitive reappraisal to decrease unpleasant emotions (Opitz et al., 2012; Shiota & Levenson, 2009). Further research also demonstrated that the functional effectiveness of older adults' brain structures involved in the cognitive control of emotions depends on underlying cognitive ability (Winecoff, LaBar, Madden, Cabeza, & Huettel, 2010), corroborating the view that cognitive decline associated to later stages of adulthood (Craik & Salthouse, 2007) may affect older adults' ability to regulate emotions.

Humour as an extrinsic source of emotion regulation

As outlined by Gross and Thompson (2007), emotion regulation, defined as a various set of processes by which emotions are regulated, is not limited to the way an individual *intrinsically* regulates his own emotions. It also includes *extrinsic* regulatory processes that are considered as essential as the intrinsic regulation to change the latency, rise time, magnitude, and duration of the emotional response. Extrinsic forms of emotion regulation may result from environmental events (e.g., a distracting stimulus) or the behaviour of others (e.g., the social support of friends), which are extrinsic resources in the environment susceptible to aid in emotion regulation. Although they are considered as ecological forms of regulation in adults, no research has been yet done on the effect of ageing on these processes.

Amongst the various types of extrinsic emotion regulation, one powerful source has been found to be humour (Samson & Gross, 2012; Strick, Holland, Van Baaren, & Van Knippenberg, 2009). Research has shown that the induction of humour in experimental conditions can reduce negative feelings (Danzer, Dale, & Klions, 1990; Moran, 1996; Szabo, 2003; Yovetich, Dale, & Hudak, 1990). Watching funny movies reduces the anxiety (Moran, 1996) and has a greater distracting effect than an aerobic session (Szabo, 2003). Humorous stimuli have also been found to reduce stress induced by the anticipation of an electric shock (Yovetich et al., 1990). It is likely that multiple mechanisms are involved in humorous extrinsic regulation, but the respective influence of these distinct mechanisms is still debated. Some hypotheses have been offered, considering humour as a source of positive emotions able to facilitate distancing from negative emotions and then reducing them (Apter & Smith, 1977; Caron, 2002; Frederickson & Levenson, 1998; Samson & Gross, 2012). Apter and Smith (1977) have argued that humour allows one to re-evaluate the gravity of a situation and thus to distance oneself from the sources of negative emotions. According to Caron (2002), humour is a specific way to induce the positive emotion of mirth, a playful emotion that enables coping with negative situations. Such explanations emphasize the possibility that the beneficial effect of humour (the reduction of negative feelings) could create the conditions for a positive mood and provide greater facility for dealing with negative situations.

Alternatively, a dominant cognitive approach in the literature has suggested that the processing of

incongruity, inherent to humorous stimuli, may lead to a reduction of resources allocated to the processing of negative emotions (cognitive distraction hypothesis; Strick et al., 2009; Strick, Holland, van Baaren, & van Knippenberg, 2010). In their attempt to explain how humour can be used to cope with negative emotions in young adults, Strick et al. (2009) postulated that humorous emotion regulation could be an effect of cognitive distraction. This hypothesis was based on the observation that cognitively demanding tasks, such as the resolution of a mathematical problem, could reduce negative feelings previously induced by negative pictures (Van Dillen & Koole, 2007). In the literature on humour, the dominant theoretical model of incongruity-resolution (Suls, 1983) states that the understanding of humour relies on the cognitive resolution of the incongruity inherent to the humorous stimuli (e.g., a joke). As a result, the understanding of humorous stimuli would need more attentional resources than other categories of stimuli (e.g., a positive picture). Strick et al. (2009) went one step further, hypothesizing that the resolution of the incongruity in humorous stimuli would distract participants from thoughts related to negative emotions, thereby reducing their negative feelings. In their experiment, young participants were faced with either strong or moderate negatively valenced IAPS (International Affective Pictures System; Lang, Bradley, & Cuthbert, 2008) pictures[1] followed by humorous or simply positive cartoons equated for their positivity but distinctive in terms of the resources demanded (i.e., the humorous cartoons were found to be more distracting than the simply positive ones when presented during a digit-span task). To reduce the awareness of the beneficial effects of humour on subjective experience, the participants were told that the experiment aimed to evaluate how much they liked a coloured square after each trial. Results showed a lower level of negative feeling when the negative induction was followed by humorous cartoons rather than by the simply positive ones. The authors concluded that such difference might be related to the change in terms of cognitive load required to understand each of the two types of stimuli (humorous cartoons vs. simply positive ones) and argued that the more costly a stimulus is in attentional resources, the more likely it is to have a distracting effect and be able to attenuate the negative feeling. A closer examination of this study indicates that these data do not provide definitive evidence for the cognitive distraction hypothesis. Indeed, the effect of the humorous stimuli was not compared to the effect of a set of incongruous (but not humorous) stimuli controlled to be equal or greater in terms of cognitive load. Making such comparison would have allowed testing the cognitive distraction hypothesis that would has postulated an equivalent beneficial effect of both these stimuli on negative emotions. Hence, the question of how an extrinsic source such as humour could help to cope with negative emotions remains open.

Current research

In this context, we thought that investigating the extrinsic humorous emotion regulation among older adults could be of particular interest for at least two reasons. First, such examination should provide new insights into how the elderly can cope with negative emotions. Second, we have the intuition that the age-related changes observed in both cognitive and affective domains should help to test alternative hypotheses regarding the very nature of the mechanisms that are involved in extrinsic humorous emotion regulation. As ageing is associated with a decrease in the abilities to inhibit unrelated stimulation (Craik & Salthouse, 2007) and a greater susceptibility to cognitive distraction (Carlson, Hasher, Connelly, & Zacks, 1995; Tun, O'Kane, & Wingfield, 2002) as well as a tendency to allocate a greater attention to positive stimuli than to negative ones (Carstensen & Mikels, 2005; Charles, Mather, & Carstensen, 2003; Mather & Carstensen, 2003, 2005), age group comparison should allow testing of the

[1]The IAPS pictures have been widely used in ageing-oriented research on emotion, given evidence that the intentional unpleasant emotional state was successful elicited in different age groups (e.g., Opitz et al., 2012; Winecoff et al., 2010)

cognitive distraction versus positive affect elicitation hypotheses.

In the present study, we used a paradigm similar to that of Strick et al. (2009) and went one step further by introducing a new condition with incongruous material with a twofold purpose. Participants were first placed in an emotion induction phase, with a strongly negative, a moderately negative, or a neutral picture taken from the IAPS (Lang et al., 2008). Then, in an emotion regulation phase, they were presented with a humorous, a simply positive, or a weird cartoon with the instruction to assess their negative feeling on a 10-point scale. This was designed to investigate the extent to which each of the three categories of cartoons (i.e., humorous, simply positive, weird) was able to down-regulate a negative emotion previously induced by the pictures. Finally, the participants were asked to judge how much they enjoyed a coloured square. This instruction was given to disguise the hypothesis under investigation and thus ensure as much as possible an extrinsic emotion regulation. All cartoons were taken from Schmidt (2002) and consisted of original stimuli (i.e., humorous) that were retouched to be presented as (a) a simply positive version created to be easily understood, positive but not really funny, and (b) a weird version created to be incongruous and not funny. The cognitive load required to understand each of these three categories of cartoons was controlled to ensure that the weird cartoons were more costly than the humorous ones in cognitive resources since the aim was to determine the respective effect of humour and cognitive load factors on extrinsic emotion regulation.

Although no previous studies have attempted to predict the interaction between advancing age and humour on down-regulation processes of negative feelings, the literature on ageing allows some predictions to be made. As mentioned above, ageing is associated with a decrease in the abilities to inhibit unrelated stimulation (Craik & Salthouse, 2007) and, at the same time, a greater susceptibility to cognitive distraction (Carlson et al., 1995; Tun et al., 2002). Given these age-related changes in cognitive domain and with the hypothesis that humorous emotion regulation is an effect of cognitive distraction, older adults would be more easily distracted from their negative emotions by nonrelevant stimuli, in particular stimuli producing greater distraction elicited by their higher level of incongruity (i.e., weird stimuli). Thus, it would be expected that, compared to young adults, when a negative emotion is induced, older adults would report a lower negative feeling after viewing weird cartoons than after viewing simply positive or humorous ones. Alternatively, given the age-related changes in the affective domain (i.e., positivity bias) and with the hypothesis that humorous emotion regulation is a result of positive affect elicitation, older adults who tend to allocate greater attention to positive stimuli, in particular those that produce greater funniness, should take advantage from humorous stimuli for dealing with negative emotions. Consequently, it would be expected that compared to young adults and in a condition when a negative emotion is induced, older adults would report a lower negative feeling after viewing humorous cartoons than after viewing simply positive ones, which in turn would have a greater effect on negative emotion reduction than that of incongruous cartoons.

Method

Participants

Thirty young adults and 25 older adults participated in the experiment and were recruited without financial compensation. The young adults were psychology undergraduate and graduate students at the University of Franche-Comté. The older adults came from several local communities in Besançon, including universities for senior citizens. Four young participants were excluded from the analysis because of their high levels of state-anxiety (standard scores higher than 55 on State–Trait Anxiety Inventory Form Y, STAI–Y, corresponding to high anxiety; Spielberger, Bruchon-Schweitzer, & Paulhan, 1993) and/or depression (scores above 27 on Beck Depression Inventory–II, BDI–II; Beck, Steer, & Brown,

1998). Four more young participants were also discarded from the analysis because they were insensitive to the emotion manipulation (their mean score on the negative feeling scale was inferior to 1 whatever the experiment condition). As a result, the data of 22 young adults and 25 older adults (ranging in age from 56 to 82 years, $M =$ 67 years, 56% women) were analysed. As shown in Table 1 and as expected, young adults had better performances than older adults on the Advanced Progressive Matrices, Set 1 (Raven, Raven, & Court, 2003), $t(45) = -3.87$, $p < .05$, on the Letter–Number Sequencing subtest of the Wechsler Adult Intelligence Scale–Third Edition (WAIS–III), $t(45) = -2.54$, $p < .05$, and on the spatial memory subtest of the Wechsler Memory Scale–Third Edition (WMS–III), $t(45) = -6.72$, $p < .001$. Depression assessment (Beck et al., 1998) did not differ significantly between age groups, $t(45) = -1.84$, $p = .07$. However, young adults showed higher levels of state anxiety, $t(45) = -2.64$, $p < .05$, and trait anxiety, $t(45) = -4.20$, $p < .001$, in the STAI–Y test (Spielberger et al., 1993) than older adults. The Mini Mental State Examination (MMSE, Derouesne et al., 1999) scores for the older adults ranged from 27 to 30 with a mean score of 29, suggesting no cognitive impairment.

Materials

Emotion induction. Thirty-six emotional pictures taken from the IAPS (Lang et al., 2008) and controlled for their valence and arousal were used for the emotion induction procedure (see Appendix). These pictures were selected on the basis of young and older adults' ratings (on a 7-point scale) provided by Grühn, Schiebe, and Baltes (2007) in order to create three emotion induction conditions: (a) a neutral condition with 12 neutral pictures (mean scores of valence ranged from 4.58 to 5.19 for older adults and from 4.07 to 4.88 for young adults); (b) a moderate negative condition with 12 moderately negative pictures (mean scores of valence ranged from 2.26 to 3.46 for older adults and from 2.52 to 3.63 for young adults); and (c) a strong negative condition with 12 strongly negative pictures (mean scores of valence ranged from 1.63 to 2.65 for older adults and from 1.42 to 2.58 for young adults). For each emotion induction category, we ensured that the mean score of arousal rating was not significantly different between age groups [for neutral, $t(22) = 0.791$, $p = .44$, for moderately negative, $t(22) = 0.219$, $p = .83$, and for strongly negative, $t(22) = -1.39$, $p = .18$]. The neutral pictures depicted various contents like landscapes, architecture, common objects, or people with neutral expressions. The moderately negative pictures showed various unpleasant contents such as disabled children, war and misery scenes, dead animals, or drug addicts. The strongly negative pictures portrayed more explicitly violent or shocking scenes such as dead bodies, mutilations, or starving people.

Emotion regulation. The experimental material consisted of black and white humorous cartoons drawn by Larson (1985, 1987, 1988) and retouched by Schmidt (2002) to constitute three versions of each cartoon. The humorous version of the cartoons corresponded to the original cartoons. The simply positive version of the cartoons was created by removing or changing humorous elements in the original version (i.e., humorous cartoons), so that the caption was no longer funny. The weird version was created by adding incongruent elements to the original version (i.e., humorous cartoons) so that the caption appeared strange and was no longer funny. For example, a humorous picture depicts a dog lying on a couch, in consultation with a psychologist, with below the caption: "It's the postman, he terrifies me … ." In the simply positive version of the cartoon, the dog was replaced with a man, whereas in the weird version, a cow appeared instead of man. For each cartoon, all of the versions presented contained exactly the same caption, which was translated into French from the original cartoons using the reverse translation method. Two separate pilot studies were conducted on 36 cartoons (12 humorous, 12 simply positive, 12 weird) with two purposes: to determine the main features of the cartoons, and to control the cognitive load of

Table 1. *Sample characteristics*

Characteristic		*Age group*	
		Young (22)	*Older (25)*
Demographic characteristics			
	Age (years)	23 (4)	67 (8)
	Sex (% women)	55	56
	Education (years)	15 (1.84)	11 (3.01)
Self-reported health (max. 5)		4.4 (0.65)	3.9 (0.78)
Cognitive scores			
	Advanced Progessive Matrices (Set 1, max. 12)**	10.00 (1.63)	7.56 (2.55)
	Letter–Number Sequencing (max. 21)*	12.77 (2.67)	10.56 (1.49)
	MMSE (max. 30)	—	29 (.97)
Affective scores			
	Depression (BDI–II, max. 63)	10.82 (5.81)	7.80 (4.79)
	State Anxiety (STAI–Y, max. 80)**	32.55 (8.86)	26.96 (5.44)
	Trait Anxiety (STAI–Y, max. 80)**	40.45 (6.40)	33.52 (4.9)

Note: Standard deviations are listed in parentheses. MMSE = Mini-Mental State Examination; BDI–II = Beck Depression Inventory–II; STAI–Y = State–Trait Anxiety Inventory Form Y.
*Significant difference at $p < .05$.
**Significant difference at $p < .001$.

their different versions (simply positive, humorous, weird). In the first pilot study, the 36 cartoons were presented to 18 young adults (ranging in age from 19 to 25 years, $M = 20$ years, 50% women) and 18 older adults (ranging in age from 59 to 87 years, $M = 69$ years, 79% women). The mean rating and the time required for the participants to evaluate the extent to which each cartoon was easy to understand on a scale going from 0 "not at all easy to understand" to 9 "extremely easy to understand" were recorded. The participants were also asked to indicate the extent to which each of the cartoons were funny, from 0 "not at all funny" to 9 "extremely funny"; weird, from 0 "not at all weird" to 9 "extremely weird"; and positive, from 0 "not at all positive" to 9 "extremely positive". As shown in Table 2 and confirmed by a repeated measures analysis of variance (ANOVA) including age group as a between-subjects factor and cartoon version as a within-subject factor, there was no significant effect of age group, except for the assessment, $F(1, 38) = 11.69$, $p < .001$, $\eta_p^2 = .26$, and the response time, $F(1, 38) = 8.18$, $p < .05$, $\eta_p^2 = .18$, when understanding the cartoons. The young adults had a greater and a quicker understanding of the stimuli than the older adults. Importantly, the mean score of understanding for the older adults remained higher than the median value (4.5), indicating that the older adults were able to fully understand the experimental material. There was also a significant effect of cartoons for all the dependent variables. As shown in Table 2 and confirmed by post hoc Bonferroni test comparisons, the weird cartoons were judged as less easy to understand than the humorous ones ($p < .001$) and the simply positive cartoons ($p < .001$), respectively, $F(2, 76) = 54.27$, $p < .001$, $\eta_p^2 = .59$. No significant difference was observed between the humorous and the simply positive version on the level of understanding. In line with this, more time was required to understand the weird cartoons than the humorous ($p < .001$) and the simply positive ones ($p < .05$), respectively, $F(2, 76) = 10.37$, $p < .001$, $\eta_p^2 = .21$. Moreover, the simply positive cartoons were understood as quickly as the humorous ones. The humorous cartoons were judged as funnier than the simply positive ($p < .001$) and the weird ones ($p < .001$), respectively, while the simply positive cartoons were judged as funnier than the weird ones ($p < .001$), $F(2, 76) = 130.61$, $p < .001$, $\eta_p^2 = .77$.[2] The weird cartoons were judged as weirder than the humorous ones

Table 2. *Mean ratings and performances from pilot study*

	Cartoon version										
	Humorous			*Simply positive*			*Weird*				
Characteristic	*Young*	*Older*	p[a]	*Young*	*Older*	p[a]	*Young*	*Older*	p[a]	*Age group* p[b]	*Cartoons version* p[c]
Understanding (max. 9)	7.58 (0.29)	5.75 (0.29)	*ns*	6.69 (0.33)	5.66 (0.35)	*ns*	5.15 (0.39)	3.83 (0.39)	*ns*	<.05	<.001
Understanding RT (ms)	7,503 (711)	13,020 (711)	*ns*	8,817 (909)	13,487 (909)	*ns*	10,093 (930)	14,410 (930)	*ns*	<.001	<.001
Funniness (max. 9)	6.83 (0.35)	5.47 (0.35)	*ns*	2.28 (0.35)	3.44 (0.35)	*ns*	3.15 (0.43)	4.24 (0.43)	*ns*	.47	<.001
Weirdness (max. 9)	5.13 (0.41)	5.97 (0.41)	*ns*	2.70 (0.37)	3.97 (0.38)	*ns*	7.05 (0.36)	6.10 (0.36)	*ns*	.39	<.001
Positivity (max. 9)	4.38 (0.33)	4.20 (0.33)	*ns*	4.12 (0.34)	4.73 (0.34)	*ns*	3.52 (0.34)	4.10 (0.34)	*ns*	.43	<.05

Note: From Pilot Study 1. Unpooled standard errors in parentheses. RT = reaction time; *ns* = not significant.
[a]*p*-value refers to the post hoc Bonferroni pairwise comparisons test. [b]*p*-value refers to the main effect of age group. [c]*p*-value refers to the main effect of cartoon version.

($p < .001$), which in turn were judged as weirder than the simply positive version ($p < .001$), $F(2, 76) = 73.12$, $p < .001$, $\eta_p^2 = .66$. Finally, the weird cartoons were judged as less positive ($p < .001$) than the simply positive ($p < .001$) and the humorous ones, respectively, $F(2, 76) = 6.21$, $p < .05$, $\eta_p^2 = .14$ (see Footnote 2). Importantly, the simply positive cartoons were judged as equally as positive as the humorous ones.

In the second pilot study, a dual-task paradigm was used to obtain a more objective measurement of the cognitive demand required by the different versions of the cartoons (i.e., humorous, simply positive, weird). We expected that the cognitive resources needed for understanding the weird cartoons would be higher than those required for understanding the simply positive version, and at least as costly as those needed for the humorous one. Thirty new younger participants (ranging in age from 18 to 28 years, $M = 22$ years, 66% women) were asked to identify visual targets (i.e., red crosses with either a diagonal or a vertical orientation) located in 66 different places in each cartoon, which were then presented twice for 6 s in a random order. The targets were displayed at variable onset time (from 1 s to 4 s). The participants were instructed to identify the visual target as quickly as possible by pressing one of two corresponding keys and, at the same time, to watch the cartoons attentively in order to understand them as best as possible. To make sure that the participants were not completely absorbed by the target identification task, they were asked after each trial to rate the extent to which each stimulus was easily understandable, from 0 "not at all easy to understand" to 9 "extremely easy to understand". As expected, item analysis showed a significant main effect of the cartoon version on response accuracy, $F(2, 33) = 4.40$, $p < .05$, $\eta_p^2 = .21$. Simple contrasts confirmed that the mean percentage of correct response was significantly lower during the presentation of the weird cartoons (86%) than during the presentation of the humorous versions (92%), $F(1, 33) = 8.43$, $p < .05$, $\eta_p^2 = .20$. The mean percentage of correct response was also lower, and almost statistically significant, during the presentation of the weird cartoons (86%) than during the presentation of the simply positive ones (90%), $F(1, 33) = 3.91$,

[2]Significant Age Group × Cartoon Version interactions were found on both funniness ratings, $F(2, 76) = 21.42$, $p < .001$, $\eta_p^2 = .36$, and on weirdness ratings, $F(2, 78) = 9.21$, $p < .001$, $\eta_p^2 = .20$. Post hoc Bonferroni test comparisons did not show significant pairwise differences between age group depending on the cartoon version.

$p = .06$, $\eta_p^2 = .12$. The mean number of correct responses did not differ between the simply positive and the humorous cartoons, $F(1, 33) = 0.86$, $p = .36$. The results also showed a significant main effect of the cartoon version on the mean correct reaction times (RTs) for target identification, $F(2, 33) = 5.50$, $p < .05$, $\eta_p^2 = .25$. Simple contrasts confirmed that mean correct RTs were longer in the weird version (1309 ms) than in the simply positive (1157 ms), $F(1, 33) = 10.13$, $p < .05$, $\eta_p^2 = .23$, and in the humorous one (1194 ms), $F(1, 33) = 5.75$, $p < .05$, $\eta_p^2 = .15$. The simply positive and the humorous versions did not differ significantly between each other, $F(1, 33) = 0.62$, $p = .44$. Taken together, these results gave evidence that the cognitive load required by the weird cartoons was higher than the one required by the simply positive and the humorous ones. Moreover, and importantly, the humorous version did not require much more cognitive resources to be understood than did the simply positive one.

Procedure

The experiment was divided into two sessions conducted with an interval of approximately one week. During the first session, the participants completed a consent form and were asked about their age, educational level, self-reported health, visual acuity, and medical history. The participants also carried out three cognitive tasks: a fluid intelligence task (Raven's Advanced Progressive Matrices, Set I, Raven et al., 2003), a working memory task (The Letter Number Sequencing subtest of the WAIS–III), and a spatial memory task (Spatial Memory Test, WMS–III). They were then asked to complete depression (BDI–II, Beck et al., 1998) and anxiety (STAI–Y, Spielberger et al., 1993) inventories. Finally, the older participants were asked to complete the Mini Mental State Examination (i.e., common screening test for dementia). This session lasted about an hour.

During the second session, the participants were tested individually in a quiet room in the presence of the experimenter. Stimuli were presented using E-Prime 2.0 software (Psychology Software Tools, Pittsburgh; Schneider, Eschman, & Zuccolotto, 2002). The participants were informed that the goal of the study was to examine the effect of emotion on colour perception, so that they would not deliberately attempt to modulate their affective feelings.

The participants were presented with a total of 36 trials, which included an emotion induction phase immediately followed by an emotion regulation phase. Two additional practice trials were included for training. For each trial, an emotion induction picture from the IAPS was presented for 4 s followed immediately by an emotion regulation cartoon for 12 s.[3] Thirty-six pairs of stimuli were created associating an induction picture (i.e., neutral, moderately negative, strongly negative) and a cartoon (i.e., humorous, simply positive, weird) so that three different stimuli of each induction category (i.e., neutral, moderately negative, strongly negative) were associated with one of the three cartoon versions (i.e., humorous, simply positive, weird). These pairs were then presented to the participants in a random order. For each trial, the participants were asked to look at the picture and the cartoon successively and then to assess the extent to which they experienced a negative feeling on a one-dimensional 10-point scale ranging from 0 "not at all negative" to 9 "completely negative". Immediately after the negative feeling rating, the participants had to rate the extent to which they liked a coloured square on a 10-point scale ranging from 0 "not at all" to 9 "very much". The coloured squares were presented in three shades of blue, grey, green, and red. Each trial ended with a blank screen for 4 s, after which the participants had to begin the next trial when they judged themselves ready.

Results

Negative feeling ratings

A repeated measures ANOVA was conducted on the participants' negative feeling ratings with age group as a between-subjects factor and emotion induction (i.e., neutral, moderately negative, strongly negative) and emotion regulation (i.e.,

[3]Pilot Study 1 gave evidence that 12 s is enough to fully understand cartoons in both age groups.

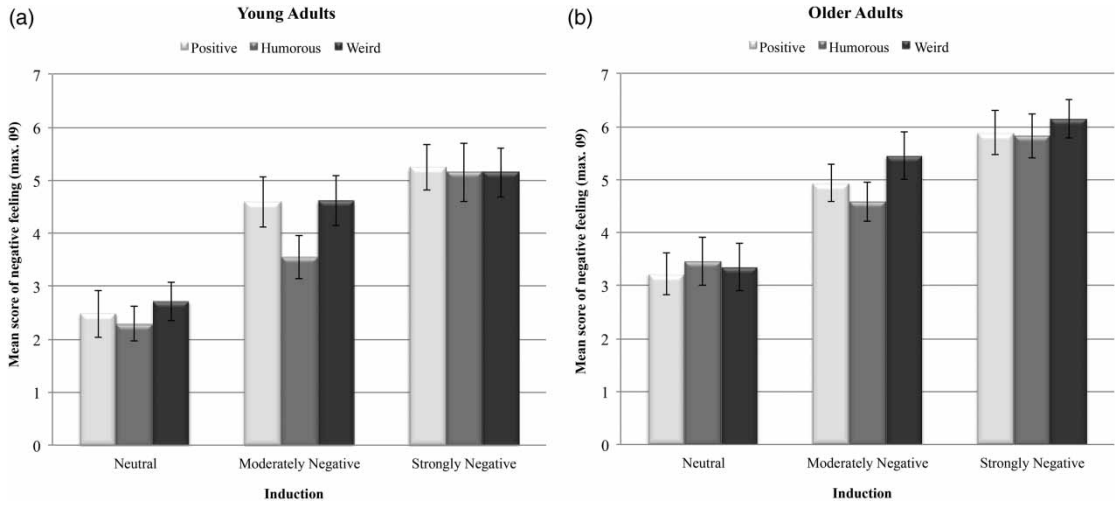

Figure 1. *Mean score of negative feeling and standard deviation as a function of emotion induction (i.e., neutral, moderately negative and strongly negative IAPS pictures) and emotion regulation (i.e., simply positive, humorous, and weird cartoons) for younger and older adults.*

humorous, simply positive, weird) as within-subject factors.

As expected, a main effect of emotion induction was observed, $F(2, 90) = 74.31$, $p < .001$, $\eta_p^2 = .62$, indicating that the higher the negative emotional induction, the higher the reported negative feeling. This was confirmed by post hoc Bonferroni test comparisons ($ps < .001$). There was also a main effect of emotion regulation, $F(2, 90) = 5.51$, $p < .05$, $\eta_p^2 = .11$, as well as an Emotion Induction × Emotion Regulation interaction, $F(4, 180) = 3.12$, $p < .05$, $\eta_p^2 = .06$. No other significant main effect or interaction was found. As shown in Figure 1(a) and 1(b), and confirmed by simple contrasts effect, when moderately negative emotions were induced, the young and the older participants both showed a lower negative feeling after being exposed to the humorous cartoons than after being exposed to the simply positive, $F(1, 45) = 12.53$, $p < .001$, $\eta_p^2 = .22$, or to the weird ones, $F(1, 45) = 17.64$, $p < .001$, $\eta_p^2 = .28$. No significant difference was observed between simply positive and weird cartoons, $F(1, 45) = 2.88$, $p = .10$. In the two other conditions of regulation (i.e., neutral, strongly negative), the mean score of negative feeling did not significantly vary as a function of emotion regulation.

The role of cognitive factors and reported anxiety on the reported negative feeling

In order to control the role of cognitive and affective factors on the reported negative feeling, we computed a set of Pearson correlations between negative feeling ratings in the three conditions of emotion regulation (i.e., humorous, simply positive, weird) in the moderately negative induction condition and the mean scores of fluid intelligence (Raven's matrices), working memory performances (Letter–Number Sequencing), spatial memory performances (Spatial Memory Task), and reported anxiety (State and Trait), which are the factors for which significant differences have been observed between age groups. No significant relationship was observed between the affective or cognitive characteristics and the negative feeling ratings, whatever the emotion regulation.

The role of cartoon features on the reported negative feeling

In order to control the potential link between the reported negative feeling observed in the main experiment and the different features of the cartoons (i.e., understanding, funniness, weirdness, and positivity) previously assessed in Pilot Study 1 for each version (i.e., humorous, simply positive,

weird), we computed a set of item analyses. For each age group, a Pearson correlation was computed between the mean score of negative feeling and the mean score of understanding, funniness, weirdness, and positivity rating for each cartoon. No significant correlation was found either in young adults or in older adults.

Discussion

In this study, we used an experimental design similar to the one used by Strick et al. (2009) with the aim of investigating the effect of age on the way humorous, simply positive, and incongruous cartoons can reduce a negative feeling previously induced by negative pictures. Our second goal was to use such age group comparison in order to test whether Strick et al. (2009)'s cognitive distraction hypothesis could fully account for the extrinsic humorous emotion regulation phenomenon. To this end, we measured the negative feeling reported by young and older adults after an emotion induction phase (i.e., neutral, moderately negative, and strongly negative pictures) immediately followed by an emotion regulation phase (i.e., humorous cartoons judged as funnier than the others, simply positive and weird cartoons judged as not funny but characterized by a higher cognitive load than the other cartoons).

An interesting finding of the present research is that when a moderately negative emotion is induced, young and older adults both reported stronger down-regulation of their negative feeling after being presented with the humorous cartoons than after being presented with the simply positive or the weird ones. First of all, this beneficial effect of humour confirms what we previously demonstrated in the first pilot study, namely that older adults are still quite able to fully comprehend and appreciate the humorous material used in the present study. Second, the lack of an age effect on the reported negative feeling following the humorous extrinsic source of emotion regulation corroborates neither the hypothesis that ageing would be associated with more effective extrinsic emotion regulation due to greater cognitive distractibility (e.g., Carlson et al., 1995; Tun et al., 2002), nor the findings that when a negative mood is induced, older adults would focus more on a source of pleasurable experience than their younger counterparts (Isaacowitz, Toner, Goren, & Wilson 2008). As we failed to reject the null hypothesis, these results need to be interpreted with caution. However, considering the whole pattern of results independently of the age difference, it parallels the lack of cognitive distraction effect observed in older adults.

When compared to incongruous stimuli (i.e., weird cartoons that were controlled to require more cognitive resources and therefore were more likely to elicit cognitive distraction), our findings showed that humorous cartoons work more effectively as a source of down-regulation of negative feelings in both young and older adults. This result does not corroborate the cognitive distraction hypothesis (Strick et al., 2009; Van Dillen & Koole, 2007) according to which the beneficial effect of humour on a reported negative feeling is primarily due to the high cognitive load needed to understand the cartoons. This latter hypothesis assumes that weird cartoons would be more effective to reduce negative feelings. Nevertheless, we did not find any evidence for this cognitive distraction effect. As a result, the cognitive load required to understand the humorous cartoons cannot be considered as the sole factor that can explain extrinsic emotion regulation processes in young and older adults.

Some theoretical descriptions of humour, especially those of Caron (2002), Dixon (1980), and Apter and Smith (1977), postulate that humour might be a way to reappraise negative events in a funny and, consequently, more positive way. In the present study, it might be thought that the emotion regulation effect is the result of the positive emotional response elicited by the appreciation of humour (i.e., mirth), which is in agreement with previous findings showing that the feeling of positive emotions is a way to reduce negative ones (Frederickson & Levenson, 1998). Such hypothesis would predict that older adults show a more successful down-regulation of negative feelings when presented with extrinsic humorous cartoons than do their younger counterparts. However, our

results failed to demonstrate such age-related differences.

Among another potential explanatory factors, some empirical evidence exists to support the claim that positive emotions broaden the scope of attention to facilitate the encoding of irrelevant information in the environment (e.g., Biss & Hasher, 2011; Fredrickson & Branigan, 2005). According to this view, because of the effect of elicited positive emotions on attention, humour might distract attention from thoughts related to negative feelings. However, given that negative feeling of participants did not correlate with any of the cartoon features (i.e., understanding, funniness, weirdness, and positivity), it remains difficult to conclude about the very nature of the underlying mechanism. Maybe the beneficial effect of humour is mediated by several mechanisms at play. More research is needed to draw conclusions about this issue. More especially, further study should be conducted to determine whether the beneficial effect of the humorous cartoons might somewhat be linked to an indirect cognitive factor corresponding to an attentional broadening. Recently, Steinmetz, Muscatell, and Kensinger (2010) have suggested that the broadening of attention may happen in the same manner for both young and older adults (see also Didierjean, Maquestiaux, Vieillard, Ruthruff, & Hartley, 2013). If so, the fact that the beneficial influence of humour on a reported negative feeling was the same in older adults as in young adults would be no longer surprising.

The present findings showed that extrinsic down-regulation was observed only in moderately negative induction, whereas previous research by Strick et al. (2009) found a beneficial effect of humour on emotion regulation in both the mildly and the strongly negative emotion conditions. One possible explanation would be that in a situation in which participants were faced with strong negative pictures, humorous stimuli could lose their protective function and appear as inappropriate or even hurtful. However, when comparing the emotional valence (IAPS norms) of the visual material we observed that pictures selected by Strick et al. (2009) were more negative in overall than those used in the current research. Therefore, the differences between the present results and those reported by Strick et al. (2009) are hardly explained by the selection of the IAPS pictures. Another possible explanation would be that different forms of humour would have different effects on the emotional state. Samson and Gross (2012) have shown that positive humour (i.e., nonhostile) have to be distinguished from negative humour (i.e., ironic, aggressive) in that it allows people to reinterpret and look on the bright side of a negative event. Given such a hypothesis, the more humour is perceived as positive, the more it should be effective to down-regulate strongly negative emotions. In the present research, the humorous cartoons were judged as intermediate on the positivity scale, which is in line with the idea that in a condition of strongly negative induction, the humorous material would not convey a sufficiently positive meaning (in the sense of nonhostile significance) to successfully down-regulate emotions. Further studies must address this question by controlling the positive and the negative form of the humorous material.

The present data also showed that when presented with neutral pictures (i.e., emotion induction phase), neither young adults nor older adults reported a significantly lower negative feeling when exposed to the humorous cartoons than when they were exposed to the other cartoons. This apparent unexpected result can be explained by the fact that the emotional scale of the negative feeling (ranging from "not at all negative" to "completely negative") taken from Strick et al. (2009) was designed to capture subtle changes in negative rather than in positive feeling. In future research, it would be useful to introduce 2 one-dimensional scales in order to account for changes in both positive and negative feelings.

Conclusion

To the best of our knowledge, this is the first study showing that humorous stimuli may be effective in extrinsic emotion regulation in both young and older adults, and that the processes underlying the down-regulation of negative

feeling cannot be considered *only* as a cognitive distraction effect in terms of available resources or as an amusement effect enhancing abilities to cope with negative feelings. A goal for future research is to determine whether there are one or multiple mediators primarily underlying the humour effect as a function of age. More generally, the present data strengthen the idea that humour is useful for coping with negative emotions. It may represent an interesting form of therapy to help the elderly cope with anxiety and depression (Walter et al., 2007), as well as a relevant method to take care of older adults, especially in the hospital setting (Mallett, 1995).

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APPENDIX

Young and older adults' affective mean scores for valence and arousal ratings

	Valence		*Arousal*	
IAPS reference	*Young*	*Older*	*Young*	*Older*
Neutral				
7185	4.654	5.154	3.077	3.154
7500	4.704	4.815	3.333	3.407
7450	4.231	4.654	3.385	3.423
2230	4.111	4.852	3.667	3.667
7491	4.346	5.038	3.538	3.538
1616	4.407	4.630	4.481	4.481
9070	4.808	4.577	4.231	4.077
2780	4.593	4.852	4.185	4.00
2890	4.923	4.808	4.423	4.115
2455	4.074	4.815	4.370	4.037
2210	4.885	5.038	4.077	3.615
2220	4.346	5.192	4.654	4.115
Mean	4.51	4.868	3.951	3.802
Moderately negative				
2375.1	2.889	2.259	6.296	6.593
9341	3.346	3.038	5.346	5.615
2900	3.154	3.462	5.654	5.846
5972	3.038	2.538	6.385	6.577
9220	3.231	3.615	5.192	5.308
9041	3.63	3.185	5.222	5.296
9280	3.154	3.500	5.538	5.462
7361	2.885	3.038	7.077	6.846
9561	2.519	3.407	6.704	6.444
9530	2.731	2.885	6.269	5.923
3180	2.615	3.423	6.385	6.038
9520	2.577	3.231	6.462	5.962
Mean	4.51	3.131	6.044	5.992

(*Continued overleaf*)

Appendix 1. Continued.

	Valence		*Arousal*	
IAPS reference	*Young*	*Older*	*Young*	*Older*
Strongly negative				
3301	2.519	1.852	6.852	7.556
6370	2.577	2.154	7.000	7.692
9570	2.222	1.63	7.296	7.778
2095	2.296	2.407	6.593	7.037
3181	2.115	2.654	6.808	7.231
2981	2.519	1.815	6.889	7.296
6415	2.185	1.815	7.296	7.519
9040	1.731	1.654	7.538	7.577
9800	2.500	2.00	7.154	7.192
3005.1	1.423	1.846	8.115	8.038
6212	2.346	2.115	7.077	6.962
9180	2.423	2.538	6.538	6.308
Mean	4.510	2.040	7.096	7.348