Running head: EFFECTS OF AGE ON DETECTION OF EMOTION

.

Effects of Age on Detection of Emotional Information

Christina M. Leclerc and Elizabeth A. Kensinger

Boston College

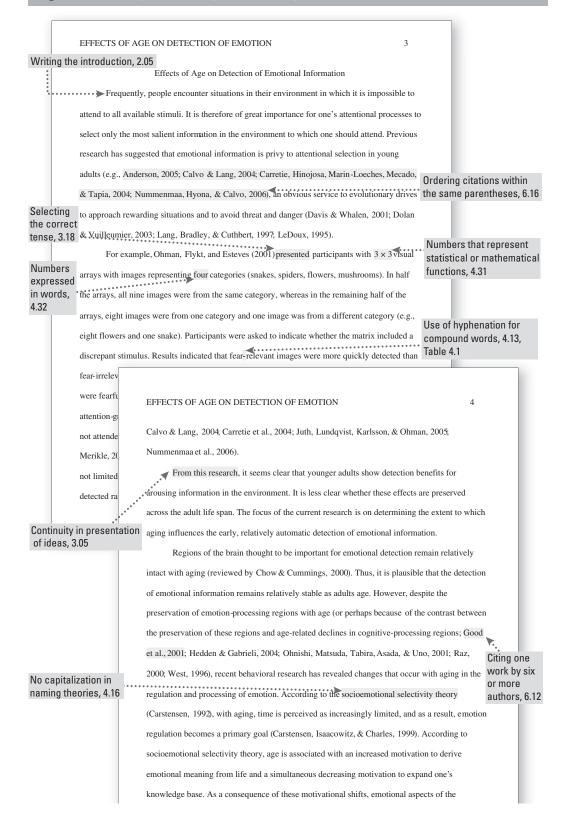
Author Note

Christina M. Lecl

Boston College.

This research was supported by National Science Foundation Grant BCS 0542694 awarded to Elizabeth A. Kensinger.

Correspondence concerning this article should be addressed to Christina M. Leclerc,
Department of Psychology, Boston College, McGuinn Hall, Room 512, 140 Commonwealth
Avenue, Chestnut Hill, MA 02467. Email: christina.leclerc.1@bc.edu



EFFECTS OF AGE ON DETECTION OF EMOTION

To maintain positive affect in the face of negative age-related change (e.g., limited time. two grammatically remaining, physical and cognitive decline), older adults may adopt new cognitive strategies. One such strategy, discussed recently, is the positivity effect (Carstensen & Mikels, 2005), in which older adults spend proportionately more time processing positive emotional material and less time processing negative emotional material. Studies examining the influence of emotion on memory (Charles, Mather, & Carstensen, 2003, Kennedy, Mather, & Carstensen, 2004) have found that compared with younger adults, older adults recall proportionally more positive information and proportionally less negative information. Similar results have been found when examining eye-tracking patterns. Older adults looked at positive images longer than younger adults did, even when no age differences were observed in looking time for negative stimuli

Using the colon between complete clauses, 4.05

Capitalization of words beginning a sentence after a colon, 4.14

Hypotheses and their correspondence to research design, Introduction, 2.05

Using the semicolon to

clauses not joined by

separate two independent

Based on this previously discussed research, three competing hypotheses exist to explain age differences in emotional processing associated with the normal aging process. First,

(Isaacowitz, Wadlinger, Goren, & Wilson, 2006). However, this positivity effect has not gone

uncontested; some researchers have found evidence inconsistent with the positivity effect (e.g.,

Grühn, Smith, & Baltes, 2005; Kensinger, Brierley, Medford, Growdon, & Corkin, 2002).

emotional information m facilitated detection of er emotional information m detection of emotional in principally on positive en not negative, emotional i

The primary goal To do so, we employed a EFFECTS OF AGE ON DETECTION OF EMOTION

.. a conjunction, 4.04 rapidly detect emotional information. We hypothesized that on the whole, older adults would be slower to detect information than young adults would be (consistent with Hahn, Carlson, Singer, & Gronlund, 2006; Mather & Knight, 2006); the critical question was whether the two age groups would show similar or divergent facilitation effects with regard to the effects of emotion on item detection. On the basis of the existing literature, the first two previously discussed hypotheses seemed to be more plausible than the third alternative. This is because there is reason

Using the comma between elements in a series, 4.03

Punctuation with citations in parenthetical material, 6.21

to think that the positivity effect may be operating only at later stages of processing (e.g., strategic, elaborative, and emotion regulation processes) rather than at the earlier stages of processing involved in the rapid detection of information (see Mather & Knight, 2005, for discussion). Thus, the first two hypotheses, that emotional information maintains its importance across the life span or that emotional information in general takes on greater importance with age, seemed particularly applicable to early stages of emotional processing.

Indeed, a couple of prior studies have provided evidence for intact early processing of

emotional facial expressions with aging. Mather and Knight (2006) examined young and older adults' abilities to detect happy, sad, angry, or neutral faces presented in a complex visual array. Mather and Knight found that like younger adults, older adults detected threatening faces more quickly than they detected other types of emotional stimuli. Similarly, Hahn et al. (2006) also found no age differences in efficiency of search time when angry faces were presented in an array of neutral faces, compared with happy faces in neutral face displays. When angry faces,

compared with positive and neutral faces, served as nontarget distractors in the visual search

arrays, however, older adults were more efficient in searching, compared with younger adults,

Citing references in text, inclusion of year within paragraph, 6.11, 6.12

Prefixes and suffixes that do not require hyphens, Table 4.2

EFFECTS OF AGE ON DETECTION OF EMOTION

7

negative stimuli were not of equivalent arousal levels (fearful faces typically are more arousing than happy faces: Hansen & Hansen, 1988). Given that arousal is thought to be a key factor in modulating the attentional focus effect (Hansen & Hansen, 1988; Pratto & John, 1991; Reimann & McNally, 1995), to more clearly understand emotional processing in the context of aging, it is necessary to include both positive and negative emotional items with equal levels of arousal.

categories of emotional information (positive high arousal, positive low arousal, negative high arousal, and negative low arousal) with their detection of neutral information. The positive and negative stimuli were carefully matched on arousal level, and the categories of high and low arousal were closely matched on valence to assure that the factors of valence (positive, negative) and arousal (high, low) could be investigated independently of one another. Participants were presented with a visual search task including images from these different categories (e.g., snakes, Using abbreviations, 4.22; Explanation cars, teapots). For half of the multi-image arrays, all of the images were of the same item, and for used often in APA journals, 4.25;

In the current research, therefore, we compared young and older adults' detection of four

Prefixed words that require hyphens, Table 4.3

the remaining half of the arrays, a sing items was included. Participants were the array, and their reaction times wer differences in response times (RTs) ba categories. We reasoned that if young information, then we would expect sir stimuli for the two age groups. By cor were younger adults, older adults shou emotional items (relative to the neutra

Identifying

Method

subsections within the

section, 2.06

of abbreviations, 4.23; Abbreviations Plurals of abbreviations, 4.29

EFFECTS OF AGE ON DETECTION OF EMOTION

8

for the arousing items than shown by the young adults (resulting in an interaction between age

Elements of the Method section, 2.06; Organizing a manuscript with levels of heading, 3.03

Participants

Younger adults (14 women, 10 men, $M_{age} = 19.5$ years, age range: 18–22 years) were recruited with flyers posted on the Boston College campus. Older adults (15 women, nine men,

 $M_{\text{age}} = 76.1 \text{ years}$, age range: 68–84 years) were recruited through the Harvard Cooperative on Aging (see Table 1, for demographics and test scores). Participants were compensated \$10 per hour for their participation. There were 30 additional participants, recruited in the same way as described above, who provided pilot rating values: five young and five old participants for the assignment of items within individual categories (i.e., images depicting cats), and 10 young and 10 old participants for the assignment of images within valence and arousal categories. All participants were asked to bring corrective eyewear if needed, resulting in normal or corrected to normal vision for all participants.

Using numerals to express numbers representing age, 4.31

Materials and Procedure

Participant (subject) characteristics, Method, 2.06

The visual search task was adapted from Ohman et al. (2001). There were 10 different types of items (two each of five Valence × Arousal categories: positive high arousal, positive low arousal, neutral, negative low arousal, negative high arousal), each containing nine individual exemplars that were used to construct 3 × 3 stimulus matrices. A total of 90 images were used, each appearing as a target and as a member of a distracting array. A total of 360 matrices were presented to each participant; half contained a target item (i.e., eight items of one type and one target item of another type) and half did not (i.e., all nine images of the same type). Within the

EFFECTS OF AGE ON DETECTION OF EMOTION

matrix. Within the 180 target trials, each of the five emotion categories (e.g., positive high arousal, neutral, etc.) was represented in 36 trials. Further, within each of the 36 trials for each emotion category, nine trials were created for each of the combinations with the remaining four other emotion categories (e.g., nine trials with eight positive high arousal items and one neutral item). Location of the target was randomly varied such that no target within an emotion category was presented in the same location in arrays of more than one other emotion category (i.e., a negative high arousal target appeared in a different location when presented with positive high arousal array images than when presented with neutral array images).

The items within each category of grayscale images shared the same verbal label (e.g., mushroom, snake), and the items were selected from online databases and photo clipart packages. Each image depicted a photo of the actual object. Ten pilot participants were asked to write down the name corresponding to each object; any object that did not consistently generate the intended response was eliminated from the set. For the remaining images, an additional 20 pilot participants rated the emotional valence and arousal of the objects and assessed the degree of visual similarity among objects within a set (i.e., how similar the mushrooms were to one another) and between objects across sets (i.e., how similar the mushrooms were to the snakes).

Valence and arousal ratings. Valence and arousal were judged on 7-point scales (1 =

→ negative valence or low arousal and 7 = positive valence or high arousal). Negative objects received mean valence ratings of 2.5 or lower, neutral objects received mean valence ratings of 3.5 to 4.5, and positive objects received mean valence ratings of 5.5 or higher. High arousal objects received mean arousal ratings greater than 5, and low arousal objects (including all neutral stimuli) received mean arousal ratings of less than 4. We selected categories for which both young and older adults agreed on the valence and arousal classifications, and stimuli were

Latin abbreviations, 4.26

9

Numbers expressed in words at beginning of sentence, 4.32

10

positive high arousal h arousal. etween-categories f exemplars (e.g., a set the rest of the cipants made these sual dimensions in ated how similar the mushrooms equated on withins well as for the

Italicization of anchors of a scale, 4.21

overall similarity of the object categories (ps > .20). For example, we selected particular

mushrooms and particular cats so that the mushrooms were as similar to one another as were the cats (i.e., within-group similarity was held constant across the categories). Our object selection also assured that the categories differed from one another to a similar degree (e.g., that the mushrooms were as similar to the snakes as the cats were similar to the snakes).

Procedure

Each trial began with a white fixation cross presented on a black screen for 1,000 ms; the matrix was then presented, and it remained on the screen until a participant response was recorded. Participants were instructed to respond as quickly as possible with a button marked *yes* if there was a target present, or a button marked *no* if no target was present. Response latencies and accuracy for each trial were automatically recorded with E-Prime (Version 1.2) experimental

EFFECTS OF AGE ON DETECTION OF EMOTION

11

software. Before beginning the actual task, participants performed 20 practice trials to assure compliance with the task instructions.

> Elements of the Results section, 2.07

Abbreviations accepted as words, 4.24

Analyses focus on participants' RTs to the 120 trials in which a target was present and was from a different emotional category from the distractor (e.g., RTs were not included for arrays containing eight images of a cat and one image of a butterfly because cats and butterflies are both positive low arousal items). RTs were analyzed for 24 trials of each target emotion category. RTs for error trials were excluded (less than 5% of all responses) as were RTs that

Symbols, 4.45; Numbers, 4.31

were £3SD from each participant's mean (approximately 1.5% of responses). Median RTs were then calculated for each of the five emotional target categories, collapsing across array type (see Table 2 for raw RT values for each of the two age groups). This allowed us to examine, for

Nouns followed by numerals or letters, 4.17

example, whether participants were faster to detect images of snakes than images of mushrooms, regardless of the type of array in which they were presented. Because our main interest was in examining the effects of valence and arousal on participants' target detection times, we created scores for each emotional target category that controlled for the participant's RTs to detect neutral targets (e.g., subtracting the RT to detect neutral targets from the RT to detect positive high arousal targets). These difference scores were then examined with a $2 \times 2 \times 2$ (Age [young, *** older] × Valence [positive, negative] × Arousal [high, low]) analysis of variance (ANOVA). This ANOVA revealed only a significant main effect of arousal, $F(1, 46) = 8.41, p = .006, \eta_p^2 = .16$, with larger differences between neutral and high arousal images (M = 137) than between neutral. and low arousal images (M = 93; i.e., high arousal items processed more quickly across both age groups compared with low arousal items; see Figure 1). There was no significant main effect for valence, nor was there an interaction between valence and arousal. It is critical that the analysis

Reporting p values, decimal fractions, 4.35

Statistical symbols, 4.46, Table 4.5

Numbering and discussing figures in text, 5.05

EFFECTS OF AGE ON DETECTION OF EMOTION

revealed only a main effect of age but no interactions with age. Thus, the arousal-mediated effects on detection time appeared stable in young and older adults.

The results described above suggested that there was no influence of age on the influences of emotion. To further test the validity of this hypothesis, we submitted the RTs to the five categories of targets to a 2 × 5 (Age [young, old] × Target Category [positive high arousal,

Statistics in text, 4.44

positive low arousal, neutral, negative low arousal, negative high arousal]) repeated measures ANOVA.² Both the age group, $F(1, 46) = 540.32, p < .001, \eta_p^2 = .92$, and the target category, mathematical copy, 4.46 $F(4, 184) = 8.98, p < .001, \eta_p^2 = .16$, main effects were significant, as well as the Age Group × Target Category interaction, $F(4, 184) = 3.59, p = .008, \eta_p^2 = .07$. This interaction appeared to reflect the fact that for the younger adults, positive high arousal targets were detected faster than or variables when targets from all other categories, ts(23) < -1.90, p < .001, with no other target categories differing significantly from one another (although there were trends for negative high arousal and negative low arousal targets to be detected more rapidly than neutral targets (p < .12). For older adults, all emotional categories of targets were detected more rapidly than were neutral targets, ts(23) > 2.56, p < .017, and RTs to the different emotion categories of targets did not differ significantly from one another. Thus, these results provided some evidence that older adults may show a broader advantage for detection of any type of emotional information, whereas young adults' benefit may be more narrowly restricted to only certain categories of Elements of the emotional information.

As outlined previously, there were three plausible alternatives for young and older adults' performance on the visual search task: The two age groups could show a similar pattern of enhanced detection of emotional information, older adults could show a greater advantage for

Discussion

Spacing, alignment, and punctuation of

12

Discussion section, 2.08

Capitalize effects they appear with multiplication signs, 4.20

EFFECTS OF AGE ON DETECTION OF EMOTION

13

emotional detection than young adults, or older adults could show a greater facilitation than young adults only for the detection of positive information. The results lent some support to the first two alternatives, but no evidence was found to support the third alternative.

In line with the first alternative, no effects of age were found when the influence of valence and arousal on target detection times was examined; both age groups showed only an arousal effect. This result is consistent with prior studies that indicated that arousing information can be detected rapidly and automatically by young adults (Anderson, Christoff, Panitz, De Rosa, & Gabrieli, 2003; Ohman & Mineka, 2001) and that older adults, like younger adults, continue to display a threat detection advantage when searching for negative facial targets in arrays of positive and neutral distractors (Hahn et al., 2006; Mather & Knight, 2006). Given the

Clear statement of support or nonsupport of hypotheses, Discussion, 2.08

relative preservation of & Bennett, 2004; Jennin

to take advantage of the

However, despit age groups, the present age-related enhancement the five categories of er high arousal images (as advantage for detecting suggests a broader influ

that the positivity effec

for the hypothesis that a

It is interesting

Use of an em dash to indicate an interruption in the continuity of a sentence, 4.06; Description of an em dash, 4.13

EFFECTS OF AGE ON DETECTION OF EMOTION

14

processing, given that no effects of valence were observed in older adults' detection speed. In the present study, older adults were equally fast to detect positive and negative information, consistent with prior research that indicated that older adults often attend equally to positive and negative stimuli (Rosler et al., 2005). Although the pattern of results for the young adults has differed across studies—in the present study and in some past research, young adults have shown facilitated detection of positive information (e.g., Anderson, 2005; Calvo & Lang, 2004; Carretie et al., 2004; Juth et al., 2005; Nummenmaa et al., 2006), whereas in other studies, young adults have shown an advantage for negative information (e.g., Armony & Dolan, 2002; Hansen & Hansen, 1988; Mogg, Bradley, de Bono, & Painter, 1997; Pratto & John, 1991; Reimann & McNally, 1995; Williams, Mathews, & MacLeod, 1996)—what is important to note is that the older adults detected both positive and negative stimuli at equal rates. This equivalent detection of positive and negative information provides evidence that older adults display an advantage for the detection of emotional information that is not valence-specific.

Thus, although younger and older adults exhibited somewhat divergent patterns of emotional detection on a task reliant on early, relatively automatic stages of processing, we found no evidence of an age-related positivity effect. The lack of a positivity focus in the older adults is in keeping with the proposal (e.g., Mather & Knight, 2006) that the positivity effect does not arise through automatic attentional influences. Rather, when this effect is observed in older adults, it is likely due to age-related changes in emotion regulation goals that operate at later stages of processing (i.e., during consciously controlled processing), once information has been attended to and once the emotional nature of the stimulus has been discerned.

Although we cannot conclusively say that the current task relies strictly on automatic processes, there are two lines of evidence suggesting that the construct examined in the current

EFFECTS OF AGE ON DETECTION OF EMOTION

research examines relatively automatic processing. First, in their previous work, Ohman et al. (2001) compared RTs with both 2×2 and 3×3 arrays. No significant RT differences based on the number of images presented in the arrays were found. Second, in both Ohman et al.'s (2001) study and the present study, analyses were performed to examine the influence of target location on RT. Across both studies, and across both age groups in the current work, emotional targets were detected more quickly than were neutral targets, regardless of their location. Together, these findings suggest that task performance is dependent on relatively automatic detection processes rather than on controlled search processes.

Use of parallel construction with coordinating conjunctions used in pairs, 3.23

15

Although further work is required to gain a more complete understanding of the agerelated changes in the early processing of emotional information, our findings indicate that

3445.134.2.258

Discussion section ending with comments on importance of findings, 2.08

young and older adults study provides further of of emotional images ar (Fleischman et al., 200although there is evider information (e.g., Carst present results suggest tasks require relatively

EFFECTS OF AGE ON DETECTION OF EMOTION

16

Construction of an accurate and complete reference list, 6.22;
General description of references, 2.11

Anderson, A. K. (2005). Affective influences on the attentional dynamics supporting awarenes Journal of Experimental Psychology: General, 154, 258–281. doi:10.1037/0096-

Anderson, A. K., Christoff, K., Panitz, D., De Rosa, E., & Gabrieli, J. D. E. (2003). Neural correlates of the automatic processing of threat facial signals. *Journal of Neuroscience*, 23, 5627–5633.

Armony, J. L., & Dolan, R. J. (2002). Modulation of spatial attention by fear-conditioned stimuli: An event-related fMRI study. *Neuropsychologia*, 40, 817–826. doi:10.1016/S0028-3932%2801%2900178-6

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology*, 56, 893–897. doi:10.1037/0022-006X.56.6.893

Calvo, M. G., & Lang, P. J. (2004). Gaze patterns when looking at emotional pictures: Motivationally biased attention. *Motivation and Emotion*, 28, 221–243. doi: 10.1023/B%3AMOEM.0000040153.26156.ed

Carretie, L., Hinojosa, J. A., Martin-Loeches, M., Mecado, F., & Tapia, M. (2004). Automatic attention to emotional stimuli: Neural correlates. *Human Brain Mapping*, 22, 290–299. doi:10.1002/hbm.20037

Carstensen, L. L. (1992). Social and emotional patterns in adulthood: Support for socioemotional selectivity theory. *Psychology and Aging*, 7, 331–338. doi:10.1037/0882-7974.7.3.331

Carstensen, L. L., Fung, H., & Charles, S. (2003). Socioemotional selectivity theory and the regulation of emotion in the second half of life. *Motivation and Emotion*, 27, 103–123.

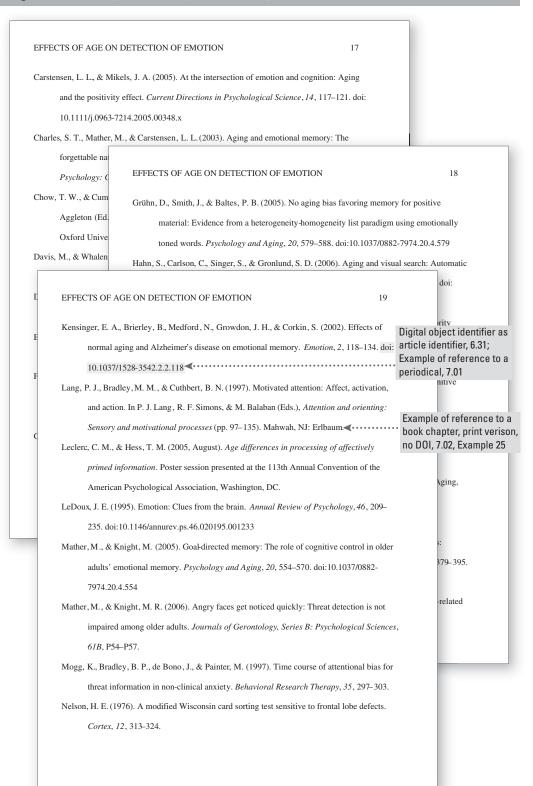


Figure 2.1. Sample One-Experiment Paper (continued)

EFFECTS OF AGE ON DETECTION OF EMOTION 20 Nummenmaa, L., Hyona, J., & Calvo, M. G. (2006). Eye movement assessment of selective attentional capture by emotional pictures. Emotion, 6, 257-268. doi:10.1037/1528-Article with more than 3542.6.2.257 seven authors, 7.01, Ohman, A., Flykt, A., & Esteves, F. (2001). Emotion drives attention: Detecting the snake in the Example 2 7/0096-EFFECTS OF AGE ON DETECTION OF EMOTION module Rosler, A., Ulrich, C., Billino, J., Sterzer, P., Weidauer, S., Bernhardt, T., ... Kleinschmidt, A. (2005). Effects of arousing emotional scenes on the distribution of visuospatial attention: Changes with aging and early subcortical vascular dementia. Journal of the Neurological orphology Sciences, 229, 109-116. doi:10.1016/j.jns.2004.11.007 Shipley, W. C. (1986). Shipley Institute of Living Scale. Los Angeles, CA: Western Psychological Services. Spielberger, C. D., Gor Palo Alto, CA: EFFECTS OF AGE ON DETECTION OF EMOTION Wechsler, D. (1987). W Placement and format Footnotes <---of footnotes, 2.12 Corporation. ¹Analyses of covariance were conducted with these covariates, with no resulting Wechsler, D. (1997). To influences of these variables on the pattern or magnitude of the results. III. New York, 2 These data were also analyzed with a 2×5 ANOVA to examine the effect of target West, R. L. (1996). An category when presented only in arrays containing neutral images, with the results remaining Psychological I qualitatively the same. More broadly, the effects of emotion on target detection were not Williams, J. M., Mathe qualitatively impacted by the distractor category. psychopatholog Wilson, B. A., Alderma Behavioural As. England: Tham

EFFECTS OF AGE ON DETECTION OF EMOTION

T-1-1-

Participant Characteristics

	Younger group		Older group			
Measure	M	SD	M	SD	F(1, 46)) p
Years of education	13.92	1.28	16.33	2.43	18.62	<.001
Beck Anxiety Inventory	9.39	5.34	6.25	6.06	3.54	.066
BADS-DEX	20.79	7.58	13.38	8.29	10.46	.002
STAI-State	45.79	4.44	47.08	3.48	1.07	.306
STAI-Trait	45.64	4.50	45.58	3.15	0.02	.963
Digit Symbol Substitution	49.62	7.18	31.58	6.56	77.52	<.001
Generative naming	46.95	9.70	47.17	12.98	.004	.951
Vocabulary	33.00	3.52	35.25	3.70	4.33	.043
Digit Span-Backward	8.81	2.09	8.25	2.15	0.78	.383
Arithmetic	16.14	2.75	14.96	3.11	1.84	.182
Mental Control	32.32	3.82	23.75	5.13	40.60	<.001
Self-Ordered Pointing	1.73	2.53	9.25	9.40	13.18	.001
WCST perseverative errors	0.36	0.66	1.83	3.23	4.39	.042

Selecting effective presentation, 4.41; Logical and effective table layout, 5.08

EFFECTS

Table 2

Raw Respo

Category Positive h Positive le Neutral Negative Negative

of the same

Note. Valu

recorded in

positive hig arousal, an Note. The Beck Anxiety Inventory is from Beck et al. (1988); the Behavioral Assessment of the Dysexecutive Syndrome—Dysexecutive Questionnaire (BADS—DEX) is from Wilson et al. (1996); the State—Trait Anxiety Inventory (STAI) measures are from Spielberger et al. (1970); and the Digit Symbol Substitution, Digit Span—Backward, and Arithmetic Wechsler Adult Intelligence Scale—III and Wechsler Memory Scale—III measures are from Wechsler (1997). Generative naming scores represent the total number of words produced in 60 s each for letter F, A, and S. The Vocabulary measure is from Shipley (1986); the Mental Control measure is from Wechsler (1987); the Self-Ordered Pointing measure was adapted from Petrides and Milner (1982); and the Wisconsin Card Sorting Task (WCST) measure is from Nelson (1976). All values represent raw, nonstandardized scores.

Elements of table notes, 5.16

23

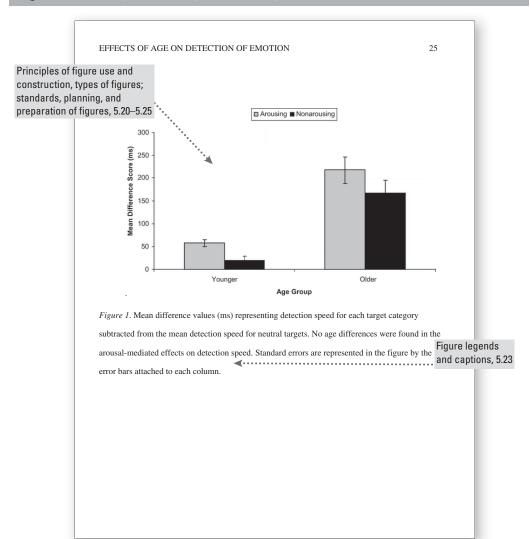


Figure 2.2. Sample Two-Experiment Paper (The numbers refer to numbered sections in the *Publication Manual*. This abridged manuscript illustrates the organizational structure characteristic of multiple-experiment papers. Of course, a complete multiple-experiment paper would include a title page, an abstract page, and so forth.)

INHIBITORY INFLUENCES ON ASYCHRONY

Inhibitory Influences on Asychrony as a Cue for Auditory Segregation

Auditory grouping involves the formation of auditory objects from the sound mixture reaching the ears. The cues used to integrate or segregate these sounds and so form auditory objects have been defined by several authors (e.g., Bregman, 1990, Darwin, 1997; Darwin & Carlyon, 1995). The key acoustic cues for segregating concurrent acoustic elements are differences in onset time (e.g., Dannenbring & Bregman, 1978; Rasch, 1978) and harmonic relations (e.g., Brunstrom & Roberts, 1998; Moore, Glasberg, & Peters, 1986). In an example of the importance of onset time, Darwin (1984a, 1984b) showed that increasing the level of a harmonic near the first formant (F1) frequency by adding a synchronous pure tone changes the phonetic quality of a vowel. However, when the added tone began a few hundred milliseconds before the vowel, it was essentially removed from the vowel percept.... [section continues].

General Method **◄**······ Elements of empirical studies, 1.01

Overview

In the experiments reported here, we used a paradigm developed by Darwin to assess the perceptual integration of additional energy in the F1 region of a vowel through its effect on phonetic quality (Darwin, 1984a, 1984b; Darwin & Sutherland, 1984)....[section continues].

Stimuli

Amplitude and phase values for the vowel harmonics were obtained from the vocal-tract transfer function using cascaded formant resonators (Klatt, 1980). F1 values varied in 10-Hz steps from 360–550 Hz—except in Experiment 3, which used values from 350–540 Hz—to produce a continuum of 20 tokens....[section continues].

Listeners

INHIBITORY INFLUENCES ON ASYCHRONY

2

Listeners were volunteers recruited from the student population of the University of Birmingham and were paid for their participation. All listeners were native speakers of British English who reported normal hearing and had successfully completed a screening procedure Plural forms of nouns (described below). For each experiment, the data for 12 listeners are presented....[section of foreign origin, 3.19

continues]. Procedure

At the start of each session, listeners took part in a warm-up block. Depending on the number of conditions in a particular experiment, the warm-up block consisted of one block of all the experimental stimuli or every second or fourth F1 step in that block. This gave between 85 and 100 randomized trials.... [section continues].

Data Analysis

The data for each listener consisted of the number of /I/ responses out of 10 repetitions for each nominal F1 value in each condition. An estimate of the F1 frequency at the phoneme boundary was obtained by fitting a probit function (Finney, 1971) to a listener's identification data for each condition. The phoneme boundary was defined as the mean of the probit function (the 50% point)...[section continues].

Multiple Experiments, 2.09 ····· Experiment 1

In this experime pure-tone captor. Each tone captor and a center continues].

Method

INHIBITORY INFLUENCES ON ASYCHRONY

3

There were nine conditions: the three standard ones (vowel alone, incremented fourth, and leading fourth) plus three captor conditions and their controls. A lead time of 240 ms was Abbreviating units used for the added 500-Hz tone.... [section continues]. of measurement. Results and Discussion 4.27, Table 4.4

Figure 4 shows the mean phoneme boundaries for all conditions and the restoration effect for each captor type. The restoration effects are shown above the histogram bars both as a boundary shift in hertz and as a percentage of the difference in boundary position between the incremented-fourth and leading-fourth conditions.... [section continues].

Experiment 2

This experiment considers the case where the added 500-Hz tone begins at the same time as the vowel but continues after the vowel ends.... [section continues].

Method

There were five conditions: two of the standard ones (vowel alone and incremented

Style for metric units, 4.40

Policy on metrication, 4.39; fourth), a lagging-fourth condition (analogous to the leading-fourth condition used elsewhere), and a captor condition and its control. A lag time of 240 ms was used for the added 500-Hz

tone.... [section continues]

Results and Discussion

INHIBITORY INFLUENCES ON ASYCHRONY

1984; Roberts & Holmes, 2006). This experiment used a gap between captor offset and vowel onset to measure the decay time of the captor effect ...[section continues].

Method

There were 17 conditions: the three standard ones (vowel alone, incremented fourth, and leading fourth), five captor conditions and their controls, and four additional conditions (described separately below). A lead time of 320 ms was used for the added 500-Hz tone. The captor conditions were created by adding a 1.1-kHz pure-tone captor, of various durations, to each member of the leading-fourth continuum....[section continues].

Results

Use of statistical term rather

Figure 6 shows the mean phoneme boundaries for all conditions. There was a highly than symbol in text, 4.45 significant effect of condition on the phoneme boundary values, F(16, 176) = 39.10, p < .001. Incrementing the level of the fourth harmonic lowered the phoneme boundary relative to the vowel-alone condition (by 58 Hz, p < .001), which indicates that the extra energy was integrated into the vowel percept....[section continues].

Discussion

The results of this experiment show that the effect of the captor disappears somewhere between 80 and 160 ms after captor offset. This indicates that the captor effect takes quite a long time to decay away relative to the time constants typically found for cells in the CN using physiological measures (e.g., Needham & Paolini, 2003)...[section continues].

Summary and Concluding Discussion

Darwin and Sutherland (1984) first demonstrated that accompanying the leading portion of additional energy in the F1 region of a vowel with a captor tone partly reversed the effect of the onset asynchrony on perceived vowel quality. This finding was attributed to the formation of

a perceptual group between the leading portion and the captor tone, on the basis of their common onset time and harmonic relationship, leaving the remainder of the extra energy to integrate into the vowel percept... [section continues].

[Follow the form of the one-experiment sample paper to type references, the author note, footnotes, tables, and figure captions.]

Figure 2.3. Sample Meta-Analysis (The numbers refer to numbered sections in the *Publication Manual*. This abridged manuscript illustrates the organizational structure characteristic of reports of meta-analyses. Of course, a complete meta-analysis would include a title page, an abstract page, and so forth.)

THE SLEEPER EFFECT IN PERSUASION

1

The Sleeper Effect in Persuasion:

A Meta-Analytic Review

Persuasive messages are often accompanied by information that induces suspicions of invalidity. For instance, recipients of communications about a political candidate may discount a message coming from a representative of the opponent party because they do not perceive the source of the message as credible (e.g., Lariscy & Tinkham, 1999). Because the source of the political message serves as a discounting cue and temporarily decreases the impact of the message, recipients may not be persuaded by the advocacy immediately after they receive the communication. Over time, however, recipients of an otherwise influential message may recall the message but not the noncredible source and thus become more persuaded by the message at that time than they were immediately following the communication. The term sleeper effect was

.... Italicize key terms, 4.21

used to denote such a d noncredible source) becomemory of the message

Sample of Studies

means of multiple proc

(1887-2003), Dissertati

Social-Science-Citation

credibility, source cred

persistence, attitude ma

We retrieved re

THE SLEEPER EFFECT IN PERSUASION

2

Guidelines for reporting meta-analysis,

2.10; see also Appendix

retention, attitude and decay, and persuasion and decay. Because researchers often use the terms opinion and belief, instead of attitude, we conducted searches using these substitute terms as well.

Description of meta-analysis, 1.02;

Second, ... [section continues].

Selection Criteria

We used the following criteria to select studies for inclusion in the meta-analysis.

1. We only included studies that involved the presentation of a communication containing persuasive arguments. Thus, we excluded studies in which the participants played a role or were asked to make a speech that contradicted their opinions. We also excluded developmental studies involving delayed effects of an early event (e.g., child abuse), which sometimes are also referred to as sleeper effects[section continues].

Identification of elements in a series within a sentence, 3.04

Moderators

For descriptive purposes, we recorded (a) the year and (b) source (i.e., journal article, unpublished dissertations and theses, or other unpublished document) of each report as well as (c) the sample composition (i.e., high-school students, university students, or other) and (d) the country in which the study was conducted.

We also coded each experiment in terms of[section continues].

Studies were coded independently by the first author and another graduate student.

Paper adapted from "The Sleeper Effect in Persuasion: A Meta-Analytic Review," by G. Kumkale and D. Albarracin, 2004, *Psychological Bulletin*, 130, pp. 143–172. Copyright 2004 by the American Psychological Association.

Figure 2.3. Sample Meta-Analysis (continued)

THE SLEEPER EFFECT IN PERSUASION

3

was satisfactory (Orwin, 1994). We resolved disagreements by discussion and consultation with colleagues. Characteristics of the individual studies included in this review are presented in Table 1. The studies often contained several independent datasets such as different messages and different experiments. The characteristics that distinguish different datasets within a report appear on the second column of the table.

Dependent Measures and Computation of Effect Sizes

We calculated effect sizes for (a) persuasion and (b) recall–recognition of the message content. Calculations were based on the data described in the primary reports as well as available responses of the authors to requests of further information...[section continues].

Analyses of Effect Sizes

There are two n

effects....[section contin

To benefit from the str

conduct analyses using

estimation of overall ef
Sample of Studies and
Descriptive cha
Table 2....[section cont

The data analys

A thorough und condition differences at

Overview of the Avera

THE SLEEPER EFFECT IN PERSUASION

place over time...[section continues].

In light of these requirements, we first examined whether discounting cues led to a decrease in agreement with the communication (boomerang effect). Next,...[section continues].

Use at least two subheadings

Ruling out a nonpersisting boomerang effect. To determine whether or not a delayed increase in persuasion represents an absolute sleeper effect, one needs to rule out a nonpersisting boomerang effect, which takes place when a message initially backfires but later loses this reverse effect (see panel A of Figure 1)....*(section continues).

Average sleeper effect. Relevant statistics corresponding to average changes in persuasion from the immediate to the delayed posttest appear in Table 4, organized by the different conditions we considered (i.e., acceptance-cue, discounting-cue, no-message control, and message-only control). In Table 4, positive effect sizes indicate increases in persuasion over time, negative effect sizes indicate decay in persuasion, and zero effects denote stability in persuasion. Confidence intervals that do not include zero indicate significant changes over time. The first row of Table 4 shows that recipients of acceptance cues agreed with the message less as time went by (fixed-effects, $d_+ = -0.21$; random-effects, $d_+ = -0.23$). In contrast to the decay in persuasion for recipients of acceptance cues, there was a slight increase in persuasion for recipients of discounting cues over time ($d_+ = 0.08$). It is important to note that change in discounting-cue conditions significantly differed from change in acceptance-cue conditions, (fixed-effects; B = -0.29, SE = 0.04), $Q_B(1) = 58.15$, p < .0001; $Q_E(123) = 193.82$, p < .0001.....[section continues].

Summary and variability of the overall effect. The overall analyses identified a relative sleeper effect in persuasion, but no absolute sleeper effect. The latter was not surprising, because the sleeper effect was expected to emerge under specific conditions....[section continues].

THE SLEEPER EFFECT IN PERSUASION

5

Moderator Analyses

Although overall effects have descriptive value, the variability in the change observed in discounting-cue conditions makes it unlikely that the same effect was present under all conditions. Therefore, we tested the hypotheses that the sleeper effect would be more likely (e.g., more consistent with the absolute pattern in Panel B1 of Figure 1) when...[section continues].

Format for references included in a meta-analysis with less than 50 references, 6.26

THE SLEEPER EFFECT IN PERSUASION

6

References

References marked with an asterisk indicate studies included in the meta-analysis.

Albarracín, D. (2002). Cognition in persuasion: An analysis of information processing in response to persuasive communications. In M. P. Zanna (Ed.), Advances in experimental social psychology (Vol. 34, pp. 61–130). doi:10.1016/S0065-2601(02)80004-1 ... [references continue]

- Johnson, B. T., & Eagly, A. H. (1989). Effects of involvement in persuasion: A meta-analysis.
 Psychological Bulletin, 106, 290–314. doi:10.1037/0033-2909.106.2.290
- *Johnson, H. H., Torcivia, J. M., & Poprick, M. A. (1968). Effects of source credibility on the relationship between authoritarianism and attitude change. *Journal of Personality and Social Psychology*, 9, 179–183. doi:10.1037/h0021250
- *Johnson, H. H., & Watkins, T. A. (1971). The effects of message repetitions on immediate and delayed attitude change. *Psychonomic Science*, 22, 101–103.
- Jonas, K., Diehl, M., & Bromer, P. (1997). Effects of attitudinal ambivalence on information processing and attitude-intention consistency. *Journal of Experimental Social Psychology*, 33, 190–210. doi:10.1006/jesp.1996.1317

. . . [references continue]

[Follow the form of the one-experiment sample paper to type the author note, footnotes, tables, and figure captions.]