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How Camera Changes and Information Introduced Affect the Recognition of Public Service Announcements: A Test Outside the Lab

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Abstract
This study investigated the impact of formal features on the recognition of televised public service announcements in a real-life setting. Recognition percentages of 193 public service advertisements (PSAs) derived from campaign evaluation studies were related to content analysis data of the ads. Regression analyses showed that formal features of PSAs accounted for 5% to 7% of the variance in PSA recognition. More specifically, the analyses showed that increasing the number of camera changes in PSAs slightly increases PSA recognition if the amount of information introduced by these camera changes is small, but increasing the number of camera changes tends to decrease PSA recognition substantially as the amount of information introduced by these camera changes increases. This finding implies that PSA producers should be reluctant in introducing much new information through fast-paced messages. Moreover, these results indicate that earlier findings observed in controlled, experimental settings do have ecological validity.

Keywords
Limited Capacity Model of Motivated Mediated Message Processing (LC4MP), public service announcements, camera changes, information density, ad recognition

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"Filling out tax forms: We can't make it more pleasant, but we do make it easier," and "Take time to be a dad today": just a few examples of the many televised public service advertisements (PSAs) that were launched by governments, non-governmental organizations (NGOs), and other (non-profit) organizations in the last years. Ads like these are part of campaigns that are typically meant to raise awareness among the public (e.g., to inform about the possibility to fill out your tax form online) or even to change their attitudes and behavior (e.g., to persuade fathers to be more involved in their children's lives). However, today's saturated media environment presents a major challenge in this regard. The challenge is how to attract the viewer's attention to these PSAs. Attention is especially important to campaigns aiming to inform the public about a particular issue, because attention is a prerequisite to activate the cognitive subprocesses of encoding, storage, and retrieval that affect the viewer's memory (cf. Lang, 2000, 2006). Moreover, attention is crucial to campaigns aiming to persuade viewers by means of an argument-based strategy (as opposed to an affect-based strategy). Specifically, attention is required to enable the formation of inferences based on the provided information, which might result in attitude change (e.g., Eagly & Chaiken, 1993; Petty & Cacioppo, 1986).

Acknowledging that the relation between attention and recognition is complicated, several studies have assumed that advertisements that have received attention should leave at least a minimal memory trace in viewers. This minimal memory trace has been shown to be validly measureable by measures of advertisement recognition, which have been referred to as "encoded exposure" (Southwell, 2005a, 2005b; Southwell, Barmada, Hornik, & Maklan, 2002) or "confirmed ad recall" (Niederdeppe, 2005; Niederdeppe, Davis, Farrelly, & Yarsevich, 2007). In accordance with this view, the present study focuses on ad recognition as an indication that an advertisement has at least been encoded in working memory.

Apart from interventions such as increasing the amount of advertisements or investing in media planning, PSA recognition may be promoted by the way content and production features are applied in the production of PSAs. In this study, we investigate how formal features of PSAs relate to ad recognition. Specifically, we focus on the role of camera changes (i.e., the change from one camera shot to another camera shot) and the information that is introduced by each camera change. As will be described below, effects of camera changes and information introduced on PSA recognition have been both theoretically hypothesized and empirically demonstrated in a number of laboratory studies. However, an important question is whether similar effects can be detected in a large sample of PSAs that actually have been broadcast, and of which ad recognition has been estimated in campaign evaluation surveys. This question is important because the answer will tell us whether the effects of camera changes that were found in the laboratory are substantial enough to be found amid an array of other factors affecting ad recognition. This question is also relevant to campaigners because the answer gives them an indication of the audience attention that can be gained by carefully editing PSAs. Only very few studies have reported on this issue (Niederdeppe et al., 2007; Southwell, 2005a, 2005b). Moreover, these studies were based on relatively small samples of

PSAs. For this reason, this study provides an empirical account of the impact that camera changes have on PSA recognition at a macro-level of analysis, using a considerably wider sample of PSAs.

Camera Changes and Information Processing

The theory that has been most widely used to predict effects of camera changes is the Limited Capacity Model of Motivated Mediated Message Processing (LC4MP; Lang, 2000, 2006). A key proposition from the model is that people only have a limited number of cognitive resources available for the complex task of information processing. The outcome of information processing ultimately depends on the amount of cognitive resources that are required to process a message and the amount of resources that are—in a controlled or automatic fashion—allocated to this task.

Based on a number of study findings in which effects of various types of camera changes on attention and memory were investigated (e.g., Geiger & Reeves, 1993; Lang, Geiger, Strickwerda, & Sumner, 1993), Lang and Basil (1998) proposed an explanation of these findings in line with what nowadays is known as the LC4MP. They argue that a camera change is an audiovisual feature that signifies a sudden change in audiovisual information to the viewer, and that is hence expected to elicit an automatic allocation of additional cognitive resources to process the message. However, camera changes also introduce changes in the audio or visual information to be processed, implying an increase in the resources required to further process the message. As long as the total of resources required to process the message does not exceed the total of resources allocated, increases in camera changes will lead to improved message processing. However, especially large increases in camera changes that introduce a lot of new information could lead to a situation of cognitive overload, in which the total of resources required to process the message does exceed the total of resources allocated. Cognitive overload implies deteriorated message processing, which may manifest itself in a number of information-processing outcomes, including a decrease of message recognition.

To evaluate the validity of this explanation, some studies tested quite specific hypotheses regarding the effects of two distinct types of camera changes: cuts (camera changes between scenes) and edits (camera changes within scenes). Assuming that cuts introduce a relatively high amount of new information, Lang, Bolls, Potter, and Kawahara (1999) found support for their prediction that the relation between the number of cuts and information-processing outcomes is likely to have the shape of an inverted U. Increasing the number of cuts in audiovisual messages from low to moderate improved information processing, indicating that the introduction of new information did not yet lead to a situation in which the total of resources required to process the message exceeded the total of allocated resources. However, high levels of cuts induced cognitive overload. In addition to this study, Lang, Zhou, Schwartz, Bolls, and Potter (2000) investigated the influence of edits in audiovisual messages on information processing. Edits introduce little new information, implying that the use of edits would not easily overload the information-processing system. The findings from the study supported this prediction: increasing the number of edits in audiovisual messages from relatively slow to fast improved information processing.

A limitation of the studies discussed above concerned the distinction between two types of camera changes (e.g., cuts and edits), as it was regarded as a relatively imprecise measure of the amount of new information to be processed following a camera change. As Lang, Bradley, Park, Shin, and Chung (2006) noticed, a change from one visual scene to another visual scene (cut) may entail relatively little new information if the transition to the new visual environment may be expected from the storyline, or if it was already verbally announced. In contrast, an edit from a long shot of a crowd to the face of a single person within the crowd can entail far more new information. To develop a new measure, Lang et al. (2006) adopted a procedure in which they scored each camera change on the presence of seven characteristics that indicated the amount of information introduced by the camera change. By summing up the scores of all camera changes, they created a very precise measure of the information introduced in the PSA. In their study, this new measure better explained patterns in outcome variables than the cuts versus edits distinction did.

Studies applying this new measure of information introduced have provided results that were in line with predictions derived from LC4MP propositions. In particular, these studies revealed an interaction between the number of camera changes and the amount of information introduced by each camera change. Increasing the number of camera changes appeared to have a positive effect on message recognition, but this effect tended to become negative as the audiovisual information that was introduced by the camera changes increased. Consequently, the resources required to process the messages increased up to the level that exceeded the total of resources allocated (e.g., Fox, Park, & Lang, 2007; Lang et al., 2006; Lang, Park, Sanders-Jackson, Wilson, & Wang, 2007).

Recognition Effects in Controlled Versus Real-Life Settings

A common feature of the studies described so far is that it were all experiments conducted in laboratory settings. Notwithstanding the importance of their findings, the question remains whether effects found in controlled laboratory settings also hold in a real-life setting. In experimental studies, researchers largely control the comparability of stimulus messages (i.e., the PSAs), contextual influences on message processing (e.g., exposure time, screen size, presence of distractors), and participant characteristics (e.g., age, gender, education). The advantage of this strategy is that researchers largely diminish the variance in the outcome variable derived from these sources, which may enable them to even detect effects that are rather subtle. However, one may still ask whether these effects can be found in a study design that exerts less control over the message, context, and participant characteristics, and how substantial these effects are (cf. Slater, 2004).

Only very few studies investigated the impact of camera changes outside the laboratory (Niederdeppe et al., 2007; Southwell, 2005a, 2005b). In these studies, characteristics from a number of PSAs were content analyzed and, subsequently, these content analysis data were related to recognition measures obtained from evaluation studies following the campaign. The studies were theoretically inspired by the laboratory studies of the impact of cuts and edits on recognition (e.g., Lang, Bolls, et al., 1999; Lang et al., 2000). The impact of edits on PSA recognition was only studied in the Niederdeppe et al. (2007) study. In accordance with LC4MP propositions, this study both hypothesized and found that the number of edits had a positive effect on PSA recognition.

Regarding the impact of the number of cuts, both the Niederdeppe et al. (2007) and Southwell (2005a, 2005b) studies acknowledged the inverted U-shaped relation between the number of cuts and PSA recognition that can be expected from an LC4MP perspective. However, none of the studies could fully test this relationship because of limitations in the available data. Niederdeppe et al. stated that the large majority of PSAs in their sample had less than 10 cuts per 30 seconds, which was defined as a moderate level of cuts in earlier research (cf. Lang, Bolls, et al. 1999; Lang, Chung, Lee, Schwartz, & Shin, 2005; Lang, Potter, & Bolls, 1999). Niederdeppe and colleagues therefore expected a positive effect of the number of cuts on PSA recognition, and that was what they indeed found. In contrast to this study, the Southwell (2005b) data featured considerably more cuts per 30 seconds (18.6 on average, cf. Southwell, 2005b), which led the author to expect a negative impact on PSA recognition. This negative effect was found in his analyses at the aggregate level (Southwell, 2005b) and in multilevel analyses (Southwell, 2005a). Taken together, one might assume that the Niederdeppe et al. findings covered the left part of the theoretically predicted inverted U, whereas the Southwell (2005a, 2005b) findings covered the right part of the inverted U (cf. Niederdeppe et al., 2007). Nevertheless, the studies provided no proof of the inverted U.

The Present Study

The findings from the Niederdeppe et al. (2007) and Southwell (2005a, 2005b) studies show that some findings from earlier laboratory studies on the impact of cuts and edits (e.g., Lang, Bolls, et al., 1999; Lang et al., 2000) on message processing may also be observed outside the laboratory. However, the more specific finding of an inverted U-shaped relation between the number of cuts and PSA recognition (Lang, Bolls, et al., 1999) could not be replicated, most likely because of limitations in the data regarding the variance in the numbers of cuts. The first aim of the present study was to fill this gap.

To this end, the design of the current study is based on the Niederdeppe et al. (2007) and Southwell (2005a, 2005b) studies in that it relates characteristics from PSAs to recognition measures obtained from studies evaluating the PSA campaigns. However, the sample in the current study includes 193 PSAs. This sample is considerably larger than the sample sizes in both the Niederdeppe et al. and Southwell (2005a, 2005b) studies, which included 45 and 23 PSAs, respectively. Moreover, the composition of the sample showed considerably more variance in especially the numbers of cuts. Drawing from LC4MP theory and the previous studies based on this model, the following hypotheses will be tested:

Hypothesis 1 (H1): The number of edits has a positive effect on PSA recognition.

Hypothesis 2 (H2): The effect of the number of cuts on PSA recognition takes the shape of an inverted U.

As far as known, no studies with real-life data replicated laboratory studies featuring the measure of information introduced, particularly the finding that effects of camera changes vary according to the amount of information introduced by camera changes (e.g., Fox et al., 2007; Lang et al., 2006; Lang et al., 2007). The second aim of the present study was to fill this gap as well. To accomplish this, the number of camera changes and the information introduced by each camera change are coded for each PSA in the dataset. Once more building upon LC4MP theory and the empirical studies based on the model, the following hypothesis will be tested:

Hypothesis 3 (H3): The number of camera changes has a positive effect on PSA recognition if the amount of information introduced by the camera changes is low, but the effect becomes increasingly negative when the information introduced by camera changes increases.

Method

Design and Procedure

This study was carried out in The Netherlands and consisted of two steps. The first step involved a content analysis of television PSAs that were broadcast by the Dutch government between 1999 and 2009. Because campaigns have been launched by a variety of ministries of the Dutch government, the PSAs cover a wide range of subjects. Nevertheless, the government policy's main themes, such as national health, road safety, and the reduction of crime and violence, are prominent subjects in the PSAs (Van Noort, 2008). The content analysis was used to code the numbers of cuts, the numbers of edits, the numbers of camera changes (cc), and information introduced (ii) in each PSA. In addition, the duration of the advertisements was coded (in seconds) to serve as a control variable in the analysis.

In a second step, the content analysis data were merged with data that were obtained from the Public Information and Communication Office of the Dutch Ministry of General Affairs, which is responsible for planning and financing the PSA campaigns, and for the evaluation of these campaigns (Van Noort, 2008). They provided data at the aggregate level that were derived from campaign evaluation surveys among a representative sample of the Dutch population. In particular, these data included estimates of the dependent variable, which is the percentage of respondents recognizing each PSA.

In addition, the data included information on three more variables for which we needed to control in the analysis. First, the data included a measure of media weight in terms of the budget that was spent on the televised PSA campaign. This variable is relevant to include in the analysis as it indicates the media effort of each campaign. One might argue that PSAs that were more frequently broadcast and/or broadcast on channels that reach larger audiences have a higher chance of being recognized. It is therefore important to control for the budget that was spent on each campaign. Second, the data included estimates of the general interest in each PSA topic, which were based on surveys conducted prior to the campaigns. General interest in topics prior to the start of a campaign is important to be included in the analysis as it can be expected that a higher interest in a certain topic increases attention for campaigns on this topic and may therewith affect recognition. Third, although most advertisements were exactly equal in duration, some were slightly longer, which may affect recognition. Duration of the PSA was therefore included as the third control variable.

Sample

The PSAs that were included in the content analysis study were broadcast on television as part of cross-media campaigns that ran between 1999 and 2009. Originally, the sample consisted of all 281 advertisements that were televised in these years. Each campaign was evaluated in a campaign evaluation survey. A number of advertisements were broadcast in more than 1 year and were consequently evaluated more than once. For each of these advertisements, only data from the first evaluation study of the campaign featuring the advertisement were included in the sample, resulting in a remaining number of 205 advertisements. Because data regarding the variables recognition, topic interest, or budget spent on the campaign were missing for some advertisements, a final sample of N = 193 PSAs remained for the analysis.

The campaign evaluation surveys were executed by two Dutch market research agencies, TNS Nipo (1999-2006) and Intomart GFK (2007-2009). Three samples of the Dutch population aged 18 years and older were composed for each campaign, in order to conduct surveys prior to the start of a campaign (n = 400), during this campaign (n = 600), and after the campaign (n = 400). If the campaign targeted adolescents, an additional sample of young people aged between 13 and 17 was included. All these samples were deemed representative (Van Noort, 2008). For the current study, only the surveys that were conducted prior to and during the campaigns are important, because they, respectively, included the measures for general topic interest and recognition. One limitation regarding the samples needs to be mentioned. It is possible that participants evaluated more than one campaign because regularly more than one campaign was evaluated within the same survey. This implies that some dependency existed between the samples on which the aggregated measures for topic interest and recognition were based.

Measures

The content analysis measures were derived from two distinct content analyses of the PSAs, involving different coders. Eight coders coded cuts and the edits in the PSAs; two other coders coded the camera changes and the information introduced.

Cuts per second (cuts/sec). The number of cuts was coded for each PSA. A cut was defined as a camera change from one visual scene to another visual scene. Some campaigns consisted of more than one advertisement. Because only an overall recognition score was available for these campaigns, we decided to code the cuts for each advertisement within that campaign and calculated the mean number of cuts of the total campaign thereafter. We have no reason to expect that this choice significantly affected the results, as these ads were generally very similar, and thus also the number of cuts was highly comparable within the same campaign. A total number of 29 advertisements (15% of the sample) were coded by all coders to estimate the reliability of the coding regarding the cut variable. The reliability was good (Krippendorff's α = .84). The variable cuts/sec was calculated by dividing the number of cuts by the duration of the ad in seconds (M = 0.36, SD = 0.24).

Edits per second (edits/sec). Using the same procedure, the number of edits was coded for each PSA. Edits were defined as camera changes within a visual scene. The reliability was reasonably good (Krippendorff's α = .77). The variable edits/sec was calculated by dividing the number of edits by the duration of the ad in seconds (M = 0.09, SD = 0.11).

Camera changes per second (cc/sec). The number of camera changes was coded for each PSA campaign. A total number of 50 advertisements were double coded to estimate the reliability of the coding regarding the camera changes variable. This reliability was perfect (Krippendorff's α = 1.00). Because four advertisements had zero camera changes, the construction of the "information introduced per camera change" (described next) would become problematic for these advertisements. For this reason, we conducted a linear transformation on the camera changes variable by adding 1 to the number of camera changes for each advertisement (thus equaling the number of camera shots). Next, the variable cc/sec was calculated by dividing the number of camera changes by the duration of the ad in seconds (M = 0.51, SD = 0.26).

Information introduced per camera change (ii/cc). In the next step, the amount of new visual information was coded for each camera change separately. To this end, seven characteristics were coded that represent the introduction of new information: object change, novelty, unrelatedness, distance, perspective, emotion, and form change. These categories were based on a previously used coding instrument constructed by Lang et al. (2006). One hundred camera changes were double coded in order to estimate the intercoder reliabilities. Table 1 gives an overview of these reliabilities, as well as brief descriptions and descriptive statistics for the seven characteristics. We constructed the variable ii/cc by summing up the information introduced by each camera change in the same PSA, divided by the number of camera changes (M = 2.65, SD = 0.78).

Recognition. The measure of recognition used in this study is largely similar to the "encoded exposure" measure used by Southwell et al. (2002). To construct the

Table 1. Overview of Characteristics Representing Information Introduced in PSAs.

Variable	Definition
Object change	Presence of a new central object (e.g., environment, person) in the shot following the camera change (α = .88; presence = 11.10%)
Novelty	Presence of a central object in the shot following the camera change that has not appeared before (α = .89; presence = 6.34%)
Unrelatedness	A lack of narrative relatedness between the information in the shot following the camera change and the information in the previous camera shot (α = .93; presence = 1.68%)
Distance	Presence of a closer shot of the central object in the shot following the camera change (α = .77; presence = 4.66%)
Perspective	Presence of perspective changes between two subsequent camera shots, that is, when the viewer looks at the central object from another camera angle than before the camera change (α = .74; presence = 8.02%)
Emotion	A change in the presence, intensity, or nature of emotions between two subsequent camera shots. Emotions may refer to emotional places (e.g., cemeteries), events (e.g., weddings), people (e.g., crying), and activities (e.g., fighting; α = .90; presence = 3.23%)
Form change	Presence of structural changes between two subsequent camera shots (e.g., a cut from color to black-and-white, from pictures to text; α = .95; presence = 3.41%)

Source. Based on De Ros (2008) and Lang, Bradley, Park, Shin, and Chung (2006).
Note. PSA = public service advertisements.

measure, the advertisement that was broadcast over the course of a campaign was shown to the respondents who took part in the evaluation surveys. After watching the advertisement, they responded to the question, "Have you seen this ad during the past few weeks?" by choosing one of three answer categories (1 = *no, definitely not*, 2 = *maybe*, 3 = *yes, definitely yes*). In the aggregate-level dataset from the Public Information and Communication Office that we had at our disposal, the variable recognition is predefined as the percentage of the sample that declared to have "definitely" or "maybe" recognized the advertisement (M = 76.00%, SD = 11.90).

Control variables. The three control variables were measured as follows. First, the duration of the advertisements was measured in seconds and entered into the analysis as "ad duration" (M = 27.05, SD = 0.33). Second, the data that were obtained from the Public Information and Communication Office included the "budget spent on each televised PSA" in hundreds of thousands of euros, which was entered into the analysis as "TV budget" (M = 2.51, SD = 1.64). Third, the evaluation survey that was conducted prior to the start of each campaign included a question regarding the extent to which the participant was interested in the campaign topic. Participants indicated their topic interest on a scale ranging from 1 (*not interested at all*) to 5 (*very interested*). The mean topic interest was used as an aggregate-level measure of the general interest the

Table 2. Regression Analyses Predicting PSA Recognition: The Role of Cuts and Edits.

	Model 1			Model 2			Model 3		
	B	*SE*	β	*B*	*SE*	β	*B*	*SE*	β
Ad duration	3.76	2.37	.10	3.99	2.34	.11†	3.53	2.30	.10
TV budget	2.70	0.48	.37**	2.67	0.47	.37**	2.53	0.46	.35**
Topic interest	3.19	0.90	.23**	3.19	0.89	.23**	2.86	0.88	.21**
Cuts/sec				−8.39	3.10	−.17**	−2.21	3.68	−.04
Edits/sec				8.62	6.88	.08	4.18	10.57	.04
$(\text{Cuts/sec})^2$							−23.07	7.67	−.23**
$(\text{Edits/sec})^2$							2.56	38.44	.01
Constant	−45.85	64.76		−52.01	63.90		−36.50	62.91	
ΔR^2	.22**			.03*			.04*		

Note. $N = 193$. The cuts/sec variable and the edits/sec variable were centered on the 0 value.
PSA = public service advertisements.
†$p < .10$. *$p < .05$. **$p < .01$.

advertisement topic elicited and was entered in the analysis as "topic interest" ($M = 4.22$, $SD = 0.87$).

Results

To test H1 and H2, the effects of the numbers of cuts and edits on PSA recognition were estimated in a set of three regression analyses. First, the effects of the control variables "ad duration," "TV budget," and "topic interest" were estimated (Model 1). Second, the variables "cuts/sec" and "edits/sec" were added to the equation (Model 2). Third, to test for curvilinear relationships, square terms of both the "cuts/sec" and "edits/sec" variables were added (Model 3). To avoid collinearity problems, a centering procedure was applied, in which the mean value of either the "cuts/sec" (0.36) or "edits/sec" (0.09) was subtracted from each score on, respectively, the "cuts/sec" and "edit/sec" variable before computing the square term of the variables.

As shown in Table 2, the control variables "ad duration," "TV budget," and "topic interest" explained 22% of the variance in PSA recognition (Model 1). Adding the "cuts/sec" and "edits/sec" variables to the model increased the variance explained significantly by 3%. The significant *B*-coefficient ($B = -8.39$) shows that the overall effect of the number of cuts per second on ad recognition was negative. The overall effect of the number of edits was positive but not significant, which does not provide support to H1 (Model 2). Adding the square terms "cuts/sec^2" and "edits/sec^2" to the model accounts for a further increase of 4% in the variance explained. As expected, only the square term "cuts/sec^2" was significant. The negative sign ($B = -23.07$) of the square term indicated that the number of cuts has an inverted U-shaped effect on ad recognition, which does provide support to H2 (Model 3). The crest-point of the curve can be calculated at 0.31 cuts/second. In all, the numbers of edits and (especially) cuts accounted for 7% of the variance in PSA recognition.

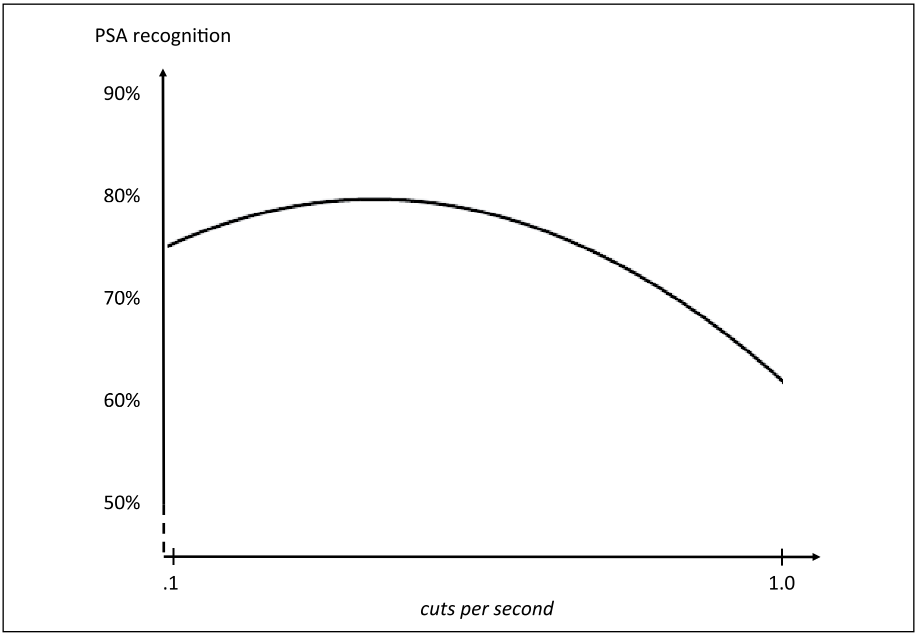

Figure 1. PSA recognition predicted by the number of cuts per second (N = 193).
Note. PSA = public service advertisements.

Figure 1 visualizes the relation between the number of cuts per second and PSA recognition, based on the estimates of Model 3 (see Table 2). It shows that although increasing the number of cuts to 0.31 cuts/sec (9.3 cuts in a 30-second PSA) slightly increases PSA recognition, further increasing the number of cuts will decrease PSA recognition substantially.

To estimate the effects of the number of camera changes and the information introduced by each camera change (H3), a second set of regression analyses was carried out. First, Model 1 was extended by adding the variables “cc/sec” and “ii/cc” to the equation (Model 4). Second, the interaction variable “cc/sec*ii/cc” was added (Model 5). To avoid collinearity problems, once more a centering procedure was applied, in which the mean value of “ii/cc” (2.65) was subtracted from each score on “ii/cc” before computing the “cc/sec*ii/cc” variable.

As shown in Table 3, adding the “cc/sec” and “ii/cc” variables to the model increased the variance explained significantly by 3%. The significant B-coefficient ($B = -8.22$) shows that the overall effect of the number of camera changes per second on ad recognition was negative (Model 4). However, adding the interaction variable “cc/sec*ii/cc” to the model accounts for a further increase of 2% in the explained variance, suggesting that the overall effect of the number of camera changes per second needed to be qualified. In support to H3, the negative sign of the interaction coefficient ($B = -7.33$) indicated that the effect of the number of camera changes per second became increasingly negative as the information that is introduced per camera change

Table 3. Regression Analyses Predicting PSA Recognition: The Role of Camera Changes and Information Introduced.

	Model 1			Model 4			Model 5		
	B	*SE*	β	*B*	*SE*	β	*B*	*SE*	β
Ad duration	3.76	2.37	.10	3.59	2.33	.10	3.69	2.31	.10
TV budget	2.70	0.48	.37**	2.75	0.47	.38**	2.72	0.47	.38**
Topic interest	3.19	0.90	.23**	3.14	0.89	.23**	2.98	0.89	.22**
cc/sec				−8.22	3.14	−.18**	−7.61	3.13	−.16*
ii/cc[a]				−0.11	1.04	−.01	2.51	1.61	.17
cc/sec × ii/cc[a]							−7.33	3.47	−.22*
Constant	−45.85	64.76		−37.00	63.80		−38.77	63.23	
ΔR^2	.22**			.03*			.02*		

Note. *N* = 193. PSA = public service advertisements.
[a]The ii/cc variable was centered on the 0 value.
**p* < .05. ***p* < .01.

increased (Model 5). Combined, the number of camera changes per second and the information introduced per camera change accounted for 5% of the variance in PSA recognition.

Figure 2 visualizes the relation between the number of camera changes per second, the information introduced per camera change, and PSA recognition, based on the estimates of Model 5 (see Table 3). It shows that although increasing the number of camera changes may slightly increase PSA recognition if the amount of information introduced by these camera changes is small, increasing the number of camera changes tends to decrease PSA recognition substantially as the amount of information introduced by these camera changes increases.

A final set of analyses aimed to control for the influence of outliers. All analyses were repeated under the restriction that none of the variables were permitted to have any score more than 3 standard deviations from the mean score. As a consequence, nine outliers on the "TV budget" variable were omitted (each of them > *M* + 3*SD*), three on the "cc/sec" variable (each of them > *M* + 3*SD*), four on the "ii/sec" variable (each < *M* − 3*SD*), and one on the dependent variable "recognition" (<*M* − 3*SD*)—16 cases in total (one case was an outlier on more than one variable). Overall, the results on the remaining 177 cases hardly differed from the results reported in Tables 2 and 3. The only difference worth mentioning is that the variance explained by the influence of edits and (especially) cuts decreased from 7% to 5%, and the variance explained by the combined influence of the "cc/sec" and "ii/cc" variables decreased from 5% to 3%.

Discussion

Two conclusions may be drawn from this study. First, the pacing of camera changes and the amount of information introduced by these camera changes explained 5%

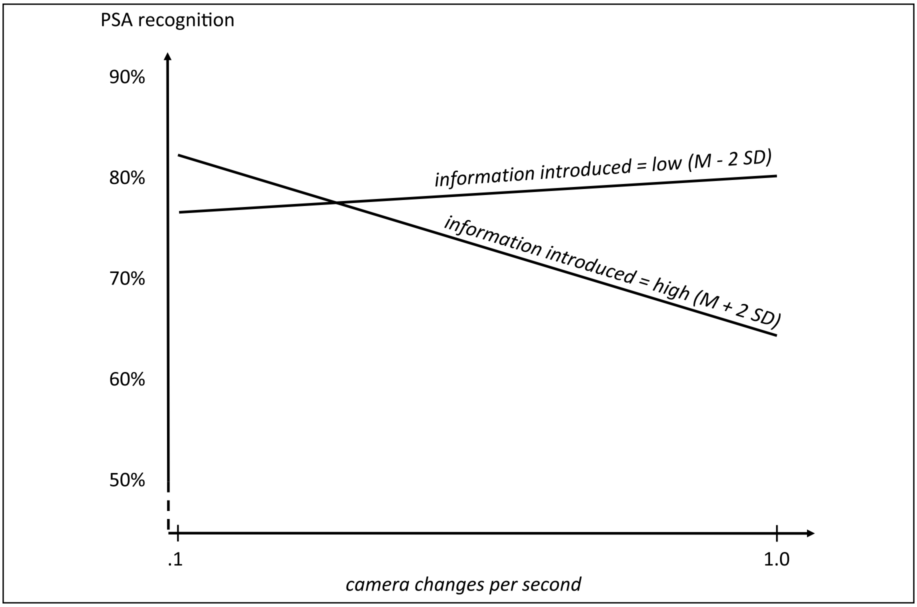

Figure 2. PSA recognition predicted by the number of camera changes per second and the amount of information introduced per camera change (N = 193).
Note. PSA = public service advertisements.

(modeled as cc/sec and ii/cc) to 7% of the variance (modeled as cuts and edits) in the recognition of the PSAs, which is quite substantial. Second, most variables behaved empirically as predicted by LC4MP theory and experimental findings. In particular, increasing the number of cuts increased PSA recognition slightly but only up to a moderate amount of cuts (H2). Also, increasing the number of camera changes increased PSA recognition slightly if the amount of information introduced by these camera changes was small, but increasing the number of camera changes severely decreased PSA recognition as the amount of information introduced by these camera changes increased (H3). It should be noted that the effect of the pacing of edits on recognition (H1) was not significant. However, given the limited presence of edits in our sample (slightly less than three edits in a 30-second ad on average), this may not come as a big surprise.

The aim of this study was to investigate whether previously found effects of various kinds of camera changes on message recognition are substantial enough to persist in real exposure situations. Because the results of the study showed that the effects of camera changes and information introduced by these camera changes are substantiated outside the laboratory, they underline the ecological validity of these experiments. At a more general theoretical level, the study findings also provide additional support to the LC4MP (Lang, 2000, 2006). This theoretical model has been successfully applied in studies, including a variety of measures (recall and recognition tests, self-report measures, and physiological measures). However, the designs of these studies showed little variety as experimental designs dominated. This study shows that the theoretical predictions derived from the LC4MP still hold with a study design that differs from the experimental designs.

Limitations

Obviously, the strength of this study in terms of ecological validity comes at the cost of decreased internal validity. This particularly concerns the dependent measure in the study: advertisement recognition, which is limited in two respects. The first limitation is that the recognition measure was a simple "yes/maybe versus no" dichotomy. Although the measure was based on a procedure that in a study by Southwell et al. (2002) yielded a valid measure, it is a relatively crude measure. In contrast, many of the laboratory studies we referred to in this study applied a controlled exposure or non-exposure to a stimulus, combined with a signal-detection-based measure of recognition (e.g., Fox et al., 2007; Lang et al., 2007; Lang et al., 2000). This procedure allowed these researchers to construct a very precise measure of recognition ("memory sensitivity," cf. Shapiro, 1994). The data used in the current study did not offer the possibility to calculate such a precise measure. The second limitation of the recognition measure is that it is likely to somewhat overestimate the percentage that actually did recognize an advertisement. Overestimation may be caused by the fact that although the recognition measure in the campaign evaluation surveys used three answer categories ("yes, definitely yes," "maybe," and "no, definitely no"), the dataset at our disposal had the "maybe" and the "definitely yes" answers merged into one category, which could not be altered.

The question is whether these limitations regarding the internal validity are worth the price that has been paid for ecological validity. We argue that the answer is "yes." First, random error potentially resulting from our simple dichotomy may at worse have attenuated the findings somewhat. Second, potential overestimation in our recognition scores seems unlikely to be driven by our independent variables. As a result, such systematic bias is unlikely to have affected the slopes in the regression analyses, which are of primary interest to our conclusions. Third, and most important, the study findings are in accordance with both earlier studies on the subject and theoretical predictions. The role of cuts, camera changes, and the amount of information introduced by the camera changes are in line with both theoretical expectations derived from LC4MP premises and earlier findings from laboratory studies (e.g., Fox et al., 2007; Lang et al., 1993; Lang et al., 2007; Lang et al., 2000). In addition, the strong effect of the television budget variable on ad recognition was previously found in studies on the topic (Niederdeppe, 2005; Southwell, 2005a, 2005b; Southwell et al., 2002). These findings provide additional support for our assumption that any random and systematic measurement error did not seriously distort the patterns that were found in the current study. The findings (particularly curvilinear effect of cuts/sec and the subtle interaction between cc/sec and ii/cc) are more readily explained by the theory applied in this study rather than by measurement error.

A limitation of this study that also warrants some discussion concerns the fact that we conducted the analyses on data at an aggregated level of PSAs. This means that we could not study potential (cross-level) interactions between features of the PSAs and features of the individual respondents of the surveys that may have further qualified our study findings. Such interactions are conceivable, and one promising individual-level variable in this respect is age. Southwell et al. (2010) found that the impact of exposure to advertisements on recognition was considerably weaker for older participants than it was for younger ones, a finding they explained by changes in cognitive functioning throughout the life cycle (cf. Southwell, 2010). Age-related changes in cognitive functioning may likely interact with the cognitive load imposed by a combination of fast-paced and information-dense ads. Future studies using real-life data may account for the variance in recognition introduced at the level of individuals by the merging of individual-level data from a large number of campaign evaluation studies with campaign data, including the PSA data. However, such complex datasets may be difficult to realize, and we found it hardly surprising to find the Southwell (2005a) and Niederdeppe et al. (2007) studies as the only examples of this approach. Still, these studies may shed more light on potentially differential effects of camera changes and information introduced among different populations.

Practical Implications

At a practical level, the current study offers several insights to campaigners whose primary aim it is to inform viewers. First, the findings from the second, third, and fourth model we estimated show that, on average, substantially increasing the number of camera changes in ads will result in deteriorated ad recognition, and that this is particularly true for increasing the number of cuts. This implies that PSA designers should be very reluctant in designing fast-paced ads. Second, the findings from our fifth model (which did include the interaction variable cc/sec × ii/cc) further qualify this advice by taking the moderating role of information density into account. The findings from this model imply that PSA designers should be especially reluctant in introducing too much new information through fast-paced messages, as this will decrease ad recognition even more severely. Third, the findings from our models showed that investing an additional €100,000 would result in an approximately 2.7% gain in audience recognition. From Figures 1 and 2, it may be clear that this percentage may easily be gained by careful editing (all else being equal), for instance, by slowing down an information-dense message. This example shows that potential benefits from careful editing are by no means trivial.

To a certain extent, the current study offers similar insights to campaigners aiming at persuasion by means of an argument-based strategy: Careful editing may facilitate cognitive processing of the information that is provided. According to dual processing model logic (e.g., Eagly & Chaiken, 1993; Petty & Cacioppo, 1986), this should also facilitate attitude change through "central" or "systematic" processing of the information presented in the ads. Kang, Cappella, and Fishbein (2006) provided some empirical support for this expectation by showing that in anti-marijuana PSAs that imposed little cognitive load on participants, more positive effects of argument quality were found on perceived ad effectiveness, ad liking, and positive thoughts about the ad. However, two related cautionary remarks should be made here. First, the very same careful editing that facilitates information processing might also activate other inferential processes that are not necessarily helpful in persuasion. In particular, three experiments conducted by Shapiro and Kim (2012) suggested that editing styles that facilitate information processing also enable viewers who perceived a message initially as more or less realistic, to reevaluate the messages realism during the viewing process. Second, the same editing that hinders information processing might facilitate other processes that are helpful in persuasion. To exemplify, a study by Geiger and Reeves (1991) showed that political ads featuring a more dynamic structure (a high pace of camera shots combined with high amounts of information introduced by the camera shots) had an inhibiting effect on memory for information presented in the ads, particularly in terms of response latency. However, the positive connotations associated with the dynamic structure of the ad had the desired effect of more positive candidate evaluations. As another example, a study by Chock, Fox, Angelini, Lee, and Lang (2007) showed that increased production pacing in anti-substance radio PSAs—especially when combined with arousing content—increased the perceived effects of the message on the participants' self.

To conclude, our general advice to PSA designers to be reluctant in introducing much new information through fast-paced messages particularly holds for PSAs primarily aiming at informing viewers. To some extent, it also holds for PSAs aiming at persuasion by means of an argument-based strategy. However, one should beware of potential effects that "slowing down" the PSA's pace could have on factors such as perceived realism, perceived relevance, and associative processes, all of which might be affecting persuasion in unintended ways.

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