2.1 Human Processing of Commercial Information in Digital Environments

Abstract: In theories of advertising effects attention is generally considered as being most essential for consumers' processing of commercial messages. Especially in digital media environments where many different information sources compete for the users’ attention and where the next channel is only a fingertip away it is important to provide content that satisfies the users’ needs and is attractive to them. The good news is: information processing with reduced attention can also result in intended effects. To understand which specific conditions cause such effects and what different kinds of effects are to be expected, active psychological research on advertising in digital media settings is necessary. In this paper, selected results from this research will be discussed in the framework of a limited-capacity model of human information processing.

1 Introduction

In almost every model of advertising effects attention is considered as being a crucial factor for commercial information to be effective. As the total capacity that is available in the human mental architecture for the processing of input information is limited (Mangold 2015), and as many different information sources compete for the consumer’s attention, commercial information might not get the capacity necessary to elicit intended effects on memory, attitude formation, or decision behaviour.

In the traditional mass media (printed matter, radio, television), advertisers have been confronted with a balancing act between either making commercial information more salient by putting it in the foreground or by moving it more into the background, and thus being confronted with the risk that it might be missed by consumers. For example, when a television viewer is watching a commercial spot there is not a high probability that important product information will be missed. However, commercial spots tend to be evaluated negatively by viewers and processing might fail because consumers use commercial breaks to look at the TV guide or their smartphone, to talk to each other, or even to leave the room. Product placements on the other hand, are evaluated more positively and viewers tend to stay in front of the TV and follow the TV programme they are embedded in. But product placements have a significantly
higher probability of being overlooked. Consequently, despite their tendentially negative image radio or television spots have been preferred for commercial communication, as long as not too many alternative programme channels have been offered to the radio or TV audience, and as long as it took some effort to switch channels.

The situation is becoming more complicated in digital media environments. Users still have a limited capacity for the processing of input information, but meanwhile there are many more sources from which information can be accessed. Furthermore, switching to another channel is much easier in digital environments: the next video and the next website are only the click of the mouse or the touch of a finger away. That is, consumers tend to be less motivated to stick with the processing of information from media they are not interested in, because it requires so little effort to find a better alternative.

As a consequence, the designers of commercial messages in digital media environments should take consumers’ specific needs relating to the given information into account more carefully, in order to achieve the degree of attention necessary for intensive processing. But as the number of competing information sources is considerably higher, and as a perfect match between the content offered and users’ needs probably might not be possible, research is required on the effects that might be expected even in cases where commercial information is processed with reduced attention.

In the next section an architecture for consumer-information processing will be introduced that offers an appropriate framework for the discussion of the above questions. Then, the specific needs of users that are satisfied during their interaction with digital media will be discussed. A limited number of basic human needs have been identified in empirical studies that are relevant both to the content, as well as the interactivity provided by digital media. In addition, a method will be described that is specifically adapted to revealing the users’ needs that are being satisfied or not during their interaction with digital media. Following that, the effectiveness of processing commercial information with a low receptive capacity will be discussed, and the relationship between allocated capacity and different kinds of effects will be explained. If such an unconscious processing of input information is possible it has to be discussed as to whether this establishes the opportunity to disinform or even manipulate consumers.

2 An Architecture for Consumer Information Processing

In this paper a modified version of Lang’s (Lang 2000, 2009) limited capacity model of mediated motivated message processing (LC4MP) has been chosen to
explain advertising effects in digital media environments (see fig. 1). A specific feature of this model is an implemented mechanism of capacity allocation that provides an appropriate explanation for the effects of processing information with a varying attention capacity. Cognitive information processing, and motivation and emotion, are controlled by two separate subsystems thus enabling a detailed explanation of interactions between cognitive and motivational/emotional states.

In the LC4MP humans are conceived of as systems which permanently exchange information with their physical environment. Information processing is performed by an architecture that receives information from the outer world through the senses (predominantly the visual and the auditory senses), decodes this information (i.e. understands it), processes this information (e.g. thinks about it), and possibly acts on its environment according to processing results. Information input from the environment is represented by structured patterns of physical energy that stimulate the human’s sensory organs. Initially, these patterns of energy can be conceived of as data; only if a meaning can be assigned to them, will they become information for the individual. In this view, information is identical to symbolic patterns that are connected to (inner) meaning by the information processing system.

**Figure 1:** An architecture for human information processing (modified version based on Lang 2000, 2009)
During encoding the system first attempts to find an appropriate meaning for the data pattern transported from the senses to the working memory. If this process succeeds, a representation of the environment will be constructed in the working memory that serves as a basis for subsequent processing (e.g. thinking, problem solving, deciding and judging). To be able to assign a meaning to input data, knowledge has to be retrieved from the long term memory. Important processing results may in turn be stored in the long term memory. As it might be necessary during processing to retain some information for a limited duration (e.g. for intermediate results when performing a calculation), five to nine information elements (e.g. single units such as digits or letters, but also more complex chunks such as numbers or words) can be stored temporarily in the short term memory. Information processing may finally result in an instruction for the motoric system to initiate an action, but this is not a necessary consequence of operations in the working memory.

The upper part of the architecture displayed in fig. 1 is called the cognitive or representational subsystem, because here representations of the environment are constructed. In the lower part of fig. 1 the second subsystem is responsible for dealing with the motivational and emotional states of the individual. Emotions and motivations (needs, goals, and gratifications) are strongly interconnected: if a person's needs are satisfied, this person will experience positive emotions. If however, an expected need satisfaction is frustrated, the person will experience negative emotions. Emotional and motivational states also affect the way in which information is processed by the representation system.

A central assumption in Lang’s (2000, 2009) LC4MP is that every process being executed in the architecture needs capacity. The amount of capacity that has to be allocated to a process in order to ensure proper execution is variable: “easy” (i.e. superficial) processes that do not require much concentration can be performed with less. For example, well trained and thus automatically running processes (like riding a bicycle or driving a car) are typical low capacity processes. “Deep” (i.e. thorough) processes however, that require concentration for their proper execution need a higher capacity. A process that requires a high capacity for thorough and deep operation but does not get it will operate superficially and will thus be imprecise.

Processes running with a high capacity differ from processes running on low capacity with regard to certain characteristics:

- **High capacity processes** are voluntarily controllable, their operation is governed by rules, and information is processed in a logical and rational way. During processing, the system searches for the overall best solution for a problem. The individual is consciously aware of the processing that is going on, and the processing details as well as results can be retained in memory.
- *Low capacity processes* on the other hand, evade voluntary control, and the processing style is heuristic, following “rule of the thumb” rather than the rule of logic and rationality. As a result, low capacity processes provide an approximation of good, but not necessarily the best solutions. They operate unconsciously, and the process details are not stored in memory.

A second central assumption within the LC4MP is that the total amount of capacity available for processing in the system is limited. That is, the allocation of processing capacity is compensatory: if one process gets more capacity for operation, other processes being executed at the same time will get less. This is the reason for the fact that although humans in principle are able to process more than one information source in parallel (e.g. thinking about a problem while riding a bicycle), only one process can be really deep and thorough, while all other processes will operate superficially. This mechanism constitutes no restrictions for habitual and therefore low capacity demanding processes (such as the routine activities already mentioned). But in principle, as soon as at least two require a higher level of capacity for sufficiently deep and thorough operation, only one will get enough capacity, while others will only function in a superficial manner – the person experiences *cognitive overload*.

To summarize, the demands of different processes for a variable level of capacity are strongly related to the kind of processing (deep and rule-governed or superficial and heuristic). Processes not receiving the capacity they would require for thorough operation will only attain superficially computed results. But what are the principles according to which capacity is allocated to currently operating processes? What are the factors that determine whether a process will get more or less capacity? The following determinants are mentioned in Lang’s (2000, 2009) publications:

- **Voluntary control:** Despite the fact that people generally tend to assume that they have a strong voluntary influence on the way in which information is processed in their heads, the effects of voluntarily capacity allocation to selected processes is only weak. This becomes obvious from the example where a student is learning for his exam. If he is not very much interested in the topic, learning becomes tedious and even after many repetitions learning success is only moderate. There doesn’t seem to be a way of just voluntarily increasing the capacity allocated to learning and thus with a simple trick improve learning.

- **Characteristics of the stimulus:** Attention will be very much attracted by stimuli that are salient to a person. Stimulus saliency is determined by stimulus properties like size, colour, movement, or loudness. For example, an ad which is big and displays loud colours will probably get more attention.
capacity than small and colourless stimuli. If a stimulus with not very salient features per se (e.g. an uncoloured ad) differs considerably from its context (e.g. with coloured text and pictures), it becomes salient by that.

- **Motivation**: Capacity will be allocated automatically to the processing of stimulus information that is related to a person’s interests, needs, goals, or expected gratifications. Having the right motivation is a much stronger determinant for capacity allocation than any of the other factors listed here.

- **Emotions**: In numerous empirical studies the influence of mood on the style of thinking has been demonstrated (cf. Bless, Fiedler 2006). When in a bad mood people think in a stricter, more rule-based, and more logical manner. In a good mood however, people think more superficially, they use heuristics, and are more creative. It is quite obvious that emotion-dependent differences in information processing are related to differences in capacity allocation: in a negative emotional state more capacity will be allocated to processing input information than in a positive state. An explanation for this relationship is given by cognitive tuning theory (Kuschel et al. 2010): emotional states serve as information about processing demands, and with this information the system can tune its processing activities to maximum performance in the existing environment. If a person is in a bad mood this signals that some kind of problem needs to be solved. As problem solving requires logical and thorough thinking, the system assigns most of the capacity available to these cognitive operations. A good mood, on the other hand, indicates the nonexistence of problems, and as a consequence there is no need to allocate so much capacity to information processing.

3 **Satisfaction of Consumer Needs in Digital Environments**

As has been indicated in the previous section motivation is one of the dominant factors for the allocation of capacity. Accordingly, if an advertiser’s intention is to get enough capacity for his commercial message to be processed deeply and thoroughly, he should provide messages that optimally satisfy the customers’ needs. Need satisfaction is affected by messages in digital media in two different ways. For one, *content* can be provided to the user that matches his or her interests, goals, gratification expectations etc. For the other, the *interaction with the interface* of the digital media can be more or less satisfactory.

A number of theoretical approaches to *basic human needs* have been published. What these studies have in common is that the needs postulated by
the authors are based on empirically collected data. Data from interviews or questionnaires have been submitted to statistical complexity reduction with procedures such as factor analysis. As a result between three and sixteen basic need dimensions have been found. Although it is assumed in these approaches that the set of needs reported in the publications applies to everyone, the intensity of each need varies between individuals. So a need profile can be identified for every human being in which some needs are more prominent, while others have a weaker intensity.

- Reiss and Haverkamp (1998) claim to have found in total sixteen basic desires which form the so called Reiss profile. The basic needs in their model are acceptance, curiosity, eating, family, honour, idealism, independence, order, physical activity, power, romance, saving, social contact, social status, tranquillity, and vengeance.


- Sheldon et al. (2001) report having found ten different basic needs: self-esteem, autonomy, competence, relatedness, pleasure-stimulation, physical thriving, self-actualization-meaning, security, popularity-influence, and money/luxury.

The determination of to what extent certain basic needs are affected by a product, a service or a commercial message is complicated by the fact that customers tend not to be consciously aware of their own needs. As a solution, the laddering interview has been developed by Reynolds and Gutman (1988). Laddering is an interview technique used in marketing research to gain insight into how the needs of customers are affected by products. This method is based on means-end chain theory (Gutman 1982) according to which customers have cognitive combinations in their minds consisting of the attributes of products (means) and goals (ends). If the attributes and goals match, the product is evaluated positively by the customer because it satisfies his needs.

When conducting a laddering interview for a specific product the interviewee will first become acquainted with the product and its features. Then the interviewer tries to find out which of the product’s properties are most salient to the consumer. For example, if a person is testing a bio-soy burger the attributes “healthy”, “vegetarian” and “sustainable” might be most important to him. Then by subsequently asking why-questions the specific meaning of these attributes to the test person are uncovered. For example, the interviewee might connect the property “vegetarian” to the fact that for this food no animal had to be slaughtered, which in turn is connected to one of his central values. It may also be possible that a product has disadvantageous features. For example, when
cosmetics have been tested using animals this may conflict with the customer’s value of not killing animals for economic purposes. It is obvious that the same property of a product might have different benefits for different people. This reflects the fact that the profile of needs varies from person to person.

Laddering is a well-established method for uncovering the needs that are affected by the properties of a product. However, without modification it is not applicable to identifying the features of interactive media (e.g. the interface of a website or a software), that satisfy certain needs of the user, as laddering is not designed to capture dynamic and time dependent features. As an alternative the valence method has been developed on the basis of the means-end chain theory by Burmester et al. (2010). These authors assume that certain design features of the interface (e.g. interaction elements, interaction styles) are more prominent to the user than others. While interacting with this interface in the experience phase the user presses a green button whenever he experiences positive emotions. If a negative emotional state occurs the user indicates this with a red button. In the subsequent interview phase the user will be interviewed about those sections of the interaction that he has previously marked. Again, similar to laddering, subjects are asked what properties of the media have caused the positive (or negative) emotion, what the reason for this emotion is and what meaning the property of the interface has for the user. In the subsequent analysis the basic needs underlying the combination of interface properties and emotional states will be identified.

4 Low Capacity Consumer Information Processing

If a commercial message to customers cannot satisfy their needs to an extent, it requires them to process that information attentively and deeply, this does not necessarily exclude the effects of that message. An experiment most frequently cited in this context was conducted by Vicary (Mangold 2015, p. 142). In 1957, in a cinema in Fort Lee (USA), he presented a movie to the audience which contained messages such as “eat popcorn” or “drink Coca-Cola”. The presentation time of these messages was too short for conscious recognition. Vicary reported an increase of popcorn sales of 58% and Coca-Cola sales of 18% during the interval. Obviously “subliminal” processing of information input (i.e. processing below the threshold of consciousness) can affect decisions and corresponding behaviour of humans. As an inspection of Vicary’s original data is not possible, and as it has even been assumed that Vicary’s study was a fake to promote his newly established marketing agency (Danzig 1962), a replication with similar
experimental conditions has been published by Karremans et al. (2006). In this study subjects were instructed to identify on a computer screen the strings out of a series that contained lower case letters. Before each task a prime was presented for 23 milliseconds. In control conditions the prime consisted of the letters “NPEIC TOIL”. In the experimental conditions the letters were rearranged to make the words “LIPTON ICE”. After having finished the tasks, subjects were asked whether they wanted mineral water or iced tea to drink. In the control conditions 31% of the subjects and in the experimental conditions 54% chose the iced tea. In a replication of this experiment subjects ate a salty candy before they solved the tasks. Now 20% of the thirsty subjects in the control conditions decided for iced tea, whereas 85% in the experimental conditions made this choice. Obviously, the effect of unconsciously processing advertising information is considerably stronger if the subjects experience a specific need that is related to the unconsciously processed input information.

Studies on the unconscious processing of commercial information have so far predominantly been conducted using experimental settings that resemble mass media reception. Are the results also transferable to digital media environments? At least for the presentation of banner ads on websites, Yoo (2008) was able to demonstrate similar effects. The author presented three different web-pages to subjects for a duration of 45 seconds each. In the two experimental conditions each page displayed an advertising banner at the top with varying brand information. One group of subjects was asked to carefully evaluate the page, thus assuming that they would focus their attention both on content as well as on the advertisement (the attentive group). Subjects in a second group were instructed that they should understand the content of the page and that they would be submitted to a comprehension test afterwards. This instruction was intended to focus their attention on the content and distract it from the banners (the distracted group). In a control group no advertising banners were present on the pages. As a task subjects were asked to complete word stems (like S T R _ _ _) to full words. For the analysis the number of completed words that were present on the banners was counted. Further, a recognition test was conducted. Results of this explicit test of brand memory demonstrated that subjects in the attentive group remembered significantly more brand words than those in the distracted group, who did not have a better memory performance than the control group. According to this experiment the processing of banner information with a low capacity seems to have little effect on memory.

The resulting pattern is different however, if the results for the word completion task are examined. In the control group only 36% of the word fragments were completed into words that were displayed on the banners. In contrast, in the attentive group 57%, and in the distracted group 55% of completed words
were identical to words that were also part of the banner messages. In addition, subjects from both experimental groups exhibited a more positive attitude towards the brands presented on the banners, and more frequently assigned the brands to a consideration set of five products they might buy compared to members of the control group. Similar to many other studies Yoo (2008) was able to demonstrate that even processing advertising information with only a low level of capacity can result in effects that are in the interests of the advertisers. Effects induced in low capacity processing conditions are called *implicit* because they are not conscious to the person and cannot be measured directly with methods like questionnaires. As implicit effects are inherent to information processing but not based on information explicitly stored in memory, they can only be made observable indirectly by methods such as reaction time measurement, free association, word completion, or the misattribution of feelings.

Despite the impressive number of studies demonstrating implicit effects, there is still a lack of theoretical approaches that can serve as a framework for explanation. According the *LC4MP* low capacity processing is uncontrollable, unconscious, more superficial, and without memory trace. But this model does not define a processing structure that is causal to the differences. A model published by Gawronski and Bodenhausen (2006) not only includes assumptions about the two different levels of human information processing, but it also incorporates statements regarding an architecture in which these two different modes of processing are carried out.

According to the *associative propositional evaluation model (APEM)*, information input to the sensory system will be processed in parallel in two different structures. In the *associative subsystem* (lower part of fig. 2) information elements (e.g. brand names or product properties) are represented by nodes in a network. Nodes can have varying activation states; the amount of activation reflects the relevance of the element represented by the node for ongoing information processing. Nodes are connected to each other, and activation will be propagated from one (activated) node to connected nodes. The stronger the connections between two nodes are, the more activation will be exchanged between them. The spreading of activation is automatic and uncontrolled by the person. It is also fast and concludes within a short space of time. When information is presented to the system, sensory nodes are stimulated and activated. This activation will automatically be spread to connected nodes and activate them in turn. If, for example, a person is a fan of *Apple* smartphones, this positive attitude is represented by nodes for positive properties (e.g. “good”, “modern” or “cool”) that are strongly connected to the node for an *Apple* smartphone. If a person sees such a smartphone (e.g. in the warehouse or in a commercial), this will automatically activate nodes which represent positive properties. The
resulting activation pattern then, represents the meaning or the attitude formed by the associative system.

In parallel to activation spreading, a process is initiated in the propositional subsystem. Here information processing is rule-governed: symbolic information in the system is modified according to rules (i.e. program instructions) by a central processor. Processing that follows the rules of logic and rationality is deep and thorough. Processing in the propositional structure is slower and requires more capacity than associative processing. When a person does not have much capacity available for the processing of certain information – for example, when not much time is left for a decision or when other capacity-consuming processes are executed at the same time – there is a high probability that processing results will mostly reflect the operation of the associative system. However, when enough capacity is available, processing will be completed within the propositional architecture.

These assumptions have been corroborated by results from a study conducted by Shiv and Fedorikhin (1999). In an experiment, two groups of subjects were instructed to retain either a two-digit or an eight-digit number while they crossed a room. Before they had to recall the number at the other side of the room they
were confronted with two kinds of dessert: subjects could choose between a tasty looking chocolate cake or a healthy fruit salad. After they had decided on one of the sweets subjects were asked to recall the (two or eight digit) number. The analysis reveals a strong influence of the experimental conditions on the preference for chocolate cake or fruit salad. In the eight-digit conditions, subjects more frequently chose chocolate cake than in the two-digit conditions. An explanation for this result can be given within the APEM framework: retaining a two-digit number is a relatively easy task that does not require a large amount of capacity. That is, when subjects were deciding on one of the two desserts they had enough capacity left for a decision process at the propositional level. Here the more frequent decision for fruit salad was quite rational and well founded. Subjects who had to retain an eight-digit number, however, did not have much capacity left for coming to a decision and were only able to process information at the associative level. In the associative subsystem more positive properties are connected to chocolate cake than to fruit salad which triggered the decision in favour of the high calorie sweet. That both the associative and the propositional subsystem are operating in parallel is demonstrated by the observation that subjects deciding for fruit salad reported that at first they impulsively tended to go for chocolate cake but in the end decided to be reasonable and take the fruit salad. Obviously, although the associative decision process came to a conclusion earlier the state of the associative system was overwritten by the outcome of the propositional process.

To summarize, at least implicit effects (like stimulating brand associations or improving attitudes toward the brand) can also be found in situations in which advertising information is processed with only a low level of capacity by media users. These effects are not conscious to the person and can only be verified using specific methods of indirect measurement. Implicit effects can appropriately be explained according to the APEM as being based on associative processing, that is, on the spread of activation between nodes linked to each other.

5 Conclusion

According to the model introduced in this paper media recipients have a limited capacity for the processing of the commercial information offered to them. Advertising in traditional mass media always has been confronted with the problem that only a fraction of mediated information is processed intensively by the recipients. The good news is: processing with low capacity may also be
effective in certain ways. For example, latent needs can be made salient and intensified (Karremans et al. 2006).

Meanwhile our media environment has changed radically; digital media provide an uncountable number of different sources offering multimedia information which is accessible through interactive interfaces. But the way in which information offered by the media is processed in the human cognitive architecture still remains the same: the users’ capacity is limited, and only a highly restricted number of information sources can be processed at the same time. But today, users have many more options for alternative information and it is quite easy and effortless for them to switch to a competitive channel. One option to get the users’ attention and interest is to provide content and interactivity that is related to his or her currently active needs. But even in situations where media users do not pay much attention to advertising in digital media it still can be effective and match the advertiser’s intentions (Yoo 2008).

As priming studies demonstrate, commercial information will also be processed unconsciously and can influence a person’s thinking, decisions, and actions. As she is not aware of this impact – doesn’t this set the stage for disinformation or even manipulation of consumers, especially in digital media? The answer is: no. Results from priming studies reveal that unconscious priming can only make existing (latent) needs obvious and salient to the subject and thus intensify them. However, it could never be shown that this priming mechanism allows the creation of new and previously non-existing needs or motivates subjects to make decisions that are contradictory to their general intentions. Despite all the differences – with respect to the motivated and unconscious processing of advertising information, new digital media environments are very similar to the traditional mass media.

**Publication Bibliography**


