

The fluent story

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Chapter 5

Conclusion

Processing fluency, or the ease we experience when processing information, bears a substantial power over our feelings and evaluations. What makes processing fluency so powerful, – and a fascinating phenomenon at that –, is the fact that we all experience it daily. For example, imagine you are in your favorite coffee shop. Notice the way it is decorated; does it look neat and organized or is the arrangement seemingly random? Also the font of the menu, is it easily readable? Is the music pleasant to listen to? Interior decoration, menu font and even sounds harbor fluency cues that influence the judgment of your favorite coffee place. As such processing fluency is an omnipresent, all-encompassing phenomenon that each of us experiences daily, yet most so unconsciously. This makes processing fluency a fascinating research topic, which serves as the theme of this dissertation.

Even though positioned at the very end of this dissertation, the concluding chapter is more so a prelude to the topic of processing fluency, than a conclusion. Having conducted a thorough review of extant research in this field affords us the unique opportunity to understand where processing fluency as a research theme currently stands and where it is headed. Hence, in addition to providing a summary of the individual chapters, we look at what is in store for processing fluency research in the near future: We identify gaps in the literature and point at fruitful research avenues within this field. We also sketch how the effect of processing fluency can be leveraged beyond the consumer behavior context and how processing fluency and emerging technologies could work together. After summarizing the key findings of this dissertation’s three main projects, we elaborate how the chapters are thematically linked and how they fuel one another.

5.1 Summary of Chapters

Having arrived at this point in the dissertation we hope that the reader has found answers to questions such as “What is processing fluency? What is disfluency? Under which conditions are fluency effects more or less pronounced and to which extent do they influence actual consumer behavior?” In fact, these are but a few questions that the three projects contained in this dissertation address. Examining the processing fluency phenomenon, we make use of various research methods: a meta-analysis, a technical essay as well as a classic experimental laboratory design. The dissertation kicks off by looking at the history of processing fluency

research. In a meta-analysis we collect, categorize and synthesize processing fluency studies published in the past 16 years. The increasing number of processing fluency studies, the at times opposite findings as well as a lack of conceptual clarity regarding the processing (dis)fluency phenomenon evident in the literature, spell out the need for a meta-analytic investigation.

Taking all studies that were published in the past 16 years in leading marketing and psychology journals together, we find that processing fluency has a sizable and overall positive effect ($r = .29$). A positive effect size means that processing fluency is effective in positively influencing consumer behavior across contexts, bringing about beneficial outcomes associated with processing fluency, such as increased product evaluations or favorable attitudes. Looking at our meta-analytic sample as a whole, we noticed that processing fluency research can be split into distinct themes. These themes revolve around the cognitive processes involved in fluency sensations. Indeed, each experience of processing fluency relates to a cognitive process. As an example, perceptual fluency arises when a stimulus is visually easy to identify, hence this stimulus is perceptually fluent. In the course of reviewing extant literature, we identified five such processes that give rise to fluency experiences, namely perceptual, higher-order cognitive, memory-based, linguistic and embodied-cognitive processes. Our meta-analysis shows that while perceptual- and higher-order cognitive fluency are the most prominent classes of fluency researched, it is embodied-cognitive fluency that bears the strongest effects. That is, fluency that is physically experienced, for example in form of objects with large enough handles for optimal grasp, shows a particularly strong impact on a range of outcome variables. Based on the results of the meta-analysis we formulate the fluency-as-default hypothesis. That is, we speculate that processing fluency itself presents a default state, while disfluency is a deviation from the norm. A first hint at the viability of this hypothesis is the fact that we find stronger positive effects associated with sensations of disfluency as opposed to fluency. More research is needed to test this assumption.

A substantial part of a meta-analysis is the discussion of how the results serve as a catalyst for advancing a given research field. Based on our meta-analytic investigation we found several topics that are worth further investigation: For example, we find that although motor fluency has a particularly strong effect, research in this field is surprisingly sparse. Only a handful of studies investigate motor fluency effects in relation to processing disfluency. Hence research in processing fluency is in dire need of more studies specifically investigating the effects of motor fluency. Another fruitful research endeavor is to pit different processing fluency sources (e.g. perceptual fluency vs. motor fluency) against each other in an attempt to systematically map the conditions in which processing fluency as opposed to processing disfluency is effective. This recommendation is powered by our finding that some cognitive processes (higher-order cognitive processes) are more sensitive (i.e. show stronger effect sizes) to sensations of fluency while others (perceptual processes) are stronger affected by disfluency. In sum, our meta-analysis enables researchers and practitioners to keep track of extant fluency research. Our insights gleaned from meta-analytic investigations provide options for future research as well as help provide a more nuanced understanding of the processing fluency phenomenon.

A crucial element of a meta-analysis is the collection of studies that make up the meta-analytic sample. Indeed, issues of sample reliability, more specifically publication bias, often arise in combination with meta-analytic data. Since it is often impossible to obtain unpublished papers, samples of meta-analyses are mostly comprised of published studies.

This is also the case for the meta-analysis presented in chapter 2. Only including published studies in a meta-analysis could lead to publication bias. Publication bias describes the fact that studies that demonstrate confirmatory results ($p \leq .05$) are more likely to be published than those showing non-confirmatory results or null effects. There are methods to remedy this situation, most notably the trim-and-fill method; however, they are not without problems. In chapter 3 we present a novel technique called p -curve and apply it to the data of chapter 2. As such, chapter 3 is a technical paper that serves as an extended appendix to chapter 2, the meta-analysis. Additionally, it also presents the first independent application of p -curve to a substantial body of literature.

P -curve is a newly developed technique that can both detect and correct for publication bias. Essentially p -curve is a distribution of p -values cited in the studies that are included in a meta-analytic sample. The logic behind p -curve is simple: If there truly is an effect of processing fluency, we should observe a larger number of studies with very small p -values compared to studies with p -values hovering around the .05 mark (the latter being a sign for p -hacking, a common occurrence among published studies and by extension a symptom of publication bias). The shape of p -curve is indicative of whether or not a given sample shows signs of publication bias. The distribution of p -values included in the sample of chapter 2 is significantly right-skewed, indicating that there are more p -values close to .00 than to .05. This informs us that the studies included in the sample bear evidential value. There are no signs of p -hacking and publication bias respectively, attesting to the reliability of the meta-analytic results of chapter 2.

Having confirmed in chapter 3 that the results of the meta-analysis are reliable, we take a closer look at opportunities for future research gleaned from the meta-analysis. Inspired by gaps in the literature we formulated the research themes for chapter 4. Indeed, chapter 4, which is a controlled laboratory experiment, is borne out of three specific gaps we identified in the processing fluency literature: For one, there are only few processing fluency studies that experimentally investigate actual behavior. To our knowledge there is no study that has investigated the effects of processing fluency in relation to consumption volume. At the same time, the rising rate of obesity so prevalent in our times presents an unprecedented urgency to find ways to combat this issue (World Health Organization, 2017). Hence, we chose consumption volume as the behavioral outcome variable.

Moreover, there is only one study in our meta-analytic sample that focusses on the effects of brand logo complexity through the lens of processing fluency. This is surprising, given the latest surge of flat design permeating brand logos on a large scale. Indeed, many famous logos now look decidedly simpler and flatter and hence it could be argued that processing fluency increased. Thus, investigating logos in relation to processing fluency is a timely issue. In chapter 4 we present participants with two versions of the same logo (fluent vs. disfluent logo). Research has shown that the experience of processing fluency influences buying intentions of food products, but no study has examined how package features (i.e., a brand logo), transferring a feeling of fluency, might impact actual food intake. Thirdly, results from chapter 2 show that there are positive effects associated with processing disfluency, yet only very few studies have dealt with this topic. In fact, of all effect sizes we gathered in the meta-analysis only 11% show positive disfluency effects. Hence, we make it a point to not only employ a control condition, but to also test to which extent disfluency effects play a role in the consumption context.

More concretely, chapter 4 encompasses two experiments, in which we assess how simple

versus complex brand logos impact food consumption. Study 1 shows that individuals consume more from a product which features a simple, flat logo, compared to a product that features a complex logo. Study 2 shows that the nature of the product is an important moderator to this effect: While for non-prestigious products simple brand logos increase consumption (a replication of study 1), the opposite is the case for prestigious food products. Here we note increased consumption volume in combination with a disfluent logo. While the findings are consistent with earlier work on fluency effects within the food domain, this research shows explicitly that package features have a differential impact on actual food intake, depending on the nature of the product. This effect-flip adds to the growing body of studies that attest positive downstream effects to processing disfluency. It also shows that time has come to update the traditional fluent-is-better tenet.

5.2 Future Research

Having provided a short summary of the dissertation's three chapters it is now time to focus on the future of processing fluency research. In this section we present research ideas, powered by insights generated from the sum of this dissertation's projects.

We found that both motor fluency as well as processing disfluency bear a particularly strong effect on consumer behavior. While in the past decade the number of studies attesting positive effects to disfluency was rising, there is still only a limited number of studies which focus on motor fluency and much less so in combination with processing disfluency. Hence more studies should be devoted to uncovering the specific effects of motor fluency and particularly motor disfluency. Given this, a bridge between processing fluency and user experience (UX) is plausible, since user experience describes consumers' attitudes and emotions with regards to using a particular product or device (International Standards Organization, 2010). Without a doubt, ease of use is a valuable component in the research field of human-computer interfaces. Indeed, there is a report issued by cyber security company Radware (2015), aptly calling processing fluency the missing link in UX. The report attests to the value of processing fluency in UX design. It is all the more surprising that to date there are no scholarly articles that jointly investigate processing fluency and user experience. Given the strong effects of motor (dis)fluency together with the surprising lack of available studies in this field we believe that investigating (motor) fluency in the context of user experience is a promising research field. An example are haptic feedback patterns (slight vibrations) incorporated in the user interface of an app present a way to introduce motor (dis)fluency. Given that research suggests that disfluency prompts a more analytical mindset it is conceivable that disfluent haptic feedback patterns may in fact be especially beneficial for apps of firms in the financial or insurance industry and less so for apps with emotional content, e.g. apps of beauty brands. In fact an ever increasing number of brands make use of apps as a new marketing target channel. Hence this field of research is bears exciting novel insights.

Besides motor fluency, another research stream could be devoted to investigating processing fluency related to linguistic processing, especially in view of the rapid rise of smart speakers. Smart speakers are wireless speakers equipped with a virtual assistant that reacts to voice commands. A prominent example is Amazon's Echo device range. Smart speakers are growing in popularity. In fact, as of December 2017, 16% of American homes are equipped with a smart speaker. Within the next three years this number is projected

to be 75% (NPR, 2017). Given the rapid rise of smart speakers, research in perfecting linguistic capabilities of these devices is timely. Principles of linguistic fluency can be applied to virtual assistants that produce voice commands: Rhymes, syntax structure, and pronounceability are all parameters that harbor fluency cues. Endowing these fluent cues, such as simple syntax structure and clear pronunciations to these smart speakers can prove to be an important USP in a soon-to-be saturated market.

Another research field which currently creates a big buzz is machine learning. Where there is a lot of data, there is machine learning. Being home in the area of artificial intelligence, machine learning describes how machines make sense of a large amount of data, much like humans do (Kirk, 2014). Hence, it does not seem far-fetched to weave the principles of processing fluency into algorithms designed to recognize pattern in data. In fact, pattern recognition is a central theme to machine learning. More specifically, by means of algorithms a machine could be trained to distinguish between fluent and disfluent visual elements of a given logo. Classifying the training data for such an algorithm we suggest using the five levels of complexity devised by Henderson and Cote (1998). With such an algorithm, a machine could learn to discern which brand logos are fluent and which have predominantly disfluent features, informing R&D departments working on the latest product innovations.

On a more philosophical note, processing fluency can aid in the discourse of whether or not machines learning mirrors human learning. Processing fluency is a meta-cognitive cue that the human brain automatically detects. What are the implications for machine learning and artificial intelligence if machines start to understand fluency cues? What will the next steps be? Certainly, processing fluency research has yielded a number of interesting results, but there is so much more to be explored in the years to come.

In this context we could also envision the application of emerging technologies, which brings us to our next point. As the meta-analysis shows, measurements of processing fluency are largely limited to traditional methods, such as Likert scales. The advancement of immersive technologies, that is technologies that blur the line between the physical and the virtual realm, harbor new possibilities in processing fluency research. Starting off with a more fundamental question, research could be devoted towards uncovering parallels between human sensations in the physical as opposed to the virtual world. Do the fluency cues stemming from virtual objects influence us to the same extent as physical stimuli do? And if so, what implications does this have for human cognition at large?

Immersive technologies can also serve as a new measurement tool for processing fluency. For instance, processing fluency researchers can easily make use of VR glasses, more specifically head mounted displays (HMD) which immerse the participant in a virtual environment. Researchers could simulate environments with varying fluency features and track consumers' eye movements. Indeed, nowadays there are several, quite affordable brands of VR glasses that have eye tracking capabilities. With this technology one could investigate the ramification of motor fluency in the context of app design. Additionally, research addressing the impact of servicescape changes on consumer behavior (Brüggen, Foubert, & Gremler, 2011) could be revisited and extended with novel measurement techniques including motor fluency as a dimension assessing consumers' impressions.

In the context of more traditional measurement scales of processing fluency, our meta-analysis yields an interesting insight: To date, there is no validated, psychometrically sound

measure of processing fluency. Researchers avail themselves of a multitude of measurement tools. While likert-type rating scales are the most widely used tool to measure processing fluency, a psychometrically validated scale of processing fluency does not yet exist. In fact the question how to accurately measure processing fluency has received little research attention – until now. Graf, Mayer, and Landwehr (2017) also noted this research gap we described in our meta-analysis. Employing classic scale development procedures they tested the commonly used one-item scale (*easy – difficult*) against a five-item semantic differential capturing similar dimensions. Both scales show an equal level of predictive validity across five processing fluency manipulations. As such, their work presents a starting point for future research in this field. In fact, we advocate for the use of a comprehensive processing fluency measurement catalog that suits the measurement of *all* variants of processing fluency across contexts. That is, depending on the cognitive process that gives rise to fluency experiences, e.g. motor fluency vs. perceptual, we could envision that a different measurement tool would be applicable (behavioral assessment vs. likert scale). Hence the question how to accurately measure processing fluency presents a novel research field with much yet to be explored.

Keeping with the topic of measuring processing fluency, another idea for future research revolves around implicit measures of processing fluency. Processing fluency is a meta-cognitive cue, operating largely besides our awareness. Hence making use of implicit measures such as the Implicit Association Test (IAT) or Affect Misattribution Procedure (AMP) to measure this construct suggests itself (for a review of implicit measurement techniques see Gawronski and De Houwer (2014)). In fact Makin, Pecchinenda, and Bertamini (2012) have successfully used the IAT to measure visual symmetry which itself is a fluent cue as it is more rapidly processed than asymmetric patterns. Future research could be devoted to refining implicit measures of processing fluency effects, such as the AMP. In this procedure participants are briefly presented with a prime which is then followed by a neutral stimulus (Chinese ideograph). Participants' task is to indicate whether they deem this ideograph more or less pleasant than an average ideograph. Future studies employ fluent and disfluent stimuli to investigate to which extent processing fluency colors implicit attitudes. We recommend to focus research attention on the AMP, as it presents a promising alternative to the IAT because of its high effect sizes and reliable estimates (Gawronski & De Houwer, 2014).

5.3 Managerial Implications

With processing fluency being such an omnipresent phenomenon, this conclusion would not be complete without also mentioning ways in which the effects of processing fluency can be leveraged beyond the realm of academic research. We believe that branding, commercial market research, neuromarketing and product innovation can benefit from the potentials of the processing fluency effect.

Results from chapter 4 can serve as direct input for brand managers of consumer goods. Specifically, we found that food products that are deemed basic benefit from fluent cues, whereas products with a more sophisticated brand image fare better with disfluent package elements, evidenced by increased consumption volume. Based on this we recommend brand professionals to consciously make use of the concept of fluency cues in package- and logo design, while always keeping in mind product prestige: Low-frills products should transport

an image of familiarity and reliability. This is best achieved with a clear and simple, and hence fluent packaging. Logos of basic products should adopt a flat design, and their packages should be easy to handle (e.g. large and clearly marked tabs to open package). Based on our results we strongly advise a change of strategy for more prestigious products (e.g. Lindt Chocolates, Caviar). For these products we recommend a complex design style, both in terms of its logo and packaging: Logos can include several elements and shapes and the packaging could be oddly shaped. Taken together these present disfluent cues, which signal rarity and uniqueness, which is precisely what sophisticated products are valued for.

Our findings can also be applied in a health context. Given the rise in obesity, promoting healthier eating habits is essential. Small cues in a consumer's environment such as packaging style can have considerable impact. Hence, thinking of ways to promote a healthier lifestyle we derive the following recommendations based on results of Chapter 4's studies: Commonly available fruits such as apples, bananas and kiwis best feature fluent logos (in form of stickers placed on the fruit itself). Our results show that this stimulates consumption (all else being equal). More exquisite types of fruits such as Pineapple Guavas or Pitayas however should feature disfluent logos, as we show that this configuration leads to an increased consumption volume.

Brand professionals are often informed by market research agencies with regards to their strategies. These agencies make use a number of key performance indicators (KPI's) to glean insights from. Commonly employed metrics include direct measures of consumer's attitudes. Here the awareness, recognition and consideration of a given product or ad is assessed by means of rating scales, rankings and check-offs (Lautman & Pauwels, 2009). Market research firms are on a perpetual quest to identify novel key performing indicators (KPI's) that drive both consumer behavior and ultimately, a market research firm's business. In this area, too, results from this dissertation yield valuable insights. In market research all is pointing towards the use of behavioral measures. We advocate that processing fluency, and more specifically, motor fluency presents a promising KPI for market research. For example in the context of product pre-testing, indications of motor fluency can be used to measure a products' success. Participants of focus groups could be specifically asked about the experience of motor fluency when interacting with a given product. This may yield interesting insights especially in the context of car clinics, where participants are invited to physically explore prototypes of cars. Participants' statements regarding whether a given model 'feels right' on various dimensions (seats, center console, overall model shape) certainly serves as invaluable input for car company's R&D departments.

Processing fluency can also serve as an indicator for ad performance. Processing fluency, operationalized by reaction time, presents a useful KPI to measure the performance of ads. For instance, how long does it take consumers to recognize the product? Is it desirable to show the product up front, aiding the processing of the remainder of the commercial, or is a level of disfluency, evidenced by suspense created from showing the target product at the end a better option? There are many insights to be won from investigating processing fluency in the area of market research.

More and more market research firms specialize in neuromarketing. This means these companies specifically leverage neuro-cognitive insights to explain consumer behavior. Here the focus is to uncover the neural correlates involved in product evaluations. An interesting subfield of neuromarketing is *neuromarketing*. Neurodesign explores why the human brain is attracted to certain designs more than to others. Insights from this field are especially

relevant to package creators, brand professionals and graphic designers. With processing fluency as the source of attractiveness, neurodesigners could find the ideal level of fluency of a given packaging or logo for example. Here we envision that principles of perceptual fluency, found in symmetry and familiarity may play a chief role. It is also interesting to see whether certain color combinations are more or less fluent.

Moving on to the realm of product innovation, the effects of processing fluency can also be leveraged in user-centered design (UCD). User-centered design is a product design philosophy that aims at fitting the product, most notably web-interfaces and -technologies to the users, not the other way round. That is, it aims to render a new product highly usable (Consortium, 2004). Product designers adhering to UCD analyze the way consumers use a given product and validate this in tests using prototypes and beta versions, as in the case of web interfaces. Sticking with the example of creating a new web interface, among the essential UCD elements of a web site are: visibility, accessibility, legibility and language (Turkiyan, 2012). Interestingly though this is not mentioned explicitly, essentially processing fluency is the key to good (web) design. In fact in their ideal form all four of these elements show high level of processing fluency. In crafting a web interface, high *visibility* is recommended. That is, a simple website architecture, with clearly marked navigation panes, captures the user's attention and prolongs their stay on the website. Given our insights on processing fluency, this is plausible because fluent interactions engender positive evaluations. Processing fluency is also evident in the principle of *accessibility*. Users have a positive interaction if they find information quickly. Hence an intuitive arrangement of information that facilitates processing fluency (especially memory-based fluency) is desirable. Examples of intuitive controls are the location of information on a website, e.g. contact data at the bottom, while the log-in button is typically located on the upper right. Having a website that is highly readable is another essential feature of a well-designed web interface. Indeed, increased processing fluency through *legibility* can be achieved by a wise choice of italics and bold styles, while avoiding excessive use of capital only letters. Lastly, though it may not at first appear so, *language*, too is a crucial element of a web interface (Turkiyan, 2012). In addition to a beautiful font, the choice of words also bears fluency cues. As such it is recommend to make use of simple syntax, avoid jargon and overly long sentences. Taken together, an ideal web site instills fluency cues on all touchpoints of a website, be it conceptually, via text or visuals. Knowing this, we invite web designers to consciously leverage the effects of processing fluency.

Having arrived at the end of this dissertation, I hope that the reader gained a better understanding of the processing fluency effect, and how it can be leveraged in a consumer behavior context and beyond. Consequently, readers of this dissertation may face the same situation as the author, namely being very attuned to fluency effects surrounding them, realizing just what pervasive of a phenomenon processing fluency is: Be it the spelling of one's favorite restaurant or the name of a friend's child, the look and feel of the user-interface of one's smartphone, the ring of political campaign slogans or the way one's coffee machine is to be operated, processing fluency cues are imbued everywhere ready to influence us (un)consciously.