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Welcome to the Jungle! The Neuromarketing Literature Through the Eyes of a Newcomer

Structured Abstract:

Purpose – In order to grow, any field of research must both encourage newcomers to work within its boundaries, and help them learn to conduct excellent research within the field's parameters. In this paper, the authors examine whether the existing body of neuromarketing literature can support such growth. Specifically, the authors attempt to replicate how a newcomer to the field of neuromarketing would go about orienting themselves to the field, and learn how to conduct excellent neuromarketing research.

Design/ Methodology/ Approach - A total of 131 papers, published in the areas of 'neuromarketing' and 'consumer neuroscience' were downloaded, and then identified as conceptual or empirical in nature. A separate database was created for each type of research paper and information was recorded. For both conceptual and empirical papers the citation details, notably year of publication, journal, journal ranking and Impact factor were recorded. Papers were then descriptively analysed with regards to number of publications over the years, content, and journal quality.

Findings – We find that interest in the field is growing, with a greater variety of topics and methods appearing year on year. However, we also identify some issues of concern for the field if it wishes to sustain this growth. First, the highly fragmented literature and the lack of signposting makes it very difficult for newcomers to find the relevant work and journal outlets. Second, there is a lack of high-quality, user-oriented methodological primers that a newcomer would come across. Finally, neuromarketing as it appears to a newcomer suffers from a lack of clear guidance on what defines good vs bad neuromarketing research. As a large majority of the reviewed papers have appeared in lower ranked journals, newcomers might get a biased view on the acceptable research standards in the field.

Originality/ value - The insights from our analysis inform a tentative agenda for future work which gives neuromarketing itself greater scientific purpose, and the potential to grow into a better-established field of study within marketing as a whole.

The earliest appearance of the term 'neuromarketing' in the title of a scholarly publication can be traced back to mid-2007, when both Lee, Broderick, and Chamberlain (2007), and Fugate (2007) published papers (at approximately the same time), in the *International Journal of Psychophysiology,* and the *Journal of Consumer Marketing* respectively[1]. Prior to this, marketing-relevant topics had been examined in scholarly research in the emerging field of neuroeconomics (Braeutigam, 2005; Braeutigam et al., 2001; Camerer, Loewenstein, and Prelec, 2005), and also in commentaries about marketing practice in the neuroscientific literature itself (e.g. see July 2004 Editorial of *Nature Neuroscience,* and February 2004 Editorial of *The Lancet*).

In the ensuing decade, it is undeniable that there has been a significant rise in the amount of research appearing in scholarly marketing journals that employs neuroscientific methods, albeit from a baseline of virtually zero. This is strong evidence of a burgeoning interest in such research amongst marketing scholars. Indeed, in 2015 the esteemed *Journal of Marketing Research* published a special issue devoted to neuromarketing research (Camerer and Yoon, 2015), and the 2016 *Association for Consumer Research* also featured a special session on neuromarketing (Reimann, Hedgcock, and Craig, 2016), as did the 2016 *European Marketing Academy* (Koller and Lee, 2016). That said, a number of scholars have suggested that there would be significant benefit to a greater focus on programmatic and integrative research in the area (e.g. Brieter et al., 2015; Smidts et al., 2014; Solnais et al. 2013).

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[1] It should be noted that Smidts (2002) does use the term 'neuromarketing' in his inaugural address to the Erasmus Institute of Management. One may also consider Shiv et al. (2005) as a relevant starting point, although – despite being published in *Marketing Letters* – it discussed the impact of neuroscience on decision making research, not marketing in general. Ambler et al. (2004), in *Psychology and Marketing*, also predates this, although again this is a choice-focused study. Arguably, and especially given Breiter et al's (2015) neuromarketing framework, these studies may fit better into a neuroeconomic context. Whatever one's view on that, neither mentions the term 'neuromarketing'.

With the growing interest in neuromarketing has come a commensurate growth in the number of scholars looking to enter the area. Indeed, if neuromarketing[2] is to develop further as a fully-fledged area of marketing scholarship, this should be welcomed, because growth in the use of neuroscientific methods, theories, and paradigms within marketing scholarship is necessary for neuromarketing to deliver on the promise identified in prior work. However, for the field to become widely accepted, growth in the number of scholars engaged in neuromarketing research must also result in a growth in the amount of research of high impact and high quality. This is a potential issue since, unlike most other research methods which may be used by marketing researchers, neuroscientific paradigms often require training of the type rarely (if ever) provided in typical marketing doctoral programmes. As such, the existing neuromarketing literature plays an unusually powerful role in driving expansion of the field beyond already existing networks of experienced collaborators and their own students. Without the benefit of such collaborators, how then should a marketing researcher approach the task of beginning research into neuromarketing?

In the present paper, we review the scholarly field of 'neuromarketing' from the perspective of a marketing scholar without a background in neuroscience, who wishes to begin working within the neuromarketing area. In doing so, we provide a picture of the current state of the literature as it would appear to an interested newcomer to the field. As published neuromarketing papers increase in number and visibility, it is likely that an ever-increasing number of marketing scholars will look towards the area as one likely to furnish them with interesting topics and problems. However, a growth in interested researchers,

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[2] We are aware that some authors differentiate 'neuromarketing' from 'consumer neuroscience', with the former applying to commercial market research, and the latter to academic work (e.g. Plassman et al., 2015, Javor et al., 2013). While we do agree that this distinction in nomenclature is meaningful, it would appear that the majority of academic literature does not strictly differentiate in this way. Indeed, Reimann et al (2011) use the terms 'neuromarketing' and 'consumer neuroscience' interchangeably. As such, we follow the main body of academic work, and the title of this special issue, in using the term 'neuromarketing' to refer to scholarly research in the area. Where commercial research is covered, it is specified as such.

coupled with increasing access to sophisticated neuroscience research methods, comes with caveats. Specifically, as Ruff and Huettel (2014, p. 77) state, such growth makes it "possible for inexperienced researchers to design and carry out cognitive neuroscience experiments without having a deep understanding of the underlying brain function or of what they are recording" with the outcome that it is in fact "easier for researchers to make mistakes!" Indeed, similar issues have been noted with the increasing accessibility of sophisticated quantitative analysis techniques (e.g. Guide and Ketokivi, 2015; Steiger, 2001).

As such, a primary contribution of this paper is to provide what could be called a user-oriented introduction to the neuromarketing literature. In doing so, we discuss the different steps a newcomer is likely to take when moving into the neuromarketing field, along with their informational needs at various stages of their development as a neuromarketing researcher. We examine the fit between these needs and the neuromarketing literature that is most visible, and thus that they are most likely to uncover in their searches. We find that there is often a lack of fit, such that much of the current literature in the field may not help those who may be inexperienced in neuromarketing to conduct strong research. In particular, while we find that there do exist excellent accounts of neuromarketing research and (especially) neuromarketing methodologies, many of these are unfortunately quite unlikely to be found by newcomers who search the literature for 'neuromarketing' or 'consumer neuroscience' studies. This is especially so for researchers who may not yet be sure what differentiates strong neuroscientific work from that which is weaker. Accordingly, another contribution of the present paper is to raise visibility of the significant amount of high-quality work outside the set which may be uncovered in a typical search from a marketing perspective. We therefore have two target audiences for this paper; a) those new to the field of neuromarketing, who wish to transition into the area while avoiding common pitfalls and hazards, and b) those who may already be well established researchers in the field. Our

contribution to the latter group is twofold; a) to provide a set of directions for future high-quality work in neuromarketing, to fill the informational gaps we uncover in our review, and b) to raise the possibility that knowledge that may seem second nature to them, may actually be comparatively inaccessible to newcomers to the field.

ANALYSIS OF LITERATURE: METHOD

Figure 1 presents a process describing the various steps we believe a typical marketing researcher, who may be at least somewhat experienced in the classic marketing and social science research methods, but not in neuroscience, would likely conduct in order to enter the field of neuromarketing. The obvious first steps revolve around the availability and accessibility of relevant publications, the scope of neuromarketing itself, and gaining an appreciation of the existing state of knowledge. From there, it is to be expected that most researchers would begin to explore the different ways of conducting neuromarketing research, and what would differentiate good quality work from weaker research. At this point, a typical researcher's attention may turn to methods of getting established in the field, including identification of networks to develop, and how to generate funding. Figure 1 also shows the various informational needs at each stage of the process of entering the neuromarketing field, and our view of whether the current state of the literature provides for that need. Specifically, we use a 'tick' to indicate a good fit between a newcomer's information needs and the content of the most visible articles in the field; a 'cross' to indicate a poor fit, and a '-' to indicate neither a good nor bad fit (i.e., if there are both good and poor aspects of fit). We discuss the reasoning behind our conclusions in the balance of the present paper, beginning with the details of our literature search.

FIGURE 1 ABOUT HERE

In keeping with our prime objective to understand how a newcomer without a neuroscience background may look to enter the field of neuromarketing, we looked to search the literature in the kind of way that might be typical of such a researcher. As such, in order to find the most pertinent literature, the search term "neuromarketing" was used to search Google Scholar without any restriction on the date parameters (we conducted the first search in 2016). As the earliest journal publication hits for this search term were in the year 2007, and because many of the hits suggested that the terms 'consumer neuroscience' and 'neuromarketing' were used interchangeably (e.g., Reimann et al. 2011), we suggest that it is very likely that a newcomer would subsequently conduct a search on Google Scholar with the former term, and pay particular attention to research post-2007. It was important not to limit to any specific application of neuroscientific technique (e.g. using the search terms "fMRI and Marketing") as we anticipated that relevant research may also use other neuroscientific methods of a data collection, and that it was unlikely that a newcomer would be so specific in terms of methodology. Further parameters were agreed, for example only peer reviewed academic work appearing in scholarly journals or academically-oriented book publications was considered relevant. Therefore, working papers, and reports regarding commercial work, were filtered out/ dismissed. Our intention here was not to do a formal 'systematic review' of the area, but instead to gain as broad an overview of the scholarly work appearing in journals and book publications as possible. As such, our methodology certainly allows us to gain insight into the most visible articles in the area over the past decade – exactly as would be uncovered by a relative newcomer to the field.

A total of 131 papers were downloaded which were then identified as conceptual or empirical in nature, resulting in a split of 45 empirical research papers and 86 conceptual papers. A separate database was created for each type of research paper and information was

recorded. For both conceptual and empirical papers the citation details, notably year of publication, journal, journal ranking and Impact Factor were recorded. As a journal ranking measure, we identified each paper's classification in the *2015 Academic Journal Guide* as published by the *Chartered Association of Business Schools*. This is a widely applied journal guide that many business schools adopt when making hiring and promotion decisions for researchers. It thus serves as a well-established measure for journal quality. The ABS list distinguishes between five different quality levels (in increasing order of journal quality): ABS 1, ABS 2, ABS 3, ABS 4, and ABS 4*. To include papers that had been published in non-listed journals or book chapters, we added two more classifications: *Not Ranked*, and *Not Ranked & No IF*, where the distinction between both categories was that the former included non-listed journals that had an Impact Factor (such as *Journal of Neuroscience*), and the latter included only non-listed journals without an Impact Factor (such *as International Journal of Social, Behavioral, Educational, Business and Industrial Engineering*). As well as this basic common information, we recorded a number of specifically relevant details about each type of paper.

For conceptual papers, we developed from discussion a categorization of papers regarding their main apparent objective. A total of eight categories emerged: Overview (35 papers), Ethics (10), Agenda for Future Research (3), Theory Development (2), Critical Evaluation (2), Methodological Primer (3), Other (14), and Multiple (17). Papers in the *Overview* category present an introduction to the field, methods, and research topics of neuromarketing, and papers that discuss ethical considerations for marketing practitioners, and/ or researchers appear in the *Ethics* category. Papers in the *Theory Development* category include articles that develop a conceptual framework for the field of neuromarketing (Breiter et al. 2015), or develop a theory in traditional marketing areas, such as branding, that lends itself to empirical testing with neuroscientific methods (Schmitt, 2012). Papers in the *Critical*

Evaluation category highlight the limits and shortcomings of neuromarketing, and discuss avenues for how the field can increase its impact on marketing theory more broadly (Ariely & Berns 2010; Plassmann et al. 2015). We classified articles that discuss the use of neuroscientific methods in general, and/ or specific steps in their application as *Methodological Primers*. Papers that presented an editorial, viewpoint, literature review, or exploratory study of consumers' attitude towards neuromarketing were classified as *Other*. Finally, whenever a paper included content that related to more than one of the previous categories, we classified it as *Multiple Things*. An example in this category is Smidts et al. (2014), because the authors combine aspects of an overview article with an agenda for future research.

Empirical papers were categorised according to citation information, including year of publication, journal, ABS 2015 ranking and Impact factor. This allows for direct comparison with the publication details of the conceptual papers. The neuroscientific method or technique employed for data collection was recorded and where multiple methods were used (e.g. fMRI and a skin conductance measure) the details of all the methods were recorded. Justification for the application of neuroscientific techniques were categorized. A total of six discrete categories emerged and two categories where multiple categories were cited as the justification for use of neuroscience methods were also noted.

Papers in the *complementary data source* category identified the benefits of neuroscientific methods as complementary (and generally preferable) to traditional self-report measures (e.g. Couwenberg et al. 2016; Rampl et al. 2016). Benefits of neuroscientific methods such as the reliability of data (e.g. Chen et al, 2015) and real time information (e.g. Cascio et al, 2015), were often cited in such papers. Papers that were classified as *novelty* cited that the theory under consideration had never been investigated using neuroscience methods and this was the main justification for adopting such techniques. Papers categorized

under *theory development* state that evidence from the literature indicates that there should be a specific theory-driven contribution from the use of neuroscientific methods (e.g. Bagozzi et al, 2012; Daugherty et al, 2016).

A number of studies were categorized under *prior research* where the justification for the use of neuroscience was primarily that prior research in the field had adopted neuroscience techniques (e.g. Milosavljevic et al, 2012). Papers categorized as *more accurate data* centred their justification for use of neuroscientific methods as a means to obtain 'hidden information' (e.g. Boksem and Smidts, 2015) which can range from true preferences to tapping into the subconscious (Touchette and Lee, 2016). Interestingly, some empirical studies presented no clear justification for the adoption of neuroscience methods and these were categorized as *None*. On occasion, it was suggested that a reason for using neuroscientific methods was that commercial enterprises were doing so, although this was always combined with another justification e.g. more accurate data. A further set of papers suggested that neuroscientific methods could obtain both complementary *and* more accurate data.

In the next section, we discuss how well the reviewed papers address a newcomer's key questions when moving into the field of neuromarketing.

THE FIELD'S ANSWERS TO A NEWCOMER'S KEY QUESTIONS

We structure our discussion according to the key questions, and a newcomer's information needs as previously displayed in Figure 1.

1. WHAT IS NEUROMARKETING?

To answer this question, a newcomer first needs to have access to a broad topical range of papers in the field of neuromarketing. Figures 2 and 3 reveal that this need is increasingly addressed by the field.

Specifically, Figure 2 shows that the visibility of publications in the field for newcomers is on the rise, as reflected in increasing numbers of both conceptual and empirical articles that have appeared over the past ten years. Similarly, Figure 3 shows the variety of topics (conceptual) and methods (empirical) covered by the most visible neuromarketing and consumer neuroscience research over the last 10 years, using the categories detailed earlier. It appears that the variety of topics being covered is steadily increasing and, despite the overall dominance of functional magnetic resonance imaging (fMRI) over the last decade (discussed below), the variety of methods employed to study neuromarketing issues is also increasing over time. We thus conclude that there is a good fit between newcomers' need for access to a broad range of papers in the field, and what the field has to offer to such newcomers. On the surface, this seems like heartening news. However, on deeper reflection there are some significant concerns for the field that can be drawn from these results. Indeed, it is very rare to see any other method utilized. It is of particular note to see that magnetoencephalography (MEG) did not seem to be utilised at all in the papers uncovered in our search. Given both the well documented challenges in using fMRI discussed in the neuroscience literature (discussed in subsequent sections), and the useful attributes of MEG itself, this seems a missed opportunity.

Figure 3 also shows that there exist a large number of overviews of neuromarketing and consumer neuroscience. Indeed, our analysis reveals that about forty percent of the most visible conceptual papers in the field could be considered primarily as overviews, with many of the papers covering multiple topics also having significant overview content. Accordingly, one would think that these overviews should serve as good starting points to teach

newcomers the scope of neuromarketing, its relationship with traditional marketing, and the required level of interdisciplinary knowledge necessary to navigate the field.

However, closer looks at the reviewed papers often revealed a considerable lack of one or several such considerations: while many papers defined the scope of neuromarketing in line with the classical definition by Lee et al. (2007), i.e., neuromarketing meaning the application of insights from neuroscientific methods to marketing problems, some papers presented a rather different understanding of the field's scope, suggesting instead, for example, that studies in behavioural economics *per se* represent an important type of neuromarketing research (Neto et al., 2011). It is easy to see how papers with this latter understanding could lead a newcomer astray from the marketing context. Additional confusion for newcomers could arise from the relative share of different neuroscientific methods across empirical papers in Figure 3. In some ways, our findings suggest that in fact it might be argued that rather than neuromarketing meaning the application of neuroscience to marketing problems it may be more accurate to consider it at present to mean the application of *neuroimaging* to marketing problems. Indeed, the growth of neuromarketing research since 2007 seems to have been driven by use of a single method – fMRI, and while EEG has also been used to study neuromarketing issues since 2007, all but 4 studies using EEG since 2007 are published in 2015 and 2016.

While to some extent the label neuroscience versus neuroimaging is semantic, from another perspective it does represent something reasonably profound. Specifically, neuroimaging itself is really a technique in the service of some other purpose, rather than an end in itself. At times however, it is not clear in neuromarketing literature that the objective of a given study is really anything more than presenting descriptive images of the brain responding to some given marketing-relevant stimulus, or performing some task. Obviously,

such results are interesting, but researchers, in particularly, inexperienced newcomers, should be very cautious in interpreting such results.

We were also concerned to see that virtually all reviewed papers had an overly narrow view on the scope of Lee et al. (2007)'s definition of neuromarketing as the application of insights from neuroscientific methods to marketing problems; while this definition entails both, neuromarketing as the application of neuroscientific *methods* to generate new insights about marketing problems, and neuromarketing as the derivation and testing of behavioral predictions from neuroscientific *theories*, virtually all reviewed papers focused only on the former interpretation. As a consequence, newcomers might get an overly narrow understanding of the scope of neuromarketing and - as we discuss in subsequent sections - such a view can undermine the field's impact on marketing, in general. Overall, however, we observe both, positive and negative aspects of the field's ability to help a newcomer clearly define the scope of neuromarketing. Accordingly, we evaluate the fit for this need as neither good nor poor.

Regarding guidance on the field's relationship with traditional marketing, many overview articles simply pointed at neuromarketing's apparent ability to shed light on unconscious and emotional processes, thereby complementing traditional research methods. However, as there was almost a complete absence of neuroscientific foundations in these articles, the underlying basis for neuromarketing's ability to shed light on those processes remained often unclear. This lack of clarification about the relationship between traditional and neuroscientific research in marketing is even more concerning when looking at the reviewed empirical literature, because very few empirical studies provide strong justification for exactly *why* neuroscientific investigations are justified over and above existing behavioral work, and exactly *what* new and unique knowledge is being created. Overall, we thus

conclude that there exists a poor fit between newcomers needs for guidance on the difference from traditional marketing, and on the level of required interdisciplinary knowledge.

Further, even fewer of the reviewed studies demonstrate a strong awareness of the drawbacks of neuroscientific methodologies, and many demonstrate a number of important misconceptions about just what insight neuroscientific methods can provide. We will address these issues in depth in subsequent sections, but conclude at this stage, that there exist already some not-inconsiderable entry barriers for newcomers trying to answer the supposedly straightforward question 'what is neuromarketing?'.

2. <u>WHAT DO WE ALREADY KNOW?</u>

While an answer to this question first requires knowledge of which journal outlets to examine for relevant neuromarketing research, there was often very little guidance in the identified publications on how to obtain this knowledge. In view of the interdisciplinary nature of the field, this represents a considerable entry barrier for newcomers, because it is very difficult to determine the set of journal publications that one should focus on. Related to this problem is our own experience that the finally determined set of publications can easily become overwhelmingly large, because of the very broad range of journals that have previously published relevant neuroscience studies (ranging from marketing-specific journals such as *Journal of Consumer Research*, *Journal of Consumer Psychology*, and *Journal of Marketing Research,* to other domain-specific journals such as *Psychological Science*, *Annual Review of Psychology*, *NeuroPsychoEconomics*, *NeuroImage*, *Neuron*, *Journal of Neuroscience Methods*, and general-interest journals such as *Science*, *Nature*, or *PLoS One*). We thus believe that greater signposting for newcomers is warranted in this area in order to avoid them getting lost in the 'jungle' of existing neuromarketing knowledge.

Similarly, we found very little guidance on how to read empirical neuromarketing papers. This situation is concerning, because empirical neuromarketing papers differ quite substantially in their representation of results from that in traditional marketing publications (e.g., color-coding used to highlight the level of statistical significance, frequent absence of estimation equations and regression tables). Accordingly, newcomers face what seems like an unnecessarily steep learning curve when trying to navigate the field on their own. While we believe that part of this situation relates to the previously mentioned lack of neuroscientific foundations in overview articles (making it very difficult to grasp the meaning/ importance of different cortical areas of activation), to us the biggest problem seems to be attributable to the considerable lack of visible *user-oriented* methodological primers. We discuss this problem in greater detail in the following section, but conclude at this stage, that both, newcomers' need for guidance on relevant work and outlets, and their need for guidance on how to read empirical neuromarketing papers, are poorly addressed by the most visible studies in the field.

3. <u>HOW TO CONDUCT EMPIRICAL NEUROMARKETING RESEARCH?</u>

The first step towards answering this question is gaining detailed knowledge about the available neuroscientific methods, their typical procedures, strengths and weaknesses. On top of this, it is critical for newcomers to know how to acquire and analyse data with each method, and how to report the empirical results. Unfortunately, while at least one primer is excellent in many ways (Reimann et al, 2011, discussed later), we found no methodological primer that addressed all of these points in the set of reviewed papers. In fact, two out of three methodological primers that we identified either discussed only aspects of the statistical analysis of neuroscience data (Vecchiato et al. 2010) or just provided short descriptions of the most commonly used methods (EEG, fMRI, PET, MEG) in terms of their ability to record

brain activity (Sebastian, 2014). While this latter paper also briefly discussed the advantages and disadvantages of these methods, it provided very little guidance on when to use a specific method. We therefore evaluate the overall fit of a newcomer's need for an overview of neuroscientific methodologies as neither good nor poor. Even more concerning, we also noticed a complete lack of comprehensive style guides for how to report the results in the clear majority of these methodological primers. Accordingly, there is a poor fit between newcomers' need for style guides on how to report the results. In view of this situation, we assert that there is a glaring lack of visible user-oriented methodological primers in the field, and that this type of paper would be of major interest and influence in the field. Without such primers, the informed use of neuroscientific methods may be restricted to a small set of researchers who have access to expertise already (e.g. they may be trained neuroscientists, or have expert colleagues). This makes the growth of the neuromarketing field much less likely.

The lack of a strong set of user oriented primers is particularly problematic in light of the fact that neuroscientific methods are not routinely taught in marketing doctoral programmes, and also because of the significant potential for methodological missteps in terms of data collection, analysis, and interpretation inherent to the complex area of neuroimaging and neuroscience in general (Ruff and Huettel, 2014). The upshot of this is that marketing scholars are without specific guidance on methodological choices, and the comparative advantages and disadvantages of one technique or another. We believe that it is unlikely that this gap in the literature is the reason for the dominance of fMRI in neuromarketing, since a similar dominance can be observed in virtually all cognitive neuroscience. However, we do think that the lack of clear marketing-focused methodological guidance has contributed to the situation.

Looking at the reviewed empirical literature, the situation is amplified, because we do not only observe a lack of explanation for why neuroimaging in general is

employed, but also for why a specific method itself is to be used, over and above competing methods. For example, why use fMRI rather than MEG, or why use EEG over MEG? Why not some other method? There are of course many different methods available, and each method has significant strengths and weaknesses. Without a clear discussion of the objective for the use of a given method, it is not clear that the choice is anything other than opportunistic, or worse constrained by a lack of awareness or knowledge of other techniques. The choice of neuroimaging method is particularly important to justify, given that the most popular method (fMRI) employs large fixed equipment, which both consumes large amounts of resources, and is also used for vital and socially beneficial medical research purposes (Telpaz et al., 2015). Justifying why such equipment is to be used appropriately for marketing research studies is likely to be a key way to expand the acceptance of such work, particularly among neuroscience researchers, thereby increasing the impact of work in neuromarketing. Unfortunately, our analysis of the primary justifications given in the reviewed empirical neuromarketing and consumer neuroscience literature shows a lack of reflection on this need for justification. Accordingly, we conclude that there is a poor fit between newcomers' need for guidelines for how and when to use a specific method, and the most visible studies in the field. The following Figure and discussion provide our line of reasoning for this conclusion.

FIGURE 4 ABOUT HERE

Figure 4 presents the results of our categorization approach for the primary justifications in empirical papers. In our view, it is of some concern that a fairly large amount of empirical studies appeal to one or another variant of the 'research gap' justification. In particular, a significant proportion of papers justify the use of neuroscience solely on its novelty. A further group (the second largest in fact) of studies suggests that neuroscientific methods can offer

additional data (complementary data), which often takes in the basic novelty of the approach as one reason for the contribution of this complementary data. While this research gap-based justification has some merit at a basic level, it leaves aside the idea of whether the lack of neuroscientific insight in a given area is of any actual importance. Indeed the use of such gap-based justifications has been criticised recently as a way of justifying one's contribution to marketing science (e.g. Tellis, 2017). The primary issue is that such justifications leave unclear the issue of what using neuroscientific methods to investigate a given problem can actually add to our knowledge of a given phenomenon. In order to provide strong arguments for the latter, scholars need to be far clearer about exactly what type of insight the given neuroscientific method can add. More specifically, clear evidence or argument should be presented for why measurement of brain activity in this case is useful, and what it can illuminate (see also Plassman et al., 2015 for a discussion of this challenge). But, further, researchers should also be able to show evidence of why the given method they have chosen (e.g. fMRI, EEG, etc.) can actually deliver useful measurement of brain activity in this situation. As shall be seen in subsequent sections, this is also not guaranteed, and few neuromarketing-relevant studies demonstrate awareness of this. Without such justification, the use of neuroscience in marketing research essentially becomes 'window-dressing'. As mentioned before, this problem is magnified in the case of neuroscientific methods, because of their resource intensiveness, invasiveness, and potential use for other more societally-beneficial purposes.

Figure 4 shows that a number of studies did attempt to go beyond purely gap-focused justifications, to suggest that neuroscientific methods can somehow offer more 'objective' data, or otherwise acquire 'hidden' information from subjects who might otherwise be studied using behavioural or self-report measures. However, while such justifications are superficially attractive, they are themselves incomplete without a

demonstrable understanding of both the limits of neuroscientific measurement, and the inferences that can be drawn from such measures. Unfortunately, the reviewed empirical neuromarketing literature seems to rarely take such issues into account. Accordingly, we conclude that there is a poor fit between newcomers' need for an introduction to the analysis of neuroscience data, and what the most visible work in the field has to offer to these readers.

Also crucial to justifying the use of a given technique is a solid understanding of the technique itself and the necessary steps it involves. However, it is not clear from our analysis of empirical neuromarketing literature that the majority of those associated with the most visible neuromarketing research are aware of the significant literature which discusses cautions for those employed in neuroimaging work. While it is true that much of this discussion is carried out in the neuroscientific literature itself, and can thus be complex, those using neuroimaging methods have a strong responsibility to become aware of such literature, and design their work appropriately. Unfortunately, our review revealed this literature to be often invisible to newcomers, making it very difficult to behave in line with this responsibility. In the following, we illustrate this point in the context of statistical analyses in neuroscience.

Neuroscience research, particularly fMRI, is often criticised on what could be called statistical grounds. Such criticisms often focus on the issue of the small sample sizes that are common in neuroimaging work (e.g. Button, et al., 2013, and see Plassmann et al., 2015 in the neuromarketing field). However, the issue of sample size is bound up in more complex issues of power, invasiveness, estimate precision, replicability, and such like, which need discussion over and above the pure number of subjects used (e.g. Butler et al., 2017, Friston, 2012; 2013; Nord et al., in press). Perhaps more problematic are the complex issues concerning the statistical analysis of fMRI data. These issues are particularly concerning

since they may disproportionately affect neuroscientific research in areas relevant to marketing, such as social and cognitive psychology (e.g. Vul et al., 2009).

The key issue at hand revolves broadly around the area of the likelihood for false positives when making multiple comparisons in statistics. This is especially relevant because analysis of fMRI data in particular involves massive amounts of comparisons involving hundreds of thousands of voxels. The voxel is essentially the unit of analysis, representing brain activity in a given brain area (the size of which varies according to resolution, down to about $1mm^3$). It is beyond our scope to give full details of this process (Vul et al. [2009]) provide an excellent summary of a typical between-subjects fMRI analysis) but, typically, one must compare brain activation in a given set of voxels, which represents a 'part of the brain' associated with one task, versus another (which could be thought of as a control in simple terms). A quantitative 'score' for brain activity, for correlation with some behavioral response or suchlike, is computed by selecting a set of voxels for further analysis, either based on an *a priori* anatomical hypothesis, or by selecting those that achieve some arbitrary level of activation in the task of interest, compared with the control. In doing so, it is essential to correct for the chance of false positives due to the massive amount of comparisons. Bennett et al. (2011) provided a compelling demonstration of this when they showed that poor correction for multiple comparisons can result in a dead salmon exhibiting brain activity in a perspective-taking task (see also Bennet, Wolford, and Miller, 2009). Perhaps even more concerning, Vecchiato et al (2010) observed a very similar result with multiple comparisons for a plastic mannequin that 'watched' a TV advert. Unfortunately, Vul et al (2009) explain that multiple comparisons correction actually increases the seriousness of a different problem – that of the unrealistically high correlations found in many fMRI studies involving between-subjects analyses of fMRI data and individual differences in social behaviour, which is the subject of many marketing-relevant studies. In brief, the issue is one of selection bias, in that

"using the same data to filter out voxels that carry relevant signal *and* to estimate the strength/reliability of that signal results in systematic overestimation of signal strength" (emphasis added Vul and Pashler, 2012 pp. 946). Perhaps worse, Eklund et al, (2016; 2012) suggest that much commonly-used fMRI analysis software returns false positives significantly higher than it should – up to 70%, for an expected rate of 5%, most likely due to poor autocorrelation models.

Because neuroimaging analysis is complex we cannot say for sure that the empirical neuromarketing studies analysed here are subject to the issues pointed out in Vul et al. (2009) and others. However, it is telling that very few (3 from about 130 in total, and 2 from the 45 empirical studies) of the papers we analysed cited any of the critical literature mentioned above regarding statistical analysis problems, or even demonstrated an awareness of the issues of concern – even though studies such as Bennett et al. (2011) received significant publicity (not least a 2012 IgNobel prize). Although many of the key statistical issues above are not unique to fMRI (Ioannides, 2005), existing work has clearly demonstrated that fMRI in particular, by far the most popular method in neuromarketing, can be subject to serious statistical problems, to the extent that "we are led to conclude that a disturbingly large, and quite prominent, segment of fMRI research on emotion, personality, and social cognition is using seriously defective research methods and producing a profusion of numbers that should not be believed" (Vul et al., 2009; pp 285). The lack of attention paid to this in the most visible neuromarketing and consumer neuroscience literature appears therefore to us to be a potential problem for newcomers to the field. Summarizing the discussion so far, we thus conclude that there is a poor fit between newcomers' need for an introduction to the analysis of neuroscience data, and what the most visible work in the field has to offer to these readers.

Overall, we reiterate the important point that newcomers would benefit a lot from more user-oriented methodological primers that go beyond mere descriptive accounts of

neuroscientific methods, and that provide clear guidance on the steps during the statistical analysis of neuroscience data. The closest to such a user-oriented introduction that we came across during our review was the paper by Reimann et al. (2011). In this paper, the authors provide a very comprehensive treatment of the use of fMRI in consumer research. The paper is intentionally written to allow newcomers to conduct their own fMRI studies and to critically reflect on the appropriateness and use of fMRI in consumer research. Particularly valuable to a newcomer are the treatment of fMRI methodology, the provision of neuroscientific foundations to interpret existing research findings, and a clear guideline for the necessary procedures for the application of fMRI in consumer research. The fact that the authors illustrate these procedures based on a specific application is another valuable add-on, as is the list of reporting guidelines that the authors provide at the end of the paper. However, even this exceptionally well written methodological primer suffers from two limitations (one of which is not the authors' fault). First, the authors do not discuss the aforementioned problem about false-positives in neuroscientific research, and thus leave a newcomer unaware of this issue. Second, and more unfortunate, this methodological primer is not very visible in the field. In fact, this primer did not show up among the first 150 hits (including citations) for the 'neuromarketing' search term and was only among the first 30 hits during our (secondary) search for 'consumer neuroscience' papers. This made it only the third (and thus last) methodological primer that we came across during our literature search. In addition, and perhaps as a consequence, we found only two citations (one of which involving the same authors) of this paper in the 35 reviewed empirical studies since 2012. While there exist several other attempts in the literature to provide user-oriented methodological primers (e.g., Kenning et al. 2007; Ruff & Huettel, 2014), these, too, are largely invisible for an interested newcomer searching for 'neuromarketing' or 'consumer neuroscience', because they rarely use one of the two terms. For example, Kenning et al. (2007) use the term 'neuromarketing'

only once during their discussion of the methodological issues relating to fMRI data analysis, including experimental procedure, data acquisition and data analysis. Moreover, none of these other attempts seem to reach the level of depth and user-orientation as the treatment in Reimann et al. (2011). In view of these observations, it seems unlikely that the previously mentioned problems in empirical neuromarketing studies, particularly fMRI, are going to become much smaller in the near future.

4. <u>WHAT MAKES FOR GOOD VS BAD NEUROMARKETING RESEARCH?</u>

As we previously mentioned, neuromarketing will only be able to deliver on its promise as a research area, if it attracts more researchers who end up doing high quality, and high impact work. It is therefore of central importance to the field that newcomers learn to distinguish between research of different quality levels, reflect on what can and cannot be done with neuroscience data, and know which ethical questions arise in the context of neuromarketing (and how to address them). In the following, we discuss to what extent the most visible publications in the field help newcomers to achieve each of these outcomes. We start with the important topic of research ethics.

Quite apart from the methodological issues pointed out above, research has repeatedly found that brain imaging results have a significantly enhanced impact on the acceptance by readers of the claimed findings. In other words, readers may give enhanced weight to findings supported by brain images, even if the images are irrelevant to the claim being made (Weisberg et al., 2008). As such, when using neuroimaging methods, researchers should be extremely clear and transparent as to the reasons why they are using neuroimaging to support their claims, and how the neuroimaging data adds something important to the conclusions, beyond interesting descriptions of brain activity. Otherwise, they risk that their results might be used for the deception of uninformed others. Our review revealed that there are a number

of papers discussing ethical issues like these around the application of neuroscience to marketing. However, we found that almost all thought in this regard was given to the consequences for consumers when marketing *practice (read: for-profit companies)* employs neuroscientific methods (De Oliveira et al. 2015; Matthews, 2015; Olteanu, 2015; Ulman et al. 2015; Stanton et al. 2016), and / or how researchers can assure the responsible handling of data and insights created by neuromarketing research (Olteanu, 2015; Ulman et al. 2015). While this is relevant and interesting, coverage of the ethics of applying neuroscience to scholarly marketing research is scarce. This paucity is thrown into sharp relief by the active discussion around these issues in other disciplines, such as management and organizational research (e.g. Ashkanasy, 2013; Butler et al., 2017; Lindebaum, 2013; 2016; Healey and Hodgkinson 2014). Overall, we thus conclude that the fit between newcomers' need for guidance on research ethics involves both, positive and negative aspects, and is thus neither good nor poor.

To infer the extent to which the most visible studies in the field are positioned to teach newcomers the appropriate research standards in neuromarketing, we first take a look at the quality of the journals, in which these studies have been published.

FIGURE 5 ABOUT HERE

Although the picture is not completely clear, there is a generally increasing occurrence of neuromarketing and consumer neuroscience in top-level journals as judged by the (admittedly coarse) criteria of journal rankings and impact factors. Specifically, Figure 5 shows the average impact factors of published papers in each of the last ten years. To calculate the average impact factors, we only included articles in journals with an impact factor. Looking at the left graph in Figure 5, we see that the quality of conceptual paper publications has

largely been on the rise over the last ten years (the very high value in 2010 is caused by the unusually large impact factor value of 29 for the *Nature Reviews Neuroscience* publication by Ariely & Berns). This trend is particularly apparent in the years since 2011, and reflects on an increasing number of conceptual papers appearing in top-quality journals such as *Journal of Consumer Psychology*, *Journal of Marketing Research*, *Frontiers in Human Neuroscience*, and *Organizational Research Methods*. For the empirical papers, however, no clear trend emerges. While there is a steep increase in average impact factors from 2008 – 2010, this average has been on a declining trajectory ever since. However, this does not imply that empirical papers have been published in journals of lower quality in more recent years: in 2015, for example, eight of ten empirical papers were published in a Special Issue in the *Journal of Marketing Research (IF = 3.1)*. Instead, this decline reflects on a shift in publications from more neuroscientific journals, such as *Journal of Neuroscience (IF = 5.9)* and *Brain Topography (IF = 3.7)* in 2010, to more marketing and business journals (of which even the top-ranked outlets tend to show relatively lower impact factors). Finally, a comparison across both graphs shows that empirical papers tend to appear in journals with greater impact than conceptual papers.

FIGURE 6 ABOUT HERE

Figure 6 shows the quality levels of all published papers in each of the last ten years, as assessed by Impact Factor and ABS Journal Rank. The left graph in Figure 6 shows that the majority of published conceptual papers have appeared in journals that do not appear in the ABS journal guide. Of particular concern is the observation that publications in non-listed journals without impact factors have been increasing over the last three years. The right graph in Figure 5 reveals a different pattern for the empirical papers. Here, a very large share of

papers have appeared in top-quality journals with ABS 4 and ABS 4* rankings. However, it is noteworthy and concerning that in this category the first appearance of low-quality publications in non-listed journals without impact factors is in the most recent past.

FIGURE 7 ABOUT HERE

Figure 7 gives a slightly different perspective on the issue of publication quality. Specifically, we created an impact factor classification scheme which includes those journals without impact factors as zero. Looking at this chart, and combining it with the other quality charts, we can see overall that the proportion of papers that are published in top-level journals remains tiny. In fact, the proportion of papers published in journals with impact factors between 0 and 1, is at around 47% for the entire time period.

Another important consideration of research standards refers to the question what can and what cannot be read into neuroscience data. In the following, we clarify some of the current limitations for research on both behavioral and psychological topics. Concerning behavioral associations with brain activity, such as product choice and so forth, it is not clear that existing correlational designs are able to provide great insight, both because of the statistical issues discussed above, and also the lack of evidence for causality. More specifically, to strongly infer that a given area of the brain is of actual (causal) importance in a given behavior, one must be able to show either functional necessity (e.g. the task cannot occur without that brain area being active), or instead that the behavior will increase with an increase in activity of that brain region (Plassmann et al., 2015). Without such evidence, any brain activity in association with a behaviour may be epiphenomenal at best (Senior, Lee, and Butler, 2011), and perhaps entirely coincidental.

This situation is exacerbated in marketing-relevant research because of the typical complexity of behaviors studied, which are unlikely to be functionally localized (Friston, 2000). Specifically, the usual analytic methods (discussed above) for functional neuroimaging are based on the idea of the subtractive response – that is, one compares brain activity associated with an experimental task associated with a control task (Senior and Rippon, 2007). The inherent problem here is that this type of data makes it impossible to infer that brain areas that are *not* shown to be activated are in turn *not* implicated in the experimental task. Making such an inference requires what is known as the *pure insertion hypothesis*, which is the claim that brain activity specific to a given task is unchanged when one adds subsequent tasks. Unfortunately, this hypothesis may actually be impossible to prove, and at the very least is tenuous at present (Ramsey et al. 2010). Indeed, while brain regions themselves are somewhat functionally specialized, they interact in a vast network even for what might be considered simple processes, let alone the complex processes implied and often studied in marketing research studies (Friston, 2000; Lee, Senior, and Butler, 2012). It is not clear that investigations which focus on the investigation of a single brain area (typical of neuromarketing and consumer neuroscience) can provide significant insight in this regard.

When concerning the psychological concepts so popular in marketing research, including that using neuroscientific methods analysed herein (e.g. brand image, attitude, empathy, emotion), the issues are even more complex. The most well-established issue is one of *reverse inference*, which our analysis found to be indeed mentioned as a problem by several conceptual neuromarketing papers (e.g. Breiter et al., 2015; Reimann et al., 2011; Plassmann et al., 2012; Plassman et al., 2015). However, while conceptual neuromarketing work does refer to this issue, it is rarely mentioned as a potential limitation of the reviewed *empirical* neuromarketing work. The problem of reverse inference essentially concerns the

fallacy of inferring the link between brain activity and some psychological process of theoretical interest, typically (although not always) expressed as follows (see Poldrack, 2006 for further details); a) in our study, when Task A is presented (e.g. think of a brand), brain area X is active, b) prior research has found that when a given mental process B is invoked (e.g. love), brain area X is active, therefore c) the brain activity in X shown in our study means that mental process B (love) is invoked by Task A (think of a brand) – in other words, people love brands. As Poldrack (2006) and others show, this reasoning is faulty because it is based on the fallacy of affirming the consequent, and any attempt to circumvent that depends on the extremely unlikely premise that there is a one-to-one, context-invariant, mapping between the psychological process and the specific brain – or in other words if we could replace premise b) above with 'prior research shows that brain area X is active if and only if subjects are engaged in cognitive process B'. Unfortunately, evidence suggests that numerous brain regions have a high base activation (i.e. they are implicated in many different processes), and as such any activation in such a region provides little evidence for the engagement of a specific process (Poldrack, 2011). Poldrack (2011) summarizes a number of approaches to this problem, and suggests that, done well, reverse inference can be a useful hypothesis development strategy, but cannot alone be used to derive meaningful knowledge.

A further issue, absent from existing treatments of the reverse inference problem, concerns the question of whether, even if one could make a strong reverse inference that a given mental process was invoked by a given task, what would that actually *mean*? This question is not tractable by neuroscientific methods itself, but instead lies essentially in the realm of philosophy of mind. The essential issue of concern is whether there is anything more to mental processes than their physical manifestations – i.e. brain activity. It is beyond the scope of this paper to do more than raise the basic questions (readers are referred to Bagozzi and Lee, 2017 for more detail), but it seems to us that many of the justifications of

neuromarketing and consumer neuroscience research as somehow uncovering 'more accurate', 'objective', or 'hidden' information, necessarily make an extremely strong implicit claim. This is particularly so if the research explores what could be called subjective experience constructs, such as emotions and attitudes. Specifically, to suggest that measuring brain activity gives a more accurate or objective indication of a given subjective mental experience (e.g. love), makes the implicit claim that there is nothing more to that experience than the physical brain activity to measure, and other methods (such as self-reports) are necessarily wrong to some greater or lesser extent. This then leads one to question whether subjective experiences as we 'feel' them even exist. If so, one can question a very large body of existing research regarding whether it has created any representational knowledge at all about human psychology. If there really is nothing more to subjective experiences and mental processes than brain activity, just what have we been studying? Do subjective measures (e.g. self-report scales) of, for example, 'emotions' actually measure anything real? Or, are they instead at best metaphors for physical brain processes? If so, should all our research efforts now be spent at the very least on validating them in terms of their association with their intended physical (i.e. brain activity) referent? Or instead, is there something more to subjective experience than physical brain activity? If so, what is this? Is this even possible? Issues such as this appear to us to be at the very heart of whether there is any justification for neuromarketing or consumer neuroscience research at all, yet there is no real discussion of these issues that we can find in the body of work analysed herein.

Summarizing our discussion of research standards in the field, we view the findings so far as reason for concern, because it seems likely that newcomers will be exposed to a considerable share of low-quality work when entering the field. While there is high-quality work, published in very high-quality journals, this is the minority of work that is found using searches typical of those likely to be used by newcomers. It is probably naïve at best to

assume that all newcomers will discount such a large body of research, and only focus on the minority of papers in what are called 'elite' journals, particularly those who may be less experienced, or who are working in emerging academic environments. Thus, it becomes a likely scenario that newcomers may be exposed to a preponderance of lower-quality work when approaching their first empirical research project in the field, and that they may therefore overstate the importance/ predictive power of their empirical findings. We thus conclude that there is a poor fit between a newcomer's need to learn about appropriate research standards, and the level of agreement for such standards that this person would find in the literature.

A final consideration in this context relates to the available information about consensus on the field's goals for impact. Such information is useful for newcomers but, for such consensus to develop, it is central that researchers in the field provide critical evaluations of the field's current state, as well as guidance on where the field needs to go in order to generate its full potential. In this regard, the findings from our review are of particular concern, because basic overviews outnumbered agendas for future research and theory development papers by a ratio of around 7 to 1. Obviously, one could debate the exact definitions of these categories, but the picture is clear: in any given year over the last decade, a high proportion (usually over 25%) of papers published in neuromarketing and consumer neuroscience are basic overviews of the field.

Comparing marketing to other relevant fields, the general neuroscience literature is, naturally, replete with robust conceptual discussion on the various inferential issues and methodological concerns around neuroscientific methods (e.g. Friston, 2000; Poldrack, 2006). It seems curious that so few neuromarketing studies cite such work, because such topics seem to be ripe avenues for conceptual and philosophical discussion within the neuromarketing field. An illustrative comparison can be drawn with management and

organizational research, where an active ongoing stream of conceptual literature exists, which applies more foundational neuroscience thinking to the area, develops new theories and models about how neuroscientific research can develop management knowledge, as well as exploring how more fundamental knowledge can be drawn from neuroscientific investigations of management topics (e.g. Healey and Hodgkinson, 2014; Senior, Lee, and Butler, 2011). Furthermore, there is a growing stream of literature providing strong critiques of the application of neuroscience to management and organizations (e.g. Lindebaum, 2016; Lindebaum and Zundel, 2013), with an associated and ongoing debate, in some of the field's top scholarly journals (e.g. Butler, Lee, and Senior, 2017).

Our analysis of the literature associated with neuromarketing provides virtually no similar content to that referred to above. In fact, we could find not a single article that provides a strong critique of the application of neuroscientific methods to marketing research problems (see Figure 3, conceptual papers). This is concerning, because even if we do not personally agree with the highly critical views of authors such as Lindebaum (e.g. 2016) about the application of neuroscientific approaches to management problems, it is undeniable that strong critical work provides an important service to any field. If one were to read only the marketing-relevant literature analysed here though, as a newcomer to neuromarketing is likely to, one could be forgiven for thinking that there are few caveats to the use of neuroscientific techniques, and that the application of neuroscience to marketing-relevant research topics was almost entirely uncontroversial.

Indeed, while we occasionally found articles that included short sections that discussed some of the well-known criticisms of neuroscientific research (particularly fMRI), such as sample size, and drawing inference from brain activity to behaviour and theoretical psychological processes (Plassmann et al., 2012; Plassmann et al., 2015), at no point did we discover any critiques of whether neuroscience is an appropriate or even a useful approach to

developing marketing knowledge. This seems to us to be a major omission in the marketing literature, especially one with such a rich history of critical thought.

Further, most overview papers were published in lower-level journals, as measured by either IF or journal rank. It is not especially clear why there is such a profusion of overview papers, but when compared with disciplines such as neuroeconomics, management, leadership, and organizational behaviour, marketing does seem to be an outlier. Specifically, while we are unable here to provide a similar analysis of the latter fields, informal searching will turn up far fewer general overviews. Although general overviews of the field do exist in management and organizational research (e.g. Becker and Cropanzano, 2010; Becker, Cropanzano and Sanfey, 2011; Butler and Senior, 2007), and there are a reasonably large absolute number in neuroeconomics, a larger proportion of space in these disciplines is given over to theoretical debates as cited earlier, as well as developing frameworks of how neuroscientific research approaches can inform theory development. Marketing scholarship seems to have been rather shy of developing such frameworks, with but a single paper (Breiter et al., 2015) claiming to use neuroscientific principles to develop a framework of marketing itself as a discipline. Again, this seems like a missed opportunity. Indeed, the preponderance of overviews does seem to imply a somewhat 'backward-looking' orientation, rather than providing inspiration for newcomers, thereby undermining the field's potential impact.

Additional support for this conclusion comes from our previous observation that the most visible overviews reveal an overly narrow understanding of the scope of neuromarketing as the empirical application of neuroscientific methods *only*. However, as Plassmann et al. (2015) discuss, there exist now a number of studies that have successfully applied neuroscience *theories* to derive testable predictions about consumer behavior (e.g., Van den Bergh et al., 2008; Wadhwa et al. 2008; Tuk et al. 2011) without the use of

neuroscientific methods. For example, Wadhwa et al. (2008) build on existing neuroscientific evidence on alliesthesia (the fact that people like a consumption cue more or less, depending on the physiological drive state), and hypothesize that there could also be a reverse alliesthesia mechanism (such that sampling a high incentive value consumption cue can actually increase the drive state). Across four behavioral studies they find that participants' responses are indeed consistent with a process of reverse alliesthesia, and that product sampling leads to activation of a general reward system.

To reiterate an important point, Wadhwa et al. (2008) were able to progress our understanding of marketing phenomena by building on previous neuroscientific evidence only (i.e., without direct use of neuroscientific methods). In view of the previously mentioned considerable challenges involved in applying these methods (and the extensive need to secure external funding), work along these lines promises to become a key pathway towards neuromarketing research for newcomers with a background in traditional marketing. Unfortunately, we found studies like these to be largely invisible to newcomers: except for the work by Plassmann and colleagues (2015), there was no mention of this complementary approach towards neuromarketing in the reviewed literature. This observation reiterates our previous point that there is indeed very little reflection in the literature on the different ways for neuromarketing to improve its impact on marketing more broadly, and what the goal of neuromarketing is. Overall, we thus conclude that there is a poor fit between a newcomer's need to learn about the field's goal for impact, and the level of agreement for this goal that the most visible articles provide.

5. HOW TO GET ESTABLISHED IN THE FIELD?

Our discussion so far has highlighted the challenges that newcomers to neuromarketing will face in answering each of the previous four key questions. However, even if a newcomer

successfully managed to answer those questions satisfactorily, a key challenge remains: how to establish himself or herself in the field? As in all other disciplines, part of this process requires access to research funding and building a social network with established colleagues and co-authors; such network contacts are often found at relevant academic conferences. Unfortunately, there was virtually no information about the relevant conferences, associations, or leading researchers and publications in many of the reviewed papers. A notable exception was Reimann et al. (2011) who mention the Association for NeuroPsychoEconomics, and the Journal of Neuroscience, Psychology and Economics at the beginning of their paper (p. 610). This was also the only paper that mentioned events such as the Consumer Neuroscience workshops in connection with the Annual Meeting of the Association for Consumer Research. Accordingly, we find both, positive and negative aspects of the literature for this information need, and thus label its fit with the literature as neither good nor poor. As regards access to research funding, the most visible research rarely speaks about this. This is particularly unfortunate as relevant funding bodies can often be found outside the field of marketing. For example, Shiv et al. (2005) present an introduction to decision neuroscience and point out that the substantial costs involved in neuroscientific research may require 'large grants from institutions such as the National Institute of Health' (p. 385). In light of this poor fit between the need of a newcomer to find information about research funding opportunities and leading researchers, and the information available in the most visible work, it is our view that more such specific guidance would reduce the entry barriers into the field.

HOW NEUROMARKETING LITERATURE CAN HELP THE FIELD DEVELOP

Drawing from the above discussion, along with recent research in neuroscience, we can put together a set of important issues that future neuromarketing and consumer neuroscience

work should take into account if the field is to grow strongly in the future. As already mentioned, in order to facilitate such growth, the field needs to facilitate a growth in high quality researchers, able to design rigorous research that makes the kind of significant contributions and strong inferences that should be *de rigueur* at the highest levels of marketing science. Indeed, we were struck by how rarely empirical neuromarketing research appeared in the highest-impact journals in marketing, particularly if one removes the single special issue of *Journal of Marketing Research*, which comprises almost 60% of the total number (8 out of 14) of top-ranked neuromarketing publications in the marketing literature over the past decade (see Figures 6 and 7, empirical papers). It occurs to us that if the application of neuroscientific methods to marketing research problems really does lead to significant new knowledge, commensurate with its resource intensity and impact on subjects, it should appear with far more frequency in our discipline's top journal outlets. Again, raising the number of researchers who are willing and able to conduct high-quality research in neuromarketing will significantly help raise the profile of such work in top marketing journals.

Referring back to Figure 1, our findings suggest that at present, the set of neuromarketing literature which is most likely to be found by aspiring newcomers to the field is only partially suited to the task of increasing the amount of high-quality neuromarketing research, and thus facilitating growth of the field. In particular, we find that while aspiring researchers will quickly gain access to a wide range of neuromarketing papers, they may not be as able to get strong guidance from that wide body of work on how to conduct strong marketing research. We conclude that the existing body of neuromarketing research does provide some guidance on the scope of the field, and the basic features of a number of different methodological options. However, we suggest that the actual conduct of empirical neuromarketing research – e.g. actually how to collect, analyse, interpret, and report data in

the field, is less well covered. Newcomers are also likely to be left without strong guidance about which tasks different methods are best suited for, and their strengths and weaknesses. The problem is particularly acute with regards to the statistical analysis of neuromarketing data. This lack of guidance in the conceptual literature could be seen as a possible root cause of the significant majority of empirical neuromarketing literature that our study found to appear in lower-ranked journal outlets. We accept that such guidance is of course readily available in the general neuroscientific literature. However, our review suggests that such papers are unlikely to be found and utilized by newcomers to neuromarketing. Indeed, our study found that few empirical neuromarketing papers cited these foundational neuroscientific papers. It appears probable to us that newcomers without the benefit of working in an already-established group of excellent neuromarketing researchers may never realise that they need to dig deeper than the neuromarketing literature that they would typically uncover in a review such as that we have conducted herein.

It is our view that for neuromarketing and consumer neuroscience research to make a more significant scientific contribution, a number of interlinked issues must be taken account of in the neuromarketing literature. First and arguably foremost is the need for empirical neuromarketing studies to pay greater attention to their justification for a neuroscientific approach, and how it is able to advance knowledge over and above other methods. Neuroscientific methods should not be used unless a clear need can be shown, and one which cannot feasibly be addressed by other methods. Authors of neuromarketing research reports should always be able to clearly articulate why they used neuroscientific methods, and benefit they provide to justify their use. One avenue for development may be the triangulation of neuroscientific methods with other data, such as suggested by Reimann et al. (2011).

What would help significantly in this regard is a rigorous set of user-oriented methodological primers, published in well-regarded and influential marketing journals, applying the state of the art in neuroscientific methodologies to marketing-specific issues. What would also be welcome is a robust critical discussion of what neuroscience actually has to offer marketing science. It is striking that this type of conceptual and / or critical work is far better established in top-ranked journals within management, appearing in outlets such as *Human Relations, Journal of Management, Journal of Organizational Behavior,* and *Organization Science*, compared to its rarity in similar journals within marketing (see Figures 3, 6, and 7, conceptual papers). Furthermore, in the past, top-ranked marketing journals have embraced papers covering interesting methodological advances transferred from other fields, such as structural equation modelling, formative latent variable models, heterogeneity, and the like. On occasion, methodological papers in marketing journals have even gone on to impact wider social science. Marketing scholars have also in the past been very interested in debating the scientific merits of marketing. So, it seems odd that the marketing literature should not contain robust critical discussion of such a potentially important area.

We also advocate that future empirical neuromarketing work should look to expand its scope in a number of ways. Most obviously, we would welcome greater use of methods other than fMRI, and to a lesser extent EEG. This growth however is likely to require the aforementioned increase in high-quality methodological primers. In particular, we would be delighted to see work incorporating MEG appear more frequently in marketing journals. Further, research involving transcranial magnetic stimulation (TMS) could be useful to test some of the causality assumptions pointed out by Plassman et al. (2015). We would also recommend a greater use of multiple methods, spanning both neuroscience and more traditional social psychological and behavioral methods. Bagozzi and Lee (2017) provide a framework for theory development using neuroscience in conjunction with such methods, in

an attempt to bridge the gap between so-called objective and subjective approaches to the brain and mental concepts. An early attempt at such a combinatory approach can be seen in Dietvorst et al. (2009), but its full realization in future work – although challenging – would likely provide a significant advance on current approaches to investigating many questions of relevance to marketing research.

Finally, we believe neuromarketing and consumer neuroscience should begin to move away from the current focus on the brain as a reactive modular system, towards a more dynamic network view of brain activity. More specifically, recent research has advocated that intrinsic or endogenous brain activity – that is, brain activity that is spontaneous, and not in response to some stimulus – may actually provide an important influence on how people respond to stimuli, rather than being simply noise, and lead to significant new insights, particularly around choice and decision-making, which are topics of extreme importance to neuromarketing and consumer neuroscience researchers (Braeutigam, Lee, and Senior 2017). Similarly, it is important for various reasons (many of which are detailed earlier in this paper), that neuromarketing research begins to develop a greater ability to explore networks of brain activity, rather than activity in specific regions. Further, while authors such as Plassman et al. (2012; 2015) provide good conceptual discussion of the issue, empirical neuromarketing researchers need to take into account the reverse inference problem more robustly, particularly if they continue to conduct studies which are essentially exploratory investigations of brain responses to marketing stimuli. A key area of improvement would be to increase the use of techniques advocated by Poldrack (2011), and detailed in Yarkoni et al. (2011), which create large-scale automated meta-analytic maps of brain activation (see www.neurosynth.org). While such approaches by no means solve the problems, they do provide researchers with the tools to avoid clear errors of inference, and draw more justified conclusions.

The purpose of this paper was to examine the discipline of neuromarketing through the lens of a newcomer. To this end, we tried to replicate what we view would be a very likely literature search process for such a newcomer. We thus uncovered and analysed the set of papers that we believe are most likely to comprise the set of resources a newcomer would use to chart their course in this new discipline. To some extent, our findings also paint a picture of the highest profile work in the area. We found the encouraging result that the field is growing, and there is some increase in coverage of neuromarketing in marketing's top research journals. However, we were also forced to conclude that such work was a minority of the body of neuromarketing literature, and that many areas of importance to a new scholar were conspicuous by their lack of strong coverage. With this in mind, it seems that for a newcomer the path most likely to result in success in conducting strong neuromarketing research is to join an established group of researchers in the area, who are already experienced in excellent neuromarketing research. While of course such a pathway is natural, it does have the effect of perhaps restricting the growth of neuromarketing as a field of research, and perhaps restricting the field to groups of what might be called 'insiders'. A larger set of literature resources along the lines of those suggested above would be a way of substantially increasing the potential for growth in excellent neuromarketing research, and consequently the more widespread acceptance of the field.

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Figure 1: A Newcomer's Transition into Neuromarketing
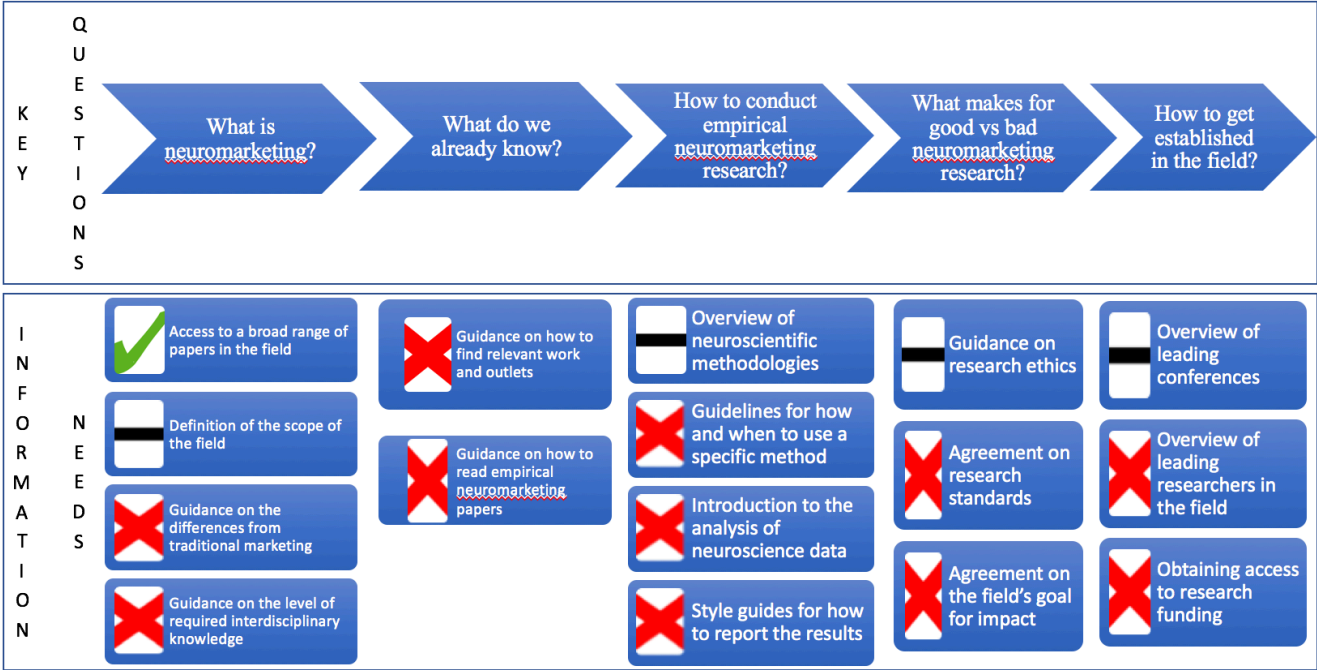
Figure 2: Number of Papers in Both Categories Over Time
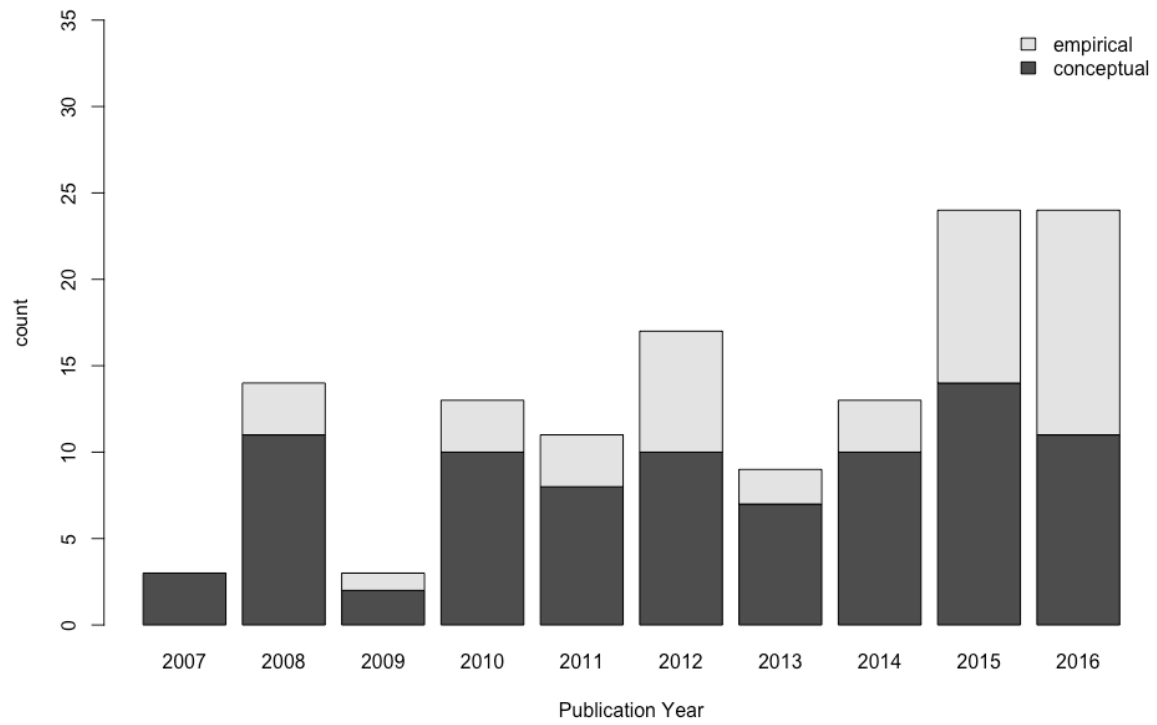
Figure 3: Categories/ Methodologies of Published Papers Over Time
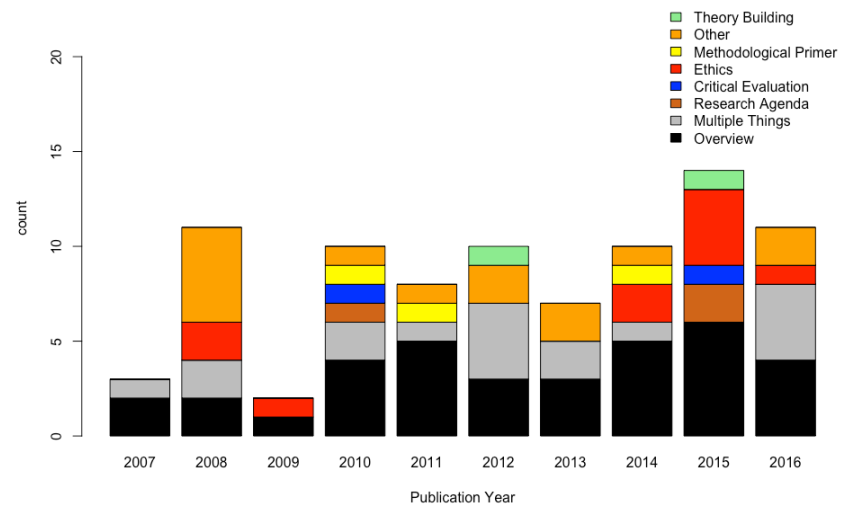
Conceptual Papers
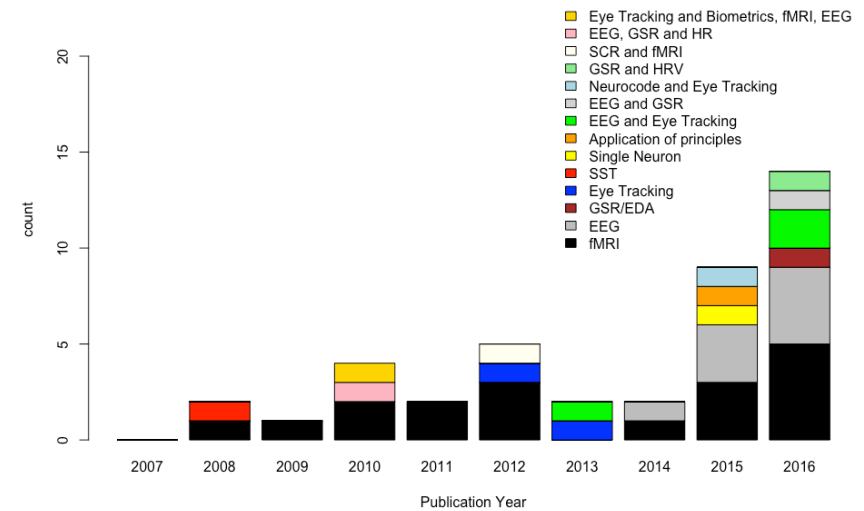
Empirical Papers

Figure 4: Justifications for the Use of Neuroscientific Methods in Empirical Neuromarketing
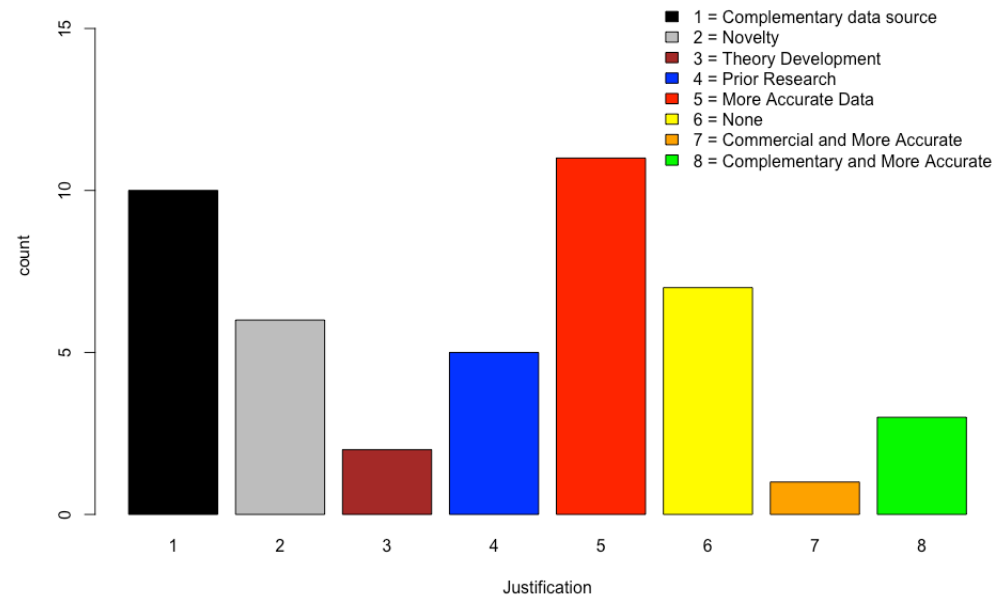
Figure 5: Average Impact Factor of Conceptual Papers and Empirical Papers Over Time
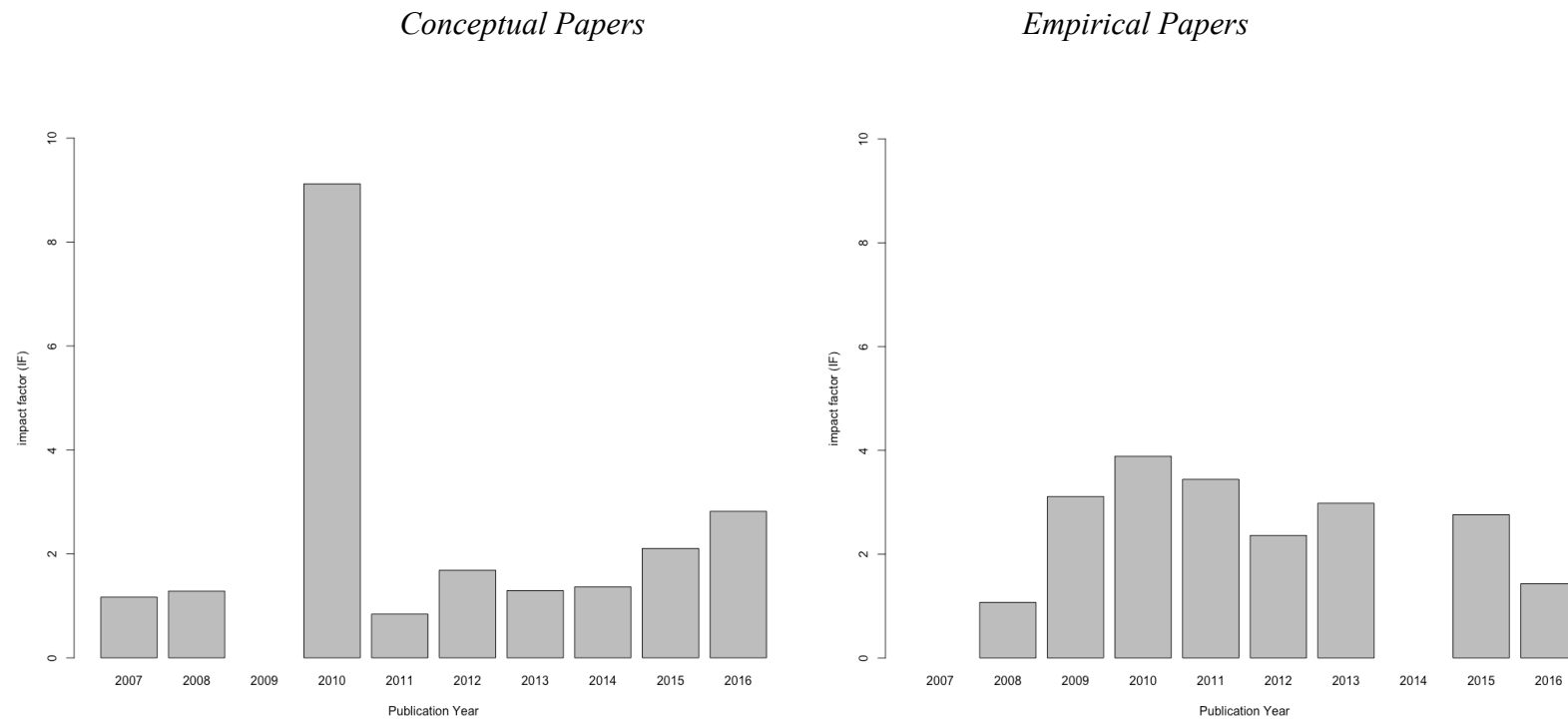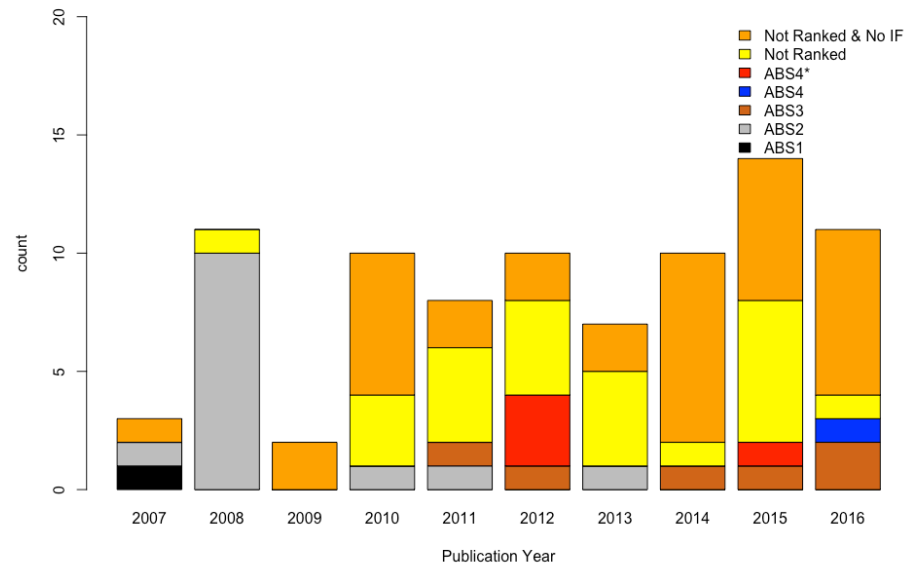

Conceptual Papers

Empirical Papers

Figure 6: Quality Levels of Published Papers Over Time
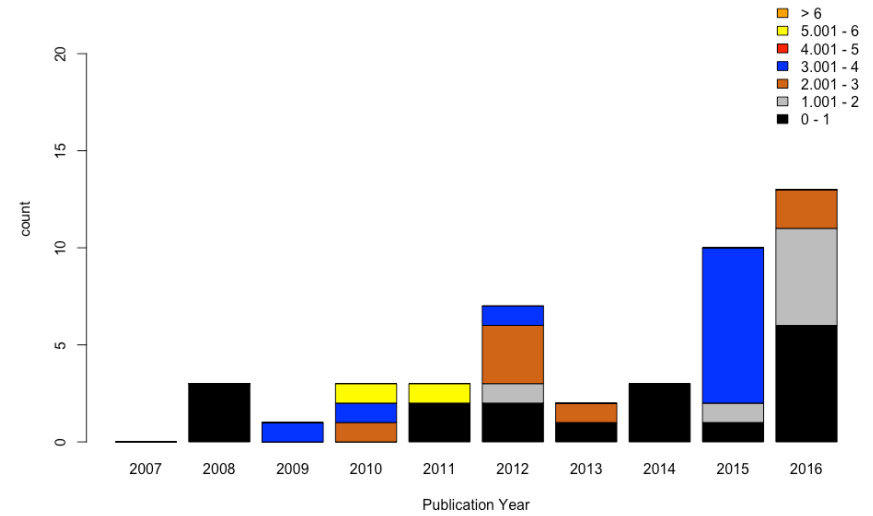

Conceptual Papers
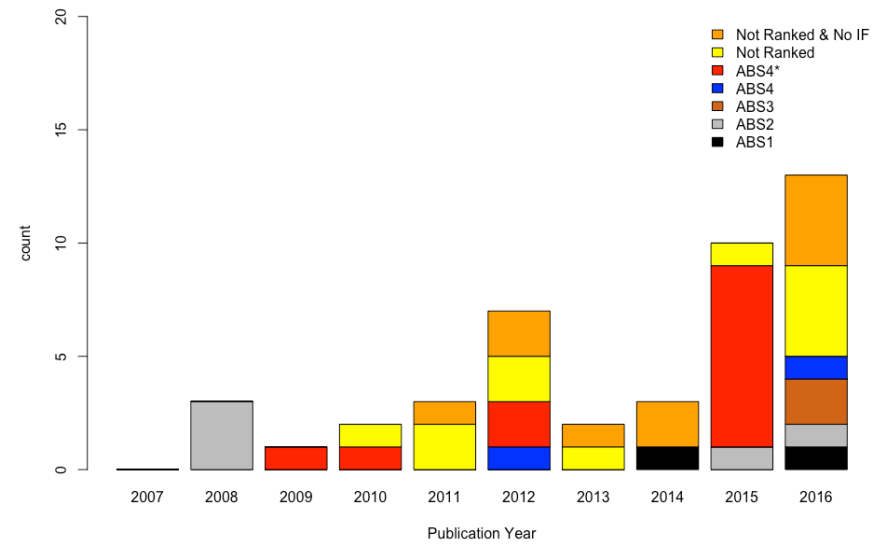
Empirical Papers

Figure 7: Discretised Impact Factors of Published Papers Over Time

Conceptual Papers

Empirical Papers