NEURO SCIENCE AND STRATEGIC MANAGEMENT

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ABSTRACT

Brain research has contributed to economics, marketing, law, and other fields. Does strate- gic management need neuroscience ? This paper examines the potential contributions of brain research to strategic management research and practice. The paper discusses the aims and methods of neuroscience, its strengths and limitations in social and economic research, and its potential contributions to strategy. The paper identifies specific research questions at the inter- section of strategy and neuroscience and appraises the prospects for substantive collaborations between neuroscientists and scholars in strategic management.

I. INTRODUCTION

This paper examines the potential fit between neuroscience and strategic management. Does strategic management need neuroscience? In at least one sense, the answer is clearly yes. Strate- gic management has long-standing interests in executive judgment and decision making and in the psychological foundations of strategy practice (Hodgkinson, 2008). If executive decision making and behavior matter, then the brain is already in the game; and the more we can learn about it, the better.

At the same time, strategy researchers need to understand what neuroscience can and cannot do and to maintain a healthy skepticism toward its more extravagant claims. In strategic manage- ment, some scholars may wonder whether pro- cesses within the individual brain can really inform research that takes the firm and industry as its primary units of analysis (Rumelt, Schendel, and Teece, 1994). In fields where brain research is fur- ther along, as in economics and social psychology, scholars have raised serious objections to brain research, some of which are relevant to strategic managemen

The following section discusses new opportuni- ties and potential contributions of neuroscience to strategy, and the next section discusses weaknesses and limitations. The paper then proposes specific research agendas in neurostrategy, and appraises the prospects of brain science for advancing research and practice in strategic management.

II. CASE FOR NEURO STRATEGY

In the present day, neuroscientists study brain localization at several levels of analysis - molecular, cellular, systemic, and behavioral. Behavioral neuroscience includes disciplines such as neuro economics and neuro marketing, which link activity in the brain to reputation, status, cooperation, trust, and altruism (social neuro- science); learning, perception, memory, and deci- sion making (cognitive neuroscience); and feel- ings, passions, sentiments, and motivational states (affective neuroscience). Clearly, some of these areas address research problems in strategic man- agement and suggest the possibility of linking strategy and neuroscience. The case for neurostrategy relies on strategy's long-standing emphasis on general managers. The Academy of Management defines business pol- icy and strategy as 'the field concerned with the roles and problems of general managers and those who manage multibusiness firms or multifunc- tional business units.' Nag, Hambrick, and Chen (2007: 944) defined

strategy as 'the major intended and emergent initiatives taken by general man- agers on behalf of owners, involving utilization of resources, to enhance the performance of firms in their external environments.' Strategic management rests on the assumption that the thoughts, feelings, and social relations

general managers influence the activities and per- formance of firms. This is evident, for example, in strategy research on upper echelons (Hambrick and Mason, 1984), executive perceptions (Sutcliffe, 1994; Starbuck and Milliken, 1988), risk prefer- ences (March and Shapira, 1992), beliefs (Den- rell, 2008), cognitive schema (Prahalad and Bettis, 1986), attention (Ocasio, 1997), causal attributions (Powell, Lovallo, and Caringal, 2006), competitor perception (Zajac and Bazerman, 1991) and aspi- rations (Mezias, Chen, and Murphy, 2002). To the extent that cognition, affect, and social perception are seated in the central nervous system and brain, strategy researchers should welcome opportunities to explore the contributions of behavioral neuro science.

but what are those contributions, exactly? The remainder of this section draws examples from neuroeconomics and other fields to explore the potential upside of neurostrategy. Three potential contributions are discussed: construct validation, theory testing, and informing strategy practce.

Cognitive neuroscience and strategic management: the road ahead

So far, our discussion has dwelt on things that we, as management scholars, should not do, or don't know how to do. We would now like to turn that on its head, and argue that by recognizing our current limitations, and the persistent tensions in our situation, we can actually move forward quickly and safely. The points here are not exhaustive; rather, they are intended to hint at the array of possibilities that lie ahead of us.

First, neuroscience methods can enable and oblige us to clarify what we mean by strategy. If strategy is seen as something that is continuously formulated, bottom-up, and adapted in response to environmental circumstances – that is, very much in line with behavioral approaches (as in e.g. Cohen, 2007; Cyert & March, 1963; Foss, Heimeriks, Winter, & Zollo, 2012; Gavetti & Rivkin, 2007; Levinthal, 2011; Winter, 2013) – then we are all on common ground. However, if strategy is understood as one-off, top-down decision-making (Ansoff, 1980, 1987) then there is a conflict. The value of neuroscience for management research lies in the opportunity to closely examine the decisions made by managers in relevant, albeit simulated, contexts, employing a behavioral lens. In other words, neuroscience and its methodologies should not be employed because managers are individuals, and hence can be "studied." They should be used because we believe that over the long term, big strategic decisions comprise a series of small, repeatable decisions, and that issues and processes related to experience and learning matter. If we share this belief, the next step is to design a task that captures these small decisions in an incentive-compatible manner, to be studied using brain imaging

Second, an alternative way to use neuroscience in strategic management research is to measure individual-level antecedents to strategic decision-making, and, indirectly, performance outcomes. In other words, brain imaging can provide objective and extremely precise measurements of how individual managers' brains activate in the presence of a given stimulus – not just while they are making a specific decision, or carrying out a strategically relevant action. For example, if one studies cooperative strategies, it might be particularly relevant to gauge managers' strength of empathic reactions to a standard set of stimuli (e.g. vignettes, pictures, short movies, etc.) to explain variation in, say, design decisions (e.g. equity or governance arrangements) or even in alliance performance. Compared to the alternative of relying on self-reported assessments, or even psychological scales, the objectivity and precision of brain imaging techniques can be a particularly strong advantage in a study

design. Incidentally, one advantage of using brain imaging techniques together with standard scales to measure a given construct lies in testing the capacity of psychological scales to capture the variance in the same theoretical constructs. Once the scales had been validated via correlational evidence with neural correlates, it would be possible to simplify future research designs that make use of them, especially for control measures.

A third area of contribution relates to the study of learning and capability building processes. In this case, the advantage offered by neuroscientific methodologies, and related bodies of knowledge, lies in the objective and quantitative assessment of learning. Here, the phenomenon of learning is defined as the variation of neural activation, or even of neural density, in the areas of the brain where the relevant cognitive or emotional processes reside, following a specific type of training or intervention aimed at developing knowledge. Whereas, in the first two approaches described above, the advantage of neuroscience lies in its superior "mapping" of individuals' strategic decisions, or of the neuropsychological antecedents of those decisions (emotions, cognitions, etc.), here our quest is to evaluate changes in neural responses in the "mapped" areas consequent to learning experiences. By carefully designing their experimental settings (sampling, randomization of allocation of interventions, active and passive control groups, etc.), management researchers can discover how effective alternative learning approaches are in developing specific strategic capabilities.

For example, suppose we were interested in studying competitive strategy interactions in a specific game-theoretic context. We could assess whether the capability to, say, anticipate a longer series of future interactions, as chess players do, is located in regions of the brain that neuroscience literature says should activate when managers exercise these "executive functions" (as neuroscientists call this type of highly evolved cognitive skill). More importantly, management scholars will be able to tackle questions such as: How do managers develop these highly relevant cognitive skills? What are the most effective training approaches for developing them? And, finally, what are the performance implications of these learning processes?

To give another, real-world example, in our study of exploration and exploitation decisions (Laureiro et al. 2014), the first phase was to "map" these decisions to the underlying neurophysiological correlates in the brains of decision-makers (first students, and then actual managers and entrepreneurs). The selection of the four-armed bandit game, with its simple, repeatable task structure that generates feedback and enables individuals to learn over time, lent itself to studying the performance implications of the capability of switching between the two modes of attention modulation (J. D. Cohen, Aston-Jones, & Gilzenrat, 2004; Daw, O'Doherty, Dayan, Seymour, & Dolan, 2006; Laureiro-Martínez, Brusoni, & Zollo, 2010; Laureiro-Martínez, et al., 2013; Laureiro-Martínez et al., 2014; McClure, Gilzenrat, & Cohen, 2006). However, these same characteristics also allowed us to explore the effectiveness of two very different approaches to the learning problem, one based on neuro-cognitive training (so-called "brain training") and the other based on meditative and introspective training, in a classical randomized controlled trial design.

FMRI As A Method For Strategic Management Research

Several methods are available to study and understand neurological and physiological mechanisms of potential interest to social science in general, and management science in particular. They include EEG, MEG, PET, GSR, and fMRI, among many others. In this piece, we focus mainly on fMRI because of its current popularity and strong potential for informing mechanistic questions in strategic management.

fMRI is a non-invasive method that enables investigators to localize and track changes in blood oxygenation during ongoing cognitive tasks (Ogawa et al., 1990). The popular blood oxygenation level dependent (BOLD) contrast, used to measure brain activity, is based on the fact that hemoglobin has different magnetic properties depending on its state of oxygenation: oxyhemoglobin is diamagnetic, while deoxyhemoglobin is paramagnetic, and paramagnetic substances distort the surrounding magnetic field more. When a particular task engages specific regions in the brain, the brain vasculature responds by increasing the flow of oxygen-rich blood into those regions. This in turn, leads to a localized increase in BOLD signal intensity in that brain region, which is measured using high-field magnetic resonance scanners (Huettel, Song, & McCarthy, 2004). Thus, the BOLD signal represents an indirect and correlative measure of local neuronal activity.

III . THE FUTURE OF NEUROSTRATEGY

The sometimes vehement tone of the neuro-skeptics can be interpreted either as against exaggerated claims in the scientific and popular press or as evidence that neuroscience has captured the attention of social scientists and must be taken seriously. In either case, the debate will not be resolved by arguments. In the run, neuroscience will continue to ride a steep growth curve in the social sciences, and its long run contributions will be assessed on a timescale of decades.

What does it all mean for strategic manage- ment? Taking an optimistic view, one could argue that strategy is well positioned to benefit from neuroscience for two reasons First, behavioral strategy has always taken a cognitive view of executive judgment and decision making; whether researchers focus on strategic decision biases or cognitive schema, neural evidence can be inter- preted through existing theoretical paradigms. Sec- ond, there is a lot of neural evidence available. Strategy researchers interested in competitive posi- tioning have access to neural studies on social norms and punishment in competitive interactions (Knoch et я/., 2010); researchers interested in dec sion making under risk have access to studies on the roles of trust (Baumgartner et al, 2009) and reputation (Izuma, Saito, and Sadato, 2008); researchers interested in loss aversion and refer- ence point framing have access to neural data on prospect theory (Fox and Poldrack, 2009). In short, behavioral neuroscience has left a large trove of neural evidence to be mined for insights in strategic management, and neuro economic particular has acted as a silent benefactor to behavioural strategy.

In future years, strategy researchers will find that neuroscience is increasingly called upon to resolve debates in behavioral strategy. Behavioral strate- gists have good reasons to familiarize themselves with the relevant neuroscience and to explore how neural methods can assist in construct valida- tion, theory testing and improved strategy practice. Many strategy researchers who focus on firms and industries may prefer to take a 'wait and see' atti- tude toward brain research, and this is understand- able. But researchers who do not keep informed of developments in behavioral neuroscience will find themselves facing theoretical claims and empirical data they do not understand

Some behavioral strategists may want to become actively involved in empirical neuroscience. Link- ing neuroscience with strategic management involves a steep learning curve and long lead times in resource accumulation and interdisci- plinary relationship building. Before applying neu- ral evidence to strategy problems, researchers need to avoid duplicating prior efforts by understand- ing the current state of play in neuroeconomics and related fields. At the same time, they need to create links with researchers in disciplines like eco- nomics and experimental psychology, which have strong communities of neuroscience expertise and cumulative research agendas in behavioral neuro- science.

Behavioral strategists should also familiarize themselves with research methods in neuroscience. Although much of the attention has fallen on brain imaging, neuroscientists use a wide range of technologies and methods. For example, transcranial magnetic stimulation (TMS) temporarily disrupts neural firing in a specific part of the brain, allow- ing researchers to determine whether the region is causally necessary to the task at hand. Behav- ioral neuroscientists increasingly use multimethod designs - for example, Blankenburg et al. (2010) combined TMS with fMRI scanning to study the effects of parietal cortex on attention processing in the visual cortex, and Hsu et al. (2005) combined fMRI scanning with a lesion method to study risk and ambiguity. It is also possible to link fMRI evidence with non-neural methods, such as hor- mone ratios or electromyography (EMG), which detects electrical potentials in muscle tissue - for example, Chapman et al. (2009) found that moral disgust in an ultimatum game activated the same. facial muscles as bad tastes. Even when using single methods, neuroscientists often view thier work in relation to cumulative meta-streams of research that embrace diverse methods. For example, a recent EEG study using ultimatum to study social compliance and punishment behaviour (Knoch et al., 2010) cited prior work on this problem using fMRI scanning (Spitzer et al 2007)and transcranial direct current stimulation (tdcs) (Knoch et al., 2008). In short, research in neurostrategy gy will require an understanding of multiple methods and how they interact in the accumulation of experimental evidance .

On the ultimate question of whether strategic management needs neuroscience, it is tempting to answer 'yes and no.' On the positive side, neuroscience brings new methods and ideas to a fast growing segment of the strategy field - behavioral strategy - that has natural links with psychology and behavioral neuroscience. Behavioral strategistics have much to gain from collaborating with neuro scientists ts, and ignoring neuroscience involves risk of obsolescence. On the negative side, behavioural strategy is not a large segment of the strategic management field and had not given rise to its own interest group in the first 30 years of the strategic management society. For researchers focused on firm- and industry-level problems, lems, neuroscience may remain peripheral in the foreseeable future, though researchers will probably seek ways to achieve closer integration between traditional and behavioral strategy.

There is another important but less obvious question to consider: Does neuroscience need strategic management? This question matters for two reasons. First, it asks whether strategic man- agement has its own research agenda in neuro- science, apart from the agendas of neuroeconomics or other fields. Although this is necessarily uncer- tain, it is a question that needs asking sooner rather than later. Second, strategy researchers who want to conduct empirical neuroscience must show neu- roscientists that strategy brings something new and interesting to their field - that is, that strategic management gives neuroscientists access to social science expertise and research insights they cannot get from economics, law, politics, or marketing strategy offers nothing new to neuroscience, then the future of neurostrategy is severely limited .

The remainder of this section identifies topic areas in which strategy may offer something new to neuroscience. The discussion is exploratory, and some of these topics could arise in one form or another in other fields. However, strategic man- agement has at least two distinctive features with direct implications for empirical neuroscience: its mission of linking research to strategy practice and its emphasis on executive judgment and decision making in the context of the firm. From the time of its founding, strategic management has defined the internally differentiated firm as a distinctive psychological context for research on judgment and decision making (Simon, 1947; Cyert and March, 1963). Decision making in firms seldom means an individual making a discrete choice, but involves complex judgments in a climate of goal conflict, group bargaining, politics, and compromise. Implementation is costly and nontrivial and requires managers to motivate actors not involved in the decision. Strategic decisions entail large resource commitments with consequences for stakeholders beyond the

decision makers, including employees, communities, governments, and investors. On the whole, the decision environment of the firm poses psychological questions that are in some ways dis- tinctive to the field of strategic management. The next discussion identifies research topics suggested by the psychological context of strategic organization. For one of these topics (group deci- sion making), the discussion gives a detailed illus- tration of a potential collaboration in neurostrat- egy. For the remainder, the topics are mentioned without further detail.

Group decision making

Group processes are studied in many fields, includ- ing politics, sociology, social psychology, and organizational behavior (Kerr and Tindale, 2004). Group phenomena such as social identity, self-categorization, and ingroup bias may have evolved from ancestral kinship relations, reciprocal altru-ism, or cultural evolution - for example, groups with strong pro-social norms may have increased their survival prospects in intergroup competition through more vigilant defense of ingroup values and resources (Mesoudi, 2009). In behavioral neu- roscience, researchers have investigated the neural correlates of outgroup discrimination, conformity, and related phenomena (Amodio, 2008).

Strategic management researchers focus on group processes that influence strategic decisions in firms. In this area, strategy researchers have discipline-specific expertise and a set of distinc- tive research questions. For example, decisions in large firms rarely fall to a lone decision maker, but involve a top management team comprised of senior executives representing product divisions or functional areas (Hambrick and Mason, 1984). These executives bargain for resources and iden- tify in various ways with the goals of the firm, the subunits to which they are accountable, and their own private aspirations. This makes it difficult for top management teams to reach optimal decisions for the firm and raises key questions about strategy process and practice.

Some of these questions have been studied in behavioral experiments, such as how top manage- ment team members juggle the interests of the firm with those of the divisions or functions they represent. Blake (1959) called this the problem of 'organizational statesmanship,' or 'loyalty ver- sus logic' (Blake and Mouton, 1961), and social psychologists ran many experiments to examine what happens when people try to optimize a joint decision while bargaining for resources on behalf of constituents. For example, Blake and Mouton (1961) and Benton and Druckman (1974) found that people bargain more competitively when rep- resenting constituents, and Duck and Fielding (2003) found that constituents prefer representa- tives who vigorously defend the group's position, even at the expense of other groups or the joint optimum.

These findings are interesting, but would be more useful to strategy researchers if they showed the mental states of constituents and representa- tives. This would allow researchers not only to explain what happened, but to predict behavior in experimental manipulations and real decision contexts. A top management team member might show loyalty to constituents for many reasons: psychological identification with subunit goals, perceived accountability to constituents, or dis- gust with the firm; and constituents might choose subunit loyalty over firm statesmanship out of self-interest, social comparison, ingroup bias, or identification with their representative. These con- ditions can be hard to adjudicate behaviorally and the corresponding mental states can only be inferred.

This is the kind of strategy problem where neu- roscience can make a difference. For example, it is possible to modify a trust game so that, rather than bargaining for themselves, subjects bargain on behalf of one or more constituents who can either be known to the subject (for tests of social iden- tification) or unknown (for tests of accountability) and who either share in the subject's payoffs or do not share.

The research design goes beyond existing trustee-based studies, involving a stylized version of behavioral experiments on constituent representation, with repeated iterations and modi- fications for fMRI scanning. Previous studies have established a baseline for the neural encoding of cooperation, competition, and trust in interactive experiments using prisoner's dilemmas, ultimatum games, and trust games (Fehr and Camerer, 2007), and results can be compared with these baselines. For example, it is known that the neural processing of subjective rewards gives a different pattern of brain activations from the pattern associated with moral reasoning, or of regarding another person as part of the self (Dovidio et al, 2008). The problem of constituent representation has many applications in strategy and organization, and neural methods offer a viable way of advancing this stream of research.

IV. CONCLUSION

Neuroscience has left an imprint on economics, law, marketing, and other disciplines and will con- tinue to influence the social sciences. In strate- gic management, neuroscience offers new oppor- tunities for strategy researchers to validate con- structs, test theories, measure variables, and gen- erate ideas, and it may offer ways to improve strat- egy practice. At the same time, neuroscience faces hard challenges in theory and measurement and has struggled to prove its capacity to solve tradi- tional problems in the social sciences. On balance, researchers in behavioral strategy should explore the potential contributions of neurostrategy, even if the majority of strategy researchers remain on the sidelines. Strategy researchers can engage with behavioral neuroscience by evaluating its existing contributions to their research questions, identify- ing topic areas for neural research, and building relationships and institutional resources to support research in neurostrategy. With time, these rela- tionships will lead to arrangements such as col- laborative funded research projects, joint research seminars, and joint doctoral scholarships in neurostrategy.

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