W.E. VAN DEN BERG

# Understanding Salesforce Behavior using Genetic Association Studies

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# Het gedrag van de salesforce proberen te begrijpen op basis van genetische associatie studies

Thesis

to obtain the degree of Doctor from the
Erasmus University Rotterdam
by command of the
rector magnificus

Prof.dr. H.A.P. Pols

and in accordance with the decision of the Doctorate Board.

The public defense shall be held on

**Friday 16 May 2014** at **09:30 hours**

by
Wouter Edzard van den Berg
born in Rotterdam, Netherlands

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|---|---|
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Internet: http://www.erim.eur.nl ERIM

Electronic Series Portal: http://hdl.handle.net/1765/1

**ERIM PhD Series in Research in Management**, 311
ERIM reference number: EPS-2014-311-MKT
ISBN 978-90-5892-362-2


Design: B&T Ontwerp en advies www.b-en-t.nl

This publication (cover and interior) is printed by haveka.nl on recycled paper, Revive®.
The ink used is produced from renewable resources and alcohol free fountain solution.
Certifications for the paper and the printing production process: Recycle, EU Flower, FSC, ISO14001.
More info: http://www.haveka.nl/greening

# Acknowledgements

Met het schrijven van dit boek sluit ik een intensieve periode van persoonlijke en academische ontwikkeling af. Hoewel ik mijzelf dan ook als auteur op de kaft mag vermelden, zie ik de inhoud van dit boek meer als een verzameling van de kennis, kunde, inzet en motivatie van alle mensen die ik tijdens deze periode heb mogen ontmoeten. Ik heb mijn uiterste best gedaan om de geleerde lessen en opgedane inzichten te ordenen en op een zo goed mogelijke manier neer te schrijven, maar toch ik sta graag even stil bij de mensen die mij tijdens deze reis hebben geholpen.

Allereerst natuurlijk mijn promotor, Willem Verbeke. Willem, als een gesofisticeerde Belg in het directe Rotterdam ben jij een unicum. Gedurende het schrijven van mijn Masterscriptie maakte ik al kennis met jouw snelle en creatieve denkvermogen, zodat je tijdens ons diner in Restaurant In Den Rustwat weinig moeite hoefde te doen om mij het promotietraject te *verkopen*. “Waar gaan we dan onderzoek naar doen?”, was mijn vraag. “Neuro-economie”, was het antwoord. In jouw gehele carrière heb je laten zien een vooruitziende blik te hebben; ook dit keer had je gelijk. De toevoeging van de inzichten van de neurowetenschappen aan de overige (sociale) wetenschapsgebieden zijn in de afgelopen periode getransformeerd van een trend naar het nieuwe fundament. Ik ben je ongelofelijk dankbaar dat je mij op *dat* punt in mijn leven op de *juiste* trein hebt gezet. Het is een blijk van wat ik misschien wel jouw mooiste (en minst bekende) eigenschap vind: de bereidheid (jezelf op) te offeren voor wetenschappelijke vooruitgang. Door mij op die trein te zetten was ik namelijk niet altijd zo dichtbij je als je had gehoopt - en mag verwachten - van een PhD student. De vrijheid die je mij tijdens dit promotietraject hebt gegeven zal ik dan ook nooit vergeten. Daarom ben ik blij om te zien dat de trein waarop jij mij hebt gezet altijd weer terug komt op jouw

station. Ik weet zeker dat we op academisch vlak nog lang en succesvol samen zullen optrekken.

Via Willem kwam ik tijdens het schrijven van deze thesis in contact met de andere wetenschappers die ik veel dank verschuldigd ben. Allereerst Rick Bagozzi: het was een eer met je te mogen werken en dat je ook zitting wilt nemen in de commissie. Frank Belschak, de discussies over interactie-effecten zullen mij bijblijven. Ad de Jong en Ed Nijssen, voor de inzichten over innovatie en commercialisatie van nieuwe producten. Het is duidelijk dat jullie in Eindhoven passen. Roeland Dietvorst, mijn voorganger bij Willem en degene die samen met hem fMRI onderzoek in Sales en Marketing op de kaart zette. Aurélie Lemmens, voor je hulp bij *time-series* analyse. Ten slotte bedank ik natuurlijk Bas Donkers en Roy Thurik als leden van de commissie.

Hoewel mijn promotietraject zich formeel via de Economische Faculteit zal voltrekken, is het een publiek geheim dat ik in de afgelopen jaren veel tijd besteed heb in de gangen, laboratoria en kamertjes van het Erasmus Medisch Centrum. Het zal dan ook niemand verbazen dat ik veel van de mensen die mij hebben geïnspireerd, gemotiveerd en bijgestaan tijdens deze belangrijke periode in mijn leven daar heb ontmoet. Het was Ype Elgersma die tijdens zijn module mijn ogen opende voor de neurowetenschappen en mij als econoom de mogelijkheid gaf te laten zien wat ik waard was. Ype, bedankt voor jouw oprechte en eerlijke opstelling; jij zorgde voor de vonk die uiteindelijk het vuur achter mijn nieuwsgierigheid naar de biologie van gedrag heeft ontstoken. Tevens stelde je mij voor aan Steven Kushner. Steven adopteerde mij en nam mij op in zijn lab. Steven, het vertrouwen, geduld en je bereidheid om te 'werken met de situatie zoals die was' waren uniek, maar verbleken bij de mentor-rol die je hebt gehad in de totstandkoming van mijn academische normen en waarden. Je hebt mij wegwijs gemaakt in het biologisch onderzoek en was altijd bereid om mee te denken over uitdagingen waar ik als neuro-econoom voor stond. Hierin werd je ondersteund

door de leden van ‘the Coolest Lab’. In willekeurige volgorde: Christian, Femke, Nilhan, Ivo, Sander, Laurie-Anne, Behdokht, Katie, Denise, Mark, Jeffrey, Bas, Shashini, Cora en de overige leden van het Kushner Lab die later zijn aangesloten. Natuurlijk vergeet ik ook de masterscriptie-, minor-, keuzeonderzoek-, en JMS-studenten die ik heb mogen begeleiden niet. Jullie out-of-the-box vragen hebben regelmatig geleid tot een doorbraak in het onderzoek. Cato en Yagmur noem ik graag nog even bij naam, want jullie enthousiasme, commitment en doorzettingsvermogen hebben mij door een van de zwaarste periodes van mijn promotietraject geholpen!

In de overgang van werk naar privé kan ik niet anders beginnen dan met Loek Worm. Loek, ik heb je leren kennen als commercieel directeur van ISAM waar jij mij de kans gaf les te geven en mij te ontwikkelen als spreker. Inmiddels ben je uitgegroeid tot een vriend waar ik voor zowel zakelijk als privé advies en vermaak terecht kan. Bij dat laatste mogen Stefanie en Jamie natuurlijk niet ontbreken. In dezelfde categorie valt Hans Meeuwisse, mijn eerste ‘echte’ baas en vriend voor het leven tegelijk. Het fundament van mijn kijk op de wereld heeft zich onder jouw vleugels in de Rotterdamse haven ontwikkeld. Een dromer ‘*by heart*’, een harde werker ‘*by nature*’. Hadden we dat allemaal maar een beetje meer. Juul en Dick, Michael en Manon, door onze schema’s is het soms lastig om een moment te vinden om bij te praten, maar jullie kijk op het leven helpt mij altijd weer vooruit.

Georges en Marianne, bij jullie kon ik altijd terecht voor steun, een gezellig praatje, of een goed ‘gevulde’ paella. Maar ook de serieuze en heftige ervaringen konden we delen, zodat deze nu de basis vormen van onze hechte band. Ik hoop dat we onze hoogte en dieptepunten nog lang met elkaar kunnen blijven delen. Patrice en Ruby, vol energie en levensgenot, jullie zijn een voorbeeld als het gaat om de werk-privé balans. Dat we nog maar vaak mogen genieten van lekkere etentjes, leuke stadjes en *superfoods*.

Dan de mensen waar het allemaal begon. Ik ben de vierde generatie die economie studeerde aan de Erasmus Universiteit Rotterdam en bedank Opa Marius, Oma Pine, Opa Wil en Oma Lies dan ook graag voor de juiste genen. Als echte Opa's en Oma's voorzagen jullie mij van (prikkelende) adviezen en levenslessen. Opa Wil, ik zal nu eindelijk 'echt' afstuderen.

Lieve Roos en Anouk, opgroeien tussen twee zussen is een nuttige exercitie gebleken voor de rest van mijn leven. Verspreid over het land is het soms ingewikkeld (geweest) intensief contact te houden. Toch bleven jullie geïnteresseerd in de voortgang van mijn promotietraject en hebben we ook een aantal pittige discussies gehad over de voorspelkracht van genetisch materiaal en de psychologische inbedding van de concepten in dit proefschrift. René en Matthijs, fijn dat jullie onderweg zijn aangehaakt. Onze levens gaan nu steeds meer parallel lopen en ik kan alleen maar hopen dat we daarmee ook onze band weer verder kunnen uitbouwen.

Pap, Mam, hoe kan ik jullie ooit teruggeven wat ik van jullie heb mogen ontvangen. Vanaf jongs af aan, in ziekte en gezondheid, in lichte en donkere dagen, zijn jullie er voor mij (geweest). Of ik nou op zaterdag om 07.00 uur of woensdag om 16:30 moest verzamelen voor een voetbalwedstrijd, jullie stonden voor mij klaar. Dit gold ook toen ik een studeerplek nodig had aan de Gerdesiaweg, of ik het even niet meer zag zitten en een *Mala* kon komen halen op de 21ste verdieping op het Erasmus MC. Jullie gaven mij de vrijheid en verantwoordelijkheden om te groeien tot de persoon die ik nu ben. Waren bereid om keuzes te maken voor mijn eigen bestwil, ook al vielen die op het moment zelf niet altijd in goede aarde. Het is een voorrecht om jullie als rolmodel te mogen hebben en te kunnen bouwen op jullie ervaring en levenslessen. Ik hoop dat we nog lang kunnen blijven sparren over academische- en levensvragen, want niets is leuker om samen geïnspireerd naar de toekomst te kijken.

Dan is nu het moment om dit proefschrift op te dragen aan de liefde van mijn leven. Pascale, houdster van de sleutel tot mijn hart: jouw onvoorwaardelijke steun, liefde, passie en doorzettingsvermogen zijn voor mij elke dag reden om het maximale uit mijzelf te halen. Ik zou dan ook niemand weten met wie ik het bereiken van deze mijlpaal liever zou vieren dan met jou. Het is elke dag genieten om met jou aan onze toekomst te bouwen en hoop dat we samen nog lang de vruchten van het leven mogen plukken!

Wouter van den Berg
Rotterdam, 07 april 2014

*Science gives one a structured opportunity to try out ideas - and, if one is not afraid of falling on one's face, to try out ideas that are raw, important, and bold.*

- Eric R. Kandel, In Search of Memory (2006)

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Bagozzi, R.P., Verbeke, W.J.M.I., Berg, W.E. van den, Rietdijk, W.J.R., Dietvorst, R.C. & Worm, L. (2012). Genetic and Neurological Foundations of Customer Orientation: Field and Experimental Evidence. *Journal of the Academy of Marketing Science*, 40(5), 639–658.

Verbeke, W.J.M.I., Bagozzi, R.P., Berg, W.E. van den (2014). The Role of Attachment Styles in Regulating the Effects of Dopamine on the Behavior of Salespersons. *Frontiers in Human Neuroscience*, 04 Februari 2014, doi 10.3389/fnhum.2014.00032.

Berg, W.E. van den, Verbeke, W.J.M.I., Bagozzi, R.P., Worm, L., Jong, A., Nijssen, E. (forthcoming). Salespersons as Internal Knowledge Brokers and New Products Selling: Discovering the Link to Genetic Makeup. *Journal of Product Innovation Management*.

# CHAPTER 1

## General Introduction

*"To its many fans, Apple is more of a religious cult than a company. An iToaster that downloads music while toasting bread would probably get the same kind of worldwide attention. Don't let that fool you into thinking that it matters. […] The iPhone is nothing more than a luxury bauble that will appeal to only a few gadget freaks. In terms of its impact on the industry, the iPhone is less relevant."*

- Matthew Lynn, financial journalist, Bloomberg.com (2007)

### *Background*

The launch and commercialization of (new) products is of vital importance for company survival and next generation growth (Di Benedetto 1999; Cohen et al. 1997; Cooper 1979). Yet, it poses serious challenges for many firms, evidenced by the high failure rate of new products (Booz-Allen and Hamilton 1982). Given the enormous costs that are involved with product development and subsequent marketing and sales activities, both company management and scholars from multiple disciplines have long been interested in identifying the key drivers behind successful launch and commercialization strategies (Montoya-Weiss and Calantone 1994).

Two additional societal developments have further contributed to the complexity of developing strategies to successfully market new and existing products. First, contemporary firms operate in a rapidly changing and complex knowledge-intensive economy (Achrol and Kotler 1999; Adler 2001), with ever-rising R&D costs, shorter product life cycles and fierce (global) competition. Second, boosted by recent technological developments such as the Internet, the current network society has significantly increased customer's access to information about alternative solutions available in the marketplace (Verbeke et al. 2010).

The widely accepted framework by Rogers (1995) posits that successful product adoption is dependent upon five factors: competitive advantage, compatibility, complexity, triability, and observability. Additionally, demographic characteristics of customers have been found to impact the product adoption process. For example, Rogers (2003) points out that younger and male consumers adopt products more quickly and more often. Others show that a buyer's propensity to adopt a product is related to perceived risk (Ostlund 1974), emotional response patterns (Raju 1980), self regulation of affects (Herzenstein et al. 2007) or even personality traits such as innovativeness (Im et al. 2003).

Clearly, in identifying key drivers of successful product commercialization, there is much leeway regarding the level of analysis to consider. Whilst some factors are related to product attributes and product placement, others touch upon intrinsic (motivational) mechanisms at the level of the actual buyer.

Yet, these findings are particularly relevant for the marketing department as they allow for customer segmentation and alignment of promotional offerings to target-group needs and perceptions. However, in our current knowledge-intensive economy, and particularly in the business-to-business market, buyers and sellers engage in long-term reciprocal relationships before completing the transaction. This is especially true for the highly complex and knowledge-intensive setting of today's post-industrial economy, where transactions are multifaceted, unstructured and highly customized to meet the specific needs of a particular buyer (Dean and Kretschmer 2007; Dhar et al. 2004; Sarvary 1999; Tuli et al. 2007). Importantly, salesperson's efforts and commitment have been found to be crucial in governing these buyer-seller relationships, positively affecting (new) product development, adoption and sales (Di Benedetto 1999; Brentani 2001; Micheal et al. 2003; Song and Montoya-Weiss 1998). Therefore, this thesis aims to investigate the drivers of successful customer-salesperson interactions in a sales context where knowledge development has become crucial to the value-creation process (Vargo and Lusch 2004).

### *Salespersons as knowledge brokers*

A recent meta-analysis on sales force behaviors demonstrates an emerging role for salespeople as knowledge brokers (Verbeke et al. 2010). Salespeople are pivotal in linking different parties both within and outside their firm, establishing a reciprocal flow of knowledge between the different members of the network. On the one hand, salespeople help customers link products with their specific needs, and explain features and usefulness of products convincingly. By doing so,

salespeople reduce the uncertainty that comes with adopting products regarding e.g. function, quality and price, and so stimulate the buying process (Kirmani and Rao 2000; Webb et al. 2010). On the other hand, as Webb et al. (2010) argue, only a small portion of all products and services are of satisfactory quality immediately after launch, allowing for marketing limited to merely creating and increasing brand or product awareness. In contrast, for the vast majority of the products and services brought to market, salespersons are in the perfect position to take back information to the firm and provide critical feedback about customers' needs and problems in technical, logistical and organizational (implemental) domains of the products and services delivered. Hence, as boundary spanner (Adams 1976), salespersons advocate product adjustments and innovation (Ernst et al. 2010; Hargadon 2010). In summary, successful salespeople stimulate and facilitate the recombination and dissemination of knowledge within their network so that they help customers (re)frame and better understand their needs, as well as help the selling company to devise possible solutions that (better) fit those needs (e.g., Wotruba 1991; Homburg et al. 2009).

In line with the above, salespeople should shift their strategies from a short-term focus on the (immediate) sale, to a more long-term and customer-centered approach aimed at opportunity identification (Bonney and Williams 2009). Such a distinction is akin to what Saxe and Weitz (1982) describe as sales-oriented versus customer-oriented selling. In short, a sales-oriented approach refers to a strategy with a clear intention to make the immediate sale by convincing customers "to buy, even if I [salesperson] think it is more than a wise customer would buy" or sometimes even painting "too rosy a picture of my [salespersons'] products, to make them sound as good as possible". In contrast, customer-oriented salespeople practice the marketing concept, and by doing so establish long-term reciprocal relationships (Kotler 1994). Concretely, they are driven by the aim of meeting mutual needs through intense and thorough

conversations with the customer, exemplified by the effort to "align customers who have problems with products that will help them solve their problems", and trying to get "customers to discuss their needs with me [salesperson]". Results of multiple follow up studies further exploring the concept of customer orientation converge into the idea that customer-oriented selling entails building long-term relationships characterized by a constant gathering and dissemination of relevant information to the customer, in an effort to continuously fulfill customer's hierarchy of latent needs (Singh and Koshy 2011). Therefore, employing a customer-oriented selling strategy seems particularly beneficial in complex buying situations and might form the basis of successful knowledge brokering.

Several other authors have previously recognized the importance of instilling psychological comfort, trust and mutual support in the buyer-seller relationship (Weitz and Bradford 1999). Indeed, strong, long-term personal relationships with customers that are beneficial for both buyer and seller have been found to have a positive impact on referrals and recommendations, and leads to lower customer turnover (Boles et al. 1997; Crosby and Stephens 1987; Crosby et al. 1990; Doney and Cannon 1997; Dwyer et al. 1987). Finally, customer orientated selling is positively associated with job satisfaction, motivation and commitment toward the organization (Pettijohn et al. 2002; Siguaw et al. 1994; Williams and Attaway 1996).

A large body of pre-existing literature suggests that successful sales force behavior might be contingent on the specific context in which salespeople operate. Therefore, the studies presented in this thesis focus on salespeople who operate in a knowledge-intensive business-to-business context. The overall aim of this thesis is to increase our understanding of the different social and cognitive skills that allow salespersons to build long-term relationships by keeping a keen eye on spotting and grasping novel opportunities that might benefit both the client and the selling company,

### *The biology of salesforce behavior*

Until recently, studies aiming to understand salesforce behaviors have relied on (verbal) self-reports, gauging psychological concepts to try and explain why salespersons take certain actions. However, advances in neuroscience and genetics have provided the social sciences with an additional level of analysis: the neurobiology of our brain. Weighing only 1350 grams, the brain is considered to be the most complex, sophisticated, and efficiently built 'machine' ever known. Even though our brain is made up of over 100 billion neurons, it requires only the power level of a 60-watt light bulb to function properly. One neuron is connected to multiple others, just as it will receive input from different neurons, summing up to 10,000 inputs per neuron. In total, there are approximately 1 quadrillion ($10^{15}$) connections, which communicate through about one million kilometers of interconnected fibers.

Every vertebrate brain can be divided into three broad zones: the hindbrain, midbrain, and forebrain. The forebrain is related to purposeful, voluntary behavior and is considered to play a role in problem solving. The midbrain is involved in maintaining wakefulness and processing visual and auditory reflexes, whereas the hindbrain controls the basic functions that are needed for staying alive, such as breathing and maintaining a heart beat. When comparing a mammalian brain to any other vertebrate brain, the expanded cortex in the mammalian brain (which is part of the forebrain) immediately stands out. Among mammals, humans have the most differentiated cortex, and within the cortex our neocortex allows for many of our higher mental functions. Throughout these zones, several interconnected systems play their role in cognitive, emotional, and bodily functions. Of special interest is the limbic system, which is the region that forms the border (limbus in latin) of the inner cortex. This area, consisting of among others the amygdala, hippocampus, thalamus, and hypothalamus, is responsible for emotional processing, behavior, and long-term memory. Besides

its role as a storage mechanism, the limbic system has a regulatory function since it has connections to the endocrine system (hormones) and the autonomic nervous system (digestion, respiration).

In short, the brain represents an interconnected neural circuit of several systems which each have their own functions. Communication occurs through electrical signals carried by neurons, which have specific transmission properties. These neuronal-transmission properties are altered due to experience, among others by the formation and elimination of synaptic connections. Taken together, a) the immense number of neurons, b) the formation of even more synaptic connections, and c) the plasticity of the weight of every individual synapse, determine the almost endless amount of differentiated patterns of connections that can be stored in the brain (for an elaborate introduction to our brain and the neural and molecular process that occur, please see *Appendix 1*).

The economists' advance in the understanding of how our brain operates has lead to the emergence of the field of neuro-economics, an interdisciplinary science that seeks to explain phenomena in economics. Neuro-economics is starting to map how biological processes can be drivers of relevant, real-world behavior, such as social interaction, influence, and capability development. In other words, it looks at the biological foundations of socio-economic behavior. From a biological perspective, our genetic make-up lies at the core of these biological processes. Indeed, the way our genes are expressed have significant impact on the way we (choose) to perceive the world and act upon the stimuli presented to us.

Our DNA can be seen as the recipe for proteins in our bodies. It is found in every cell, driving its function and impact on the system as a whole. As such, variations in our DNA can determine that some brain cells are more active than others. If this functional modification occurs in the neurons that make up our

brain, it is easy to understand that genetic variation plays a role in how we behave in certain situations.

A growing number of methods from behavioral genetics have been applied within organization behavior (see Ilies et al., 2006); methods from molecular genetics have not. Using samples of twins, behavioral genetics seeks to infer whether organizational phenomena (phenotypes), such as individual differences in personality traits, have underlying genetic (genotypes) and/or environmental causes. In a professional context, our DNA has been found to make a substantial contribution in explaining a person's professional aspirations (40-50%), work ethic (40%), job satisfaction (36%) and entrepreneurship (48%). These studies, however, did not show the specific genes that were involved in this process. Therefore, in this thesis, we present three studies that aim to find an association between particular genes and salesforce behavior. Therefore, the studies presented here use knowledge from a more primitive or fundamental level than social or psychological approaches. Specifically, it takes an inside-out approach by using knowledge about the functioning of the human body and the structure and function of the DNA (genotype) in order to study such phenotypes as job attitudes as customer-oriented selling or knowledge brokering activities.

### *On genetic association studies*

As Kreek et al., (2005) argue, there are two main strategies for studying associations between genetic information (the genotype) and specific behavior (the phenotype). The first approach is a hypothesis-oriented selection: investigating specific candidate genes based upon prior understanding of the phenomena. A second, exploratory approach conducts genome-wide scans to identify chromosomal positions that might be associated with a behavioral phenotype. A problem with the first approach is that false positives might be found, and in order to avoid this researchers suggest that studies should be

replicated. In the latter approach, there is no *a priori* clear link between the trait under investigation and the genes that are found to influence the trait, leading to possible validity issues. Similarly, this approach also suffers from a high incidence of false positive findings due to multiple testing issues and publication selection biases. Crucial for our understanding of this tradeoff is the point that when applying genetics within organization behavior contexts, it is improper to claim that one has found a universal genetic variant that predicts a phenotype; rather within the population of investigated particular phenotype, one ascertains whether genetic variants are associated with phenotypes of interest.

The studies presented in this thesis employ a candidate gene approach. Underlying our the of a candidate gene approach is the assumption that artificially imposing concepts on biomarkers without *a priori* formulating a hypothesis as to how these biomarkers influence specific behaviors could jeopardize the validity of findings. Indeed, considering that the human genome consists of over three billion mutation sites, there is ample room for false positive findings (Storey & Tibshirani, 2003). In line with this, we acknowledge the ongoing debate in the scientific literature about the most suitable approach for genetic studies, where both GWAS and candidate gene studies have advantages and drawbacks (Tabor et al., 2002). Relevant here is the point that candidate gene studies are traditionally subjected to the criticism that only a few of them have been replicated in subsequent studies (Ioannidis, Tarone, & McLaughlin, 2011; Siontis, Patsopoulos, & Ioannidis, 2010; cf. Ioannidis, 2005). However, multiple reasons suggest that we should not overly criticize or condemn the approach as unreliable and by doing so risk type II errors. For instance, many follow-up studies are typically conducted in different study populations and/or differ in the exact manner by which the phenotype under study is characterized (e.g. Noble, 1998; Palmer & Cookson, 2000).

However, above all, the lack of a rigorous characterization of the behavior under study has severely hampered scientists' ability to link genes to complex behavioral traits. To elaborate on this point, it is highly implausible if not nonsensical to suggest that there actually is a single gene that directly drives complex behaviors such as Sales or even internal knowledge brokering. This means that genes found in candidate gene studies are most likely driving, or reflecting, underlying constructs that are ecologically valid, such as impulsivity, cognitive flexibility, or stress-resilience. To solve this problem scientists are beginning to recognize the need for studying endophenotypes that reside at lower, less complex levels of analysis, and that are "envisioned to involve fewer genes, fewer interacting levels, and ultimately activation of a single set of neuronal circuits" (Gould and Gottesman, 2005, p 115). Therefore, our attempt to study candidate genes in the fields of marketing and sales should be regarded as exploratory efforts aimed at identifying which biological systems are involved. Based upon these issues and our findings, future research should explore specific variants of/and additional candidate genes related to these biological pathways. Furthermore, studies aim to identify the different contingencies and developmental constraints that play a role in regulating gene expression will help to gain a more solid and fundamental idea on the true genetic basis of behavior.

### *Aim of this thesis*

The overall aim of this thesis is to increase our understanding of biological mechanisms that drive salesforce behavior. This has both practical and academic implications. For professionals, we try to better understand what drives their behavioral strategies, such that they can understand and manage themselves more effectively. For academics, we hope to advance the ongoing debate on how to utilize the latest neurobiological insights in the social sciences in general, and find

possible strategies to incorporate genetic association studies in a sales context more specifically.

### *Outline*

This thesis is organized as follows. In **Chapter 2** we will identify the underlying behavioral strategies of customer orientated salespersons, finding that specifically their ability to recognize opportunity is of vital importance in their daily sales activities. Additionally, we provide the first evidence of an association between a specific variant of a gene regulating the dopamine system of salespeople and their propensity to engage in customer-oriented selling. Recognizing the importance of replicating (candidate) gene findings in independent samples, we replicate this finding in **Chapter 3**. Secondly, we show that their might be specific contexts or developmental trajectories on which this association is contingent by presenting data that suggests that the effect of this gene tends to be present specifically in salespersons that are able to remain at a professional (social) distance from their customers. In **Chapter 4** we show that associations between genes and salesforce behavior are not constrained within the concept of customer orientation, as the data provides evidence for an association between internal knowledge brokering and willingness to sell new products and another gene in the dopaminergic signaling pathway. Finally, in **Chapter 5** we will draw conclusions from all studies presented, and provide both academic and managerial implications.

*Adapted from:*

Bagozzi, R.P., Verbeke, W.J.M.I., Berg, W.E. van den, Rietdijk, W.J.R., Dietvorst, R.C. & Worm, L. (2012). Genetic and Neurological Foundations of Customer Orientation: Field and Experimental Evidence. *Journal of the Academy of Marketing Science*, 40(5), 639–658.

**Awarded with:** *Sheth Foundation Best Paper Award* for Volume 40 (2012) of the *Journal of the Academy of Marketing Science*.

# CHAPTER 2

# Genetic Foundation of Customer Orientation: Field and Experimental Evidence


**Abstract**

We explore genetic bases for customer orientation (CO) and contrast them with sales orientation (SO). Study 1 is a field study that establishes that CO, but not SO, leads to greater opportunity recognition. Study 2 examines genetic bases for CO and finds that salespeople with CO are more likely to have the 7R variant of the *DRD4* gene. This is consistent with basic research on dopamine receptor activity in the brain that underlies novelty seeking, the reward function, and risk taking.

## *Introduction*

In their visionary paper, Saxe and Weitz (1982) explore two contrasting orientations by which salespeople interact with customers: sales versus customer orientation. Under the former, salespeople are driven by such notions as, "I try to sell customers all I can convince them to buy, even if I think it is more than a wise customer should buy," where the motivation is to meet one's own short-term interests and goals and not necessarily the customer's. Under the latter, salespeople are guided primarily by such ideas as, "I try to align customers who have problems with products that will help them solve their problems," where the aim is to meet mutual needs and the hope is to build long-term relationships.

Sales orientation (SO) involves persuasion and "selling to" customers, whereas customer orientation (CO) is more about "interacting with" and encouraging customers to talk about their problems so that the salesperson can figure out their needs (a process akin to co-creation of solutions) and bring them in touch with solutions to their problem. Seldom has a concept sparked so much interest, resonating with both researchers and practitioners (e.g., Franke and Park 2006; Homburg et al. 2009; Leigh et al. 2001).

Academics and sales managers are very interested in successfully selecting and managing salespeople, but to understand the basis for salesperson motivation and implement successful policies in this regard, they need to know the why behind CO and SO. Here is where the situation is muddled, for many anecdotal and loosely conceived explanations lack coherence and managerial relevance. Saxe and Weitz (1982) proposed that researchers should explore the psychological mechanisms underlying CO, and indeed a plethora of selling and marketing research has attempted to do just this. For example, in their meta-study, Franke and Park (2006, pp. 693–695) suggested that CO is associated with the desire to maintain a long-term relationship with the customer, practicing the marketing concept, intrinsic motivation, empathic ability, and willingness to take

risks (e.g., betting on uncertain long-term sales results instead of maintaining a short-term focus). These psychological explanations are rather at arm's length and reflect outside-in rationalizations, meaning that they rely on general, coarse-grained psychological mechanisms to explain overt behavioral orientations or tendencies. At first sight, they might seem ad hoc, incoherent, and difficult to comprehend and implement. Yet their face validity seems compelling. More finely grained explanations rooted perhaps in neuroscience and even genetic evidence are needed. Could diverse psychological explanations be supported by hard-wired biological mechanisms, which specifically activate when salespeople engage in CO as opposed to SO? Until now, the idea of using biological mechanisms to increase our understanding of salesforce behavior has not received much attention.

The goal of our research is to take a biological perspective on the role of CO versus SO in personal selling. We explore biomarkers based on genetic analysis. However, before we begin our investigation of biomarkers, it is important to demonstrate the phenomenon (phenotype) under investigation in the field (Kreek et al. 2005). This suggests evidence for external validity and provides targets for investigation by biological methods. Study 1 shows that CO versus SO plays a role in the field and Study 2 examines the biological bases for CO and SO. In Study 1, we explore Saxe and Weitz's (1982) early conjecture that salespeople with CO adopt the marketing concept (p. 343) and that CO is especially beneficial for complex buying tasks (p. 348). We interpret these suggestions in a contemporary light: nowadays industrial salespeople operate as knowledge brokers in knowledge-intensive economies (e.g., Verbeke et al. 2011) and engage in opportunity recognition (Bonney and Williams 2009), which is defined as "efforts to make sense of signals of change […] to form beliefs, whether or not enacting a course of action to address this change could lead to net benefits" (Gregoire et al. 2010, p.415, emphasis in original removed; see also Bonney and

Williams 2009). More specifically, in Study 1, we develop an opportunity recognition scale and test whether CO or SO predicts opportunity recognition.

Second, there is evidence in the basic science literature suggesting that opportunity recognition may have a genetic component in that novelty seeking, the functioning of the human reward system, and response to delayed gratification have been shown to be associated with the activation of the dopamine system in the brain (e.g., Dreber et al. 2009). Since dopamine receptors play an important role in the activation and regulation of the dopamine system, we focus on two genes that encode for these receptors, and which have been previously shown to affect dopamine system regulation (e.g., Nicolaou and Shane 2009). In particular in Study 2, we investigate whether CO, but not SO, is associated with genes known to affect dopamine regulation.

The paper is organized as follows. First, we present Study 1, our field study of the relation between CO and SO and opportunity recognition. Then comes Study 2, which examines genetic underpinnings of CO and SO. We end with a general discussion and managerial implications for our findings.

### *Study 1: CO versus SO and opportunity recognition*

Saxe and Weitz (1982) noted that salespeople with high CO operate in a sense as mini-marketers during sales conversations with customers. They enter sales conversations with such mindsets as "I try to get customers to discuss their needs with me." As we move into a knowledge-based economy, salespeople with high CO must spend time collecting information about customer needs and also demonstrate how their products—often complex solutions—can satisfy those needs. CO may not be correlated with work experience, per se (Franke and Park 2006, p.700). We assume that salespeople with CO, as opposed to SO, constantly source knowledge (learn) both during and between sales conversations (e.g., visiting trade fairs or reading journals), such that they build insights (categories,

solutions) that allow them to better spot customer needs (opportunity recognition) and connect those needs with their categories or solutions (knowledge brokering) (Bonney and Williams 2009; Gregoire et al. 2010; Verbeke et al. 2011). As salespeople interact with customers, they engage in analogical reasoning (Holyoak 1985), meaning that they look for similarities between what they see or hear (largely a bottom-up process) and what they know (top-down process) via mental representations. To the extent that salespeople seek to construct (or find) analogies during sales encounters, which involves situated cognition and awareness of contextual factors (Franke and Park 2006, p. 695; Homburg et al. 2009), they in turn passionately engage customers in stimulating, functional conversations, thus energizing discussions in intellectual and emotional ways. These processes result in a form of co-creation of solutions that is beneficial to both buyer and seller. Business-to-business salespeople (the focus of our research) seldom meet with a single customer; rather, they meet with various members of a buying center. As salespeople interact with people in the buying center, they can uncover the idiosyncratic needs of these people and explore what drives them or how they view their problems and opportunities (e.g., Weitz and Bradford 1999). Doing this should enable salespeople to solve the different needs and pains of buying center members, or at least offer solutions. All this is consistent with the opportunity recognition process. In this spirit, we explore how salespeople engage in opportunity recognition.

**Opportunity recognition**

We constructed an opportunity recognition scale based upon Johnson et al.'s (2004) suggestion that people in marketing possess environmental knowledge in both functional and interactional senses. Three kinds of knowledge are relevant.

*Contextual knowledge formation*

Opportunity recognition involves analogical reasoning that connects a target stimulus (e.g., a statement of need by the customer) to a source (a category or abstract framework that meets customer needs). Opportunity recognition entails aligning abstract insights derived from analyses of the industry, buyer, and own firm capabilities, product solutions, etc. with the concrete needs and issues of customers. Salespeople gather abstract knowledge on the industry and competition from such sources as customers (Bonney and Williams 2009), trade fairs, conferences, industry publications, and face-to-face contact with experts. Rodan and Galunic (2004) showed that knowledge heterogeneity (i.e., the variety of knowledge, know-how, and expertise derived from one's network) is positively related to performance and innovativeness. Key here is the idea that the abstract nature of the source content, where a wide range of abstract metaphors is used to recognize a situation, is both conducive to opportunity recognition and generates explicit "brain activation" in this regard (Gregoire et al. 2010, p. 417). High CO should foster knowledge formation, because as salespeople develop more abstract insights (generalizations), they remain curious about new developments and sensitive to threats and opportunities, and so they can make better connections between what customers communicate and their own general knowledge/ experience of the solutions needed and how to deliver them. CO thus implies that the salesperson who possesses broad experience relevant to sales practice will more likely recognize a customer's still dormant or vaguely specified needs. Equally, salespeople with a broad perspective give customers a way to validate their own ideas about the industry and product solutions, which is one way that salespeople function as knowledge brokers. Note that sourcing information also involves tradeoffs and risk taking: time spent gathering knowledge might be better spent on actual selling (e.g., Saxe and Weitz 1982). Salespeople with SO should draw the line closer to actual selling than salespeople with CO. Indeed,

salespeople with SO should allocate fewer resources to contextual knowledge gathering (because they are focused on convincing the customer to buy), and as a consequence they should learn less than salespeople with CO about how the customer-seller gap can be bridged. Relative to salespeople with CO, salespeople with SO place less emphasis on learning and exploration, and they prefer instead to emphasize "selling to," thereby painting an overly rosy picture of their services or pressuring customers into buying their solutions; this practice makes them, so to speak, "ego-centered tellers" and not "empathic sellers" (Richardson 1994).

*Motivation to learn about customers*

High CO implies having natural curiosity and a readiness to uncover particular customer needs and determine how to meet those needs through the resources (products) of one's own firm (Saxe and Weitz 1982). Recognition of opportunities has two sides. From the customer's point of view, when customers feel that a salesperson cares about and understands their needs, they should experience psychological comfort (Edmonson and Woolley 2003; Tanner et al. 2008) and voice tacit needs more readily and in ways better understood by the salesperson. Those salespeople with high CO tend to be excited, curious, and vigilant when customers interact with them, even if only to make complaints or express concerns. Saxe and Weitz (1982) characterize this as the "free-flow of information," which is best exemplified by customers who ask challenging questions of salespeople, and salespeople who make suggestions for new product solutions to customers. Mercier and Sperber (2011) recently argued that analogical reasoning is largely motivational and occurs most naturally in two-way conversations. Quality interactions are needed to translate and reconcile abstract ideas with customer needs and validate customer judgments about competitive offers (Cross and Sproull 2004). When salespeople are perceived as

knowledgeable about the market, they become trusted advisors, and the resulting solutions are in fact co-creations (Vargo and Lusch 2004).

In contrast, salespeople high in SO seek mainly to persuade customers, do not encourage customers to mention their own issues, and create fewer opportunities for psychological comfort; hence, their customers have less chance to express, let alone validate, their needs or issues than they would have interacting with salespeople high in CO.

*Buying center knowledge formation*

In many selling situations, customers are multiple parties in buying centers with individual perceptions of their firm's actual requisites and constraints. To be effective, salespeople need to understand the reasons for all the different interpretations of a problem, factors inhibiting buying, and implications for sales. Moreover, salespeople should not only be aware of multiple points of view, but these in themselves should motivate salespeople to come up with tailor-made solutions that will have a greater buy-in for multiple parties in the buying center. Indeed, this is a key reason why tailor-made solutions proliferate.

For example, customers may readily recognize the functional value of a proposed solution, yet they may also suspect that it will have undesired implications from a political perspective (e.g., Dawes et al. 1998; Kohli 1989). However, in a knowledge-based economy, the political meaning of a proposed solution is not the only thing that counts. Members of the buying center should have the absorptive capacity to understand what a solution means to their firm in terms of its technical, financial, and organizational consequences as well.

Salespeople with high CO infer the various perspectives of pain or resistance to product adoption through the verbal and nonverbal cues given by customers in interpersonal interactions (Homburg et al. 2009). High CO leads salespeople to immerse themselves empathetically, through building informal

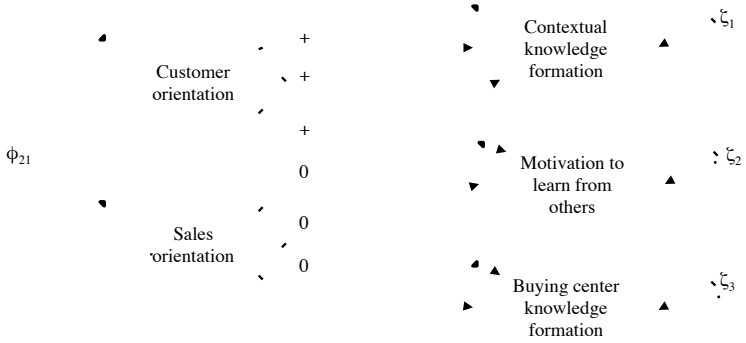
networks, into the professional life of the buying center members and ask customers specific questions designed to gauge their absorptive capacity. It is precisely these insights (into pain or resistance, absorptive capacity) that allow them to co-create better solutions and learn why and how customers buy.

Salespeople with high SO focus on transmitting their own messages and are less interested in discovering the personal subtleties of members of the buying center; they learn relatively less than salespeople with high CO and may even alienate members of the buying center ("this salesperson does not care about or listen to us"). Hence, we propose the following hypotheses:

H1: The greater the CO, the greater the contextual knowledge formation effort, motivation to learn from customers, and implementation of buying center strategy.

H2: SO will not relate significantly to contextual knowledge formation effort, motivation to learn from customers, and implementation of buying center strategy.

**Figure 1** presents a structural equation model that summarizes the hypotheses.




Predictions: + = significant predictive relation; 0 = non-significant predictive relation.

**Figure 1.** Causal model for testing effects of customer orientation and sales orientation on opportunity recognition dimensions (indicators of factors omitted for simplicity).

## Method

Thomas et al. (2001) developed a ten-item short-form SOCO scale, where five items measure sales orientation, and five items customer orientation. Using confirmatory factor analysis, Periatt et al. (2004) showed that a two-factor SOCO model fit their data well. We began our investigation with an attempt to replicate the ten-item version validated by Periatt et al. (2004). We found that seven of the original ten items proposed by Thomas et al. (2001) worked well but that three new items performed better than the three in the original short-form scale. **Table 1** presents our own ten-item short form. We eliminated item 13 from the SOCO scale because it did not express an action, as do the other CO items (item 13 measures a state of mind). In addition, item 13 loaded unacceptably low (.40) on the CO factor in the confirmatory factor analysis by Periatt et al. (2004). We also eliminated item 16 from the SOCO scale because it is nearly identical to items 14 and 23 that are included, and it had the second lowest loading on the CO factor in the study by Periatt et al. (2004). In our exploratory factor analysis, items 13 and

16 loaded on other factors than the remaining short-form items. Instead, we used the first two items from the SOCO scale because they capture aspects of CO that were not well represented on the original short form. Namely, the new items measure attempts by the salesperson to give an accurate description of what a product can be expected to do for the customer, and get the customer talking about their needs. Items 1 and 2 loaded .40 and .71, respectively, on our exploratory factor analysis.

On the SO short form, four of five items from the original scale worked well, but we eliminated item 22 and replaced it with item 3. Item 22 in our exploratory factor analysis failed to load satisfactorily on any factor, whereas item 3 loaded .49 on SO.

We performed confirmatory factor analysis on the new short-form scale and found that the two-factor model fit very well: $\chi 2(1)=2.28$, p=.13, NNFI=.97, CFI=.99 and SRMR=.01. The factor loadings for the CO factor ranged from .82 to .93 and for the SO factor from .82 to .87. The two factors correlated -.58 with an s.e.=.08. Thus, the items for the new short form of SOCO measure both factors well and achieve discriminant validity. Next, all three scales for opportunity recognition (i.e., contextual knowledge formation, motivation to learn from customers, buying center knowledge formation) were administered along with the reduced versions of the CO and SO scales (see **Tables 1** and **Table 2**).

Our sample of 132 salespeople came from a variety of firms across multiple industries who participated in an executive education program at the collaborating university. The salespeople came from a variety of firms across multiple industries: 4% from automotive, 3% from food and beverage, 13% from banking, 3% from utilities, 8% from manufacturing, 31% from professional services, 4% from pharmaceuticals, 2% from telecom, 5% from logistics, 16% from IT, 3% from retailing, 3% from energy, and 5% from other industries. The

sample consisted of 71% men, 29% women, with an average age of 36.3 years (s.d.=9.1) and an average experience in selling of 10.4 years (s.d.=8.0).

The items for the three opportunity recognition scales were generated from interviews with salespeople and from the literature reviewed above. A total of 17 items was generated, but based on an exploratory factor analysis, two items were dropped because they cross-loaded too highly on multiple factors. Loadings on all factors ranged from .48 to .95, and all cross-loadings for the 15 items were less than .25. They were pretested for clarity and relevance during seminars with other salespeople from similar industries. **Table 2** shows the 15 items used in Study 1. One bilingual speaker translated items from the original English version into the native language of the salespersons under study. A second bilingual speaker then translated these back into English, and then the original and the translation were compared to resolve discrepancies. The reliabilities for CO, SO, and the three dimensions of practical opportunity recognition are .84, .79, and .79, .77, and .79, respectively.

**Table 1.** Items from the SOCO scale used in Study 1.

**Customer orientation (CO)**

1. I try to get customers to discuss their needs with me.
2. I try to find out what kind of product would be most helpful to a customer.
3. I try to bring a customer with a problem together with a product that helps him solve the problem.
4. I try to give customers an accurate expectation of what the product will do for them.
5. I try to figure out what a customer's needs are.

**Sales Orientation (SO)**

1. I try to sell a customer all I can convince him to buy, even if I think it is more than a wise customer would buy.
2. I try to sell as much as I can rather than satisfy a customer.
3. If I am not sure a product is right for a customer, I will still apply pressure to get him to buy.
4. I paint too rosy a picture of my products, to make them sound as good as possible.
5. It is necessary to stretch the truth in describing a product to a customer.

**Table 2.** Items from the opportunity recognition scale used in Study 1.

**Contextual knowledge formation**

1. I try to keep up by reading journals related to my industry.
2. I ask myself what the important issues in my work are and then I ask how new information fits into this framework
3. I combine my experiences and insights concerning the industry in which I work
4. I gather knowledge from my industry from different perspectives
5. I regularly talk to people working in my industry to keep up with the new developments.
6. I study my competitors at trade fairs and conferences

**Motivation to learn from customers**

1. I feel stimulated to come up with new ideas when customers or people in the buying center express their thoughts and ideas.
2. I notice that many of my ideas are generated by customers asking me challenging questions.
3. When customers make suggestions or make complaints I seek to learn from them.
4. When customers ask me difficult and challenging questions I get stimulated.
5. When customers ask me challenging questions, If eel as if I am in the flow.

**Buying center knowledge formation**

1. I seek to find out in detail what training members of the buying center have had and how they keep up with the developments in their industry.
2. I try carefully to gauge the influence of a specific person in the buying process.
3. I try to get gauge to what extent customers act as professionals.
4. I always ask how people in the buying center really perceive us.

**Results**

We ran a structural equation model on the data corresponding to Fig. 2, where two indicators per factor were developed by parceling items; the procedures and criteria were discussed in Bagozzi and Heatherton (1994) and Bagozzi and Edwards (1998). The overall model fit well: $\chi 2(25)=27.69$, $p=.35$, NNFI=1.00, CFI=1.00, and SRMR=.026. Factor loadings for CO were .83 and .93, SO were .78 and .86, contextual knowledge were .95 and .93, learning from customers were .84 and .91, and buying center learning were .90 and .80; all error terms were significant but very low in value. Importantly, CO significantly predicted contextual knowledge formation ($\gamma=.75$, $t=5.42$, std $\gamma=.59$), motivation to learn from customers ($\gamma=.65$, $t=4.30$, std $\gamma=.55$), and buying center knowledge formation ($\gamma=1.01$, $t=5.15$, std $\gamma=.64$), whereas SO failed to significantly predict contextual knowledge formation ($\gamma=.05$, $t=.58$, std $\gamma=.06$), motivation to learn from customers ($\gamma=-.05$, $t=-.49$, std $\gamma=-.06$), and buying center knowledge formation ($\gamma=-.14$, $t=-1.10$, std $\gamma=-.13$). The explained variance estimates showed R2=.40 for contextual knowledge formation, R2=.26 for motivation to learn from customers, and R2=.33 for buying center knowledge formation. Multiple regression analysis showed that CO and SO did not interact significantly ($\beta=-.02$, $t=-.27$ for contextual knowledge formation; $\beta=.03$, $t=.44$ for motivation to learn from customers; $\beta=-.02$, $t=-.21$ for buying center knowledge formation).

**Discussion**

Customer orientation, especially salient for complex products in knowledge-intensive economies, requires salespeople to seek sources of industry-related knowledge, learn from customers, and try to understand the different perspectives of buying center members (all of which are aspects of opportunity recognition). Salespeople who engage in opportunity recognition try to get customers to discuss

their needs with them. Figuring out which product would be most helpful for the customer is a typical tactic of customer-oriented salespeople. The findings show that CO is related to opportunity recognition, whereas SO is not. The next study takes a biological perspective in seeking to understand genetic bases for CO dimensions associated with the diligent, empathic search for new nuances when interacting with customers. CO, such as might be reflected in how members of the buying center consider and frame their needs, can be seen to reside in certain biomarkers, especially those involved in the dopamine system. We develop this perspective below.

### *Study 2: Genetic analysis of customer versus selling orientation*

> *[DRD4 gene] children have their own strengths and limitations: they don't do well in the school environment of repetition, auditory learning, and rote memorization that has been set up for "normal" kids, and they don't make very good bookkeepers or managers. Genetically these kids are pioneers, explorers, and adventurers. They make great innovators, and they find high levels of success in any field where there's a lot of change, constant challenge, and lots of activity. Such personalities are common among emergency room physicians, surgeons, flight pilots, and salespeople. (Hartmann and Palladino 2004,p.6)*

In the field of entrepreneurship, a pioneering study has found that the ability to identify business opportunities has a genetic component (e.g.,Nicolaou and Shane 2009). Nicolaou et al. (2008) conjecture that people carrying the *DRD4* gene have greater sensitivity to certain environmental stimuli, akin to what psychologists call novelty seeking or sensation seeking. Novelty seeking refers to the need for varied, novel, and complex experiences and the willingness to take physical and social risks for the sake of such an experience (Zuckerman 1994). The focus here

is not to understand novelty seeking per se, but to determine whether it functions as a mechanism that motivates salespeople to engage customers in discussing and figuring out their needs, so that solutions can be effectively presented. As Study 1 showed, this is associated with opportunity recognition.

Novelty seeking is influenced by the dopamine system in the brain. Also known as the reward system, the dopamine system tags behavioral strategies and their consequences, as well as changes in the environment such as opportunities, with incentive salience (Berridge and Robinson 1998). Two genes, encoding for dopamine receptor 4 (*DRD4*) and dopamine receptor 2 (*DRD2*), regulate dopamine signaling in the brain. Specific variants of these genes have been shown to increase the salience of information, which plays a role in opportunity recognition processes (Nicolaou et al. 2008). Anatomically, the dopamine signaling pathways include such brain structures as the ventral tegmental area, nucleus accumbens, striatum, and the prefrontal cortex. These regions are activated when people feel motivated and anticipate satisfaction in learning (e.g., Berns 2005). In other words, dopamine signaling is related more to the anticipation of a reward than to the actual receipt of a reward.

The goal of Study 2 is to investigate whether there is a specific association between variants of the *DRD4* and *DRD2* genes and CO and SO. A targeted study in genetics requires the development of robust hypotheses, based upon the biological mechanisms in which the genes of interest function. As mentioned above, common genetic variability in the *DRD4* and *DRD2* genes has been found to have a functional impact in the regulation of the dopaminergic system and is implicated in behaviors such as risk taking, novelty seeking, addiction, and impulsivity (Dreber et al. 2009; Ebstein et al. 1996; Eisenberg et al. 2007). Yet there are also functional differences.

*DRD4*

The *DRD4* gene has attracted much attention lately in the popular press where Hartmann and Palladino (2004) termed it the "Edison" gene, referring to its implications for enhancing people's ability to engage in divergent thinking (novelty seeking) and consequently remain engaged in tasks that they are interested in (Cloninger 2004, p. 304; Hallowell and Ratey 1994). It is exactly this divergent, exploratory, and discovering ability that should be related to spotting business opportunities and persistently seeking to pursue such goals (incentive salience). This insight translates well into what has further been elaborated on by Nicolaou et al. (2008), namely, that the association between the *DRD4* receptor gene and novelty seeking found by Ebstein et al. (1996) should spill over to other contexts, such as entrepreneurship and creative selling. People with the *DRD4* gene should be more sensitive than others to new information about potential business opportunities. That is, the *DRD4* gene interacts with information about opportunities to increase the likelihood that a person will identify a new business idea, and so increase the probability that the person will engage in opportunity recognition as described and found in Study 1.

The 7-repeat (7R) variant of the *DRD4* gene is believed to have the greatest effect on this behavior. Carrying the 7R variant has been associated recently with the traits of novelty seeking, risk taking, and behavioral disinhibition (Congdon et al. 2008;Dreberet al. 2009; Ebstein et al. 1996). Based upon these findings and the notion that entrepreneurs are more action oriented and prefer engaging in multiple activities simultaneously (Baron and Ward 2004), Nicolaou and Shane (2009) speculated that the likelihood for a person to engage in entrepreneurial activity might be influenced by variation in the *DRD4* gene. We propose that similar mechanisms drive the opportunity recognition behavior found in high CO salespeople, and we therefore conjecture that carrying the 7R variant of the *DRD4* gene contributes to the extent to which salespeople display a natural

curiosity toward understanding how customers' problems match firms' solutions. Consequently, salespeople with the 7R variant of the *DRD4* gene should score higher on CO than salespeople without the 7R variant. The opposite should occur for SO: people with the 7R variant should score lower on SO than those without the 7R variant. Thus,

H3: Salespeople with the 7R variant of the *DRD4* gene should score higher on CO (lower on SO) than those without the 7R variant

*DRD2*

Variability in the *DRD2* gene has been shown to modulate dopamine activity in the brain. Previous findings show that the less frequent A1 version of this gene is associated with addictive disorders and antisocial traits. Due to a reduced dopamine response to pleasurable stimuli (such as drugs, alcohol, or food), carriers of the A1 variant require and seek more stimulation. In addition, these individuals favor immediate gratification rather than long-term rewards (see Dreber et al. 2009, p.89). Further, the cognitive inflexibility of A1 carriers should relate to the salesperson's unwillingness to switch strategies. For example, "Even if I am not sure a product is right for a customer, I will still apply pressure to get him to buy" (item 3 in the SO scale) suggests a rigid strategy for salespeople with SO. Salespeople with high CO invest more in understanding customers, which in turn might result in more long-term relationship gains and fewer immediate rewards than would be expected for salespeople with high SO. Since CO should lead to building sustainable relationships with customers, whereas SO need not, we hypothesize:

H4: Salespeople with the A1 variant of the *DRD2* gene should score higher on SO (lower on CO) than those without the A1 variant.

**Method**

Salespeople (n=65) working in B2B environments were asked to participate in a study involving DNA analysis. They came from the following industries: 4% from automotive, 3% from food and beverage, 15% from banking, 3% from utilities, 9% from manufacturing, 23% from professional services, 7% from pharmaceuticals, 2% from telecom, 5% from logistics, 20% from IT, 3% from retailing, and 6% from other industries. Respondents answered an online questionnaire containing CO and SO questions from the SOCO scale (see **Table 1**). The average age was 34 years (s.d.=5.8). The alphas of the CO and SO scales were .72 and .64, respectively. We followed recommended practice to gather DNA data and analysis, and allele frequencies analysis using the Hardy-Weinberg Equilibrium. For further details, please see *Appendix 3*.

We used parametric t-tests for equality of means on the five-item CO scale and five-item SO scale and *DRD2*/*DRD4* polymorphisms of participants (see *Appendix 3*, and **Table 3** and **Table 4**).

**Table 3.** *DRD4* 48 bp VNTR allele frequencies, genotypes, genotype and classifications (N=65)

| Allele | N | % |
|---|---|---|
| Allele | | |
| 2 | 8 | 6.2% |
| 3 | 2 | 1.5% |
| 4 | 91 | 70.0% |
| 5 | 1 | 0.77% |
| 7 | 25 | 19.2% |
| 8 | 3 | 2.3% |
| Total | 130 | 100.0% |
| Genotype | | |
| 2/2 | 1 | 1.54% |
| 4/2 | 5 | 7.69% |
| 4/3 | 2 | 3.08% |
| 4/4 | 30 | 46.15% |
| 4/5 | 1 | 1.54% |
| 7/2 | 1 | 1.54% |
| 7/4 | 20 | 30.77% |
| 7/7 | 2 | 3.08% |
| 8/4 | 3 | 4.62% |
| Total | 65 | 100.0% |
| Genotype Classification [a] | | |
| No 7R | 39 | 57.97% |
| 7R | 26 | 42.03% |
| Total | 65 | 100.0% |

[a] Allele frequencies are in HWE ($\chi^2$=0.3915, p-value=0.5315, one-sided)

**Table 4.** *DRD2* Tas1a allele frequencies, genotypes, genotype and classifications (N=65)

| Allele | N | % |
|---|---|---|
| Allele | | |
| A1 (T) | 37 | 28.5% |
| A2 (C) | 93 | 71.5% |
| Total | 130 | 100.0% |
| Genotype | | |
| A1/A1 | 7 | 10.77% |
| A1/A2 | 23 | 35.38% |
| A2/A2 | 35 | 53.85% |
| Total | 65 | 100.0% |
| Genotype Classification [a] | | |
| No A1 | 35 | 53.85% |
| A1 | 30 | 46.15% |
| Total | 65 | 100.0% |

[a] Allele frequencies are in HWE ($\chi^2$=1.1165, p-value=0.29065, one-sided)

## Results

**Table 5** and **Table 6** present the results of the statistical tests. Significant differences were found for the effects of the 7R variant of the *DRD4* gene on CO, as hypothesized. The test on differences in means between salespeople with no 7R forms of the *DRD4* gene (M=5.87) and those with one or more 7-repeat forms (M=6.24) is significant at a 5% significance level (p=.04). The test results on the difference in means between salespersons with the A1 variant form of dopamine receptor 2 (*DRD2*) is not significant with respect to SO (p=.99) but approached significance for SO (p=.07).

**Table 5.** Statistical *t*-test – *DRD4* 48 bp VNTR *t*-test for equality of means (equal variances assumed)

| | Group | Mean | *t-test* (two sided)[a] | *p*-value |
|---|---|---|---|---|
| Customer orientation | No 7R | 5.87 | **-2.12** | **0.04** |
| | 7R | 6.24 | | |
| Selling orientation | No 7R | 5.41 | 0.35 | 0.73 |
| | 7R | 5.34 | | |

[a] Bold values are significant at a 5% significance level

**Table 6.** Statistical *t*-test – *DRD2* Taq A1 *t*-test for equality of means (equal variances assumed)

| | Group | Mean | *t-test* (two sided)[a] | *p*-value |
|---|---|---|---|---|
| Customer orientation | No A1 | 6.02 | 0.01 | 0.99 |
| | A1 | 6.02 | | |
| Selling orientation | No A1 | 5.23 | -1.83 | 0.07 |
| | A1 | 5.59 | | |

[a] Bold values are significant at a 5% significance level

## Discussion

As predicted, we found a significant association between the presence of the 7R allele of the *DRD4* gene with CO and no association with SO. This is consistent with research that shows a correlation between the *DRD4* gene and both novelty seeking (Munafo et al. 2008) and risk taking in financial contexts (Dreber et al. 2009). Moreover, the analyses showed a marginally significant effect of the A1 variant of the *DRD2* gene on SO, but no significant effects of the A1 variant of the *DRD2* gene were found on CO, as expected. A positive finding between SO and the A1 variant of *DRD2* is consistent with basic research findings showing that the *DRD2* gene may be implicated in immediate reward striving and impulsiveness (e.g., Dreber et al. 2009, p. 89; McClure et al. 2004). We argue that these two

traits are not conducive to the personal selling role under consideration, which requires planning, persistence, and valuation of delayed rewards.

In sum, the findings show that CO is associated with the 7R allele of the *DRD4* gene, a biomarker that suggests why salespeople with high CO are more likely to thrive when they interact with customers (intrinsic pleasure), show persistent curiosity, and get excited when talking with customers; that is, these salespeople are curious, seek novelty, and are intrinsically motivated. SO salespeople are associated with the A1 variant of the *DRD2* gene, which suggests they prefer immediate gratification and are cognitively inflexible, two traits not conducive to favorable opportunity recognition.

## *General discussion*

Customer orientation implies that salespeople are passionately curious about the customer's needs so that they can propose a solution that meets and matches these needs. Selling orientation involves persuasion, exerting pressure, stretching the truth, or even ignoring certain needs of customers (Saxe and Weitz 1982, p. 343) in order to make a customer buy. Rather than focusing on an outside-in approach (using paper and pencil psychology-based antecedents, such as intrinsic motivation or empathy) to study CO versus SO, we sought to focus on an inside-out approach: we focused on biomarkers derived from the field of genetics.

What do the results of our two studies imply and what is the common picture or idea we might extract from them? We first suggested in Study 1 that industrial salespeople operate in a knowledge-intensive economy as knowledge brokers (and mini-marketers) who constantly seek knowledge from various sources. They apply knowledge gained by analogical reasoning to solve the problems they elicit from customers which, in turn, leads to commercial gains. We termed this process broadly as opportunity recognition. Considering that CO should influence opportunity recognition, we developed an opportunity

recognition scale and showed that CO is strongly related to opportunity recognition, but SO is not. From there, we concluded that salespeople with higher CO tend to engage avidly in conversations with customers (e.g., various members of the buying center) and in other professional situations (e.g., trade shows, social networks), striving to enrich their knowledge so as to come up with viable commercial solutions. It is this passion, curiosity, and drive to attain commercial results that inspired us to focus our inquiry on the dopamine system as well, since the operation of this system is especially known to be involved in novelty seeking, the pursuit of commercial success (incentive salience), chasing new challenges, risk taking, and the satisfaction that comes from this searching process (see Berns (2005) for a nice description of these processes and Nicolaou and Shane (2009) for further insights in the entrepreneurial area).

In our second study, we discovered that CO is significantly related to a polymorphism of the *DRD4* gene (especially the 7-repeat gene), whereas no such association was found for SO. People with a *DRD4* 7-repeat gene are known to be creative and explorative as well as entrepreneurial, attributes closely aligned with opportunity recognition and seeking commercial success. This is consistent with the meaning and implications of CO. Note that CO was not associated with the *DRD2* polymorphism (known to be associated with cognitive inflexibility, addiction, inability to switch strategies, and antisocial behavior), whereas SO was marginally related ($p<.07$). This, too, is generally consistent with the meaning and implications of SO.

As we suggested at the beginning of this paper, biomarkers provide us with insights into CO versus SO that are complementary to the existing literature. Having studied biomarkers, we might better understand earlier work (see introduction) which has found that salespeople with high CO are intrinsically motivated and empathic risk takers who are willing to miss out on short-term sales in preference to understanding the customer's problems and to securing long-term

business relationships. At first sight, these coarsely grained explanations might seem incoherent. However, our results, derived from an analysis of finely grained biomarkers, provide answers to reasons why some people engage in CO while others are more likely to engage in SO. Note that these antecedents refer to common biological roots. We believe that these biomarkers bring coherence to the outside-in explanations found in paper and pencil-based psychological research: salespeople high in CO are constantly willing or eager to learn from customers (understand their needs) and are interested in learning about the world (intrinsic motivation) so as to present commercially viable solutions to satisfy customers. All of this involves regulation by the dopamine system.

A continuous interest in customers' problems and seeking possible commercially viable solutions entails risk. Interestingly, risk taking is a phenotype or characteristic of people with the *DRD4* 7-repeat polymorphism (e.g., Dreber et al. 2009). Ultimately we agree with the basic insight that Saxe and Weitz (1982) propose when they state that the benefits of CO selling must be weighed against its costs, such as reflected in (a) the salesperson's time spent identifying customers' problems and solutions, (b) reduced margins or increased service costs entailed in satisfying customers, and (c) lost sales (at least in the short run) that might have been achieved with more aggressive selling approaches (see Franke and Park 2006, p.694). In an era when salespeople constantly have to come up with sales results in order to meet their firm's sales objectives, and their results are monitored by their firm's CRM and SFA systems, it is easy to succumb to SO because salespeople with CO do not always sell quickly (Saxe and Weitz 1982).

*Adapted from:*

Verbeke, W.J.M.I., Bagozzi, R.P., Berg, W.E. van den (2014). The Role of Attachment Styles in Regulating the Effects of Dopamine on the Behavior of Salespersons. *Frontiers in Human Neuroscience*, 04 Februari 2014, doi 10.3389/fnhum.2014.00032.

# CHAPTER 3

# The Role of Attachment Styles in Regulating the Effects of Dopamine on the Behavior of Salespersons


## Abstract

Two classic strategic orientations have been found to pervade the behavior of modern salespersons: a sales orientation (SO) where salespersons use deception or guile to get customers to buy even if they do not need a product, and a customer orientation (CO) where salespersons first attempt to discover the customer's needs and adjust their product and selling approach to meet those needs. Study 1 replicates recent research and finds that the Taq A1 variant of the *DRD2* gene is not related to either sales or CO, whereas the 7-repeat variant of the *DRD4* gene is related to CO but not SO. Study 2 investigates gene × phenotype explanations of orientation of salespersons, drawing upon recent research in molecular genetics and biological/psychological attachment theory. The findings show that attachment style regulates the effects of *DRD2* on CO, such that greater avoidant attachment styles lead to higher CO for persons with the A2/A2 variant but neither the A1/A2 nor A1/A1 variants. Likewise, attachment style regulates the effects of *DRD4* on CO, such that greater avoidant attachment styles lead to higher CO for persons with the 7-repeat variant but not other variants. No effects were found on a SO, and secure and anxious attachment styles did not function as moderators.

## *Introduction*

Organizations are especially interesting social environments as they differ from everyday social groups such as found in family life, friendship, or hobby clubs. Within organizations, people undertake both long and short-term strategies to fit into their group and interact with others outside their group to meet the needs of their organization. Consistent with the emerging organizational cognitive neuroscience (OCN) framework (Senior et al., 2011), we seek to understand the biological processes — hard-wired neurological and endocrine processes conserved over millions of years in different species — that might help us understand how people operate in organizations, particularly those whose job requires them to deal with others outside their organization to meet their organization's mission. Specifically, we seek to explain the strategic orientation that salespersons take in their relationship with customers. Two fundamental, recently studied orientations are the sales orientation (SO) and customer orientation (CO) (Bagozzi et al., 2012). A SO involves the use of deception and guile by a salesperson to get customers to buy even if they do not need a product. A CO characterizes a salesperson's attempts to first discover the customer's needs and then adjust their product and selling approach to meet those needs. Sometimes the terms hard and soft selling are used to describe these orientations, where the latter generally leads to long-term relationships, whereas the former, given its one-sided exploitive nature, is typically short-lived.

Hard-wired neurological and endocrine processes, which undergird phenotypical selling and COs, provide ultimate explanations that define evolutionary fit outcomes. In developing our hypotheses and interpreting findings, which entail cross-level gene and phenotype descriptions, we draw upon molecular genetics research to ground our studies. Our approach is guided by two aims recently recommended in the literature, namely, (1) to replicate recent findings so as to show the relevance of candidate genes and set up the need to

explore gene-phenotype interactions to explain strategic orientations of salespersons on the job (Munafò et al., 2008), and (2) to give special attention to definition and measurement of explanatory phenotypes and develop a theory accounting for how they moderate the effects of candidate genes on strategic orientations (Munafò et al., 2008).

Originally introduced in 1982 (Saxe and Weitz, 1982), the concepts of sales and COs and their measurement have found currency across many studies, where more than 30,000 salespeople have been investigated (Franke and Park, 2006). Nearly all of this research has been conducted at the psychological level of investigation, with self-reports as measures of independent and dependent variables. The sole exception appeared in a recent study by Bagozzi et al. (2012) (Study 2), where the *DRD2* A1 was found to be marginally associated with a SO ($p = 0.07$), and the *DRD4* $7R^+$ allele was found to be significantly associated with a CO ($p = 0.04$). The rationale for the former finding was that salespeople carrying the A1 variant should have a reduced response to dopamine, seek greater stimulation, and favor greater immediate gratification than carriers of the other variants, and therefore should be inclined to press customers into yielding without fully taking into account their needs. In contrast, the rationale for the latter finding was that salespeople carrying the $7R^+$ variant should be more curious and open to opportunity recognition, greater risk takers, and more inclined to search for unique needs of customers and put greater effort into finding and constructing a mutually beneficial match between buyer and seller.

A shortcoming of the study by Bagozzi et al. (2012) is that finding the main effects of candidate genes might occur by chance and reflect a false-positive outcome. To guard against prematurely placing too much credence on the findings in Bagozzi et al. (2012), it would be advisable to conduct replications on different subjects operating in different organizational environments. Further, discovery of the effects for individual candidate genes may be unrealistic in that factors other

than genes may be of equal or greater importance or may be conditional on when and how genes function, if they function at all, in real-world job environments under naturalistic conditions. Therefore, our second aim is to develop a meaningful phenotype to explore a plausible gene × phenotype interaction effect on salesperson job orientation in the field. The phenotype chosen was the biological/psychological theory of attachment.

The OCN perspective seeks to uncover the role of higher-order psychological concepts in translational research by explicating hard-wired biological mechanisms and in doing so deepen and even change the measurement and functioning of these concepts (Senior et al., 2011). The challenge with developing strong hypotheses is that most studies in genetics are more on patients and less on healthy people, let alone people who operate in professional settings. In this regard, the *DRD2* ("reward or reinforcement gene") and *DRD4* ("impulsive gene") are known as risk genes, meaning that they are linked with such non-desirable phenotypes as addiction or impulsivity (e.g., Noble, 2000; Eisenberg et al., 2007; Green et al., 2008). Given the differential sensitivity hypothesis, which suggests that in different environments a particular gene might have opposite effects (Belsky et al., 2009), carriers of certain alleles of the *DRD2* or *DRD4* might actually thrive in certain environments, rather than necessarily exhibit the risk factors associated with clinical populations. Such a perspective might help us make better predictions and lead to better understanding of phenotypes and their effects. In what follows we explore the pathways in which *DRD2* and *DRD4* are expressed, and we investigate how polymorphisms of these genes regulate these pathways differently under the differential influence of the attachment phenotype.

Consequently, we investigate the moderating role of attachment, where we also examine a type of differential sensitivity and challenge the received view in the literature. Attachment theory arose out of clinical and cross-cultural research by Bowlby (1988) and Ainsworth (1991). A central claim is that young

children develop stereotypical interpersonal styles because of relationships with early caregivers, typically the mother. Three distinct patterns tend to develop: anxious, avoidant, and secure. The anxious style is marked by the tendency to seek support from an attachment figure, to worry about being rejected, to harbor doubts about one's self-efficacy, to have low self-esteem, to crave attention and closeness, to feel vulnerable and helpless, and to possess a negative self-model, while being generally positive toward others because of a desire for support and protection. The avoidant style is characterized by a low need to feel close to others, a tendency to seek independence and self-reliance, and a propensity to focus on positive features of the self and downplay negative ones to build a positive self-model, while being dismissive or mistrustful of others. The secure style is distinguished by a positive self-image and relative openness and trust in relationships with others. Considerable evidence shows that attachment styles formed early in life persist to influence adult behavior (Mikulincer and Shaver, 2007).

Recent research with adults finds that the secure attachment style is the most functional across a wide variety of relationships. For example, consumer behavior research finds that people with secure, as opposed to anxious or avoidant, attachment styles form positive relationships and experience positive outcomes in service settings (e.g., Mende and Bolton, 2011). Research with employees in organizations shows that workers with avoidant and anxious attachment styles are less supportive in helping colleagues (Geller and Bamberger, 2009). We would argue, consistent with research with adults in family and romantic relationships (e.g., Mikulincer and Shaver, 2003, 2007), that the secure attachment style should be functional in everyday consumer behavior because consumers seek to find products that meet personal needs, and initial openness and trust when facing sellers should be conducive to meeting personal needs, whereas anxious or avoidant styles would interfere with the discovery of desired requisites. Likewise,

within organizational boundaries, workers function best when cooperation and trust flourish and they strive to fit in and work together on common goals. Here a secure attachment style should promote such endeavors, whereas anxious and avoidant styles should interfere or lead to disharmony.

In contrast to research with consumers and workers *within* organizations, and opposite to predictions of attachment theory in romantic and family contexts, we argue that the secure attachment style will not be more functional than other attachment styles for salespersons, but rather the avoidant style will be most conducive to successful exchanges. This seeming paradox is based on the contingent role that the attachment phenotype plays in the unique context of business-to-business selling. Salespersons in such contexts function in decidedly *inter*-organizational environments where they venture away from the home organization to negotiate deals inside the buyer's organization. This not only weakens felt normative and peer pressure from the home organization, but exposes the seller to greater pressure from buyers in a more vulnerable setting, and leads to an interpersonal environment with more uncertainty, ambiguity, and tension than typically found in intra-organizational or personal relationships. Somewhat similar psychological tensions occur for ambassadors, diplomats, and inter-mediators in government and similar settings.

In a business-to-business context, informal norms and company policies by both seller and buyer firms typically caution, and even dictate and sanction, against the development of intimate or overly personal relationships (Anderson and Jap, 2005). Rather, buyer and seller are required to conform to professional rules of decorum and propriety. Codes of conduct and ethical guidelines govern personal involvement, fraternization, leaking of corporate information, and standards of behavior. Coupled with legal and moral issues concerning sexual harassment, bribery, kickbacks, and related topics, such work guidelines place real restrictions on the nature of social contact between sales representatives and

buyers and color transactions. In addition, sales representatives operate as organization-boundary spanners and engage in such proactive behaviors as seeking new customers and making autonomous decisions when negotiating prices, especially in business-to-business contexts, all of which require sales representatives with an ability to behave efficaciously during interactions with customers (Crant, 1995).

These norms and expectations lead us to propose that avoidant styles are particularly suited for sales representatives in such relationships in business-to-business contexts. It is fruitful to conceive of attachment styles as working cognitive models on how one regards others and the self in social relationships in terms of the support one can give or get in times of need. Attachment styles are mental representations of person-person transactions that motivate one to seek protection or help from others in inter-personal relationships, to the extent that there is a threat or danger (Mikulincer and Shaver, 2003, 2007). Research shows that persons with avoidant attachment style prefer to hold a certain emotional distance from interaction partners to be able to keep the initiative and behave proactively (see Mikulincer and Shaver, 2003; Ein-Dor et al., 2010). Arguably, in common business-to-business settings, policies, and norms require that sales representatives uncover the needs of customers, offer solutions, and achieve commercial results. At the same time, persons with avoidant styles tend to be self-reliant (see Mikulincer and Shaver, 2003; Richards and Schat, 2011), which is a useful trait in sales representatives who operate in demanding inter-firm environments and are often physically away from both the home organization and its social support. Although some people are both high in avoidance and anxiety (termed in the literature, "fearful avoidance"), Mikulincer and Shaver (2003, p. 70) note that such persons are "less likely to arise in normal samples of college students and community adults" and are more common "in samples of abused or clinical samples." Thus, the avoidant attachment style, where social anxiety is not

a deficit, is consistent with modern characterizations of business relationships. Successful business-to-business sales representatives need to be sufficiently independent and detached, self-reliant, and not deterred by anticipatory anxiety to function well in such contexts (which tends to occur when representatives ask commitments of customers or when they have to close a deal; Vinchur et al., 1998; Richards and Schat, 2011). These conditions fit the avoidant attachment style well.

The secure attachment style is less conducive to the demands on sales representatives in business-to-business contexts. Researchers characterize the secure style as one where the person exhibits "comfort with closeness" and intimacy (Mikulincer and Shaver, 2003, p. 9). Such an orientation is not largely an asset in formal business relationships because buyers and sellers realize that there is potential for tension between the goals of buyer and seller organizations. Also, give and take are integral parts of the relationship, as both parties are required to meet the requisites of their home firms, which often do not fully coincide with the other firm's. Intimacy or comfort with closeness may even interfere with interactions in some business relationships. In addition, it is possible for employees to be too secure and not motivated as much by "the hunger to make a sale" or "the fear of failure," whereas a person who is avoidant in orientation is more likely to be more motivated. The avoidant style places emphasis on business goals, not personal relationship ones, *per se*, although goals can be met mutually in business-to-business contexts, and thereby promoted largely when a CO vs. a SO is pursued. This is especially salient in inter-organization relationships.

The anxious attachment style also seems not to fit business-to-business settings as well as the avoidant style. Preoccupation with the fear of rejection or failure to make a sale, or "a strong need for closeness, [and] worries about relationships," as found for anxious attachment style persons (Mikulincer and Shaver, 2003, p. 69; see also Ein-Dor et al., 2010, p. 134), would seem to lead sales representatives to work too hard to elicit immediate support and even

affection from customers, which draws attention away from exploring via conversation the needs of buyers and then presenting a commercially viable solution to meet those needs and close the sale. The avoidant style should entail less disruptive and more realistic coping with fear or anxiety (e.g., Ein-Dor et al., 2010, p. 134; Richards and Schat, 2011).

The avoidant attachment style thus seems to strike a balance between the secure and anxious styles. To the extent that avoidant attached salespeople remain self-confident, they should abstain from relying too much on trust in others, meaning that they will retain a certain amount of self-reliance, spontaneity, and initiative to make sure customers understand offers and respond accordingly. The avoidant attachment style salesperson is therefore neither too secure nor too anxious but rather reflects a realization that selling to business customers is more rooted in a rational or professional relationship than a personal one *per se*.

In sum, we hypothesize that the avoidant attachment style, but not the anxious or secure, should function as the best moderator of the effects of the *DRD2* and *DRD4* genes on CO. How this happens also invokes differential sensitivity.

### *Study 1: Replication genetic association with customer orientation*

The two genes, *DRD2* and *DRD4,* although often perceived as risk genes, might turn out to be functional in a selling context (Goodman, 2008; Tripp and Wickens, 2009). Both genes code for receptors for dopamine (a catecholamine), which is known to modulate synaptic transmission, especially in the cortex and striatum (Tritsch and Sabatini, 2012). Specifically, *DRD2* is mainly expressed in the ventral striatum and thus might affect instrumental learning and conditioning, whereas the *DRD4* is mostly expressed in the prefrontal cortex (PFC) and might affect how people process information and engage in self-regulation. These mechanisms for dopamine (D) modulation are vast, operating in pre-synapsis

neurotransmitter release (e.g., vesicular release machinery), in post-synapsis detection of neurotransmitter detection (e.g., modulating membrane insertion), and synaptic integration and excitability (e.g., modulating ion channels) (Tritsch and Sabatini, 2012). Therefore, as Green et al. (2008) suggest, it is too simplistic to relate a specific gene polymorphism to a specific region of the brain, given the huge connectivity between the brain nuclei but also the great complexity of neuromodulation. Rather than one or a small number of regions of the brain involved, it is more realistic to expect many regions to be engaged in a complex system of interactions.

Here we mainly focus on the differential roles of the D1-like (D1 and D5) and D2-like (D2, D3, and D4) receptors in the intercellular integration within post-synapse areas. The D2-like receptors compared to the D1-like type receptors have a higher affinity for dopamine (10 to 100-fold greater for the D3 and even more greater for the D4) (Tritsch and Sabatini, 2012). A key for both cognition and reward system functioning is the D1/D2 ratio (dual state model). Here, the D1 receptor plays a gating role by controlling the threshold of significance above which information must pass before it can be admitted to working memory (achieving stabilization), and the D2 signals the presence of information (mostly reward based information) that allows the PFC network to respond to this new information by updating its working memory system (achieving flexibility) (Seamans and Yang, 2004; Savitz et al., 2006). The D1/D2 ratio regulation implies that D1-like receptors are bound to *stimulatory* G proteins (hence called G protein-coupled receptors) that energize adenylyl cyclase, and this activates the production of cyclic adenosine monophosphate (cAMP), and thus activation of protein kinase A (PKA). PKA mediates the phosphorylation and regulates the function of a wide area of cellular substrates such as K+, Na+ and Ca+, glutamate, GABA receptors, and transcription factors. D2-like receptors bind to *inhibitory* G proteins that hinder adenylyl cyclase and thus reduce the production of cAMP, which prevents

cAMP activation of PKA and also reduces N-methyl-D-aspartate (NMDA) receptor activation and GABA-ergic inhibition (Seamans and Yang, 2004; Tritsch and Sabatini, 2012).

Dopamine levels have an effect on the D1/D2 ratio, but this effect is different in the PFC (slow modulation) compared to the striatum (reinforcing brief activity), thus complicating the ability to make clear conjectures (Tripp and Wickens, 2009). The striatum and PFC are mutually interconnected, as well as to the dopamine system, and thus stimulation by dopamine effects both reward seeking and planning, which is why dopamine levels have an inverted U curve effect on cognitive performance; both low and high levels of dopamine fail to affect cognitive performance, but intermediate levels effect cognitive performance strongly. This is because the striatum is activated more intensely by dopamine and (due to its connection with the PFC) leads to reductions in flexibility of switching costs, at least under some conditions such as in planning (Aarts et al., 2011).

For cognitive processes, when dopamine levels are high (low), there is a higher (lower) D1/D2 ratio, which due to cAMP activation and its intracellular chain reaction effects the excitatory release of glutamate from pyramidal cells of the PFC. Consequently, there is stronger excitatory signaling and better inhibition of noise due to distraction in the environment (in other words, more focus occurs). Higher PFC activation also feedbacks back to the striatum and allows for better regulation of striatal impulses (needed for self-regulation and inhibition). However, higher dopamine levels in the striatum have a different effect: activation in the striatum helps a person respond flexibly to environmental cues, especially for what is desired (routines and wanting). However, when strongly activated, the striatum might predispose a person to respond inflexibly to the environment as routine responding takes over (Aarts et al., 2011). In short, strong striatum activation might compromise cognitive flexibility or raise switching costs. We expect that the two candidate genes (*DRD2* and *DRD4*) will affect the D1/D2 ratio

and thus have an impact on cognitive and reward processes. Somewhat similar outcomes happen with the *COMT* gene where Met carriers experience lower ability of enzyme breakdown of dopamine, and thus dopamine levels remain high, and a higher D1/D2 ratio occurs resulting in greater cAMP activation, higher glutamate levels, and greater cognitive focus, at the cost of more rigid behavior.

The *DRD4* gene (D2-like), located on chromosome 11p15.5, codes for the dopamine D4 receptor and includes in exon III a 48-bp variable number of tandem repeats (VNTR) polymorphism, which contains 2–11 repeats. This VNTR is located in a region that encodes the supposed third cytoplasmic loop of the receptor that couples to inhibiting G proteins, which reduce the production of cAMP, and thus inhibits the chain reaction in the neuron (Wang et al., 2004; Barnes et al., 2011). Carriers of the *DRD4* $7^{+}$repeat ($7R^{+}$) variant of this polymorphism in the *DRD4* gene experience reduced ability to blunt cAMP signaling in neurons (Asghari et al., 1995; Oak et al., 2000), compared to $7R^{-}$ carriers (both in the pre- and post-synapsis), and thus are less able to play an inhibitory role, so undergo higher glutamate activation. Due to the fact that *DRD4* is mainly expressed in the PFC, there is more cognitive elaboration and higher alertness for what might be new. This leads to the following cognitive and behavioral effects: the dopamine system switches too quickly from a tonic to a phasic state (higher sensitivity to reward salience) (Grace, 1991), and this makes the person more open to experience; indeed Munafò et al. (2008) showed that carriers of the *DRD4* $7R^{+}$ were more likely to show approach-related personality traits (especially novelty-seeking). Carriers of the *DRD4* $7R^{+}$ are less able to maintain cognitive self-control than non-carriers and thus are more vulnerable to distracting information, which if occurring in a sales conversation might consist in lost information that is relevant, such as happens with non-verbal signals. Similarly, carriers of the *DRD4* $7R^{+}$ are less able to self-regulate and have

difficulties postponing gratification, making them vulnerable to committing more impulsive behaviors (Munafò et al., 2008).

Successful selling requires salespeople to look for opportunities displayed implicitly in interpersonal encounters (e.g., being sensitive to implicit meaning and non-verbal communication) and explicitly by customers (e.g., voicing needs, objections). Salespeople who are carriers of the *DRD4* $7R^+$ might be more likely to respond to these changes and thus better sense opportunities than non-carriers.

The *DRD2* gene, located on chromosome 11q22-q23 (region rs 180049), codes for the dopamine receptor D2, and includes exon 8 of the ANKK1 gene (Ritchie and Noble, 2003). *DRD2* is especially active in the ventral striatum, and it is the most widely expressed D receptor in the brain (Tritsch and Sabatini, 2012). Carriers of the *DRD2* Taq A1 experience a reduction in both pre and post-synaptic D2 sites, which results in increased dopamine release. More dopamine means that there is a greater activation of neurons in the striatum (Laakso et al., 2005). As dopamine levels rise, so will activation of the striatum (the D1/D2 ratio changes accordingly, and the consequent intracellular cascade will occur). Due to the connection with the PFC, this might affect flexibility in cognitive tasks and produce a concave U effect. Optimal levels of dopamine might result in optimal cognitive performance, but too much dopamine results in lower cognitive performance. For example, Stelzel et al. (2010) found that carriers of *DRD2* Taq A1, were less proficient in adjusting their behavior based on feedback about earlier performance (but not when they engaged in a novel cognitive task). In addition, because the striatum (especially the NAcc) has the most D2-like receptors, there is also a higher probability that carriers have greater wanting and reward dependency (Trifilieff et al., 2013). Thus, they might be more motivated and willing to put pressure on customers due to their stronger wanting. Considering the facets of a SO described above, carriers of the *DRD2* Taq A1 might engage more frequently in a SO.

**Method**

Sample. A total of 64 salespeople, all working in business-to-business environments, were asked to participate in a study involving DNA analysis. They came from the following industries: 4% came from automotive, 3% from food and beverage, 15% from banking, 3% from utilities, 9% from manufacturing, 23% from professional services, 7% from pharmaceuticals, 2% from telecom, 5% from logistics, 20% from IT, 3% from retailing, and 6% from other industries. Respondents answered an online questionnaire containing CO and SO questions from the SOCO scale (Saxe and Weitz, 1982), identical to those used in the study by Bagozzi et al. (2012) (see **Table 7**). The response format was a 7-point disagree-agree Likert format. However, one item from the CO and two items from the SO were deleted because theyloaded too low on their respective factors, based on exploratory factor analysis. Nevertheless, since one aim of our study is to replicate the original findings of Bagozzi et al. (2012), we will report results for the SO and CO scores on the scales from the current study, as well as the original scales as used by Bagozzi et al. (2012). The alpha of the (4-item) CO scale from this study was 0.71 (5-item Bagozzi et al., scale = 0.60). The alpha of the (3-item) SO scale was 0.76 (5-item Bagozzi et al., scale = 0.82).

Procedure and statistical analyses. We followed recommended practice to gather DNA data and analysis, and allele frequencies analysis using the Hardy–Weinberg Equilibrium. We use parametric *t*-tests for tests of equality of means on the CO scale and SO scale and *DRD2*/*DRD4* polymorphisms of participants.

**Table 7.** Items from the SOCO scale used in the replication study.

**Customer orientation (CO)**

1. I try to get customers to discuss their needs with me.
2. I try to find out what kind of product would be most helpful to a customer. *
3. I try to bring a customer with a problem together with a product that helps him solve the problem.
4. I try to give customers an accurate expectation of what the product will do for them.
5. I try to figure out what a customer's needs are.

**Sales Orientation (SO)**

1. I try to sell a customer all I can convince him to buy, even if I think it is more than a wise customer would buy.
2. I try to sell as much as I can rather than satisfy a customer.
3. If I am not sure a product is right for a customer, I will still apply pressure to get him to buy.
4. I paint too rosy a picture of my products, to make them sound as good as possible. *
5. It is necessary to stretch the truth in describing a product to a customer.

* These items were removed from the analysis in the current study due to insufficient factor loadings.

## Results

**Table 8** and **Table 9** present the findings. The results for DRD2 show that neither CO (t = –0.69, p = 0.91; t = –0.85; p = 0.87) nor SO (t = –0.31, p = 0.77; t = – – 0.38; p = 0.70) differ significantly between the A1 and no-A1 variants. By contrast, for DRD4, 7R+ carriers have significantly higher means than non-carriers on CO (t = 2.37, p = 0.02; t = 2.60, p = 0.01), but no differences were found on SO (t = –0.11, p = 0.91; t = –0.50; p = 0.62).

**Table 8.** Statistical *t*-test – *DRD2* Taq A1 *t*-test for equality of means (equal variances assumed)

| | Group | Mean | *t-test* (two sided)[a] | *p*-value |
|---|---|---|---|---|
| Customer orientation | No A1 | 6,33 | -0.69 | 0.91 |
| | A1 | 6.42 | | |
| Customer orientation | No A1 | 6.15 | -0.85 | 0.87 |
| *(Bagozzi et al., 2012)* | A1 | 6.26 | | |
| Selling orientation | No A1 | 5.33 | -0.31 | 0.77 |
| | A1 | 5.49 | | |
| Selling orientation | No A1 | 5.42 | -0.38 | 0.70 |
| *(Bagozzi et al., 2012* | A1 | 5.31 | | |

[a] Bold values are significant at a 5% significance level

**Table 9.** Statistical *t*-test – *DRD4* 48 bp VNTR *t*-test for equality of means (equal variances assumed)

| | Group | Mean | *t-test* (two sided)[a] | *p*-value |
|---|---|---|---|---|
| Customer orientation | No 7R | 6.26 | **-2.37** | **0.021** |
| | 7R | 6.59 | | |
| Customer orientation | No 7R | 6.09 | **-2.60** | **0.012** |
| *(Bagozzi et al., 2012)* | 7R | 6.42 | | |
| Selling orientation | No 7R | 5.35 | -0.11 | 0.91 |
| | 7R | 5.38 | | |
| Selling orientation | No 7R | 5.34 | -0.50 | 0.62 |
| *(Bagozzi et al., 2012)* | 7R | 5.49 | | |

[a] Bold values are significant at a 5% significance level

**Discussion**

Molecular genetics has the potential to inform organizational theory about key phenotypes from a biological perspective. However, to have a significant impact both in predicting and understanding behavioral tendencies or traits, findings between variants of specific genes and phenotypes should be replicated using different independent samples. We replicated recent findings concerning the relationship between the *DRD4* and *DRD2* genes and CO and SO, respectively (Bagozzi et al., 2012). In particular, consistent with Bagozzi et al. (2012), we found that salespeople carrying the $7R^{+}$ variant of the *DRD4* gene have a higher propensity to engage in CO. In contrast, no relationship between the variants of the *DRD2* genes and SO was found. It must be noted, however, that in Bagozzi et al. (2012) the association between *DRD2* A1 and SO was only marginally significant ($p = 0.07$).

Our findings show a clear impact of genes on SO, which goes beyond the scope of behavioral genetics. We would like to point out that such replications of candidate gene studies are rare, and indeed failures to replicate are the norm (e.g., Seabrook and Avison, 2010). One group of researchers (Chanock et al., 2007, p. 655) characterizes the published literature in this regard as "a plethora of questionable genotype-phenotype associations, replication of which has often failed in independent studies." The latter authors maintain: "the challenge will be to separate true associations from the blizzard of false positives attained through attempts to replicate positive findings in subsequent studies" (p. 655).

### *Study 2: Gene-environment interactions driving customer orientation*

Our aim in Study 2 is to develop a theoretical basis for hypothesizing the conditions for the effect of key dopamine genes in an organizational context by specifying a particular gene-environment (phenotype) interaction. Since the molecular genetics approach more directly reflects how the brain functions (in this case the dopamine system), we are able to better understand how actions are initiated and maintained. These molecular mechanisms potentially contribute to our understanding of the phenotype, since they offer an additional explanation as to how our brain influences our behavioral tendencies. Specifically, salespeople's curiosity and eagerness to understand customers' needs involve regulation of the dopamine system known to be involved in novelty-seeking and the related motivational processes reviewed above, as governed by attachment style individual differences.

Attachment systems imply double-sided mechanisms: people, when anxious, seek proximity with others but also need to *feel secure in relationships,* such that they can further broaden and build behavioral repertoires in different social environments. Attachment styles develop in young children (Van IJzendoorn, 1995) exploring their environment. They experience fear when confronted with challenging situations, and then seek proximity to attachment figures (such as parents) and, when present/supportive, secure attachment styles evolve such that children comfortably seek and feel support from significant others; especially oxytocin (OT) and dopamine are involved in this (see hereafter). Based on these experiences, children develop a secure *working model*, developing expectations for predicting future interactions (cognitive schemas) and believing that others will be available and respond empathically if necessary. Children can then co-regulate stress (achieving emotional comfort or "neuroception" of safety) and attain feelings of security, allowing them to broaden their social exploratory behaviors, develop a theory of mind (TOM), de-activate negative expectations and

boost their coping skills, such as is reflected in better ability to not get distracted and to conduct cognitive reappraisal (Porges, 2003). Secure attached people also like to give comfort to others (e.g., Mikulincer and Shaver, 2003).

The pleasant feeling that comes from close interaction (social approach) occurs because when children are nurtured by their parents there is a modest increase in dopamine transmission in the NAcc, which activates dopamine receptors D1 and D2, and both influence affection and pleasure and help maintain social bonds. D1 and D2 have different effects on approaching behavior as they have contrasting effects in the intracellular mechanisms: D2-like receptors (expressed in neurons that project from the rostral shell of the nucleus accumbens to the ventral pallidum) are necessary for the formation of a pair bond. Specifically the D2 receptors are bound to inhibitory G proteins, which act to reduce the cAMP, which prevents PKA, and is associated with the facilitation of attachment (primary unconditional rewarding). D1 receptors are bound to stimulatory G proteins, which increases cAMP signaling, which in turn increases PKA, and results in reduced mating partner preferences, but especially reduces the seeking of new partners once a bond has been made. Key is that OT promotes the activation of inhibitory G proteins and down regulates the intracellular cAMP cascade. OT also enhances the hedonic value of social interactions by activating areas rich in dopamine receptors in especially the reward system (which includes the VTA, substantia nigra). OT changes how the dopamine system updates the outcome of actions; it reduces the feelings of risk (reduction in amygdala activation), and this motivates people to undertake social interactions and experience them as intrinsically rewarding. In other words, for many people, especially stable-attached persons, social interaction with significant others is intrinsically rewarding.

There is now evidence that secure interactions entail long-term changes in the brain: secure attached people have greater gray matter reward volume in the

reward network and interconnected regions such as hypothalamus or orbito frontal cortex (OFC) (e.g., the ventral striatum is differentially activated in secure mothers when they see their own babies smiling or crying, Strathearn et al., 2009). In addition, secure mothers also experience increased gray matter volume in the amygdala, the longer the post-partum period; in other words, it shows that they have a greater affective vigilance for their own children compared to other children. Secure mothers also have greater gray matter volume in areas related to TOM processes, such as the PFC, STS, and fusiform gyrus, and higher BOLD (blood-oxygen-level dependent) signal responses when hearing babies, which shows that as they interact with people they constantly improve their TOM network.

When attachment figures are not reliably available or supportive (e.g., caregivers behave unpredictably or do not provide support), a healthy sense of security is not attained, and secondary strategies of affect regulation come into play. Two internal working models emerge: avoidant and anxious.

Avoidant people do not have a healthy approaching system and have reduced, or lack, reward-related activity during positive social situations; e.g., avoidant attached individuals rate positive social information as less arousing (e.g., avoidant mothers had low activation of the ventral striatum and VTA) or do not experience positive social interaction as intrinsically rewarding compared to secure mothers, as they deactivate the attachment system and therefore do not seek to approach people (Vrticka and Vuilleumier, 2012, p. 6). Avoidant people are more concerned with self-preservation, have a positive self-model, show distrust to a partner's goodwill, and strive to maintain independence. Strong self-reliance often develops. Besides experiencing relatively low feelings of pleasure in social interaction, avoidant attached people may exhibit ill-functioning emotional coping styles: avoidant attached people de-emphasize threats and tend to cope without help or support from others; e.g., when rejected they have a decreased activation

of the anterior insula and dACC (DeWall et al., 2012), which indicates a blunted response to social negative contexts (or a lower need to feel included). The problem is that this blunting might not work when pressure is high. For example, Vrticka et al. (2012) show that when emotional regulation strategies are constrained, avoidant attached persons have higher amygdala responses to emotional stimuli.

Anxious people develop vigilance reactions: they hyper activate the attachment system when stress occurs resulting in an inability to handle threats autonomously. Anxious people tend to exaggerate threats. For example, Vrticka et al. (2008) show that the amygdala was selectively activated when angry faces were presented as negative feedback after giving incorrect responses; this leads to heightened distress and higher emotionality. This amygdala activation shows that anxious persons experience heightened distress in situations of personal failure or social disapproval. Equally, when people are excluded from others in the Cyberball paradigm, they show increased activation of the anterior insula and dAAC, which means that they are sensitive to rejection (Eisenberger et al., 2003). They become very emotional, and despite feeling that others are inconsistent and not trustworthy, they attempt to gain protection and support. Anxious people also worry that partners will not be available in times of need and attempt to gain partner attention, care, or even love. Feelings of intense dependence and clinginess may emerge.

While most research shows that insecure people might not be strong in relationship building, there is now evidence from animal research and human research in organizations that insecure attached agents are actually very productive to fit. Beery and Francis (2011) show that rats when raised in insecure conditions (low licking and grooming) actually performed better on individual cognitive tasks than rats raised in secure conditions (high licking and grooming). In addition, school children with parents who did not look after them well, actually helped

children in school better than children raised with parents who cared well for them (Obradovic et al., 2010). Therefore, we are now looking for different sorts of events to substantiate this.

Beery and Francis (2011) suggest that stressful experiences in mice do not inevitably lead to dysregulation of stress reactivity and that increases in stress reactivity (caused by early life stress due to poor maternal care) are not necessarily dysfunctional. Beery and Francis introduce the concept of stress inoculation, meaning that changes in the HPA axis and reward system to stress learned in early maternal care might actually be beneficial within certain contexts; e.g., rats subjected to stress conditions exhibited less emotionality (Levine, 1962) and demonstrated efficient neuro-endocrine responses. Confirming the effects of susceptibility to environmental influences, stress reactivity to environmental cues can lead to greater responsiveness to stimulating environments in certain contexts.

Ein-Dor et al. (2010) speak about the paradox of attachment, by which they mean that many insecure people can actually perform well at certain tasks. Using an experimental design in which fire suddenly broke out, Ein-Dor et al. found that anxious people first noted the fire, whereas avoidant people were the first to take flight, and secure people followed the avoidant attached people in fleeing. Hence, there is evidence for concluding that in certain situations insecure attached persons might perform well and outperform secure attached persons.

## Hypotheses

*DRD2 moderation*

We propose that the effects of variants of the *DRD2* dopamine receptor gene on CO will depend on the degree of avoidance attachment style. Specifically, we hypothesize the greater the avoidance attachment style, the greater the CO for carriers of the A2, A2 allele but not either the A1, A1 or A1, A2 alleles. Carriers of the A2, A2 allele vs. the other alleles are less distracted by intrusive or anxious thoughts (stemming from rumination and anticipated rejection by customers or worry that the customer will think that one is unattractive or less competent) and should therefore be more focused on the needs of customers, listen attentively, and respond to changing interpersonal give and take. In contrast, carriers of the A1, A1, or A1, A2 allele should be more rigid in their thinking and engage inflexibly in stereotypical behavior patterns (van Holstein et al., 2011). In other words, expected higher switching costs for carriers of the A2, A2 allele, compared to carriers of the A1, A2 or A1, A2 alleles, should be associated with greater focus and persistence, when salespersons interact with customers, which fosters the ability to adjust product/service offerings and one's communications to customers. Carriers of the A1, A1 and A1, A2 alleles, compared to carriers of the A2, A2 allele, should not only be more susceptible to distraction but also more impatient and unfocused.

*DRD4 moderation*

The *DRD4* dopamine receptor gene exists in variants that affect receptor activation by the dopamine neurotransmitter. Specifically, carriers of the 7R allele ($7R^+$), vs. non-carriers, have been found to engage in more risk taking (Dreber et al., 2009), novelty-seeking (e.g., Ebstein et al., 1996; cf., Munafò et al., 2008), and opportunity recognition during customer interactions (see Study 1; Bagozzi et al., 2012). Work to date has focused largely on the main effects of these gene variants, but we examine their modulating effects on the impact of the avoidant attachment style on CO. Consequently, we expect an interaction effect: the avoidant attachment style will lead to greater CO in salespeople with the $7R^+$ allele but not for salespeople without it. The rationale is that for sales representatives with the $7R^+$ allele, the greater the inclination to be open to taking risks and pursuing new opportunities, the more an avoidant attachment style will lead to a strong CO. Again, we argue that the avoidant attachment style is manifest in an ability to remain efficacious and goal driven when discussing customer needs, and present appropriate solutions without allowing feelings of rejection to intrude detrimentally and adversely affect one's efforts (see findings in the psychology literature on "suppressing distress-related thoughts," Ein-Dor et al., 2010, p. 134).

**Method**

Sample. Hypotheses were tested on a sample of 73 sales representatives who volunteered for a study of the role of biomarkers in professional relationships. Participants provided written informed consent, and the study was approved by the local research ethics committee. Participants were not told about the aim of the study at the start but were debriefed after completion of the study. All participated in post-graduate executive education programs. All were business-to-business salespeople selling financial services, trucks, IT services, insurance, pharmaceutical drugs, or consulting services. These selling positions require more

thorough and repetitive conversations with customers compared to sales interactions with consumers where impulsive buying and transactions play a more important role (e.g., retail sales; door-to-door selling). All were Caucasian, 87% men, 13% women, 49% had a university degree and the rest vocational school diplomas. The average level of selling experience was 6.8 years. All participants donated saliva so that their DNA could be analyzed for the two candidate genes, *DRD4* and *DRD2*.

Procedure. Attachment styles were measured with 12 7-point "does not describe me at all" to "describes me very well" end-points, and "describes me moderately well" as a mid-point (see **Table 10**). These items were adapted from Professor Phillip R. Shaver's latest scale, which he kindly provided. This scale is based on the original in Hazan and Shaver (1987), which was revised by Collins and Read (1990). Note that there are six items for anxious attachment, three for avoidant, and three for secure. CO was measured with 5 7-point disagree-agree items with the same format used as for the attachment style items. This scale was developed by Bagozzi et al. (2012) as a subset of Saxe and Weitz's (1982) original scale. **Table 7** shows the items.

**Table 10.** Items from the Attachment Style scale used in Study 2.

**Anxious**

1. I worry that others won't care about me as much as I care about them.
2. My desire to be very close sometimes scares people away.
3. I need a lot of reassurance that I am loved by my partner.
4. I do not often worry about being abandoned (R)
5. I find that my clos relationships don't want to get as close as I would like.
6. I get frustrated if partners are not available when I need them.

**Avoidant**

7. I want to get close to others, but I keep pulling back.
8. I am nervous when partners get too close to me.
9. I try to avoid getting too close to others

**Secure**

10. I usually discuss my problems and concerns with my partner.
11. It helps to turn to my romantic partner in times of need.
12. I turn to my partner for many things, including comfort and reassurance.

## Results

Two items from the attachment scale were deleted because they loaded too low on their respective factors, based on an exploratory factor analysis (items 6 and 10). Cronbach's alpha reliabilities for the subscales were 0.69 for anxious, 0.81 for avoidant, and 0.67 ($r$ = 0.51) for secure. Because all three factors were uncorrelated with each other, and empirical under identification occurred, we could not run a confirmatory factor analysis (CFA) for all three subscales together. A CFA for the anxious and avoidant subscales fit well: $\chi^2_{(19)} = 17.65$, $p = 0.54$, RMSEA = 0.00, NNFI = 1.01, CFI = 1.00, and SRMR = 0.076.

For the CO scale, the CFA model fit well: $\chi^2_{(5)} = 4.65$, $p = 0.44$, RMSEA = 0.00, NNFI = 1.00, CFI = 1.00, and SRMR = 0.036. Cronbach's alpha was 0.77.

Regressions were done according to standard procedures: first, we added the main effects, then the interaction effect. Here we only report the significant main findings. As we have dichotomous and continuous independent variables, we followed Jaccard and Turrisi (2003) to analyze interaction effects and graphically display the findings (see Nieuwenhuis et al., 2011). For the *DRD2* analyses, the two regression equations are, with *DDR2* coded (A1, A1 and A1, A2) = 1 and A2, A2 = 0 in the first regression and the reverse for the second:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CO = | 5.986 | +.204 | avoid | +.138 | *DRD2* | -.248 | avoid x *DRD2* |
| | (.098) | (.074) | | (.149) | | (.109) | |
| | 61.35 | 2.75 | | .930 | | -2.29 | |
| CO = | 6.124 | -.044 | avoid | -.138 | *DRD2* | +.248 | avoid x *DRD2* |
| | (.112) | (.079) | | (.149) | | (.109) | |
| | 54.68 | -.55 | | -.93 | | 2.29 | |

where standard errors are in parentheses and *t*-values appear below them. This model fit well: $F_{(3, 69)} = 2.73$, $p = 0.05$, $R^2 = 0.11$.

**Figure 2** presents the results. As hypothesized, the avoidant attachment style has a positive effect on CO for sales representatives with the A2, A2 variant of the *DRD2* gene. For sales representatives with the A1, A1, and the A1, A2 variants of *DRD2*, the avoidant attachment style has little effect on CO, as predicted.

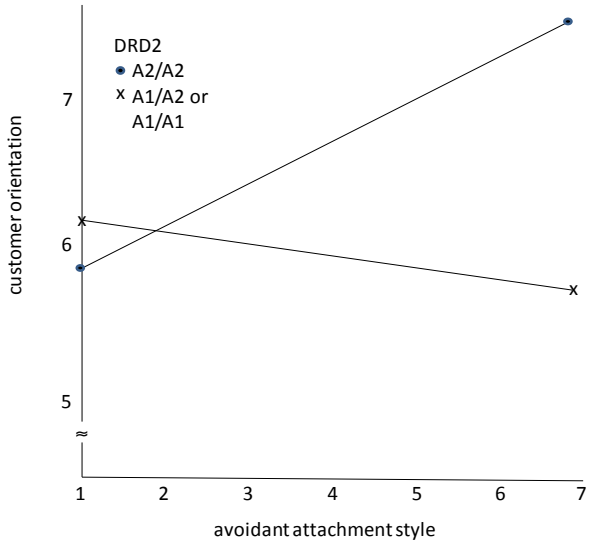



**Figure 2.** The moderating role of *DRD2* gene variants on the effects of avoidant attachment style on customer orientation.

For the *DRD4* analyses, the two regression equations are, with *DRD4* coded 7R = 0 and $7R^{+}$ = 1 in the first regression and the reverse in the second regression:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **CO =** | **6.116** | **+.038** | ***avoid*** | **+.287** | ***DRD2*** | **-.395** | ***avoid x DRD4*** |
| | (.084) | (.057) | | (.174) | | (.166) | |
| | 72.79 | .67 | | -1.64 | | -2.38 | |
| **CO =** | **5.829** | **-.433** | ***avoid*** | **-.287** | ***DRD2*** | **+.395** | ***avoid x DRD4*** |
| | (.153) | (.155) | | (.174) | | (.166) | |
| | 38.11 | 2.79 | | -.164 | | -2.38 | |

This model fit well: $F_{(3,\,69)} = 2.85, p = 0.04, R^2 = 0.11$.

**Figure 3** shows the findings. As predicted, the avoidant attachment style has a positive effect on CO for salespeople with the $7R^{+}$ variant of the *DRD4* gene. However, for salespeople with the $7R^{-}$ variant of the *DRD4* gene, the avoidant attachment style had no effect on CO, as expected.

To gain perspective, we also examined the interaction effects on CO of the anxious attachment style with *DRD2* and with *DRD4* polymorphisms, and the interaction effects on CO of the secure attachment style with *DRD2* and with *DRD4*. None of the interactions and none of the main effects were significant in the four regressions.

Also for perspective, we note that CO was not significantly correlated with the anxious attachment style ($r = 0.16$, ns), avoidance attachment style ($r = 0.07$, ns), secure attachment style ($r = 0.11$, ns), *DRD2* ($r = 0.07$, ns), or *DRD4* ($r = 0.07$, ns). Thus, CO was influenced only by the interactions of the avoidance attachment style with *DRD2* and with *DRD4* polymorphisms.

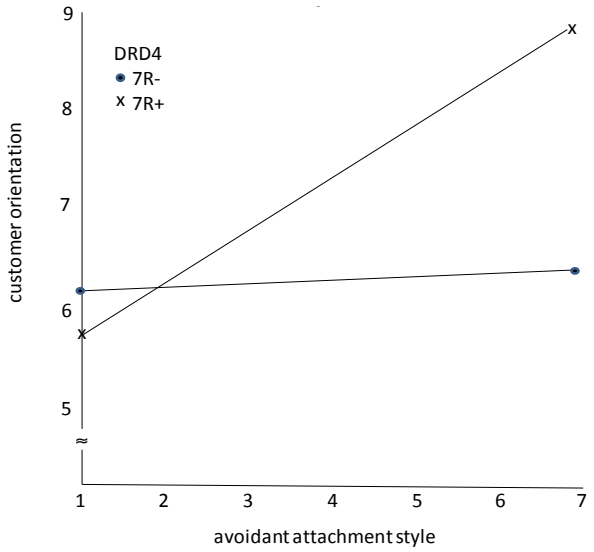



**Figure 3.** The moderating role of *DRD4* gene variants on the effects of avoidant attachment style on customer orientation.

**Discussion**

As we move into a biology-informed era in social research, researchers will benefit from scrutinizing such higher-order concepts as attitudes, personality traits, and work orientations using lower-order concepts from neuroscience (e.g., Becker et al., 2011; Senior et al., 2011) and molecular genetics. Whereas in our Study 1 we used insights from molecular genetics to replicate previous findings about the association between variations of two candidate genes, namely *DRD2* and *DRD4 (nature)*, in Study 2 we explored how gene activity is affected by interactions with the environment (*nurture*). We investigated this question because we believe that findings from such cross-level studies can enrich theory testing and knowledge development and guide practical decision-making by human resource managers. For customer boundary spanners, a meta-analysis by Ford et al. (1988) investigated how biographical and psychological variables compare in their effects on salesperson's success. Surprisingly, the results seemed to suggest that biographical information predicts performance better than psychological variables (see also Vinchur et al., 1998). Specifically, the findings showed that personal history and family background explained around 5% of the variance in performance and marital status accounted for less than 2%; in comparison, cognitive abilities explained less than 1% and vocational skills less than 1% of performance. Biographical variables, of course, beg the questions what in one's background influences behavior and what the underlying mechanisms are. The low levels of explained variance for both biographical and psychological variables suggest that the variables function poorly as main effects, and sound theories proposing interactions might be fruitful to explore in a person-by-situation exploration.

More specifically, two problems with such background variables can be identified. First, these variables can be thought to be one-step removed from the origin of salesperson behavior and serve as proxies at best for proximal

psychological determinants of behavior. Second, the use of background variables in managerial decision-making risks the stigma of excessive intrusiveness, or even worse, the application of prejudice or profiling due to race, gender, or other categories.

In an effort to elucidate the interplay of *nature* and *nurture* on the etiology of SO, we examined how variants of the *DRD2* and *DRD4* genes moderate the effects of sales representative attachment styles on CO. The findings showed that the avoidant attachment style has a positive effect on CO for sales representatives carrying only *DRD2* A2 alleles, but no effect occur for sales representatives with at least one *DRD2* A1 allele. The avoidant attachment style has been shown to exhibit an orientation of emotional distance, yet a high degree of self-reliance, which seemingly fits expectations in inter-firm business relationships. However, whether, and to what extent, the avoidant style will influence CO apparently depends on the functioning of the dopamine system with regard to goal-directed, motivational, and reward-related behavior.

Carriers of the *DRD2* A1 allele exhibit reduced switching costs compared to carriers of only A2 alleles in intentional cognitive tasks (Stelzel et al., 2010). This should be manifest in greater task focus and persistence by the latter compared to the former, and greater sensitivity to task distracters and greater impatience for the former compared to the latter. The pattern of findings in **Figure 2** is consistent with this interpretation, where we found that greater adherence to an avoidant attachment style leads to a stronger CO for sales representatives with the A2 alleles, whereas sales representatives with at least one A1 allele show no relationship between avoidant style and CO.

Furthermore, carriers of the *DRD4* $7R^{+}$ allele, vs. the $7R^{-}$ allele, have been shown to be greater risk takers and have a propensity to seek opportunities while interacting with customers. This, too, appears to regulate the effect of an avoidant attachment style on CO. We speculate that the tension occurring between

the need to keep a certain amount of distance between self and customer, and the drive to seek new opportunities leads to a greater application of skills meeting (mutual) needs and greater chance of success.

Additionally, the present research also brings into focus the role in which insecure attachment styles (anxious and avoidant), as opposed to the secure attachment style, play in professional lives. In this regard, Ein-Dor et al. (2010) speak about the attachment paradox. Overall, researchers in psychology (e.g., Shaver and Brennan, 1992) have assumed that people with secure attachment styles fair better than those with insecure ones, with respect to building stable social relationships. The secure style is thought to promote stable relationships with others, because it is believed to increase fitness within the human species. However, when faced with vulnerable relationships or threatening situations, such as in many inter-firm selling contexts, people with an avoidant attachment style remain self-efficacious and goal driven, and maintain the initiative to seek innovative solutions (Ein-Dor et al., 2010). As Ein-Dor et al. speculate, avoidant attachment styles may be beneficial in certain situations. Our study shows that professional selling in business-to-business markets is such a context. Sales representatives are boundary spanners who work largely autonomously, explore the needs of customers, and shape the way customers view their own problems (Vinchur et al., 1998). They do so while maintaining a professional attitude in the face of conflicts of interest, misunderstandings, and customer resistance. In other words, whereas a secure attachment style might be best for in-group relationships, an avoidant style seems best for ingroup-outgroup relationships.

### *Future research and practical implications*

Our research paves the way for future discoveries. It would be productive to study different phenomena in organization behavior such as job attitudes, social identity, burnout and resilience, and motivation, and explore the role of genetics in combination with environmental factors. Such approaches are challenging, yet they might provide us with more insights into the concepts under study and their effects, which we exemplified in this study. Such insights also allow human resource managers to uncover what biological mechanisms are related to the (higher order) concepts they regularly use.

Elaborating on the study in this paper, we note that sales representatives do not always work alone but often in teams. Would sales teams of people who possess heterogeneous attachment styles function better than those with homogeneous styles? Such teams might contain people who seek psychological comfort (those with anxious attachment styles), sense competitive signals (those with anxious and avoidant attachment styles), and effectively implement interpersonal-change actions (especially those with avoidant attachment styles). As we studied the effects of attachment styles in interaction with genes, such questions are both difficult to ask and difficult to answer.

In terms of task-person fit, what attachment style is most beneficial for by managers that supervise sales representatives (who each have distinct attachment styles on their own)? Will managers with secure attachment styles, because they are perceived as open and trusting, attain better results, and can they bring both secure and insecure sales representatives together because they are inclined to promote cooperation, hence enhancing group or team formation and flexibility? Alternatively, could it be that managers with avoidant attachment styles empower their sales representatives because they do not seek unneeded or excessive closeness? Note that our findings showed that attachment styles interacted only with specific genes to influence COs. Holders of other genes might require

different leadership strategies or better-fit tasks other than boundary spanning roles.

Finally, attachment styles and people's genetic profile are stable and so tend to evoke automatic reactions or predictable tendencies in particular situations. Future research should study how sales representatives self-regulate such automatic tendencies and shape them into productive work orientations. For example, should firms make attachment styles part of awareness training? If attachment styles interact with genetic abilities, would such knowledge make sales representatives self-conscious of their genetic backgrounds and encourage or discourage adaptive behavior? Our findings invite researchers to explore the consequences of deeper, unconscious biological processes that shape human behavior in diverse organizational contexts.

Genetic data and measures of attachment style, if employed sensitively and applied ethically to hiring, training, and supervisory decisions along with other information, can provide more valid and fair criteria for management than reliance only on background information, interviews, and psychological tests. Of course, any use of such information must be based on validation of their effects on performances in any context, if Equal Employment Opportunity Commission Regulations and anti-discriminatory policies are to be met. Much remains to be done concerning our understanding of the role of genetic factors in organizational behavior. For example, more work is needed into how key genetic variables inter-relate with personality and situational constraints to influence behavior and outcomes. The pursuit of such ends promises to help us understand the "why" of behavior in organizations and provide policy insights.

### *Limitations*

We studied sales representatives to investigate the nature-nurture question related to molecular genetics in organizations. While this context provided initial answers, there are limitations.

First, one can argue that the sample sizes used in this study are small. However, we employed a hypothesis-driven approach, targeting only two genes and based on theory from biology and psychology, which reduces the need for large sample sizes required by exploratory searches across many genes. Importantly, we replicated findings presented by Bagozzi et al. (2012), regarding the association between carrying the *DRD4* $7R^+$ variant and the propensity to engage in customer-oriented selling. Convergent findings by two independent studies with regard to a specific genetic variant are rare in biological research and significantly contribute to the validity of the phenomena under study. Furthermore, the discovery of gene-environment interaction effects is also rarely recounted in the literature. Such interactions require the specification and test of unusual cross-level hypotheses and when found provide strong evidence for the mechanisms under research. In addition, while the costs of genetic profiling are becoming more feasible, such genetic studies compared to pencil and paper tests are difficult to implement.

Second, we assumed that attachment styles are a reflection of environmental interactions, and therefore are a proxy of the influence of *nurture,* so to speak. However, attachment styles may have genetic association as well (e.g., Gillath et al., 2008). In addition, attachment styles were inferred from questionnaires in our studies, but more objective data could have been used; e.g., observations by clinicians or other experts.

Finally, we used an attachment style questionnaire tailored to how people experience general interpersonal relationships as adults. We could have developed a domain-specific attachment style measure tailored to the organizational context

(e.g., Little et al., 2010). However, since we aimed to understand how environment and genes interact to influence behavior, we chose as our measure one that reflects the phenomenon under study in a way that functions during the critical window when one's neurobiological (stress) systems were shaped. This helps tie the findings for the adults under study to the early biological underpinnings and learning that produced the hypothesized consequences on the job.

*Adapted from:*

Berg, W.E. van den, Verbeke, W.J.M.I., Bagozzi, R.P., Worm, L., Jong, A., Nijssen, E. (forthcoming). Salespersons as Internal Knowledge Brokers and New Products Selling: Discovering the Link to Genetic Makeup. *Journal of Product Innovation Management*.

# CHAPTER 4

# Salespersons as Internal Knowledge Brokers and New Products Selling: Discovering the Link to Genetic Makeup


## Abstract

Managers increasingly realize the importance of involving the sales force in new product development. However, despite recent progress, research on the specific role of the sales force in product innovation-related activities remains scarce. In particular, the importance of a salespersons' internal knowledge brokering has been neglected. This study develops and empirically validates the concept of internal knowledge brokering behavior and its effect on selling new products and developing new business, and explores whether a salesperson's internal brokering qualities are determined by biological traits. The findings reveal that salespeople with the DRD2 A1 gene variant engage at significant lower levels of internal knowledge-brokering behavior than salespeople without this gene variant, and as a result are less likely to engage effectively in new product selling. The DRD4 gene variant had no effect on internal knowledge brokering. Management and future research implications are discussed.

## *Introduction*

The launch and commercialization of new products are vital for company performance yet pose enormous challenges for most firms, particularly in today' s hyper-competitive knowledge-intensive economy (e.g., Di Benedetto, 1999). New products provide the grounds for next generation growth and continued firm survival (Cohen, Eliashberg, and Ho, 1997; Danneels, 2002). As knowledge brokers, salespeople are pivotal both in helping new products succeed in the marketplace (e.g., Verbeke, Dietz, and Verwaal, 2010; Rodan and Galunic, 2004) and in advocating innovation (Ernst, Hoyer, and Rübsaamen, 2010; Hargadon, 2005; Obstfeld, 2005). First, recent findings demonstrate an increasingly active and significant role for salespeople in this new business development process (e.g., De Brentani, 2001; Di Benedetto, 1999; Micheal, Rochford and Wotruba, 2003; Song and Montoya-Weiss, 1998). As most new products are not perfect, salespeople need to engage customers in reciprocal information exchange to position innovations carefully, help customers link them with their specific needs, and explain features and usefulness of these new products convincingly (Webb, Ireland, Hitt, Kistruck and Tihanyi, 2011). Second, successful salespersons transfer and then discuss their acquired knowledge about customer cognitions and preferences as well as market dynamics to fellow sales colleagues and colleagues from other departments internal to the firm (e.g., new product development managers) so that these actors too can benefit from the information and enhance their business (process) decisions (Ernst et al., 2010; Rosa, Spanjol, and Saxon, 1999). Such a view is consistent with the absorptive capacity of the firm, which contends that firms source knowledge outside their boundaries (Cohen and Levinthal, 1990).

Remarkably, while the concept of knowledge brokering has received some attention in the management innovation literature (Kirkels and Duysters, 2010; Obstfeld, 2005), little is known about this concept in the context of selling new

products to existing and new accounts. As salespersons operate as boundary spanners, functioning between customers and people inside their organization (Adams, 1980), one can distinguish between salespeople's external knowledge-brokering behavior, which reflects sourcing and transferring knowledge from and with customers and internal knowledge-brokering behavior, which concerns sourcing and transferring knowledge from and with colleagues within the company. Traditionally, the role of external, customer-directed behaviors of salespersons has received most attention in the industrial marketing literature (Plouffe and Barclay, 2007). The reason is that personal interactions with customers have been considered inherently part of the salesperson's job. As a result, regular sales training and educational programs have put primary emphasis on instructing salespersons how to prepare for and approach customers. In contrast, both researchers and sales managers alike have paid little attention to internal brokering behavior. This is surprising as salespersons' internal knowledge-brokering behavior is a relevant but complex, ambiguous, and challenging activity, specifically regarding the sale of newly developed products (Plouffe and Barclay, 2007; Plouffe, Sridharan, and Barclay, 2009).

The aim of this study is to investigate the antecedents and consequences of a salesperson's internal knowledge-brokering activities with respect to new product selling. Importantly, this study leverages information about the genetic make-up of salespersons to better understand what it means to be a successful internal knowledge broker and gain insight into potential pitfalls and opportunities regarding sales strategies to employ. Genetic makeup refers to the entirety of an organism's hereditary information (also called "genome") of a particular individual or organism encoded in DNA. It includes both the genes and the noncoding sequences of the DNA (Ridley, 2006).

Currently, the fields of behavioral genetics and neuroscience gain relevance into the field of management and organization behavior by explicating

the impact of specific genes on behavioral orientations and behaviors (Johnson, 2009). For instance, Nicolaou, Shane, Cherkas, Hunkin, and Spector (2008) found that 37–42% of the variance in different measures of entrepreneurial behavior could be attributed to genetic influence. Recognizing a parallel between entrepreneurship and the creativity and perseverance to sell new products, it is anticipated that there is a similar relationship between salesperson internal knowledge-brokering behaviors and genetic makeup. Consistent with recent work by Bagozzi et al. (2012), who found an association between salespeople's customer orientation and genetic makeup, the presented study explores associations between internal brokering and genetic traits. In this study, a hypothesis-driven approach is employed by focusing on two specific genetic variants that are known to have a functional impact on brain activity. Importantly, their association with salespersons' knowledge-brokering behavior is tested. However, it is noted that, in contrast to research with higher level social and psychological concepts, research on the identification of relationships between types of behaviors and genetic makeup is difficult to implement and still at an early stage of development in the management and social sciences literature.

The paper is organized as follows. First, a theoretical perspective on knowledge brokering regarding the sale of new products is presented. Second, a scale is developed gauging internal knowledge-brokering behavior for selling new products. Third, we hypothesize and test the association between two genetic variants that are known to affect dopamine system regulation, the DRD4 7R+ and DRD2 A1, and a salesperson's willingness to engage in internal knowledge-brokering behavior. A relationship between internal brokering and new product selling is also hypothesized and tested. After presenting the results, the theoretical and managerial implications of these findings are discussed.

The results show partial support for our hypotheses. Specifically, the results demonstrate a link between internal knowledge-brokering behavior and the

DRD2 A1 gene variant but not with the DRD4 7R+ variant. Additionally, these results demonstrate an indirect effect of the DRD2 A1 gene variant on new product selling mediated by internal knowledge brokering. This suggests that insight into the impact of the DRD2 A1 gene variant on a salesperson's behavioral strategy can guide sales managers in their recruiting, training, and coaching efforts. By providing these insights, our study addresses the importance of internal navigation within the firm on salespersons' performance (Plouffe et al., 2009) and adds to the emerging stream of research using biological explanations of behavior as an additional method to understand a sales force's behavior in general, and sales of new products in particular (e.g., Bagozzi et al., 2012).

## *Theoretical background*

### A knowledge brokering perspective for selling new products

A company's capability to acquire and assimilate knowledge and then transform it into successful new products has been shown to be vital to the competitive advantage of firms (Hargadon, 2003; Hurley and Hult, 1998; Patterson, 1998; Zahra and George, 2002). Therefore, a hallmark feature of firms' innovation processes is the knowledge creation process, which is driven by individuals who operate within and between organizational departments (Nonaka and Takeuchi, 1995) and those acting as knowledge brokers regarding the marketplace (e.g., Kohli and Jaworski, 1990). Hence, innovation and knowledge brokering are closely related and fundamentally intertwined (Kirkels and Duysters, 2010).

An early perspective on knowledge brokering conceived brokering as a set of activities aimed toward facilitating the flow of information between two or more actors (Gould and Fernandez, 1989; Kirkels and Duysters, 2010; Obstfeld, 2005). For the "brokering agent," an open network and the inherent information asymmetry lead to opportunities. For example, establishing unique ties to actors in social networks, that are not easily accessible by others, provides superior access

to knowledge and information and subsequent leveraging opportunities. Burt (1992, 1997, 2004) provides insights on how to act when such "structural holes" arise and how brokering agents can benefit from the differences between actors in the network (known as the *tertius gaudens* strategy; Burt, 1992; Simmel, 1950). Structural holes refer to the absence of ties between two parts of a social network (Burt, 1992). However, as Obstfeld (2005) argues, structural holes in open networks pose serious action problems. As the brokering agent benefits from the existence of these structural holes, s/he is not inclined to engage in activities aimed at combining the different individual stocks of knowledge into newly assimilated knowledge. This might result in competition, control, and even manipulation, where brokers choose to move "accurate, ambiguous, or distorted information between contacts" (Burt, 1992, p. 33). By introducing *tertius iungens* (the third who joins), Obstfeld (2005) addresses and solves this issue, showing that the ability of such an actor to combine knowledge, based on trust and repeated social interactions and exchanges of ideas is critical (Ahuja, 2000; Obstfeld, 2005). Building on this, we define effective brokering as the ability to combine and recombine existing knowledge by bringing together different actors in one's social network (inside and outside the firm), in an effort to maximize group rather than personal benefit (Verbeke, Belschak, Bagozzi, and Wuyts, 2011). Importantly, from this perspective, brokering does not require (immediate) reward or benefit for the brokering agent but rather a long-term view is a requisite.

Salespeople hold an important brokering role. As a liaison between outside customers and conditions and trends in the environment, on the one hand, and colleagues inside the firm, on the other hand, salespersons can connect and recombine knowledge relevant to and about, for instance, the new product's development process with knowledge about customer product experiences. Sales people who are aware of this important role will be better able to contribute to their firm's short and long-term goals (e.g., selling new products). However, in

their thought-provoking article, Rodan and Galunic (2004) suggest that it is not only the network *structure* that counts but also the network *content* that effects performance. They show that successful managers not only build better network structures but make sure to include people who possess heterogeneous knowledge. This increases chances of picking up "a wider array of information about current events, news and gossip, privileged by both a greater range of information circulating in the organization and the ability to test its accuracy through independent confirmation" (Rodan and Galunic, 2004; p. 545). This suggests that the more a salesperson connects with a multitude of colleagues internally and explores the information he or she has collected from outside, the richer ideas and scenarios will be developed that, if shared internally, will benefit the firm's capacity to adapt to and drive the market.

Lastly, salespeople are in a position where they can source relevant information from colleagues who work in relatively isolated departments inside their own organization as well as from external customers. The latter help salespersons imagine the market, conceptualize customer problems that are at the basis of new products, and then better market these new products (Achrol and Kotler, 1999; Schwab, Ungson, and Brown, 1985; Vargo and Lusch, 2004). Effectively transferring information from the external environment, such as customers, to internal parties of the firm (e.g., new product developers), is important for generating ideas around (new) product development as well as mustering support for developing new products in response to this latent need information.

**Internal navigation and knowledge brokering behavior**

Whereas external knowledge-brokering behavior refers to salespersons' actions to source and transfer new product (related) knowledge from customers, internal knowledge brokering reflects the sourcing and transferring of new product

knowledge from and to colleagues of one's own organization. Effective salespeople understand the importance of customer and market feedback for long-term firm success, and recognize that they themselves are the critical link within the network that drives the organizational learning process (McKee, 1992). This requires sharing knowledge with colleagues to update their cognitive schemas (i.e., internal theories, new meanings, linguistic routines) (Boland and Tenkasi, 1995; Webb et al., 2011). By doing so, this helps the firm update its perception of the environment, potentially changing its activities in the future (Argyris and Schon, 1978; Huber, 1991).

Effective internal knowledge brokering means that salespeople discuss customer needs with colleagues and how to respond to these needs by developing new products (Ernst et al., 2010). This is particularly challenging since much of the knowledge transferred within organizations is tacit rather than explicit (Carlile, 2002; Nonaka, 1994; Spender, 1996). This includes motivating colleagues to undertake specific actions. This motivation and mobilization of people are important and require instilling new perspectives and the mustering of compliance and consensus (Noe, Colquitt, Simmering, and Alvarez, 2003). In the beginning, intra-firm (cross-silo) dissemination and recombination of knowledge will bring together different perspectives that might start out to be contradictory, producing creative abrasion, but will eventually drive organizational innovation (Brown and Duguid, 1991; Leonard-Barton, 1995). This promotes organizational learning and enhances the opportunity recognition capabilities and innovative success of the company (Hanvanich and Hult, 2006; Lumpkin and Lichtenstein, 2005).

Internal knowledge brokering also requires political skill and social navigation (Plouffe and Barclay, 2007). Consistent with this, communication and information exchange between sales and new product development departments, as well as cross-functional participation on projects, have been found to be important catalysts of new product performance as well as how products can be

more effectively brought to the market (Ernst et al., 2010; Montoya-Weiss and Calantone, 1994). Other contemporary research has also shown an impact of the internal organizational environment on sales performance (Chakravarthy and Doz, 1992).

In this reciprocal process, salespeople will learn from the new product development staff too. Drawing on different information sources from inside the firm increases the quality of their network content, giving salespersons access to important new product and technology intelligence. Such information will be difficult to understand for the salesperson if s/he is not up-to-date with the latest technological advances and jargon of new product developers, something that can be overcome by long-term involvement and engagement in continuous conversations internally over time. Insight pertains, for instance, to the technical difficulties engineers faced and could or could not resolve and why. These processes will help the salesperson effectively deal with possible information ambiguity and to develop a solid, convincing, and appealing sales message for the new product (Singh, 1993). Those salespersons that are more capable of extracting this technical intelligence and overcoming ambiguities will be better internal knowledge brokers and better able to contribute to the development and sale of new products.

*Salesperson's internal knowledge brokering behavior and genetic makeup*

Our study addresses the question of whether salespeople's engagement in internal knowledge-brokering behavior for selling new products is associated with genetic makeup. As Kreek, Nielsen, Butelman, and LaForge (2005) argue, there are two strategies within molecular genetics for studying associations between genetic information (the genotype) and specific behavior (the phenotype). Clearly, rigorous assessment of the phenotype is essential in both approaches. However, both strategies differ on their experimental design parameters.

The first approach is an exploratory approach utilizing genome-wide association scans to identify chromosomal positions that might be associated with the behavioral phenotype (van der Loos, Koellinger, Groenen, and Thurik, 2010). In such a design, research does not specify an a priori hypothesized link between the trait under investigation and specific genes but scan up to one million pseudo-randomly chosen genetic markers in an effort to find an association between the genotype and phenotype. The main drawback of this approach is the need for large sample sizes due to the statistical power problem that arises when running one million tests in a single study. This is not only a practical issue: larger respondent groups potentially lead to more heterogeneous groups regarding, for example, age, occupation, experience, and genetic makeup. Second, any findings derived are less likely to directly contribute to social science knowledge since chances are high that any genetic marker that is found to associate with the behavior (1) has not yet been characterized functionally, leading to possible validity issues regarding any causal relation of the genotype on the phenotype, and (2) is not the exact marker that is causing the behavior, since the one million markers that are tested are just a representative subset of the total of three billion markers that make up our complete genetic code. As such, this approach focuses on gene exploration and is highly suitable as a starting point for those interested in exploring the biological rather than studying the behavioral impact of a particular genetic variant.

The second approach is a hypothesis-oriented candidate gene approach: investigating specific genes based upon prior understanding of the phenomena (e.g., Bagozzi et al., 2012). In the candidate gene approach, knowledge about the biological and/or behavioral impact of genetic variants is used a priori to generate hypotheses about an association between genes and the phenotype. Since these studies target specific genes, they require far smaller sample sizes. Importantly, when an association is found, existing knowledge about the functional impact of the genetic variant directly contributes to the understanding of the phenotype

under study. Finally, drawing from an existing body of research to generate well-grounded hypotheses helps to overcome some of the validity issues that underlie genetic association studies. As such, candidate studies focus on theory testing. We suggest that this approach should be part of an iterative process in which future studies build upon, and eventually replicate and extend previous findings. Since the aim of our study is to acquire a better understanding of the impact of specific genes on internal knowledge brokering and selling new products, we take the candidate gene approach. Specifically, this study focuses on two genes that are known in the genetic literature to have a functional impact on the dopamine system and investigate their relation to salespeople's level of internal knowledge brokering.

Marketers have long been interested in motivational mechanisms related to proactivity, novelty seeking, and risk taking. For example, Raju (1980) discusses the role of arousal in novelty-seeking behavior. Such perspectives are outside-in approaches, so to speak, meaning that psychological constructs based on verbal representations by the researcher are used to represent and explain psychological processes underlying behavior of salespersons. From a biological or inside-out standpoint, by contrast, the neurotransmitter dopamine in people's brain is known to underlie mechanisms related to reward (anticipation), motivation, and goal-directed behavior. More specifically, dopamine signaling in the brain has been implicated in what is called information or incentive salience, which has both perceptual and motivational features. The dopamine system is hypothesized to transform neural representations of stimuli in the brain by converting an event or stimulus from a neutral "cold representation" (mere information) into an attractive and wanted incentive that can "grab attention" and which consequently motivates people to take actions to attain goals (Berridge and Robinson, 1998).

This study focuses on two plausible candidate dopamine gene variants that may be associated with a salesperson' s engagement in knowledge-brokering

behavior: the *DRD4* 7R+ and *DRD2* A1 gene variants. These two gene variants affect dopamine activity in the brain, leading to increased compulsive and impulsive personality traits (Nicolaou et al., 2008, Nicolaou and Shane, 2009). Studies using chemicals to mimic artificially the effect of the mutations have corroborated these processes. The blocking of dopamine functioning in the brain negatively influences one's ability to shift cognitive strategies in adaptive ways, as this ability draws upon both emotional memory and working memory in complex ways (Lange et al., 1992; Mehta, Manes, Magnolfi, Sahakian, and Robbins, 2004). Conversely, chemically increasing dopamine levels in the brain improves working memory, cognitive flexibility, and planning, and thus learning, in the long term (Cools, Barker, Sahakian, and Robbins, 2001; Cools and Robbins, 2004; Cools, Stefanova, Barker, Robbins and Owen, 2002; Mattay et al., 2002). Although active in intertwined pathways in the brain, the *DRD2* A1 and *DRD4* 7R+ gene variants relate to different brain regions, and the traits associated with these mutations differ somewhat as well.

The *DRD4* 7R+ gene variant, for instance, effects sensations of pleasure in response to risk taking. Carriers of the *DRD4* 7R+ gene variant also have lower sensitivity to risks and have a better ability to take a long-term perspective instead of pursuing short-term goals. Nicolaou et al. (2008) argue that people with the *DRD4* 7R+ gene variant are more likely to engage in entrepreneurial activity because this variant increases the pleasure from taking entrepreneurial risks even if these endeavors take a longterm perspective.

The *DRD2* A1 gene variant is associated with impulsiveness and a short-term orientation. The *DRD2* A1 gene variant is also associated with depression, anxiety, and impaired social functioning (see Hayden et al., 2010). These findings suggest that persons carrying this gene lack the necessary persistence and social ability to act as knowledge brokers and sell new products. What follows is the

development of our hypotheses. For a detailed description of the neurobiology of the dopamine system, see *Appendix 2*.

### *Hypotheses*

Dreber et al. (2009) found evidence for increased risktaking behavior in carriers of the *DRD4* 7R+ gene variant (Dreber et al., 2009; Kuhnen and Chiao, 2009). The *DRD4* 7R+ gene variant has also been associated with better cognitive performance and long-term outcomes of attention deficit hyperactivity disorder (ADHD) patients (see Cloninger [2004] for an overview). Adults carrying this variant are more likely to be divergent thinkers and involved in novelty seeking, which are key factors of successful knowledge-brokering behavior (Ebstein et al., 1996). In a sales context, Bagozzi et al. (2012) showed that carriers of the *DRD4* 7R+ gene variant score higher on customer orientation. Carriers of this gene variant exhibit increased curiosity during conversations with customers about their (implicit) needs, and a greater willingness to actively search for novel solutions for their clients. They quickly sense opportunities for problems customers face and actively seek solutions for these problems.

Based on these observations, it is proposed that carriers of the *DRD4* 7R+ gene variant more likely are good internal knowledge brokers. Because of their enhanced divergent thinking and novelty-seeking tendencies, people with *DRD4* 7+ are likely better at approaching people from different departments for learning about new developments and ideas than their counterparts without this gene variant. Carriers of *DRD4* 7+ also should come across as being enthusiastic and able to mobilize others. In effect, they exchange their own views about customer and market changes readily and try to persuade colleagues (e.g., engineers, material managers, logistic specialists) to adopt new views and ideas, and thus develop novel solutions for customers. In addition, their lower sensitivity to risk makes them less afraid to debate with and convince pessimistic colleagues of

different backgrounds and inclinations (e.g., engineers, cost accountants). Therefore, we predict that carriers of the *DRD4* 7R+ gene variant will display more internal knowledge brokering behavior. Thus, we hypothesize:

Hypothesis 1a: The *DRD4* $7R^+$ gene variant will positively affect internal knowledge brokering.

The *DRD2* A1 gene variant also effects dopamine signaling but is anticipated to have a different, negative impact on knowledge-brokering behavior than the *DRD4* $7R^+$. First, people with *DRD2* A1 gene variant tend to be impulsive and prone to addictive or inflexible behaviors. In the neuro-cognitive domain, these behaviors are characterized by the inability to adopt cognitive strategies well after receiving negative feedback. In line with this, Dreber et al. (2009) argue that people with this gene variant are oriented to short-term gratification and have difficulty engaging in long-term projects (and thus are low on persistence). Because new product development generally takes months or years, people with *DRD2* A1 should have relatively more trouble engaging in such processes and in remaining interested and engaged.

*DRD2* A1 carriers versus non-carriers should be less capable of effectively creating, maintaining, and aligning the internal networks required for selling newly developed products. Furthermore, their impulsiveness may prove frustrating or off-putting to engineers. New ideas and proposals on how to improve the new product and its positioning in the market presented spontaneously by such salespersons without proper preparation and planning may be experienced as disruptions and cause negative affect among sales colleagues and colleagues from other departments. As a result, this may undermine internal relations and knowledge exchange between the salesperson and his colleagues in the organization. Hence, we posit:

Hypothesis 1b: The *DRD2* A1 gene variant will negatively affect internal knowledge brokering.

Next, we address the question that pertains to the relationship between internal brokering and the selling of new products. We expect that selling and knowledge brokering for new products will be correlated. Knowledge brokers need to meet a diverse set of people, which requires risk taking (e.g., "would different people in my network want to meet me?") but also the ability to navigate in social contexts, initiating, and developing instrumental social relationships. In a similar way, new product selling as a non-routine activity, involves risk taking. More specifically, we propose that there will be a positive relationship between internal knowledge brokering and new product selling, and to the extent that they are heavily engaged in internal firm processes and networks, internal brokers will develop more knowledge about the new product and its unique values. This will make the internal broker more confident to approach and convince customers. Furthermore, based on this knowledge, salespeople should be more effective in their communication of unique selling points of the new product to customers. The effective communications of unique selling propositions increases a product's value perceived by customers and reduces the risk for price competition (Boulding, Lee, and Staelin, 1994; Kirmani and Rao, 2000; Waterschoot and van den Bulte, 1992). Consequently, internal knowledge brokering should also be positively related to new product selling. The long-term orientation and strong social skills associated with internal knowledge brokering will also benefit the complex and uncertain process of new product sales. This long-term orientation will help the salesperson to persevere. Due to their strong embeddedness in internal firm processes and networks, internal brokers possess a more solid knowledge base of new products. As a result, internal brokers should be more

confident and better able to identify novel market opportunities, enter new markets, and successfully approach and convince new customers to buy their new products (e.g., Porath and Bateman, 2006). Therefore, we propose:

Hypothesis 2: Internal knowledge brokering behavior will positively affect new product selling.

Finally, we predict that internal knowledge brokering plays a key intervening or transformational role. That is, we propose that the aforementioned gene variants will influence internal knowledge brokering, and brokering, in turn, will influence new product selling. This is expected because internal knowledge brokering provides a basis for new product selling and facilitates its success. Hence, we hypothesize:

Hypothesis 3: The effect of genetic makeup on sales will be mediated by internal knowledge brokering.

## *Research Methodology*

### Pre-study: Development of the internal knowledge brokering scale

First, we developed a scale to assess a salesperson's internal knowledge-brokering skills and new product sales orientation. We began by generating a pool of items drawing on both the existing brokering literature (Gould and Fernandez, 1989; Kirkels and Duysters, 2010; Obstfeld, 2005) and interviews with salespersons. Based on a pretest of 105 respondents, we purified these items and used them to develop a valid and reliable measure of internal knowledge-brokering skills and new product sales orientations, all in a relative short scale so as to be usable by researchers in larger studies of sales force behavior.

*Sample and statistical analyses*. The sample ($n$ = 144) was obtained from salespeople attending an executive sales course. The sample consisted of 73% men and 27% women. Fifty-nine percent had worked from two to six years, 30% had worked more than six years, while 11% had worked less than two years. In terms of education, 45% had a university degree, while the rest were graduates of higher vocational schools. This represents a somewhat higher percentage of college graduates than is typical in European industrial sales jobs (cf. Verbeke and Bagozzi, 2000).

*Scale results*. After inspecting the means and standard deviations of item responses, and based on an exploratory principle component analysis, we selected five core items representing internal knowledge brokering and three items representing new product sales orientation. The items referred to discussions with colleagues of different departments in one's firm with respect to changes in the marketplace, and customer needs, new products and new product ideas, and implications for the firm's launch strategy **Table 11**. An exploratory factor analysis confirmed that the items loaded on two factors according to definitions of internal knowledge-brokering skills and new product sales orientations, respectively: Eigenvalues of 4.16 and 1.14, respectively, with loadings of .53–1.00 and .38–81. Cronbach's alpha for the respective scales was .87 and .69.

**Table 11.** Study constructs

| |
|---|
| **Internal knowledge brokering** |
| 1. Regularly I talk with colleagues about what needs our customers have. |
| 2. I always discuss with my colleagues how we could best place new products on the market. |
| 3. I discuss with my colleagues how we alternative approaches for new accounts. |
| 4. I regularly discuss with colleagues what the future could look like and what that would mean for our customers and company. |
| 5. Sometimes I go to other departments in my organization to gain new ideas. |
| **New product selling** |
| 6. I like to present my customers with our most innovative products. |
| 7. I like selling products that need me to explain in great detail just what is new and exciting about them |
| 8. I like to visit new accounts where I have to present what my company is selling. |

**Main Study: Effects of genetic makeup on new product sales orientation as mediated by internal knowledge brokering**

To study the effects of genetic makeup, permission was obtained from the internal research review board (i.e., the ethics committee of the university) for conducting the research. The board gave its consent for collecting DNA data and self-reports on a questionnaire from a sample of salespeople to test our hypotheses.

*Sample*. One hundred ninety-one salespeople attending an executive sales course were invited to participate in the study. Of these, 14 had incomplete DNA data, leaving 177 for genetic analysis. However, out of these 177, seven respondents failed to respond to all items, yielding a final sample of 170 (response rate of 89%). The majority were men: 83% men and 17% women. The majority of people (50%) had worked from two to six years, 12% had less than two years work experience (which was defined as the number of years worked in the sales profession), whereas 38% had seven or more years of work experience. In terms of education, 49% had a university degree, while the rest were graduates of higher vocational schools. Similar to the prestudy, the percentage of college graduates is somewhat higher than typical in European industrial sales jobs (cf. Verbeke and Bagozzi, 2000). Methods for genotyping of the *DRD2* and *DRD4* genes can be found in technical *Appendix 3*. For their associated allele frequencies, see **Table 12** and **Table 13**. Attendees of the executive education course were personally invited to participate in our research. Participants were asked to donate their DNA and fill in a survey. Participants received no reward for participating and were only informed about the purpose of the study after completion of the survey.

**Table 12.** *DRD2* Taq1a allele frequencies, genotypes, genotype and classifications (N=177).

| Genotype | N | % |
|---|---|---|
| T/T | 58 | 33% |
| C/T | 79 | 45% |
| C/C | 40 | 23% |
| Total | 177 | 100% |
| | | |
| Genotype Classification * | | |
| No T | 72 | 41% |
| T | 105 | 59% |
| Total | 177 | 100% |

***Allele frequencies are in HWE equilibrium

($\chi 2$= 1.700 p-value = 0.192, one sided)

**Table 13**. *DRD4* 48bp VNTR allele frequencies, genotypes, genotype and classifications (N=177).

| Allele | N | % |
|---|---|---|
| HWE Groups | | |
| Homozygote non-7R | 121 | 68% |
| Heterozygote | 49 | 28% |
| Homozygote 7R | 7 | 4% |
| | | |
| Genotype Classification *** | | |
| No 7R | 121 | 68% |
| $7R^{+}$ | 56 | 32% |
| Total | 177 | 100% |

***Allele frequencies are in HWE equilibrium

($\chi 2$= 0.51 p-value = 0.47, one sided)

*Scale analysis*. We performed a maximum likelihood exploratory factor analysis with promax rotation on the eight items (five internal knowledge brokering, three new product sales orientations) and found two factors corresponding to the two key variables. The factors showed eigenvalues of 3.84 and 1.29, respectively, all items loaded appropriately on their respective factor loadings (range of loadings was .74–.93 for factor 1.56–.90 for factor 2), cross loadings were equal to or less than .25 in all cases, and the factors correlated $r$ = .44. Cronbach's alpha reliabilities were .85 and .68, respectively.

To test for discriminant validity of measures of internal knowledge brokering and measures of new product selling, we used confirmatory factor analysis (CFA). Items were parceled to form two indicators per factor corresponding to internal knowledge brokering and new product selling (see Bagozzi and Edwards, 1998; Coffman and MacCallum, 2005). First, the findings for the two-factor CFA with the correlation between factors allowed to be a free parameter showed an excellent fit: $\chi^2$ (2) = 45.42, $p$ = .00, root mean square error of approximation (RMSEA) = .34, normed fit index (NFI) = .47, comparative fit index (CFI) = .82, and standardized root mean square residual (SRMR) = .12. A $\chi^2$-difference test, $\chi^2_d$ (1) = 43.22 ($p$ < .001), demonstrated that the measures achieve discriminant validity.

*Test of effects and mediation analysis*. To test the hypotheses, we first used the process program developed by Hayes (2009, 2013). **Table 14** and **Table 15** present the findings, respectively, for the models *DRD2* and *DRD4*. As hypothesized, it can be seen in **Table 14** that *DRD2* has a significant negative effect on internal knowledge brokering, β = –.31, $t$ = –2.10, and internal knowledge brokering has a significant positive effect on new product selling, β = .53, $t$ = 7.65. Further, there is no direct effect of *DRD2* on new product selling (β = .06, $t$ = .42), but as hypothesized, internal knowledge brokering mediates the

effect of *DRD2* on new product selling (boot lower level confidence interval [LLCI] = −.39 and boot upper level confidence interval [ULCI] = −.02).

As shown in **Table 15**, *DRD4* does not significantly influence knowledge brokering (β = .08, *t* = .47), but internal knowledge brokering does significantly and positively affect new product selling (β =.53, *t* = 7.65). Next, *DRD4* has a marginally significant direct effect on new product selling (β = −.25, *t* = −1.77). However, internal knowledge brokering does not mediate the effect of *DRD4* on new product selling (boot LLCI = −.10 and boot ULCI = −.21).

**Table 14.** Findings for mediation analysis (*DRD2*)

| Independent variables | | Mediation model: Internal knowledge brokering as dependent variable | | Outcome model: New product selling as dependent variable | | |
|---|---|---|---|---|---|---|
| | Coefficient | SE | t-value | Coefficient | SE | t-value |
| Constant | 5.70 | .10 | 59.25 | 2.47 | .40 | 6.13 |
| *DRD2* | -.31 | .15 | -2.10 | .06 | .14 | .42 |
| Knowledge brokering | | | | .53 | .07 | 7.65 |
| | F (1,168) = 4.39, p = .04 | | | F (2,167) = 29.57, p = .000 | | |
| | Direct effect of *DRD2* on new product selling | | | | | |
| | Effect | SE | | T | | p |
| | .06 | .14 | | .42 | | .67 |
| | Indirect effect of *DRD2* on new product selling | | | | | |
| | Effect | Boot SE | | Boot LLCI | | Boot VLCI |
| | -.17 | .088 | | -.3857 | | -.0221 |

**Table 15.** Findings for mediation analysis (*DRD4*)

| Independent variables | | Mediation model: Internal knowledge brokering as dependent variable | | Outcome model: New product selling as dependent variable | | |
|---|---|---|---|---|---|---|
| | Coefficient | SE | t-value | Coefficient | SE | t-value |
| Constant | 5.55 | .09 | 61.60 | 2.58 | .38 | 6.71 |
| *DRD4* | .08 | .16 | .47 | -.25 | .14 | -1.77 |
| Knowledge brokering | | | | .53 | .07 | 7.81 |
| F (1,168) = .22, p = .64 | | | | F (2,167) = 31.57, p = .000 | | |
| Direct effect of *DRD4* on new product selling | | | | | | |
| | Effect | SE | | T | | p |
| | -.25 | .15 | | -1.77 | | .08 |
| Indirect effect of *DRD4* on new product selling | | | | | | |
| | Effect | Boot SE | | Boot LLCI | | Boot VLCI |
| | .04 | .08 | | -.10 | | -.21 |

## *General discussion*

We studied the role of salespeople as internal knowledge brokers when selling new products and explored whether biological traits influence salespeople's level of internal brokering. First, we conceptualized salespeoples' internal knowledge brokering in a new product selling context. This emphasis on internal brokering sheds new light on the role of salespeoples' new product knowledge sourcing and transferring behavior from and to colleagues *within* the organization. Second, we investigated associations between genetic makeup and internal knowledgebrokering behaviors. Using the candidate gene approach, we focused on two gene variants, the *DRD2* A1 and *DRD4* $7R^{+}$ alleles, which functionally govern how the dopamine network works in the brain. Building upon a growing body of literature that links people's brain functions to opportunity seeking, perseverance, cognitive flexibility, reward sensitivity, and risk taking, we

hypothesized that this signaling pathway in the brain plays a role in people's ability to broker knowledge related to selling new products.

The findings show that salespeople with the *DRD2* A1 gene variant display significantly lower levels of internal knowledge brokering than salespeople without this variant. This result is consistent with findings in the basic brain research that has found that the variant is associated with inflexible, maladaptive behavior, and impaired social functioning. In our study, salespeople with strong proclivities for internal knowledge brokering were noncarriers of the *DRD2* A1 gene variant. Such salespeople who turn out to be skilled in interpersonal communication take a flexible approach in their interactions, while adjusting their behavior based on feedback from colleagues and quickly reacting to new, emerging knowledge about their product. Also, these people are more effective in focusing on a long-term, rather than shortterm, sales perspective.

Furthermore, in line with our expectations, our results confirm the effect of internal knowledge brokering on new product selling. This finding supports Plouffe and Barclay's (2007) argument that a salesperson's exploratory navigation within their own firm is important in developing knowledge needed for effective selling performance. However, whereas the results from Plouffe et al. (2009) were limited, we found clear support for their original conjecture. We believe that our development and use of the knowledge brokering concept and our focus on new product selling account for our positive results in this regard. Our finding suggests that the broker function and its impact on overall learning of the firm and the impetus to motivate sales employees to sell new products are key processes needed for successful selling in competitive knowledge-intensive markets.

The results of our mediation analyses supported the proposition that, while success regarding new product selling may be learned, it also has a biological root. Some people seem to possess a natural tendency to engage in internal knowledge broker activities and thus are more successful in both

developing new accounts as well as selling new products. In our study, we targeted genes in the dopamine pathway, building on previous findings linking dopamine gene variants to entrepreneurship (Nicolaou, Shane, Adi, Mangino, and Harris, 2011; van der Loos et al., 2010). Our results extend prior research by identifying additional specific gene variants. It can be noted that, compared to results reported by Nicolaou et al. (2008), our level of variance explained by the genetic factors included is limited. However, Nicolaou et al. (2008) present cumulative effect sizes representing an entire genetic effect (including multiple genes, which probably interact among each other, too). In our study, we focus on only two candidate genes, and our findings are consistent with the effect sizes reported by Bagozzi et al. (2012) in a sales context. As common as in genetic research, the uncovering of genetic links is difficult to demonstrate, and particular genes by themselves typically explain small portions of behavior.

**Managerial implications**

Our findings have important implications for sales management. To begin with, sales managers should realize that selling new products is a complex activity that benefits substantially from activities of internal knowledge brokering. The same is in fact true for new account development. Indeed, this showed that the two activities are linked in a synergistic way.

Second, our findings suggest that engaging in internal knowledge brokering depends, in part, on one's genetic makeup. This suggests that managers should realize that knowledge brokering ability is partly related to salespeople's inherited characteristics and that variation in dopamine activity in the brain, in particular, undergirds at least part of the variability in knowledge brokering behaviors. Important here to mention is the current dogma in genetics that individual genetic variants associated with complex behaviors, such as internal knowledge brokering in a firm, are never sufficient, nor required to produce

specific behaviors. Instead, genes reveal a natural tendency to act in particular ways under specific conditions. This means that selection of employees based on genetic variants should not be emphasized solely or overemphasized. Nevertheless, managers can use the insights that differences in dopamine signaling in the brain underlie specific tendencies to be receptive to learning from training and coaching efforts to improve one's selling skills. Based on the findings in our current study, we would therefore suggest focus on enhancing the cognitive flexibility of salespeople and making sure that their focus is on the long term rather than on following urges for immediate gratification.

Especially regarding the latter, managers should design programs in the light of the findings herein. As incentives have effects on the dopamine system, they could potentially be ideal instruments for making sure that salespeople become more focused on the long-term, rather than on the short-term, success of the sales department. This should enhance their knowledge-brokering skills and outcomes. Indeed, a closer look at the literature on selling new products supports the conclusion that managers should strive to make their salespeople more risk tolerant through coaching (Ahearne, Rapp, Hughes, and Jindal, 2010; Fu, Richards, Douglas, and Jones, 2010). Hence, experimenting with incentive systems to find the right balance for motivating salespersons to promote internal knowledge brokering may prove worthwhile.

**Limitations**

In designing our research, we made several necessary choices that placed some limitations on our findings. First, we conducted this study among salespeople from an executive course. Although this choice helped control for potentially confounding factors, it also limited the generalizability of our results. Replications in the form of, for instance, a field study, would be useful to check the generalizability of our findings.

The absence of objective sales performance measures is another limitation. Additional work on the foundational relationship between salespeople's genetic makeup and internal knowledge brokering should therefore also examine how this link influences objective new product sales performance metrics.

Finally, extra controls could have been included in the analyses to enhance further their robustness. For instance, sales employee innovativeness and external knowledge brokering capabilities could have been included as control variables.

### *Future research*

What impact might our research have on the academic field of sales? As we move to an era of relatively easy and inexpensive methods of detecting biomarkers, such as genetic information or functional magnetic resonance imaging (fMRI)-based research, it is crucial to place emphasis on rigorously defining behavioral phenotypes. An important contribution of this line of research is the new perspective that we have taken in formulating our hypothesis: from the inner person—specifically the dopamine system—to their actual outer behaviors or tendencies. This approach allows us to understand better the motivations and choices of salespeople. It is in contrast to the reverse order of the dominant research paradigm in the literature: from the outside in, using psychological constructs such as intrinsic or extrinsic motivation, measured by questionnaires

alone to explain or predict behavior. To place our study in further perspective, the genetic differences we discovered were associated with phenotypes in what is known as "a healthy population." Whereas most genetic studies to date have been clinical investigations of patients with mental or related problems versus healthy control subjects, our study explored biomarkers to yield insights into the everyday behavior of real sales professionals. It is more difficult to find genetic effects on "normal" people than for clinically impaired individuals that display extremely abnormal behavior when contrasted with normal controls.

Underlying our use of a candidate gene approach is our belief that artificially imposing concepts on biomarkers without a priori formulating a hypothesis as to how these biomarkers influence specific behaviors could jeopardize the validity of findings. Indeed, considering that the human genome consists of over three billion mutation sites, there is ample room for false positive findings (Storey and Tibshirani, 2003). In line with this, we acknowledge the ongoing debate in the scientific literature about the most suitable approach for genetic studies, where both genome-wide association studies (GWAS) and candidate gene studies have advantages and drawbacks (Tabor, Risch, and Myers, 2002). Relevant here is the point that candidate gene studies are traditionally subjected to the criticism that only a few of them have been replicated in subsequent studies (Ioannidis, Tarone, and McLaughlin, 2011; Siontis, Patsopoulos, and Ioannidis, 2010; cf. Ioannidis, 2005). However, multiple reasons suggest that we should not overly criticize or condemn the approach as unreliable and by doing so risk type II errors. For instance, many follow-up studies are typically conducted in different study populations and/or differ in the exact manner by which the phenotype under study is characterized (e.g., Noble, 1998; Palmer and Cookson, 2000). However, above all, the lack of a rigorous characterization of the behavior under study has severely hampered scientists' ability to link genes to complex behavioral traits. To elaborate on this point, it is

highly implausible if not nonsensical to suggest that there is actually a single gene that directly drives complex behaviors such as internal knowledge brokering. This means that genes found in candidate gene studies are most likely driving, or reflecting, underlying constructs that are ecologically valid, such as impulsivity, cognitive flexibility, or stress resilience. To solve this problem, scientists are beginning to recognize the need for studying endophenotypes that reside at lower, less complex levels of analysis, and that are "envisioned to involve fewer genes, fewer interacting levels, and ultimately activation of a single set of neuronal circuits" (Gould and Gottesmann, 2005, p. 115). Therefore, our attempt to study candidate genes in the fields of marketing and sales should be regarded as exploratory efforts aimed at identifying which biological systems are involved. Based upon these issues and our findings, future research should explore specific variants of/and additional candidate genes related to these biological pathways. For example, there are different variants in both *DRD2* and *DRD4* genes that we did not study but which affect specific behaviors and are worth examining (e.g., impulsivity, incentive sensitization; Feldpausch etal., 1998; Oak, Oldenhof, and Van Tol, 2000).

To elucidate further the causal pathways between genes and behavior, future research should use multiple biomarkers from several levels of analysis to gain greater insight into these pathways. Importantly, this means that there should be a biologically plausible pathway connecting genes to the neurological activity in the mind. Whereas genes provide information on the molecular level, reflecting the incorporation of a more coarsely grained orientation, scans of brain activity (e.g., fMRI scans) could provide insight into which brain regions are activated (or not) and under what conditions. This may indirectly contribute to our understanding of what goes on in the minds of salespeople. The emerging applied science of genomic imaging-based sales management can make a critical contribution to the field of selling (and marketing) because such research lends

itself to traditional paper-and-pencil scales, observational studies, as well as studies aimed at finding neurobiological mechanisms (e.g., endocrine, genetic, or fMRI studies).

To conclude, the study of genetics for explaining social behavior in management science is only now emerging. However, it is already an exciting field that will further benefit from technical innovations in DNA sequencing methodologies, which will allow for low-cost and high-throughput data acquisition in the future. Therefore, genetic research introduces an interesting additional set of variables to study, potentially leading to more complete and robust explanations of salesforce behavior and new product adoption.

*Parts of this chapter appeared in:*

Bagozzi, R.P., Verbeke, W.J.M.I., Berg, W.E. van den, Rietdijk, W.J.R., Dietvorst, R.C. & Worm, L. (2012). Genetic and Neurological Foundations of Customer Orientation: Field and Experimental Evidence. *Journal of the Academy of Marketing Science*, 40(5), 639–658.

Verbeke, W.J.M.I., Bagozzi, R.P., Berg, W.E. van den (2014). The Role of Attachment Styles in Regulating the Effects of Dopamine on the Behavior of Salespersons. *Frontiers in Human Neuroscience*, 04 Februari 2014, doi 10.3389/fnhum.2014.00032.

Berg, W.E. van den, Verbeke, W.J.M.I., Bagozzi, R.P., Worm, L., Jong, A., Nijssen, E. (forthcoming). Salespersons as Internal Knowledge Brokers and New Products Selling: Discovering the Link to Genetic Makeup. *Journal of Product Innovation Management*.

# CHAPTER 5

# General Discussion

*"Everybody hates their phone," Jobs says, "and that is not a good thing. And there's an opportunity there." To Jobs' perfectionist eyes, phones are broken. Jobs likes things that are broken. It means he can make something that isn't and sell it to you at a premium price.*

- "The Apple of Your Ear," Time Magazine (2007)

### *Conclusion*

The aim of this thesis was to enhance our understanding of salesforce behavior by using the genetic information of salespersons as an additional variable in the analysis. All research presented in this thesis was conducted among sales professionals operating in a B2B market selling knowledge-intensive products, requiring them to act as true boundary spanners in an effort to successfully build long-term relationships with their customers. The data shows that in such a context, customer-oriented salespersons are more capable of spotting opportunities that help solve their customers' needs. Additionally, we have demonstrated an association between the genetic variants of salespeople and their propensity to engage in customer-oriented selling strategies. Specifically, carriers the *DRD4* 7R variant show higher levels of customer orientation (**Chapter 2** and **Chapter 3**), particularly when they are able to keep to keep a professional social distance between themselves and their customers (**Chapter 3**). Furthermore, salespersons that score higher on an avoidant attachment style and are carriers of the *DRD2* Taq A1 variant show less customer orientation, indicative of at least one contingent on the influence of genetic information and actual behavior (**Chapter 3**). To conclude, carriers of this same genetic variant also seem less active in engaging in internal knowledge activities, which results in a reduced willingness to sell new products (**Chapter 4**).

### *Limitations*

One shortcoming of our research concerns the construct validity of our phenotype measures for CO, SO, the three attachment styles, and the knowledge brokering scale(s). We acknowledge that full analysis of construct validity requires a multi-trait, multi-method matrix investigation to assess convergent and discriminant validity. We did not conduct such a study, but some of the features of our approach suggest that construct validity may not be a significant problem. All our

measures of variables were drawn from scales used before in a number of studies or where either pre-tested and validated prior to conducting the actual study. Thereby, they receive support for validity of measures in different research contexts with different samples. Second, all our measures achieved satisfactory reliabilities, and our factor analyses revealed that convergent and discriminant validity of measures were achieved, albeit with a mono-method approach. Future research could use confirmatory factor analysis in a multi-method design to better establish construct validity (Bagozzi, 2011).

Second, the application of molecular genetics research in organization theory and social research contexts would benefit from Genome Wide Association Studies (GWAS). This could uncover a small number of (novel) fundamental genes at work in the workplace. Regarding our choice for a candidate approach, the following can be noted. First, as recommended by Senior et al. (2011) we selected genes for study that have already received some basic research efforts in areas of psychiatry and psychology relevant to our research. Thus, our inquiry was grounded in a specific, well-defined research tradition where in one sense our findings add to this body of knowledge. Second, GWAS require large sample sizes, because they test for up to one million genetic variants at the same time, introducing severe multiple-testing design and statistical issues, and thus significantly increasing the risk for false-positive findings. Finally, in order to build the large cohort that is required to give enough power for GWAS analyses, one needs to study heterogeneous samples, which in our case would mean studying people across many occupational settings and environments and making it difficult to draw conclusions pertaining to the specific work setting we investigated. Given the limited effect sizes that are typically observed in (candidate) gene studies, this might create too much noise in the sample to be able to arrive at valid genetic effects.

### *Academic implications*

Although we believe that the studies presented in this theses are of the first studies to use biomarkers as research tools to study personal selling (cf. Dietvorst et al. 2009), our research results are not entirely different from those found in the existing literature; rather, they complement previous findings. The field of selling has not incorporated biomarker applications into policies and applications, and their use as novel research tools may provoke more questions than answers at this time. The use of biomarkers raises certain questions. For example, does it mean that people with the *DRD4* 7-repeat polymorphism have a natural advantage to become salespeople; in other words, are they born to sell? Alternatively, should we use genetic screening techniques to select, train, and coach salespeople? Further investigation is required to help better answer these questions.

What impact might our research have on the academic field of sales? As we move to an era of relatively easy and inexpensive methods of detecting biomarkers, such as genetic information or fMRI-based research, it is crucial to place emphasis on rigorously defining behavioral phenotypes. An important contribution of this line of research is the new perspective that we have taken in formulating our hypothesis: from the inner person – specifically the dopamine system – to their actual outer behaviors or tendencies. This approach allows us to better understand the motivations and choices of salespeople. It is in contrast to the reverse order of the dominant research paradigm in the literature: from the outside in, using psychological constructs such as intrinsic or extrinsic motivation, measured by questionnaires alone to explain or predict behavior. To place our study in further perspective: the genetic differences we discovered were associated with phenotypes in what is known as "a healthy population". Whereas most genetic studies to date have been clinical investigations of patients with mental or related problems versus healthy control subjects, our study explored biomarkers to yield insights into the everyday behavior of real sales professionals. It is more

difficult to find genetic effects on 'normal' people than for clinically impaired individuals that display extremely abnormal behavior when contrasted with normal controls.

### *Managerial implications*

**Chapter 2** shows that apparently when salespeople engage in CO to any extent, they tend to interact with customers with less insincere camaraderie or stretch the truth less than do salespeople with SO. They are driven by curiosity to engage in opportunity recognition. Sales managers should select salespeople with these goal orientations in mind. During job interviews and behavioral assessments, managers should explore whether salespeople are really empathetic sellers or merely selfish "tellers." They can deduce CO capabilities by asking candidates how they would approach a problem or from looking at CVs, biographies, hobbies, recommendations, personal statements, and personal interviews. Sales managers should also look at the extent to which salespersons are interested in exploring their industry and new developments within it. Finally, the sales manager must discover whether the salesperson has empathy, as opportunity recognition begins with recognizing the pain and resistance of the customer. Empathy may show up in social behaviors, such as possession of friends, social network, or interest in a coaching position for people who do sports, volunteer work, etc.

Once salespeople are hired, sales managers should allow them to explore new avenues. Since engaging in CO is a risky business and might not always immediately result in generating new or more business, sales managers should also guide their sales staff in two ways. First, they can let salespeople high in CO work together (team selling) with salespeople who are results-driven (which does not necessarily mean being high in SO). Note that salespeople with high CO are probably good team players, as their natural ability to attune with others might help them function well in a peer group of co-workers. Secondly, sales managers

should not micro-manage salespeople high in CO but should allow them to explore new avenues as far as possible (e.g., Bonney and Williams 2009; Stock and Hoyer 2005;) and give them the psychological safety to experiment and take risks (e.g., Edmonson 2002). The salesperson–sales manager interaction should be more like a coaching/ mentoring relationship than a controlling relationship (Pettijohn et al. 2002) to promote the adoption of CO. Coaching is important because too much curiosity could distract a salesperson; it needs to be channeled.

Given the fact that firms want their salespeople to share knowledge, so that the knowledge inherent in the firm can flow to other companies, salespeople high in CO should be given the chance to formally share the knowledge they have gained from customers and the market with their colleagues. Indeed, their experience and ability to signal new trends is of such importance that the firm should consider getting them to help with the development of new products (Ernst et al. 2010). Once again, natural curiosity and opportunity recognition skills may not bring many more or new customers, per se, but they can bring new market insights to the firm. Also noteworthy is the fact that salespeople high in CO might well be good team players who tend not to offend other colleagues working in-house, such as in customer support departments (which is an opportunity for research topic).

An additional side effect of natural curiosity is that inquisitive salespeople might learn faster than their managers (who might be less curious). This might provide a threat to (insecure) sales managers, but it should be seen as an opportunity for the firm. Sales managers would be wise to create platforms (knowledge sharing sessions) in their firm so that they themselves, as well as other colleagues, can assimilate in-house knowledge in the sales group as well as the firm's other departments. In doing so, they might test the future leadership abilities of salespersons high in CO. Note, too, CO rubs off and can promote positive organizational dividends in terms of company morale and esprit de corps.

With respect to selling new products, the data presented in this thesis is important for managers in several ways. To begin with, sales managers should realize that selling new products is a complex activity that benefits substantially from activities of internal knowledge brokering. The same is in fact true for new account development. Indeed, we showed that the two activities are linked in a synergistic way.

Second, our findings suggest that engaging in internal knowledge brokering depends, in part, on one's genetic makeup. This suggests that managers should realize that knowledge brokering ability is partly related to salespeople's inherited characteristics and that variation in dopamine activity in the brain, in particular, undergirds at least part of the variability in knowledge brokering behaviors. Important here to mention is the current dogma in genetics that individual genetic variants associated with complex behaviors, such as internal knowledge brokering in a firm, are never sufficient, nor required to produce specific behaviors. Instead, genes reveal a natural tendency to act in particular ways under specific conditions, and might have more explanatory than predictive power. This means that selection of employees based on genetic variants should not be emphasized solely or overemphasized.

Nevertheless, managers can use the insights that differences in dopamine signaling in the brain underlie specific tendencies to be receptive to learning from training and coaching efforts to improve one's selling skills. Based on the findings in this thesis, we would therefore suggest focus on enhancing the cognitive flexibility of salespeople and making sure that their focus is on the long-term, rather than following urges for immediate gratification.

Especially regarding the latter, managers should design programs in the light of the findings herein. As incentives have effects on the dopamine system, they could potentially be ideal instruments for making sure that salespeople become more focused on the long-term, rather than on short-term, success of the

sales department. This should enhance their knowledge brokering skills and outcomes. Indeed, a closer look at the literature on selling new products supports the conclusion that managers should strive to make their salespeople more risk tolerant through coaching (Ahearne et al. 2010 and Fu et al. 2010). Hence, experimenting with incentive systems to find the right balance for motivating salespersons to promote internal knowledge brokering may prove worthwhile.

### *Suggestions for future research*

Genetic biomarkers are inherited and cannot be changed, by definition. However, biological mechanisms are not rigidly attuned to the roles people actually play in society, as the old *nature* versus *nurture* adage implies. We suggest that people with the *DRD4* gene possess natural curiosity and will engage more easily in opportunity recognition than those without the gene. However, having a proclivity for curiosity does not mean that a salesperson will automatically engage in CO. Effective CO must be learned, and it is trainable (e.g., salespeople can learn to ask appropriate questions and engage customers strategically in sales conversations, study their industry environment). By nature, curious people may learn more easily and adopt CO, as they are driven to learn and hone their skills to achieve rewards.

It should be noted that the *DRD4* gene is known to be associated with ADHD and is found in overly creative and easily distracted people (e.g., Hartmann and Palladino 2004). It is possible that some salespeople might become too curious or enamored with novelty seeking and therefore be less likely to close a deal—which might explain why some salespeople fail to get results (e.g., Franke and Park 2006, p. 694). However, the salespeople in our sample with the *DRD4* gene and its 7R variant scored high on CO and thus by implication (and in accordance with the findings in Study 1) should exhibit greater opportunity recognition. In a sense, the ability to cope with potentially dysfunctional abilities

is a key factor in selling. If we are to understand in depth how CO operates, we should also study how salespeople with high CO are managed; it seems that salespeople high in CO may require a particular supportive environment (i.e., one not overly short-term oriented) in which they can perform unhindered so as to meet specific performance expectations.

To further elucidate the causal pathways between genes and behavior, future research should use multiple biomarkers from several levels of analysis to gain greater insight into these pathways. Importantly, this means that there should be a biologically plausible pathway connecting genes to the neurological activity in the mind. Whereas genes provide information on the molecular level, reflecting the incorporation of a more coarsely grained orientation, scans of brain activity (e.g. fMRI scans) could provide insight into which brain regions are activated (or not) and under what conditions. This may indirectly contribute to our understanding of what goes on in the minds of salespeople. The emerging applied science of genomic imaging-based sales management can make a critical contribution to the field of selling (and marketing) because such research lends itself to traditional paper-and-pencil scales, observational studies, as well as studies aimed at finding neurobiological mechanisms (e.g., endocrine, genetic, or fMRI studies).

To conclude, the study of genetics for explaining social behavior in management science is only now emerging. However, it is already an exciting field that will further benefit from technical innovations in DNA sequencing methodologies, which will allow for low-cost and high-throughput data acquisition in the future. Therefore, genetic research introduces an interesting additional set of variables to study, potentially leading to more complete and robust explanations of sales force behavior and new product adoption.

As such our research paves the way perhaps for future discoveries. It would be productive to study different phenomena in organization behavior such

as job attitudes and motivation, and explore the role of genetics in combination with environmental factors (e.g., Song, et al., 2011). Such approaches are challenging, but they might provide us with more insights into the concepts under study and their effects, which we exemplified in this study. Such insights also allow human resource managers to uncover what biological mechanisms are related to the (higher order) concepts they regularly use.

Much remains to be done concerning our understanding of the role of genetic factors in organizational behavior. For example, more work is needed into how key genetic variables inter-relate with personality and situational constraints to influence behavior and outcomes. The pursuit of such ends promises to help us understand the "why" of behavior in organizations and provide policy insights.

Elaborating on the study presented in this thesis, we note that sales representatives do not always work alone but often in teams. Would sales teams with people who possess heterogeneous attachment styles function better than those with homogeneous styles? Such teams might contain people who seek psychological comfort (those with anxious attachment styles), sense competitive signals (those with anxious and avoidant attachment styles), and also effectively implement interpersonal-change actions (especially those with avoidant attachment styles). As we studied the effects of attachment styles in interaction with genes, such questions are both difficult to ask and difficult to answer.

In terms of task-person fit, what attachment style should is most beneficial for managers who supervise sales representatives with diverse attachment styles? Will managers with secure attachment styles, because they are perceived as open and trusting, attain better results, and can they bring both secure and insecure sales representatives together because they are inclined to promote cooperation, hence enhancing group or team formation and flexibility? Or could it be that managers with avoidant attachment styles empower their sales representatives because they do not seek unneeded or excessive closeness? Note that our findings showed that

attachment styles interacted only with specific genes to influence customer orientations. Holders of other genes might require different leadership strategies or better-fit tasks other than boundary spanning roles.

Finally, attachment styles and people's genetic profile are stable and so tend to evoke automatic reactions or predictable tendencies in particular situations. Future research should study how sales representatives self-regulate such automatic tendencies and shape them into productive work orientations. For example, should firms make attachment styles part of awareness training? If attachment styles interact with genetic abilities, would such knowledge make sales representatives self-conscious of their genetic backgrounds? Our findings invite researchers to explore the consequences of deeper, unconscious biological processes that shape human behavior in diverse organizational contexts.

Genetic data and measures of attachment style, if employed sensitively and ethically to hiring, training, and supervisory decisions along with other information, can provide more valid and fair criteria for management than reliance only on background information, interviews, and psychological tests. Of course any use of such information must be based on validation of their effects on performances within any particular context, if Equal Employment Opportunity Commission Regulations and anti-discriminatory policies are to be fulfilled.

*I learned from Popper what for me is the essence of scientific investigation – how to be speculative and imaginative in the creation of hypotheses, and then to challenge them with the utmost rigor, both by utilizing all existing knowledge and by mounting the most searching experimental attacks. In fact I learned from him even to rejoice the refutation of a cherished hypothesis, because that, too, is a scientific achievement and because much has been learned by the refutation.*

- John C. Eccles (1903-1997)

# Summary in English

This thesis aims to increase our understanding of the biological and neural mechanisms that drive salesforce behavior. By gaining insights in the biological correlates underlying salesperson-customer interaction, we hope to empower sales professionals to understand and manage themselves more effectively. Also, the results presented in this thesis should help managers, HR professionals and policy makers to develop better coaching, training and support programs helping sales professionals develop to their fullest potential. Lastly, from an academic perspective, we hope to advance the ongoing debate on how to utilize the recent advancements in our understanding of the human brain in the social sciences in general, and find possible research strategies to incorporate genetic associations studies in a sales context more specifically.

Central to this thesis is the continuously developing role of the contemporary salesperson. Coming from transaction-based selling and passing through an era of using consultative selling sales strategies, recent studies suggest an emerging role for salespeople as knowledge brokers. Indeed, salespeople are crucial in linking different parties both within and outside their firm, creating a flow of knowledge between different members of the network. In line with this, salespeople should be able to shift their strategies from a short-term focus on the (immediate) sale, to a more long-term and customer centered approach aimed at opportunity identification. **Chapter 2** elaborates on this topic by exploring the genetic underpinnings of customer orientation (as opposed to a sales-oriented approach). In short, customer-oriented salespeople establish long-term reciprocal relationships with their customers. In contrast, a sales-oriented approach refers to a strategy with a clear intention to make the immediate sale by convincing customers "to buy, even if I [salesperson] think it is more than a wise customer

would buy". In this chapter, *Study 1* explores the conceptual and practical implications of customer orientation (versus sales orientation), demonstrating that it entails a greater recognition of opportunities as the foundation for successful long-term salesperson-customer relationships. To achieve this, salespersons need to seek sources of industry-related knowledge, learn from customers and try to understand the different perspectives of buying center members. They can do so by engaging into a reciprocal exchange of knowledge with the customer such that the customer will discuss their needs with them. Building on that, *Study 2* tries to find explanations as to why some salespeople tend to develop a customer-oriented sales strategy by nature. The results demonstrate that salespeople with CO are more likely to have the 7R variant of the *DRD4* gene, a gene previously associated with novelty seeking, reward functioning in the brain and risk-taking. We interpret these findings such that these salespeople are curious, seek novelty, and are intrinsically motivated to gather new ideas from their customers. Finally, when weighing costs against benefits in targeting customers' problems with potential commercially viable solutions, this finding might in indicate that customer-oriented salespeople are less sensitive to the risks involved in this process.

In **Chapter 3** (*Study 1)* we continue this line of research by replicating the genetic association between customer orientation and the 7R variant of the *DRD4* gene found in Chapter 2. A replication of a genetic association in an independent study population is regarded as the golden standard for scientific evidence. In the subsequent study (*Study 2*) we draw upon recent research in molecular genetics and biological/psychological attachment theory to shed light on possible developmental factors that contribute to becoming a customer-oriented salesperson. The findings show that attachment styles regulate the effect of *DRD4* on CO, such that greater avoidant attachment styles lead to higher CO for persons with the 7R variant but not other variants. No effects were found on a sales orientated approach, and secure and anxious attachment styles did not function as

moderators. Furthermore, this study reveals that carriers of the A2/A2 variant of the *DRD2* gene – a gene previously indicated to be associated with addiction and cognitive inflexibility – also benefit from a greater avoidant attachment style, thus leading to higher customer orientation compared to carriers of the A1/A2 or A1/A1 variant. In an effort to elucidate the interplay of *nature* and *nurture* on the etiology of a specific sales orientation, we observe that an avoidant attachment style has a positive effect on customer orientation. People with this attachment style have been shown to exhibit an orientation of emotional distance, yet a high degree of self-reliance. This fits expectations in inter-firm business relationships. However, whether, and to what extent, the avoidant style will influence customer orientation apparently depends on the functioning of the dopamine system with regard to goal-directed, motivation, and reward-related behavior.

Finally, **Chapter 4** focuses on the role of the salesforce in the development and commercialization of new products. In this chapter, we develop and empirically validate the concept of internal knowledge brokering behavior of salespeople and its effect on selling new products and developing new business. Salespeople need to help customers link new products with their specific needs, and explain usefulness of these new products convincingly. Second, successful salespersons transfer and then discuss their acquired knowledge about customer cognitions and preferences as well as market dynamics to fellow sales colleagues and colleagues from other departments internal to the firm. By doing so, these actors too can benefit form the information and enhance there business (process) decisions. Building on a solid theoretical perspective on knowledge brokering regarding the sale of new products, we develop a scale gauging internal knowledge brokering behavior for selling new products. Then, we test the association between the two previously studied genetic variants, the *DRD4* 7R and the *DRD2* A1. The findings reveal that salespeople with the *DRD2* A1 gene variant engage at significant lower levels of internal knowledge brokering

behavior than salespeople without this gene variant, and as a result are less likely to engage effectively in new product selling. The *DRD2* A1 gene variant is associated with impulsiveness, impaired social functioning, and a short-term orientation. This finding suggests that these traits underlie knowledge brokering behavior and drive the product innovation process. The *DRD4* gene had no effect on internal knowledge brokering.

**Chapter 5** summarizes the insights from the previous chapters and discusses the academic, and managerial implications as well as suggestions for future research. The results presented in this thesis suggest that salespeople should make an active effort to spot novel opportunities to help solve customer's needs. To build a long-term, valuable relationship with their customers, they will be most effective by taking a self-reliant and curious approach. Given that some of these insights are derived from biomarkers routed in the fields of neuroscience and genetics, I would strongly suggest future researchers to continue using biomarkers in future studies in the social sciences. By doing so, they can utilize the additional information derived from biomarkers to triangulate and build convergent evidence into our models to better understand salesforce behavior.

# Nederlandse samenvatting

Dit proefschrift gebruikt genetische associatie studies om inzicht te krijgen in de biologische en neurologische processen die ten grondslag liggen aan succesvolle klant-verkoper relaties. Om succesvol te zijn in de huidige kenniseconomie - waarin kennisontwikkeling cruciaal is voor het creëren van waarde voor de klant - moet de moderne sales professional zich opstellen als een kennishandelaar. Hiervoor zullen sales professionals hun korte-termijn verkoop strategieën in moeten ruilen voor een lange-termijn en klantgerichte aanpak gericht op het (strategisch) uitdagen van de klant, co-creatie en het *spotten* van latente behoeftes.

De resultaten in dit proefschrift suggereren dat het dopamine systeem in de hersenen een belangrijke rol speelt in de manier waarop sales professionals klanten benaderen. Succesvolle sales professionals gaan actief op zoek naar nieuwe kansen bij de klant, zijn cognitief flexibel en meten zich een zelfstandige en nieuwsgierige houding aan. Hierdoor zijn ze in staat om kansen in de markt sneller op te merken en nieuwe kennis beter in hun netwerk (binnen en buiten de onderneming) te verspreiden.

De inzichten in dit proefschrift geven sales professionals meer inzicht in zichzelf waardoor ze zichzelf beter kunnen managen. Daarnaast ondersteunen de resultaten in dit proefschrift managers, HR-professionals en beleidsmakers in het ontwikkelen van coaching-, trainings- en ondersteuningsprogramma's voor sales professionals die zichzelf optimaal willen ontwikkelen. Ten slotte, vanuit een academisch perspectief, blijkt dat genetische studies succesvol zijn om het gedrag van de salesforce beter te begrijpen en additioneel convergerend bewijs te verzamelen over succesvolle verkoop oriëntaties.

# Appendix 1: The human brain

## 1. Introduction

With a weight of only 1350 grams, the brain is considered to be the most complex, sophisticated and efficiently built machine ever known. For the 100 billion neurons within the brain to function, it requires only the power level of a 60-watt light bulb. Shaped by an exceptionally long history of adaptive evolutionary forces, the brain was designed to maximize reproductive fitness.

The most remarkable feature of the brain is its ability to optimize its performance to ever-changing circumstances. It may seem that some parts of the brain are indeed highly pre-programmed to allow for processing of sensory input, motor control, and natural responses (Rakic 1998). However recent literature reveals plasticity mechanisms capable of altering the constitution of the brain beyond genetic predetermination.

While details are still being worked out, somehow these alterations encode our experiences. However, we also know that our memory is fallible and it is certainly not always literal. Does this mean that information storage by the brain is not as sophisticated as we think? The brain receives inputs from several sensory systems of the body, and stores the information accordingly. In that sense, memory is a reconstruction of facts and experiences on the basis of the way they were stored, not necessarily as they actually occurred (Schacter 1999).

It is considered to be one of the biggest challenges neuro-scientists face at present, and progress is only made slowly, but step-by-step we are getting closer to unraveling the neural representation of a memory: how information is encoded by the brain.

## 2. How is the brain designed?

Every vertebrate brain can be divided into three broad zones: the hindbrain, midbrain, and forebrain. The forebrain is related to purposeful, voluntary behavior and is considered to play a role in problem solving. The midbrain is involved in maintaining wakefulness and processing visual and auditory reflexes, whereas the hindbrain controls the basic functions which are needed for staying alive, such as breathing and maintaining a heart beat. When comparing a mammalian brain to any other vertebrate brain, the expanded cortex in the mammalian brain (which is part of the forebrain) immediately stands out. Among mammals, humans have the most differentiated cortex, and within the cortex our neocortex allows for many of our higher mental functions.

The brain consists of several interconnected systems that each play their role in cognitive, emotional, and bodily functions. Of special interest is the limbic system, which is the region that forms the border (limbus *in latin)* of the inner cortex. This area, consisting of among others the amygdala, hippocampus, thalamus, and hypothalamus, is responsible for emotional processing, behavior, and long-term memory. Besides its role as a storage mechanism, the limbic system has a regulatory function since it has connections to the endocrine system (hormones) and the autonomic nervous system (digestion, respiration).

Within the limbic system, the hippocampus and amygdala are the main structures related to memory formation. The hippocampus plays an important role in long-term memory and spatial navigation. Specifically episodic memory, defined as the memory for facts and events, and declarative memory, memories that can be explicitly verbalized, are mediated by the hippocampus. Impairment in hippcoampal function also results in the inability to transfer information from working memory to the long-term memory capabilities of the hippocampus and cortex.

The amygdala has been identified as the main system in the processing and memory of fear and emotions. It has projections to several areas in the brain responsible for immediate somatic responses to emotional events (fight or flight). It is also interconnected with the hippocampus providing contextual information to these emotional memories.

As all organs and tissues of the body, the brain is made up of cells; neurons and glia. Neurons are responsible for the communication, whereas glial cells have been thought to play a primarily supportive role (however, see Filosa et al. 2009) for more recent data concerning glial-neuronal communication). Groups of neurons form nuclei and these nuclei form the systems described above. About one million kilometers of interconnected fibers form the infrastructure by which neurons are able to communicate. Neurons, about 100 billion (1011) in total, have the unique ability to exchange information directly from one to another. One neuron is connected to multiple others, just as it will receive input from different neurons (around 10.000 inputs per neuron). Neurons are packed closely together, about 105 per mm3 of brain. Their average diameter is 10 μm, with a surface area of 250.000 μm2. Neurons have a conduction speed of about 10 m/s, allowing intra-neuronal electrical signals to travel fast in typical biological time-scales, albeit quite slow compared to the processing speed of modern microelectronics devices. In order to communicate, neurons consist of several dendrites (the information 'receiving antennas'), a cell body (the biological workshop for the processes within the neuron), and a single axon (information 'sending antenna').

The electrical signals in an axon have an all-or-nothing character. Based on the strength of the incoming message, each neuron individually determines if the message should be passed on to the next. If the input is too small, the neuron will not continue to pass on the electrical signal. This means that the relay stops here. Otherwise, the signal continues and could eventually initiate an outcome, such as muscle movement or memory formation. As mentioned earlier, neurons

receive inputs from multiple others. When occurring simultaneously, several weak inputs might add up to a potential strong enough to excite the next neuron. This is called convergence; information from several systems in the brain can be integrated into a single signal. On the output side, though neurons usually have only one axon, this axon branches several times before it ends. This allows a single neuron to excite several others. This is called divergence, allowing for quick distribution of information signals.

Communication within the brain is not all about *excitation* of the next neuron. Within local systems, *inhibitory* interneurons play an important role in modifying the information relay. These neurons counterbalance the excitatory outputs of other neurons, allowing for complex feed-forward inhibition and excitation loops.

At an inter-neuronal level, communication occurs most commonly through chemical signals, as the vast majority of neurons are not connected physically (however, gap junctions are present in the mammalian nervous system which permits rapid and direct current flow between physically-connected neurons). Principal inputs and outputs to a neuron are most often via synapses, located on axon terminals (pre-synaptic) and dendritic branches (post-synaptic). In total, there are approximately one quadrillion ($10^{15}$) synapses, packed together on an average of 109 per mm3 of the brain. The axon of the sending neuron (the pre-synaptic neuron) sends information received at its dendrites, through to its cell body (soma) and along its axon to the nerve terminals. Synapses bridge the 40 nm gap between neurons, the synaptic cleft, leading to a conduction delay (across a synapse) of 5ms.

Synapses play an important role in determining the immensely plastic capabilities of the brain. New connections form repeatedly, just as unused connections are eliminated. This physiological plasticity is accompanied by axon branching and new synapse formation both during development and following

learning (Martin & Kandell 1996) allowing for experiences and memory to find their way into our biological self.

After formation, frequently used synapses are also strengthened, both time-limited and more permanently. These synapses become more prone to pre-synaptic signals, increasing the likelihood to become excited. Time-limited, or short-term synaptic strengthening, is rapidly induced by a potentiation of the neuron. It represents only a functional change: signals are being sent and received more efficiently. In more stable or late-phase synaptic strengthening, synapses undergo physical changes, which depends on protein synthesis. This type of change requires more time and is also less easily induced; multiple potentiations within a short time frame are required (see **figure 4**).

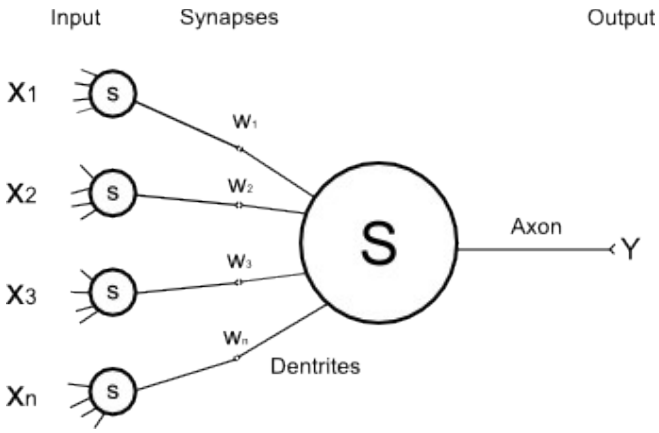



**Figure 4.** Schematic representation of a convergent neuronal organisation, where the input signals Xj are multiplied by the corresponding synaptic weights *Wj* to determine the binary "all or nothing" output signal (first proposed by McCulloch and Pitts (1943)).

To summarize, the brain represents an interconnected neural circuit of several systems which each have their own functions. Communication occurs through electrical signals carried by neurons, which have specific transmission properties. These neuronal-transmission properties are altered due to experience, among others by the formation and elimination of synaptic connections. Taken together,

a) the immense number of neurons, b) forming even more synaptic connections, and c) the plasticity of the weight of every individual synapse, determine the almost endless amount of differentiated patterns of connections that can be stored in the brain.

**3. What does the brain do exceptionally well?**

Neuro-biologists, as well as psychologists, psychiatrists, and philosophers, have long debated about the influence of nature (genetic predispositions) as opposed to nurture (experience) on development and behavior. Currently, scientists generally reject the notion that at birth, the brain is blank slate (tubula *rasa),* or that genes determine everything. However, some complex capabilities of the brain are so efficiently acquired and effortlessly utilized that they can almost be considered an innate quality.

Most humans are particularly skilled extracting meaningful patters from complex stimuli. As an example, consider face recognition. Multiple inputs need to be integrated and stored in such a way that it is easily accessible. To make it even more complex, all faces have essentially the same anatomical make-up – they look remarkably similar. Humans seem to have developed a very effective solution for this, though its underlying neural correlates are not yet fully understood.

Differentiation between subtle differences in spatial relations between facial features (eyes, nose, mouth) could therefore be the underlying memory formation mechanism. However, we do know that faces are processed holistically – as a whole – rather than as a collection of individual face features (Richler et al., 2009). This actually makes sense, since a face is effortlessly recognized; even in a crowd and even when you are not expecting to see a person at a given moment or location. In addition, consider the fact that caricatures are easily correctly

connected to person A, while in reality another individual (B), who would never be mistaken for person A, usually looks more like person A than that caricature.

In a recent study, single neurons were found to be selectively activated by strikingly different pictures of given individuals and in some cases even letter strings with their names, suggesting that some neurons might encode an abstract representation of an individual (Quiroga et al. 2005). These neurons might represent the downstream endpoint of the integration of multiple inputs, resulting from the convergent organization of that neuronal network.

Indeed, the brain is extremely capable of identifying faces with great ease, while the psychic process that produces the experience of face recognition cannot be consciously described.

The rapid acquisition of language is also an exceptional quality of the brain. The essence of language is, as Chomsky (1959) pointed out, its infinity. We are able to create new sentences of any possible length, expressions never before imagined by another brain, and engage in conversations of which the outcome could never have been anticipated upon before hand. Even still, our brains will always be able to follow. Finding words and setting up sentences does not require conscious effort – at least, in a person's native language.

Besides our ability to handle with complex input stimuli, the brain is also responsible for complex output signals such as speech production and motor coordination.

Imagine a tennis player that needs to respond to a ball that bounced right on the chalk, changing its speed and direction. Here again, there is no time for the brain to consciously calculate the exact difference in the course of the ball. The body just responds, with speed and precision. In fact, a frequently used training technique within professional sports to achieve mastery over the 'perfect movement' (let it be a penalty kick in soccer or a free-throw in basketball) is to stop trying to consciously interfere with what the body is doing. Make the

movement, and evaluate it afterwards. If an adjustment is needed, don't try to consciously alter your movement or even to address specific muscles, but just 'tell' the body that the ball should go more to the right. This way the player takes advantage of the brain's capabilities to coordinate muscle movement unconsciously in an exceptional manner.

**4. Where does the brain fall short?**

Besides the aforementioned unmatched qualities of the human brain, there are some operations for which the human brain performs relatively poorly compared to e.g. computers.

On the input side, this includes the encoding of facts and figures for organized and accurate retrieval. Where information storage capabilities are improving rapidly on computers, the brain seems to fall short compared to the enormous amounts of data that can be stored on even a simple NAND flash memory chip. Also, accurate retrieval is much better by modern computing devices, compared to the brain. As mentioned earlier, the brain is under continuous influence of the environment, and is continuously changing. As a result, memory retrieval is always done by a brain that is different from the one that stored the information in the first place. This might account for some of the differences that occur when the human brain retrieves information.

Also, the brain is not very good at explicit structured processing of information, such as doing mathematical calculations. We all experience difficulty when explicitly trying to calculate the mathematical properties of a complex differential equation, whereas a computer is able to do this quite rapidly. The processing power of the brain to explicitly perform mathematical computations lags far behind that of even the most simple digital calculator.

## 5. Conclusions

Taken together, experience-dependent plasticity has emerged as the dominant theme regarding how information is stored within the brain. It allows for biological encoding of an almost endless amount of different memory traces due to its immense supply of synaptic connections. Neuronal competition plays an important role in memory formation, however, we are only beginning to understand which specific neurons are recruited for a memory trace and why.

It seems that evolutionary forces have endowed our brain with consciousness, allowing us to reflect upon our own actions and experiences. This did, however, come at the expense of lower processing power, exemplified when we perform explicit, conscious tasks such as mathematical calculations or in attempting the organized retrieval of facts. We have yet to discover the specific neurological underpinnings of a memory. However, modern neuroscience, together with genetics and microelectronics driven advances in biological techniques are together providing novel opportunities for understanding the fascinating mechanisms underlying human brain function.

# Appendix 2: The dopamine system

The brain's dopamine system is complex. It includes various nuclei mainly involved in processing rewards, but also in cognitive and behavioral flexibility. The dopaminergic system forms a feedback loop around the nucleus accumbens (NAc) and the ventral tegmental area (VTA), which has an internal pacemaker potential maintaining an irregular, tonic-firing pattern. Additionally, the NAc receives input from the hippocampus, providing context and directing focus on tasks; the amygdala, mediating emotional salience; and the prefrontal cortex, enabling behavioral flexibility (Grace et al. 2007). When stimulated by rewards or learning about unexpected stimuli, dopaminergic activity in the VTA and subsequently the NAc has the potential to drive behavior. In short, the complexity of the system can be seen in efforts to attain flexible goal orientation, where humans have to manage the constant flow of novel and distracting stimuli through a valence threshold above which information must pass before it can be admitted to working memory and be processed in the prefrontal cortex (Savitz, Solms, and Ramesar, 2006). The presence of important often reward-based information then allows the prefrontal cortex network to respond to this information by updating the working memory system (Weinberger et al. 2001). Transitions are modulated through a well-balanced homeostatic process, heavily influenced by the different subtypes of dopamine receptors in the brain.

# Appendix 3: Procedure for DNA analysis

**DNA acquisition**

We followed recommended practice to gather DNA data. All genotyping was performed blind to demographic and clinical data (i.e., to hypotheses). DNA from saliva was collected using the Oragene DNA Self-Collection Kit (DNA Genotek, Ottawa, Ontario, Canada) and purified from 500-$\mu$l aliquots using the ethanol precipitation protocol as described by the manufacturer. Purified DNA was dissolved in 100-$\mu$l of TE buffer [10 mM Tris-HCl, 1 mM ethylenediaminetetraacetic acid (EDTA), pH 8.0].

***DRD2*/Taq1** - *DRD2*/Taq1 (rs1800497 (C/T) genotyping was performed using TaqMan® kits (Applied BioSystems, Foster City, CA), following the manufacturer's protocols. The *DRD2* genotype was assessed as an additive trait in the analysis; this refers to the presence of a T-allele (A1/A1 or A1/A2) =1, No T-allele (A2/A2)=0.

***DRD4* VNTR** - The VNTR polymorphism in exon 3 of the *DRD4* gene was amplified using primers D4-F- GCGACTACGTGGTCTACTCG and D4-R-AGGACCCTCATGGCCTTG. Reactions were performed in a 384-wells format in a total reaction volume of 10 ul containing 10 ng DNA, 1 pmol/ul of each primer, 0,4 mM dNTPs, 1 M betaine, 1x GC buffer I (Takara Bio Inc.) and 0,5 U/ul LA Taq (Takara Bio Inc.). PCR cycling consisted of initial denaturation of 1 min at 94° C, and 34 cycles with denaturation of 30 seconds at 95°C, annealing of 30 seconds at 58°C and extension of 1 minute at 72°C. PCR fragments were size-separated on the Labchip GX (Caliper Life sciences) using a HT DNA 5K chip (Caliper Life sciences). The number of *DRD4* repeats was determined using the

size of the PCR-fragments. To assure genotyping accuracy 10 random samples were genotyped for a second time. No discrepancies were found. The *DRD4* genotype was also assessed as an additive trait in the analysis; 7R absence=0, presence of at least a 7R=1.

**Hardy-Weinberg Equilibrium**

The genotype distribution was tested against expected genotype frequencies according to the Hardy-Weinberg Equilibrium (HWE) model. This law states that there is a simple relationship between the allele frequencies and the genotype frequencies (Guo & Thompson, 1992). The genotypes in our population were in agreement with the Hardy-Weinberg proportions.

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Wouter E. van den Berg (1985) obtained his master's degree in Business Economics (2008; cum laude) and his master's degree in Neuroscience (2010; cum laude) at the Erasmus University Rotterdam. As a first recognition for his ability to build bridges between different academic fields he received an honorable distinction for the Professor Lambers Prize in 2010, which is awarded to the best student who obtained two master's degrees annually. He started as a PhD candidate in the marketing department at the Erasmus School of Economics in 2008. During his PhD, Wouter has been an advocate of inter-departmental collaboration, actively bridging the fields of behavioral economics, marketing, sales, neuroscience, endocrinology and (molecular) psychiatry in his research projects. His research projects were rewarded with funding by funding comities both internal and external of the Erasmus University Rotterdam. Furthermore, part of his work has been published in the Journal of Management and the Journal of the Academy of Marketing Science, and was awarded with the Sheth Foundation Best Paper Award for volume 40 (2012). Finally, Wouter has always made it a priority to turn (academic) knowledge into action, translating recent scientific findings towards practically relevant information for professionals in the field. In order to do so, he teaches 'The Biology of Sales Performance' at the Institute for Sales & Account Management and co-founded InsightYou, an institute that aims to help people to grow professionally leveraging the latest scientific insights and their own biomarkers.

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**UNDERSTANDING SALESFORCE BEHAVIOR USING GENETIC ASSOCIATION STUDIES**

Using genetic association studies, this thesis aims to investigate the drivers of successful customer-salesperson interactions in a context where knowledge development has become crucial to the value creation process. Central to this thesis is the developing role of the contemporary sales professional. Coming from transaction-based selling and passing through an era of consultative selling sales strategies, we observe an emerging role for sales professionals as knowledge brokers. Indeed, sales professionals are crucial in linking different parties both within and outside their firm, creating a flow of knowledge between different members of the network. In line with this, sales professionals should be able to shift their strategies from a short-term focus on the (immediate) sale, to a more long-term and customer-centered approach aimed on opportunity identification.

The results presented in this thesis suggest that some sales professionals have an innate tendency to make an active effort to spot novel opportunities to help solve customers' needs. To build long-term, valuable relationships with their customers, they will be most effective if they take a self-reliant and curious approach.

By gaining insights in the *nature* and *nurture* associated with successful customer-salesperson interactions, we empower sales professionals to understand and manage themselves more effectively. Also, these insights should help managers, HR professionals and policy makers to develop better coaching, training and support programs helping sales professionals develop to their fullest potential. Lastly, we hope to advance the ongoing scientific debate on how to utilize the recent advances in genetic association studies in a sales context.

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Design & layout: B&T Ontwerp en advies (www.b-en-t.nl) Print: Haveka (www.haveka.nl)