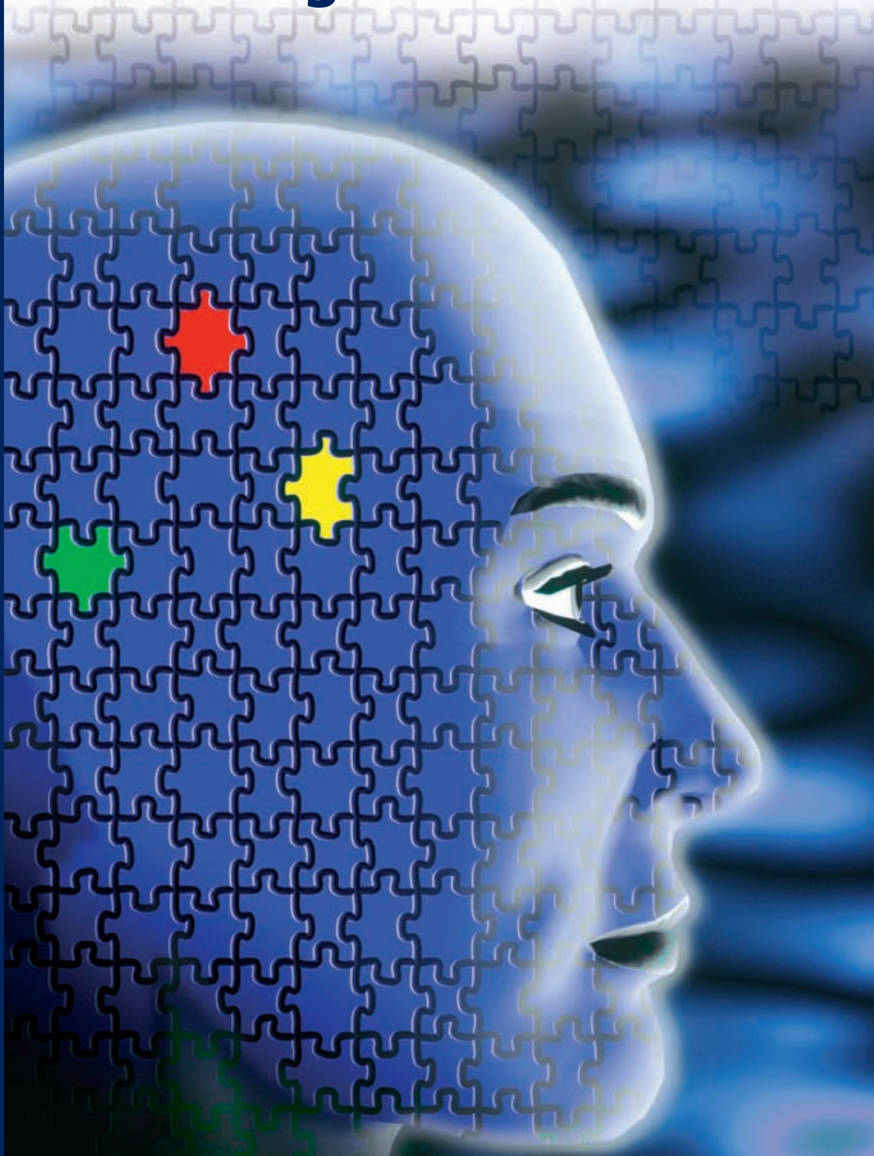
NIEK ALTHUIZEN

Analogical Reasoning as a Decision Support Principle for Weakly-Structured Marketing Problems



Analogical Reasoning as a Decision Support Principle for Weakly-Structured Marketing Problems

Analogical Reasoning as a Decision Support Principle for Weakly-Structured Marketing Problems

Analoog Redeneren als Basis voor het Ondersteunen van Beslissingen voor Zwak-Gestructureerde Marketing Problemen

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The reason to be, for everyone, is to get the most out of yourself, whatever that may be.
("het is noodzakelijk dat iedereen er is om het meeste uit zichzelf te halen wat dat dan ook mag zijn")

Johan Cruijff

This quote from Johan Cruijff continues a custom that started in 1999 when I wrote a foreword for my master thesis under Peeter Verlegh's supervision at Wageningen University. This master thesis, the Unilever Research Award I received for it (together with Thijs Vroegh), and the enthusiasm of Peeter Verlegh for doing marketing research, inspired me to apply for a PhD position in Marketing at the Erasmus Research Institute of Management (ERIM) in Rotterdam.
Several years of hard work are now reflected in this dissertation. In reference to the great Philosopher of Dutch soccer quoted above: I did my best, but I could not have done it without the help of other people. Since scientific research is about imposing structure on the chaos of every day life, I will try to classify the people that I owe a warm and sincere "thank you" into a number of cohesive groups.

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Table of Contents

Part III Conlusions & Discussion

Chapter 8 Main Findings, Conclusions, and Discussion

List of Tables

List of Figures

List of Appendices

List of Frequently Used Abbreviations

AI	= Artificial Intelligence
CBR	= Case-Based Reasoning
FMCG	= Fast-Moving Consumer Goods
MMSS(s)	= Marketing Management Support System(s)
SP	= Sales Promotion

Chapter 1

Introduction

"With recent developments in our understanding of heuristic processes and their simulation by digital computers, the way is open to deal scientifically with ill-structured problems – to make the computer coextensive with the human mind."

(Simon and Newell, 1958)

1.1 General Motivation

The above-mentioned quote from 1958 suggests that by now, i.e., in 2006, decision making should have become quite easy as a result of the developments in computer and information technology (IT). However, we cannot deny the fact that in many day-to-day situations managers still solely base their decisions on intuition, gut feeling, subjective judgment, hunches, and heuristics.

As the influential work on human judgment and decision making[1] by psychologist, and Nobel Prize winner in Economics, Kahneman and Tversky has shown, human decision making can be subject to numerous biases which may lead to poor decision performance. As opposed to what economic theory predicts, people often fail to make fully rational decisions. Instead, under conditions of uncertainty and complexity, people tend to rely on heuristics[2], i.e., they use short-cuts rather than rational analysis. Having to cope with limited brain capacity (or "bounded rationality"), emotions, (time) pressure, different stakeholders, and incomplete information, managerial decision making is often not perfectly rational and subject to biases. To simplify judgmental operations managers often base their decisions on heuristics, such as the availability of data and information, representativeness and anchoring and adjustment procedures (see Tversky and Kahneman, 1974), which may result in non-optimal choices. The availability of analytical models and computers can remove these biases and inconsistencies from the human decision-making process. Computers and models have the advantage over humans that they are unbiased, consistently integrate (loads of) data, do not get tired, bored or emotional, do not suffer from overconfidence and are immune to social pressures (Blattberg and Hoch, 1990).

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[1] In this dissertation, we will use the terms "decision making" and "problem solving" interchangeably. That is, with decision making we not only refer to the final choice among alternative courses of action, but to the whole range of activities from detecting the occasions for decision (i.e., identifying problems), developing courses of action (i.e., finding solutions to problems), elaborating on courses of action (i.e., evaluating solutions), to making a final choice (i.e., choosing the best possible solution) (Simon, 1960).

[2] The term "heuristic" was first coined by Polya (1957) in his book "How to Solve It".

This, however, only solves part of the problems. Not all problems come with complete data and knowledge which makes them amenable to the rational, modeling approach. Hence, in spite of the recent data-explosion and rapid advancements in modeling and information technology, many complex or ill-structured problems cannot (yet) be supported by (computer) decision models. Although Kahneman in his work demonstrated the fallibility of intuitive, heuristic decision making, he acknowledged that in many instances "intuitive thinking can also be powerful and accurate" (Kahneman, 2003, p. 699). Expert judgment and intuition have specific merits that are difficult to capture in a (computer) model. For instance, experts have the ability to interpret and recognize highly diagnostic, abnormal cues (so-called "broken leg" cues), they are more flexible, they are able to diagnose (in addition to models, which can only predict), and they are more proficient at attribute valuation for variables that are difficult to measure objectively (Blattberg and Hoch, 1990). Not to mention other unique human capabilities, such as self-consciousness, emotions, learning, and creativity. Hence, for complex, weakly- or ill-structured managerial problems, which are difficult to capture in an analytical model, there is much value in heuristic, expert decision making. Applying heuristics to complex, ill-structured decisions can be more efficient and effective than using imperfect and incomplete (computer) models (see, for instance, Chakravarti, Mitchell and Staelin, 1979; Åstebro and Elhedhli, 2006).

The other Nobel Prize Laureate in Economics with a bend toward psychology, the late Simon (†2001), was one of the first to recognize the huge potential of simulating heuristic decision making by computers for solving complex, weakly-structured problems (e.g., Simon and Newell, 1958). Hence, Simon devoted much of his later work to the idea that human problem solving could be perfectly simulated by building computer models of human cognition (e.g., Newell and Simon, 1961). In doing so, he became one of the founders of the field of Artificial Intelligence (AI) (to which he initially referred as "complex information processing"). For over forty years, Simon was engaged in building computer models of cognitive processes for dealing with complex and ill-structured problems, including the creative processes of scientific discovery and the use of visual imagery in thinking. To illustrate his faith in computer models as a substitute for human thinking, Simon predicted in the early 1960's that by 1985 we would have the technical capability to fully automate managerial decision making and manage corporations by machines (Simon, 1960).

Although Simon was wrong about this long-term impact (or at least about the speed of development), let us not forget that one of his other daring predictions done in 1957 (see Simon and Newell, 1958) eventually came to fruition 40 years later. In 1997, IBM's computer Deep Blue defeated the world's best human chess player and became world champion. The foundation for this victory of computer over man was laid by Simon who - together with Chase - explored the role of knowledge-based recognition processes in expert performance, with chess as their principal domain of study. This body of research has led to development of many knowledge-driven AI techniques that are available nowadays, to begin with the so-called "expert systems" in which expertise is transferred from the human to the computer. Expert systems posses the ability to retrieve relevant knowledge from their "expert knowledge" base and propose a solution. This can be based on the recognition of patterns, for instance as in chess (i.e., the system suggests a next move based on the recognition of chess patterns stored in its knowledge base), or on diagnostic cues, for instance as in medicine (i.e., given the patient's symptoms, the system diagnoses the problem and proposes a treatment based on expert knowledge about symptoms, diseases and ailments stored in the system).

In a sense, this dissertation is inspired by the work of Simon and Kahneman, as we seek ways to improve managerial decision making for complex, weakly-structured problems. In the past decades, many promising, state-of-the-art, knowledge-driven decision support tools, such as expert systems, case-based reasoning systems and intelligent agents, have originated from the field of artificial intelligence. This dissertation aims at providing managers with an effective and efficient tool to support them in their weakly-structured decision-making processes. Our goal is not to replace the manager by fully automating decision making, which also seems virtually impossible at this time, but we believe that a combination of manager and support system is most powerful. Consistent with Simon's (1985) view on computerized decision support, in this dissertation we will ask ourselves the following questions: What can we get computers to do for us in the near future? What would we like them to do that they can not do right now? Next to supporting complex structured problem solving, in the near future we would like the computer to improve decision making for weakly-structured managerial problems for which no support is available so far. As our domain of application, we choose marketing: a management domain that has to deal with a large number of weakly-structured problems.

1.2 Managerial Decision Support in Marketing

Marketing draws heavily on knowledge from basic sciences, such as psychology, sociology and economics, in order to develop its own marketing theories, such as consumer behavior. Being an applied science, the knowledge created by these marketing theories should eventually be put into action to develop more effective marketing tools. This is also advocated by proponents of the marketing engineering approach, a concept popularized by Lilien and Rangaswamy (1998). The ultimate goal is, of course, to implement these tools in practice in order to make better marketing decisions. Unfortunately, for many reasons, academic decision support initiatives do not always succeed in practice (see Little, 1970; Van Bruggen and Wierenga, 2000; Lilien, Rangaswamy, Van Bruggen and Wierenga, 2002). For instance, because managers are simply not aware of these tools, do not understand them or do not trust them and rather rely on their personal judgment, experience and intuition. A crucial success factor is the match between the type of decision support and the type of problem (e.g., Goodhue and Thompson, 1995; Wierenga, Van Bruggen, and Staelin, 1999; see also Figure 2.2).

In this respect, we can identify two approaches with regard to supporting managerial decision making in marketing: (1) using scientific marketing knowledge, and (2) using practitioners' marketing knowledge (Rossiter, 2001; 2002b; Wierenga, 2002). Analytical modeling, in which one tries to capture the accumulated scientific marketing knowledge in a structured model for optimizing decisions, is the dominant approach. Building such a model requires years of systematic, scientific research in order to identify all relevant variables and to specify the relationships between these variables. An exponent of this approach is the successful SCAN*PRO-model (Wittink, Addona, Hawkes, and Porter, 1988), which is now used by a large number of companies throughout the world for optimizing their price promotion decisions. Importantly, such a model can only provide successful decision support when the underlying problem is relatively well-known and well-structured. A problem is well-structured when it has a well-defined initial state and a goal state, problem-solving procedures for moving from the initial state to the goal state are known, all relevant variables and their underlying relationships can be specified, and sufficient and timely data is available to feed the model (see Reitman, 1965; Simon, 1973; Voss and Post, 1988).

Yet, a vast majority of the problems in marketing contains weakly-structured elements. For weakly-structured problems, it is difficult to define the exact nature, state and even the goal of the problem. These problems tend to be novel and non-routine, and suffer from incomplete data and information (Reitman, 1965; Simon, 1973; Voss and Post, 1988). As a consequence, there might be more than one solution and multiple ways to arrive at a solution. For this type of problems, the data-driven, analytical modeling approach is not very suitable. However, as mentioned, marketing knowledge is not exclusively the province of marketing science[3]. Besides the systematic, accumulated scientific marketing knowledge (e.g., empirical generalizations), there is a valuable qualitative practitioners' marketing knowledge that can be used to support decision making for these type of weakly-structured problems. To the extent that the knowledge residing in the heads of

[3] Of course, that is also a matter of definition. See for a discourse on what marketing knowledge is and what not: Rossiter (2001; 2002b).

marketing managers can be made explicit, it can be captured and stored in a system and, subsequently, made available for decision making. This expert knowledge can take, for instance, the form of mental models - which can be captured by so-called "if-then" rules in an expert system - or the form of experiences, stories, best practices or cases. An additional advantage is that by using practitioners' knowledge as the source of decision support, the adoption and use of decision support tools in practice may be facilitated.

Analogical reasoning is a natural and powerful problem-solving strategy that managers apply when confronted with a weakly-structured problem (Polya, 1957; Gentner, 1989; Finke, Ward and Smith, 1992). That is, one of the first things managers will do is to search their memory for previous, similar experiences (or cases) that could help to interpret or solve the problem at hand. From the psychological literature (e.g., Gentner, 1989b; Finke et al., 1992), we know that analogical reasoning is an effective and efficient problem-solving heuristic in such ill-defined or weakly-structured decision situations.[4]

Case-Based Reasoning (CBR) is a state-of-the-art artificial intelligence technique that builds on the principles of analogical reasoning. Case-based reasoning can be used to put the vast amount of experience-based marketing knowledge (in the form of cases) into action for supporting weakly-structured problem solving in situations for which model-based decision support is not available. So far, analogical or case-based reasoning applications can be found in domains such as medical diagnosis and law (see, for example, Kolodner, 1993; Van Kralingen, Van den Herik, Prins, Sergot, and Zeleznikow, 1996; Riesbeck and Schank, 1998). In this dissertation, we will investigate the efficiency and effectiveness of providing decision makers with analogies for supporting weakly-structured marketing problems, including the conditions under which this approach is most fruitful.

The goal of this dissertation project is to investigate the effectiveness and efficiency of analogical reasoning as a principle for marketing management support systems in weakly-structured marketing decision domains.

[4] The discussion in this section corresponds with the increasingly accepted dual-process approach to human thinking and reasoning (Stanovich and West, 2000; Kahneman, 2003). The kind of analogical reasoning described here is part of the intuitive, "System 1" thinking processes, which are fast, automatic, tacit, effortless, parallel, unconscious, and association-based. The analytical, "System 2" reasoning processes are slow, controlled, deliberate, effortful, serial and conscious (Kahneman, 2003; Hogarth, 2005). Under System 2, a person thinks about a problem in terms of concepts, relationships between concepts, principles, and applies rules to arrive at a decision. Therefore, System 2 is also called model-based or rule-based (Stanovich and West, 2000). It can be argued that much day-to-day, weakly-structured managerial decision making is (or should be) based on experience or intuition (involving System 1 processes) and that these decisions are often (better) rationalized only after the fact (involving System 2 processes) (see, for instance, Dijksterhuis, 2004; Hogarth, 2005).

1.3 Outline of the Dissertation

This dissertation basically consists of three parts. *Part I* concerns the historical and theoretical background of marketing decision support tools (to which we, from now on, refer to as Marketing Management Support Systems (MMSSs) in line with the terminology used by Wierenga and Van Bruggen, 2000). In particular, we delineate the evolution in marketing from model-based, data-driven decision support to knowledge-driven support systems like Case-Based Reasoning (CBR) systems; the object of study in this dissertation. Furthermore, we introduce our weakly-structured application domain in marketing, namely the design of sales promotion campaigns. Based on a number of research questions, we develop a conceptual framework for how the use of analogical reasoning, by means of a CBR system, can influence the quality of sales promotion (SP) campaign designs and the efficiency of the design process. Based on this framework, we formulate general hypotheses regarding the conditions under which CBR system availability will be most effective and efficient. Finally, we discuss the general methodology and the measurement instruments used in a series of experimental studies.

Part II involves a series of three studies in which we empirically investigate the conditions under which analogical reasoning, by means of a CBR system, is most effective and efficient for supporting the design of sales promotion campaigns. These conditions pertain to characteristics of the CBR system itself and in conjunction with the characteristics of the decision maker (i.e., the CBR system user). For each study, we mention only the hypotheses (as formulated in Part I) that are relevant for the variables under investigation. Study 1 is a first attempt to test the basic assumption that CBR system availability does help to improve the design of sales promotion campaigns. In the second study, we manipulate an important CBR system characteristic, namely case-base *content*, in a laboratory setting. In the third study, we investigate the effects of case-base *content* and *size* simultaneously in a comprehensive laboratory experiment. In this large-scale experiment, we also include two "no CBR system" benchmark conditions, i.e., a (rule-based) expert system condition and a no system condition.

Part III concludes this dissertation by giving an overview of the main findings of the empirical studies reported in Part II and discusses these findings in the light of the theoretical framework developed in Part I. Finally, we will outline the limitations of our studies, mention avenues for further research and provide a number of managerial recommendations. In Table 1.1, we provide a brief overview of the content of each chapter.

Table 1.1 Brief Overview of the Content of each Chapter

Overview Chapters	
Chapter One	• **"Introduction".** This introductory chapter positions the topic of this dissertation in a broader research tradition, which can be traced back to Nobel prize winners Kahneman and Simon. Both Simon and Kahneman conducted ground-breaking research on non-rational, heuristic decision making. Simon devoted much of his work to the simulation of heuristic decision making by means of computer programs, laying the foundation for the field of Artificial Intelligence (AI). In this dissertation, analogical (heuristic) reasoning will be used as a principle to develop, and empirically test, a tool for effective and efficient decision support in weakly-structured problem domains in marketing. *Keywords: Weakly-Structured Problems, Heuristic Decision Making, Artificial Intelligence, Decision Support Tools, Marketing*
Part I	
Chapter Two	• **"Marketing Management Support Systems: From Marketing Models to Case-Based Reasoning".** This chapter provides a historical and theoretical overview of Marketing Management Support Systems. It shows how marketing decision support tools evolved from mathematical models supporting well-structured problems to advanced artificial intelligence (AI) techniques that are able to mimic and support weakly-structured problem solving. In particular, we focus on an AI technique called Case-Based Reasoning (CBR), which mimics analogical reasoning, a type of human reasoning often used for solving weakly-structured problems. To illustrate this, examples of CBR-applications (outside the domain of marketing) will be given. This chapter ends with an introduction to a weakly-structured application domain in marketing: the design of sales promotion (SP) campaigns. *Keywords: Managerial Decision Making, (Marketing) Management Support Systems, Analogical Reasoning, Case-Based Reasoning, Sales Promotions, Creativity*
Chapter Three	• **"Analogical Reasoning and the Design of Sales Promotion Campaigns Designs: The Effect on Quality and Efficiency *(Theory & Hypotheses)*".** Chapter 3 takes a closer look at the design of sales promotion campaigns with analogical reasoning. Using theory and concepts from the marketing, cognitive psychology and artificial intelligence literature, this chapter provides a theoretical underpinning of how analogical reasoning (by means of a CBR system) can affect the quality of sales promotion campaigns and the efficiency of their design process. This is visualized in a conceptual framework on the basis of which we develop a number of hypotheses regarding the impact of CBR system characteristics (i.e., the number and type of analogies in the CBR system) on solution quality (i.e., the creativity of the campaign, comprising both the novelty and usability of the campaign) and solution efficiency (i.e., the time needed to design a campaign). In examining these effects, we will investigate the interaction with the characteristics of the decision maker (e.g., creative ability), look at the role of underlying process characteristics (e.g., system usage time), and explore the relation between the subjective evaluations of the CBR system and the objective outcomes. *Keywords: Conceptual Framework, General Hypotheses, Sales Promotion Campaign Design, Solution Quality (Creativity), Solution Efficiency (Time), CBR system Availability, Type and Number of Analogies, Decision Maker Characteristics, Creative Ability, Subjective Evaluations, Process Characteristics.*

Table 1.1 Brief Overview of the Content of each Chapter (continued)

Chapter Four	• **"Research Design: Methodology and Measurement".** In Chapter 4, we discuss the general research design of our empirical studies, including the methodology, the type of support systems, and the measurement instrument that are used. Furthermore, we look at how previous, related studies have tackled these methodological and measurement issues. In this chapter, we introduce and discuss the Case-Based Reasoning Sales Promotion Application that will be used in our empirical studies, which we will call *LEAPS* (*LEA*rning *P*romotion *S*ystem). One of the focal research topics in our studies is creativity. We are not only interested in the creativity of the outcome (as a measure of solution quality), but also in the creative ability of the decision maker (in conjunction with the availability of a support system). Creativity is a relatively underexposed research topic in the scientific marketing literature. Therefore, a substantial part of this chapter will be devoted to its definition and measurement. *Keywords: Research Methodology, Experiments, Design Task, CBR Sales Promotion Application (LEAPS), Expert System (BRANDFRAME), Measures, Creativity*
Part II	
Chapter Five *(Study 1)*	• **Analogical Reasoning as a Principle for Supporting the Design of Sales Promotion Campaigns: An Exploratory Study".** Chapter 5 deals with the first of the three empirical studies that will be reported in Part II. This study is a first attempt to test the basic assumption that a CBR system does help to improve the design of sales promotion campaigns. The creative ability of the decision maker is measured by means of a checklist (self-assessed) containing items related to the divergent and convergent facets of creative thinking. The task in this study concerns the design of a SP campaign for launching a new ready-made food product of a large, multinational FMCG company. *Keywords: CBR system Availability, Solution Quality and Efficiency, Creative Ability*
Chapter Six *(Study 2)*	• **"Designing Sales Promotion Campaigns with Analogical Reasoning: A Laboratory Experiment".** Chapter 6 explores the conditions under which CBR system availability is most effective. In Study 2, we investigate the influence of the type of analogies in the CBR system on the quality of the sales promotion campaigns and the efficiency of their design process. Hence, we make a distinction between near analogies (i.e., cases from basically the same problem domain) and far analogies (i.e., cases from more distant problem domains). Next to a CBR system containing only near analogies and a CBR system containing only far analogies, we use an expert system (i.e., a rule-based system) as a benchmark condition for assessing the effectiveness and efficiency of CBR system availability. Creative ability is measured by using a multiple-choice questionnaire (self-assessed), including the fluency, originality, flexibility (i.e., divergent thinking) and the elaboration (i.e., convergent thinking) facets of creative thinking. The task is to develop a loyalty and brand-image enhancing campaign for a Dutch Beer brand. This study is also used as a pilot study to refine the methodology and data-collection procedures for Study 3 (Chapter 7). Study 3 will be a comprehensive, large-scale study in which we test the effects of CBR system availability as such (as we did in Study 1 and 2), near analogies versus far analogies (Study 2), and the number of cases in the CBR system, simultaneously. *Keywords: CBR system Availability, Case Base Content, Type of Analogies, Near versus Far Analogies, Expert System, Solution Quality, Solution Efficiency, Creative Ability*

Table 1.1	**Brief Overview of the Content of each Chapter (continued)**
Chapter Seven *(Study 3)*	• **"Designing Sales Promotion Campaigns with Analogical Reasoning: A Comprehensive Laboratory Experiment".** Chapter 7 discusses the main study (Study 3) of this dissertation, in which we combine elements of the previous two studies in a comprehensive, large-scale study. This study includes six experimental conditions: (1) a CBR system *Standard Size Mixed* (50 cases), (2) a CBR system *Large Size Mixed* (100 cases), (3) a CBR system *Near Analogies*, (4) a CBR system *Far Analogies*, (5) an *Expert System*, and (6) *No System*. Furthermore, we use a psychometric test for measuring the decision maker's creative ability, viz. the Abbreviated Torrance Test for Adults (ATTA). This measurement instrument comprises the fluency, originality, flexibility (i.e., divergent thinking) and elaboration (i.e., convergent thinking) facets of creative thinking. The task in this study is exactly the same as in the Study 2, i.e., to develop a loyalty and brand-image enhancing campaign for a Dutch Beer brand. *Keywords: CBR system Availability, Case Base Content, Type of Analogies, Near versus Far Analogies, Case Base Size, Number of Analogies, Standard Size and Large Size CBR system, Expert System, No System, Solution Quality, Solution Efficiency, Creative Ability, Divergent Thinking, Convergent Thinking*
Part III	
Chapter Eight	• **"Conclusions and Discussion"**

Part I

Theoretical Background

Chapter 2

Marketing Management Support Systems: From Marketing Models to Artificial Intelligence & Case-Based Reasoning

"The basic fact we have to recognize is that no matter how strongly we wish to treat problems with the tools our science provides us, we can only do so when the situations that confront us lie in the area to which the tools apply." *(Simon and Newell, 1958)*

2.1 The First Marketing Management Support Systems

Among the first information technology (IT)-based marketing management support systems to appear in the scientific literature (see Kotler, 1971) were a model for optimizing media-allocation decisions, called MEDIAC (Little and Lodish, 1969), and a model for new product decision making, called SPRINTER (Urban 1970). Both computer-programmed models were, not surprisingly, published in the mathematical modeling-oriented journal "Operations Research". As mentioned earlier, model-based support is best suited for well-structured problem situations in which the goal of the decision maker is to optimize the outcome or objective function. In this chapter, we argue that weakly- or ill-structured management problems are better off with other types of decision support (section 2.2). Analogical reasoning is a natural, spontaneous and efficient heuristic that people apply when solving weakly-structured problems (section 2.3). Recent advancements in the field of artificial intelligence have led to the development of promising knowledge-driven tools that can provide decision support in less structured situations, for which no data-driven, model-based decision support is available. One of the most prominent tools is case-based reasoning, an AI technique that mimics analogical reasoning. Section 2.4 is devoted to the history, philosophy and working of case-based reasoning systems. Finally, we introduce a weakly-structured application domain in marketing: the design of sales promotions campaigns (section 2.5). At the end of this chapter, we provide a brief summary of the topics discussed (section 2.6).

2.2 Managerial Decision Making and Decision Support

The quantitative, model-based approach has dominated the development of support tools for a long time (subsection 2.2.1), with variable levels of success. We briefly delineate the evolution of marketing management support systems in marketing (subsection 2.2.2), and discuss the factors that drive their success (subsection 2.2.3).

2.2.1 Types of Management Problems and Their Means of Decision Support

Problems come in a rich variety of sorts and sizes. They vary considerably along dimensions such as structuredness, complexity and abstractness (Jonassen, 2000). Simon (1973) distinguishes three types of problems: well-structured problems, weakly-structured, and ill-structured problems. On the one end of the "structuredness" continuum are well-structured problems that have a well-defined initial state and goal state, and known problem-solving procedures for moving from the initial state to the goal state. For this type of problems all relevant variables and their underlying relationships can be specified, they come with complete data and information, are often repetitive and routine, and established solution techniques are available to solve them (Reitman, 1965; Simon, 1973; Voss and Post, 1988; Finke et al., 1992; Basadur, Ellspermann, and Evans, 1994; Jonassen, 2000). For ill-structured problems, on the other end of the continuum, it is difficult to define the exact nature, state and even the goal of the problem. As a consequence, there may be more than one satisfactory solution and multiple ways to reach a solution. Ill-structured problems tend to be novel and non-routine, and suffer from incomplete data and information (Reitman, 1965; Simon, 1973; Voss and Post, 1988; Finke et al., 1992; Basadur et al., 1994; Jonassen, 2000). In between these two extremes lie weakly-structured problems that contain a mixture of both structured elements and ill-structured elements (Basadur et al., 1994).

The dominant Operations Research/Management Science (OR/MS) decision support approach adopts the view that managers can follow a fairly systematic process for solving problems. This process involves basically the following steps (Simon, 1977; Turban, 1993).

1) Define the *management problem* and then construct a *mathematical model* that reflects the basic structure of this problem, including the important managerial variables.
2) Define a *criterion function* to be able to compare the relative merits of possible courses of action.
3) Obtain *empirical estimates* of the unknown *parameters* in the model.
4) Carry through the *mathematical calculations* to find the optimal course of action, i.e., *optimize the criterion function*.

This process involves the transformation of a real world problem into a prototype structure, which is also known as modeling. Simon (1977) used the term "programmed" (see Table 2.1) or well-structured for any decision-making situation to which these steps could be successfully applied.

Table 2.1 "Traditional" and "Modern" Techniques of Decision Making (Simon, 1977)

Type of Decisions	Decision-Making Techniques "Traditional"	"Modern"
Programmed: (*i.e., well-structured)* Routine, repetitive decisions Organization develops specific processes for handling them	1. Habit 2. Clerical routine: - Standard operational procedures (SOP's) 3. Organization Structure: - Common expectations - A system of subgoals - Well-defined information channels	1. Operations Research: - Mathematical Analysis - Models - Computer Simulations 2. Electronic Data Processing
Non-programmed: *(i.e., ill-structured)* One-shot, ill-structured novel policy decisions Handled by general problem-solving process	1. Judgment, intuition, and creativity 2. Rules of thumb 3. Selection and training of executives	Heuristic problem-solving techniques applied to: (a) training human decision makers (b) constructing heuristic computer programs

In operations research, for instance, problems such as production scheduling (see Table 2.2.) jobs are relatively well-defined, data are available and excellent mathematical models and techniques have been developed for optimizing the solution. However, if problems are "hopelessly qualitative" (Simon, 1977, p. 58) by nature, i.e., they cannot be described in terms of mathematical variables, the objective function cannot be quantified, no actual numerical estimates for the parameters can be obtained, the specification of the model does not fit the mathematical tools available, or the problem is too large to do the calculations within reasonable time and costs, then the problem is said to be "non-programmable" (Simon, 1977) or ill-structured. In management domains such as strategy, human resource and marketing, there are many problems that are weakly-structured or even ill-structured. Managers in these domains, as opposed to operations researchers, for instance, have to rely more on "traditional" decision-making techniques, such as subjective judgments, rules of thumb, hunches and intuition (see Table 2.1), than on mathematical analysis and models in order to solve the problem.

Consider, for example, a marketing problem like forecasting sales. In an empirical study, Blattberg and Hoch (1990) found that a combination of 50% model-based input and 50% managerial judgment provided the most accurate forecasts, which is indicative of the weak structure underlying the problem. That is, parts of the problem are well-structured and can be captured and solved by a means of a (quantitative) model, while other aspects of the problem are "fuzzy" (i.e., difficult to define) and are probably best solved by means of subjective judgment and intuition.

In 1958, Simon and Newell published their visionary paper "Heuristic Problem Solving: The Next Advance in Operations Research". In his research into organizations, Simon had observed that managers often do not behave perfectly rational, as economic theory suggests. In everyday problem solving, managers for instance do not consider all possible alternatives and try to find the optimal solution. Instead, people tend to choose the first option that comes closest to their requirements, i.e., they are satisfied with a solution that meets a pre-set acceptance criterion, since there are costs associated with finding and evaluating all possible courses of action, (Crevier, 1993). For this kind of behavior due to people's "bounded rationality" Simon introduced the term "satisficing". The concept of satisficing behavior led him to the notion that the mind mostly functions by applying approximate (non-optimal) solutions to problems (Crevier, 1993). This provided the basis for the idea of heuristic programming (see Table 2.1), which later advanced into a new area of research in computer science called "Artificial Intelligence" (AI). The heuristic programming techniques developed in the field of AI best match the way managers go about making decisions in ill-structured situations (see Table 2.1).

Not only are there differences in the degree of problem structure, management decisions are also made at different levels, cf. strategic planning versus operational control. There exists a rough, though far from perfect, correlation between the level of decisions and their degree of structure. That is, high-level management decisions appear to be far less structured than mid-level or low-level management decisions (Simon and Newell, 1958; Simon, 1977). Despite the focus in education on solving well-structured problems, the majority of problems at higher management levels - and even in everyday life - tend to be ill-structured (Simon and Newell, 1958; Basadur et al., 1994; Jonassen, 2000). Moreover, decisions made at higher levels restrict the options at lower levels. If one starts off with making a bad high-level decision, then fine-tuning or optimizing decisions at lower levels can at best mitigate the harm already done. Merging with the wrong company in the first place (a strategic level decision, see also Table 2.2), for instance, will have much larger negative financial consequences than a possible sub-optimality in synchronizing the Personnel & Organization (P&O) departments.

Table 2.2 Decision Support Framework (Gorry and Scott-Morton, 1971)

	Type of Control			
Type of Decisions	**Operational**	**Managerial**	**Strategic**	**Support Needed**
Structured	Accounts receivable, order entry 1	Budget analysis, short-term forecasting, personnel reports, make-or-buy analysis 2	Financial management (investment), warehouse location, distribution system 3	*Management Information Systems (MIS), Operations Research Models, Transaction Processing*
Semi-structured	Production scheduling, inventory control 4	Credit evaluation, budget preparation, plant layout, project scheduling, reward systems design 5	Building a new plant, mergers and acquisitions, new product planning, compensation planning, quality assurance planning 6	*Decision Support Systems (DSS)*
Unstructured	Selecting a cover for a magazine, buying software, approving loans 7	Negotiating, recruiting an executive, buying hardware, lobbying 8	R&D planning, new technology development, social responsibility planning 9	*DSS, Expert Systems (ES), Neural Networks*
Support Needed	*MIS, Management Science*	*Management Science, DSS, ES, Executive Information Systems (EIS)*	*EIS, ES, Neural Networks*	

Obviously, different types of problems require different means of support. Structured problems can be best solved with the help of standard mathematical, quantitative OR/MS modeling techniques such as linear programming, dynamic programming, game theory, and Bayesian decision theory (Simon, 1977; Turban, 1993). Ill-structured, qualitative problems, however, require different means of support than the well-structured problems in data-rich environments (Gorry and Scott Morton, 1971; Simon, 1977; Turban, 1993), since a quantitative, optimizing OR/MS approach is not possible. Most management support system (MSS) researchers will agree that in order to be successful, the characteristics of the system should match with the characteristics of the problem situation for which it is developed (e.g., Chakravarti et al., 1979; Mason and Mitroff, 1973; O'Keefe, 1989; Todd and Benbasat, 1992; Goodhue and Thompson, 1995; Wierenga and Van Bruggen, 1997; Van Bruggen and Wierenga, 2001). Already in 1971, Gorry and Scott-Morton developed a decision support framework in which they match the type of support system needed to the type of problem, along the two dimensions discussed above: the structuredness of the task and the level of management decision (see Table 2.2).

Given the high-stakes often involved, improving managerial decision making for ill-structured problems by means of knowledge-driven support systems (such as expert systems and neural networks, see Table 2.2) provides a challenging opportunity for companies to enhance their performance substantially. So far most MSS research has concentrated on supporting relatively structured problems by means of data-driven, quantitative support (like management information systems, models and decision support system, see Table 2.2), with an emphasis on model building and optimization (see Keen and Scott-Morton, 1978; Sprague and Watson, 1996). Management support systems for ill- or weakly-structured problems (e.g., problems in which creativity plays a role), however, have not received that much attention[5], despite repetitive calls for more research on this issue (e.g., Mason and Mitroff, 1973; Benbasat and Dexter, 1982; Kletke, Mackay, Barr, and Jones, 2001). This is also true for the domain of marketing (see Leeflang and Wittink, 2000; Van Bruggen and Wierenga, 2001), as we will see in the next subsection.

2.2.2 Marketing Management Support Systems

A Marketing Management Support System (MMSS) can be defined as any device combining (1) information technology, (2) analytical capabilities, (3) marketing data, and (4) marketing knowledge, made available to one or more marketing decision maker(s) to improve the quality of marketing management (Wierenga and Van Bruggen, 2000). In chronological order of their appearance in the scientific literature, we can distinguish eight types of MMSSs (see Table 2.3; for a more detailed discussion, we refer the reader to Wierenga and Van Bruggen, 2000). As one can notice from this table, there has been a shift over time from the development of data-driven MMSSs toward knowledge-driven MMSSs. Nonetheless, data-driven applications, and in particular marketing models, are still dominant (see Wierenga et al., 1999).

[5] Notable exceptions in the management domain are Elam and Mead, (1990), MacCrimmon and Wagner (1994), Massetti (1996), and Marakas and Elam (1997).

Table 2.3 Types of Marketing Management Support Systems (Wierenga and Van Bruggen, 2000)

Type of System	Abbr.	Since…	Brief Description
Marketing Models	**MM**	early 1960s	• aim at finding optimal values for marketing instruments by means of mathematical representations of marketing problems
Marketing Information Systems	**MKIS**	mid-1960s	• help analyzing the market and detecting possible causes of events by storage, retrieval and (statistical) analysis of data
Marketing Decision Support Systems	**MDSS**	early 1970s	• help answering "what-if" type of questions by means of making simulations
Marketing Expert Systems	**MES**	mid-1980s	• aim at finding a best solution for a problem within a domain of expertise by means of rule-based ("if-then rules") representation of expert knowledge
Marketing Knowledge-Based Systems	**MKBS**	early 1990s	• support the reasoning process of marketing managers by hybrid, knowledge-based systems obtaining their knowledge from multiple sources (e.g., human experts, textbooks, cases etc.) and using multiple means of knowledge-representation (e.g., rule-based, frame-based, and semantic networks)
Marketing Case-Based Reasoning Systems	**MCBR**	early 1990s	• support the reasoning process of marketing decision makers by means of analogies: storage, retrieval, and adaptation of cases
Marketing Neural Nets	**MNN**	mid-1990s	• aim at recognizing patterns from signals by modeling the way how human beings attach meaning to a set of incoming stimuli
Marketing Creativity Systems	**MCSS**	mid-1990s	• stimulate and endorse creativity of marketing decision makers by means of idea generation or associations through connections

We will illustrate the evolution from data-driven to knowledge-driven marketing management support systems on the basis of specific examples from the field of marketing communications. Marketing communications ("marcoms") is the generic term for the mix of communication tools, such as advertising, sales promotions, public relations, exhibitions, personal selling and direct mail, that a marketer can use to pursue the marketing objectives for the brand (Rossiter and Percy, 1997). Throughout the years, marketing scholars have developed a number of tools for supporting marketing communication decisions. The first tool in marketing communications (published in the journal "Operations Research"), MEDIAC, tackles an operational, micro-level marketing communication problem at the structured end of the problem-structure continuum. It provides model-based support for optimizing media-allocation decisions within higher-level constraints (e.g., the advertising budget).

- MEDIAC (Little and Lodish, 1969): a market-response model combined with a heuristic search routine and a conversational input-output program to select and schedule advertising media. The user supplies a list of media options, a budget and various objective and subjective data about the media options and the desired audience, on the basis of which the system maximizes total market response.

The next models that appear in the marketing literature are capable of optimizing and supporting higher-level advertising decisions, such as determining the budget. Still the problem-solving approach is rather operations research-like, depending heavily on parameter quantification and structure although subjective, qualitative judgment is included in both models.

- ADBUDG (Little, 1970): a multi-period advertising budgeting model for product managers. For answering advertising budget questions, it uses a quantitative, mathematical modeling approach with qualitative, subjective input (managerial judgment).
- ADMOD (Aaker, 1975): an advertising decision model to address simultaneously the budget decision, the copy decision, and the media-allocation decision. The system combines a quantitative, mathematical model with subjective judgment (heuristics).

The development of marketing management support systems then continues from the single (or small number of) decision variable models described above to integrated systems that comprised models for the whole range of marketing mix variables. Two examples from the late 1970s are the following.

- BRANDAID (Little, 1975a; 1975b): a flexible model for assembling factual data, judgment and assumptions about how the market works to describe the market and evaluate strategies. Its major submodels concern advertising, promotion, price, salesmen, and retail distribution. (business-to-consumer)
- ADVISOR (Lilien, 1979): aims at providing an understanding of and guidance for marketing mix decisions for industrial products. The system contains a set of marketing models for advertising expenditures, marketing expenditures, marketing budget allocations, year-to-year changes in advertising spending, and for selection of distribution channels. (business-to-business)

Coinciding with the development of more advanced AI techniques, such as expert systems and case-based reasoning system, which make it possible to capture also soft, qualitative knowledge and put it into action for decision making, a second generation marketing communication decision support tools appears in the late 1980s/early 1990s in the marketing literature. These tools are basically knowledge-driven, incorporating both academic and practitioners knowledge, and are capable of supporting less structured problems, such as the design of advertising campaigns.

- ADCAD (Burke, Rangaswamy, Wind, and Eliashberg, 1990): an expert system designed to assist advertisers of consumer products with the formulation of advertising objectives, copy strategy, and the selection of communication approaches. The system supports weakly-structured advertising design problems and its knowledge base comprises qualitative marketing knowledge (heuristics) from published research and practitioner expertise.
- ADDUCE (Burke, 1991): a frame-based, (empirical) knowledge-driven system for reasoning about consumer response to advertising. The system infers how consumers will react to new ads by searching for relevant past advertising experiments and then generalizing research across similar contexts (analogical/ case-based reasoning).
- BRANDFRAME (Dutta, Wierenga and Dalebout, 1997; Wierenga, Dalebout and Dutta, 2000; Wierenga and Van Bruggen, 2001): a customized, rule-based decision-support system for brand managers to monitor brands, diagnose events and plan appropriate marketing actions. The system contains a combination of academic and practical knowledge ("if-then" rules) and integrates all the information needed by the brand manager in one system. Among others, it includes an advertising and sales promotion technique recommendation module.

From this brief overview, one can deduce two shifts in the development of marketing communications support systems: (1) from supporting structured, lower-level problems towards weakly-structured, higher-level problems, and (2) from quantitative, data-driven models towards more qualitative, knowledge-driven support systems.

Besides the development of MMSSs for the field of marketing communications as such, we can look more specifically at the domain of sales promotions. Within the design of sales promotion campaigns, one can also distinguish between two broad decision levels (see subsection 2.2.1).

1) *Weakly-structured, higher-level decisions*, such as choosing the type of sales promotion and the content of the campaign.

2) *Structured, lower-level decisions*, such as deciding upon the levels of decision variables within a given campaign, like setting the price, the promotion budget and the running time of the campaign.

The most prominent examples of MMSSs within the sales promotion domain, such as the SCAN*PRO model and the other two systems mentioned below (viz. PROMOTOR and PROMOTIONSCAN), fall into the second category. That is, these systems provide data-driven support for structured, lower level decisions.

- PROMOTOR (Abraham and Lodish, 1987): an automated promotion evaluation system for manufacturers' trade promotions which may be combined with consumers promotions. The system uses available data and contains an (expert) knowledge base to recognize and adjust for data irregularities.
- PROMOTIONSCAN (Abraham and Lodish, 1993): an implemented and automated model for evaluating promotions (short-term only) and improving their effectiveness using store-level scanner data.
- SCAN*PRO (Wittink et al., 1988): a store-level model to quantify the effects of promotional activities by retailers on brand's unit sales. The model uses scanner data and accommodates temporary price cuts, displays, and feature advertising. The SCAN*PRO model is one of the most successful marketing models and has been used in over 2000 different commercial applications all over the world (Leeflang, Wittink, Wedel and Naert, 2000). As mentioned, it support the manager in making *price-promotion* decisions, such as determining the optimal depth, frequency and timing of price discounts (including feature and display support).

To conclude, hitherto the development in decision support for the domain of sales promotions has been limited to quantitative, data-driven approaches for supporting relatively structured, lower-level problems. This is partly due to the huge amounts of scanner-data that are becoming available for solving this type of problems, which makes it attractive to develop data-driven means of support. As a consequence, higher level, weakly-structured problems, such as choosing the main theme, content and technique of sales promotion campaigns, have received less attention from marketing scholars. Obviously, once a manager has decided to use a price discount, it is important to fine-tune the discount level to optimize sales volume and revenues. But maybe the manager should not have chosen a price-promotion in the first place. Therefore, the higher-level decisions should receive attention too.

2.2.3 The Match between the Demand and Supply of Marketing Management Support Systems

The eight types of systems mentioned in Table 2.3, with their different components and functionalities, constitute the supply side of decision support. At the demand side we have the characteristics of the decision situation, including the decision problem, the decision environment and the decision maker. It is important that there is a good match between the demand and supply of decision support. That is, the success of MMSSs, in terms of adoption, use, user-impact and organizational impact, largely depends on the match between the type of MMSS and the decision maker's dominant problem-solving mode in a given decision situation (Wierenga et al., 1999). In addition, characteristics of the design of the MMSS (e.g., accessibility and adaptability) and characteristics of the implementation process (e.g., top management support and training of users) can also play a role.

A problem-solving mode is a cognitive model that characterizes the way a decision maker solves a problem (Van Bruggen and Wierenga, 2001). A broad distinction can be made between the deliberate (or analytical) mode and the tacit (or intuitive) mode, with the latter requiring little apparent effort and occurring typically without conscious awareness (Hogarth, 2005). Wierenga and Van Bruggen (2000) subdivide these modes into four specific problem-solving modes: (1) optimizing, (2) reasoning (by using, for instance mental models (or representations) of real-world phenomena), (3) analogizing, and (4) creating. The first two problem-solving modes, i.e., optimizing and reasoning, are clearly part of the deliberate mode, whereas the latter two, i.e., analogizing and creating, tend more towards the tacit mode. Which mode, or combination of modes, is dominant will depend on the characteristics of the decision situation, including the decision problem (e.g., the degree of problem structure), the decision environment (e.g., time pressure) and, last but not least, the decision maker himself (e.g., his cognitive style)[6]. Finally, characteristics of the design of the MMSS (e.g., accessibility) and characteristics of the implementation process (e.g., top management support) may also play a role in the success of MMSSs.

For an elaborate discussion on the four problem-solving modes and an integrating framework of factors that determine the success of MMSSs, we refer the reader to Wierenga and Van Bruggen (2000). In Chapter 3, we will take the match between the type of decision and the type of decision support as a starting point to develop a conceptual framework regarding the effectiveness and efficiency of analogical

[6] For readability, we use "he", "his", and "himself" wherever "he or she", "his or her", and "himself or herself" are meant.

reasoning (or case-based reasoning) as a support tool for weakly-structured, higher-level sales promotion decisions.

2.3 The Principle of Analogical Reasoning

In this section, we will explain the principle of analogical reasoning. First, we describe what analogical reasoning is (subsection 2.3.1) and explain the process of analogical reasoning in more detail (subsection 2.3.2). Next, we discuss the role of domain expertise on the part of the analogical reasoner (subsection 2.3.3) and the role of the type of analogies, i.e. near analogies versus far analogies (subsection 2.3.4). Finally, we conclude this section with the contribution of analogical reasoning to weakly-structured decision making (subsection 2.3.5).

2.3.1 What is Analogical Reasoning?

One of the first, most natural and effective, heuristic problem-solving strategies that people try in ill-defined situations is to recall a previously solved problem and apply that solution method to the current problem (Polya, 1957; Finke et al., 1992). This is also known as analogical reasoning (Gentner, 1989b). Reasoning from first principles (i.e., from scratch) is not what people normally do when solving problems, especially not for many day-to-day problems, simply because it would be too time-consuming and inefficient. Consider, for instance, a relatively structured problem such as production scheduling. Assume that you have optimally planned the production process for a particular day and suddenly a rush order comes in. If no algorithms or fast computer calculations are possible, it would be dreadful and time-consuming to recalculate the optimal planning and reschedule the whole production process for that day. Hence, for solving this kind of day-to-day problems, people rather rely on short-cuts or heuristics, such as the planning adjustments they had successfully applied the previous time that there was a similar rush order situation.

Analogical cases are among the most powerful resources to support ill-structured problem solving, in particular as they represent alternative perspectives that the decision maker has to reconcile (Schank and Cleary, 1995; Jonassen, 1997). Hence, in management education, and for ill-structured management problems in particular, the use of business cases in problem solving is widespread. Reflecting on the similarities and differences with previously solved cases can help to interpret the current problem situation, identify successful courses of action, avoid potential failures, and foresee consequences of certain decisions (Jonassen, 2000). Learning from relevant, previous cases can function as a substitute for the direct experience in solving ill- or weakly-structured management problems that novice managers lack (Jonassen, 2000).

Analogies can thus be used to understand or solve new, complex, ill-structured problems by showing similarities between them and familiar problems with known solutions. Thus, analogical reasoning is about solving new problems in terms of what is already known, by transferring knowledge from familiar to novel problem domains (Gregan-Paxton and John, 1997). Drawing an analogy involves mapping attributes and relationships of the relatively well-known domain, i.e., the so-called "base" or "source" domain, onto another domain, i.e., the so-called "target" domain (Gentner, 1989b). This implies that the system of attributes and relations that holds among the base objects also holds among the target objects (Gentner, 1989b). Mapping and transferring knowledge from base to target can occur on a surface attribute level and/or on a structural relation level (see Table 2.4).

Table 2.4 Different Kinds of Domain Comparisons (adapted from Gentner, 1983; 1989b)

	Attributes	Relations	Example
Literal similarity	Many	Many	Other solar systems in the universe are like our solar system, or milk is like water.
Analogy	Few	Many	The atom is like our solar system.
Anomaly	Few	Few	Coffee is like the solar system.
Mere Appearance	Many	Few	The glass tabletop gleamed like water.

Surface similarities between the base and target domain concern the resemblance between the objects (and their attributes) in the analogy, while structural similarities refer to resemblances between the underlying systems of relations. Based on what exactly is transferred between the base and target domain, one can classify domain comparisons as: (1) literal similarities (sharing many attributes and many relations), (2) analogies (sharing few attributes, but many relations), (3) anomaly (sharing few attributes and few relations), and (4) mere appearance (sharing many attributes but few relations) (see Table 2.4). To be classified as a "true" analogy the base and the target domain should merely share structural relations, while for literal similarities both structural relations and surface attributes can be shared between base and target (Roehm and Sternthal, 1997).

Analogical reasoning (or learning) basically involves the following stages: (1) *accessing* the base domain (i.e., searching for and retrieving a potential analogy), (2) performing the *mapping* between base and target (i.e., drawing the analogy knowledge), and, if the analogy is judged to be sound, 3) *storing the inferences* in the target (i.e., transferring knowledge) (Gentner, 1989b). Access takes place when the base is retrieved from memory, which may occur spontaneously or can be prompted by external cues, such as marketing communications (Moreau, Markman, and Lehmann, 2001). Like, for example, an ad for a PDA (personal digital assistant; the target) in which similarities are drawn with a secretary (the base) (see Gregan-Paxton, Hibbard, Brunel, and Azar, 2002). The goal of the mapping phase is to identify relevant (structural) similarities (i.e., commonalities) between the base and the target and to align the differences between the domains in terms of their common relational or goal structure (Gentner and Markman, 1997). Appropriate mapping and alignment are essential for useful knowledge transfer (Clement and Gentner, 1991), since these mappings serve as paths on which additional knowledge can be transferred between the base and target (Gregan-Paxton and John, 1997).

2.3.2 The Analogical Reasoning Process

In this subsection, we will discuss the process of analogical reasoning in more detail and focus on the sub-processes of *accessing & retrieving* and *mapping & inferring*.

Accessing & Retrieving. To be able to use analogies for problem solving, it is crucial that the decision maker can access the base analogy in memory. That is, the decision maker first has to recognize the similarity between the target and the base problem stored in memory, and has to be able to recall the solution (or solution method) that was applied to the base problem (Jonassen, 1997). Regarding the ability to access a base domain in (long-term) memory, the degree to which the base and target share common attributes seems most critical (Gentner, Rattermann, and Forbus, 1993; Gregan-Paxton and John, 1997). That is, when the target shares several surface features with a base domain, access is likely to occur spontaneously (Gentner et al., 1993). In instances when few surface similarities are present, previous research (e.g., Gentner and Landers, 1985; Rattermann and Gentner, 1987) has shown that people have difficulty in recalling, retrieving and using a particular analogy, unless being prompted to (i.e., giving directions, hints or clues) (Gick and Holyoak, 1980; 1983).

Gick and Holyoak (1980; 1983), for instance, investigated in a series of studies the respondents' use of the analogy between the military story of troops attacking a fortress from different sides (the base problem and solution) and attacking a tumor using a strategy of converging rays (the target solution), when they were given Duncker's (1945) radiation problem (the target problem). When reading the military story without hints pointing at the analogy only 30% of the subjects was able to apply to military story to the radiation problem, while providing clues increased the discovery of the converging ray solution to 70% (Gick and Holyoak, 1980).

Mapping & Inferring. Once the base domain is accessed, spontaneously or prompted, the content and structure of the base domain can be compared with that of the target domain. The goal in this stage of the analogical reasoning process is to map elements from the base domain onto elements of the target domain. The alignment of base and target domain can be based on similarities in surface attributes and/or relational structure (Gregan-Paxton and John, 1997). In the process of structural alignment, people tend to focus on commonalities and their alignable differences, at the expense of nonalignable differences (Markman and Moreau, 2001). Commonalities are the matching elements in the representation, like the fact that both entities are vehicles when comparing a sports car to a minivan (Markman and Moreau, 2001). Alignable differences are aspects that are dissimilar, but are placed in correspondence based on the commonalities between base and target (Markman and Moreau, 2001). For instance, the fact that sports cars have good handling and that minivans have poor handling (Markman and Moreau, 2001). Nonalignable differences are aspects that have no correspondence at all in the other, such as the fact that sports cars have real spoilers while minivans do not (Markman and Moreau, 2001). In making comparisons, people prefer alignable differences over nonalignable differences because they require less effort to access and use and they only need relative judgments (e.g., good versus poor handling; no absolute level of handling required) for evaluating the goodness of an attribute (Markman and Moreau, 2001).

Once the mappings are in place, they can serve as paths on which additional knowledge can be transferred from the base to the target (Gregan-Paxton and John, 1997). Information (or knowledge) that is missing in the target, after the mapping has been done, may be inferred from the base domain. An analogical inference involves carrying over information from one domain (the base) to fill in missing information about another domain (the target) through a process of structural completion (Markman and Moreau, 2001). Structural completion refers to the fact that the candidate inference for filling the gap has to be consistent with, or follow logically from, the system of interconnected relations that match between the base and the target (Clement and Gentner, 1991). In other words, analogical inferences are rooted in the relational similarities, not in surface similarities.

2.3.3 The Role of Expertise

Most explanations for the low rate of spontaneous, appropriate analogical transfer have centered on the difference between novices and experts. Novices in a particular domain tend to represent analogies according to surface features (Glaser and Chi, 1988; Novick, 1988) such as visible attributes, making an appropriate analogical transfer difficult (Gregan-Paxton and John, 1997). Because of the importance of these surface features in accessing a base domain, initially this would make no difference in performance between novices and experts in the stage of retrieving candidate analogies (Novick, 1988; Gentner, 1989b). However, novices also tend to rely more exclusively on attribute-based mappings and alignments, resulting in mere appearance matches or literal similarities (Gentner, 1989b; Gregan-Paxton and John, 1997). Although relational mappings (i.e., systematicity) clearly are preferred in drawing and evaluating the analogy, novices may be unable to construct them (Novick, 1988). For novices, the mental representation of the problem may simply not contain enough high-order relations to recognize the relational similarities between a base and a target (Gentner, 1983, 1989b; Gentner, Rattermann, and Forbus, 1993). As mentioned earlier, they will generally know a few features of the concept, but they will not know how these features are related (Alba and Hutchinson, 1987; Markman and Moreau, 2001). In contrast, experts are able to construct a deeper, more meaningful representation of the problem and are therefore better able to draw appropriate analogies and make inferences based on a higher-order, relational structure (Gentner, 1989b; Finke et al., 1992). Experts have acquired a great deal of experience in the base domain and thus are likely to posses richly connected relational structures, which provide a fertile ground for making analogical inferences to fill in the missing information (Markman and Moreau, 2001).

2.3.4 The Role of the Type of Analogies

In the psychological literature, the distinction between a literal similarity and an analogy is commonly made (see Table 2.4). However, in this dissertation we prefer to describe analogies on a continuum ranging from near analogies (i.e., sharing many attributes and relations, cf. literal similarities) to far analogies (i.e., sharing few attributes and many relations, cf. "true" analogies) (see, for instance, also Dahl and Moreau, 2002). Near analogies are analogies that basically come from the same problem domain (often also referred to as "intra-domain" analogies) and, as a consequence, share many surface-level attributes and many structural relations. For instance, when merging with another company, managers could easily draw an analogy with a previous merger between two similar companies in the same business (i.e., surface-level attributes) to learn valuable lessons from about the factors that may lead to success or failure (i.e., structural relations). Far (or "inter-domain") analogies come from more distant - sometimes even "wildly discrepant" (Ward, 1998, p.221) - domains that share few surface-level attributes, but many structural relations. Consider, for instance, the discovery of the molecular structure of benzene in 1865 by Kekulé, who was inspired by the visual analogy of a snake biting his own tail (see Holyoak and Thagard, 1995), as depicted in Figure

2.1. This analogy between a snake and molecular structures, two very distant domains sharing few surface-level attributes, represented a major breakthrough in science.

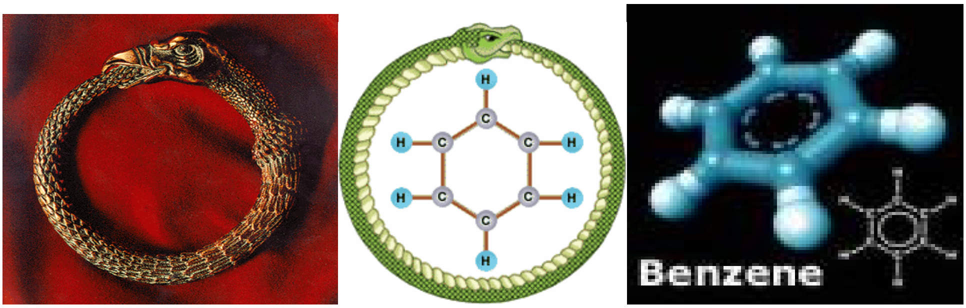

Figure 2.1 **Discovery of the Structure of the Benzene Molecule by Kekulé**

Left: **Image of a snake biting his own tale**
Middle: **Visual analogy between a snake biting his own tale and the structure of benzene molecule**
Right: **Image of the benzene molecule**

The use of analogies - and far analogies, such as the one described above, in particular - is often argued to underlie creative acts (Mednick, 1962; Koestler, 1964; Boden, 1994; Dahl and Moreau, 2002). Because the amount of cognitive effort that is needed to bridge the conceptual distance between the base and the target is larger when the domains are further away from each other, far analogies are likely to be perceived as less obvious, more novel and more creative than near analogies (Dahl and Moreau, 2002). When drawing far analogies one can map and transfer few surface-level attributes from the base domain to the target domain (Dahl and Moreau, 2002). The mapping and transferring has to occur mainly between higher-order, relational structures in the base and target domain, which requires more cognitive effort and resources (Roehm and Sternthal, 2001). That is, the problem solver has to make a mental "leap" instead of a mental "hop" (Holyoak and Thagard, 1995; Ward, 1998). In contrast, near analogies are typically drawn from base domains that have many surface and relational properties in common with the target domain. As a result, the analogy is visible at a superficial level and can thus be easily accessed and detected (by experts and novices). Hence, the use of near analogies is likely to result in solutions that are perceived as less creative than solutions that are based on more distant, far analogies.

2.3.5 The Contribution of Analogical Reasoning to Decision Making

From the discussion in the previous subsections, it has become clear that for accessing a base domain surface commonalities are most important, while for mapping and transferring useful knowledge and judging the soundness of an analogy higher-order relational (or structural) commonalities are crucial (Ross, 1989; Gentner, 1989b; Gentner et al. 1993). Hence, for the efficient and effective retrieval and use of analogies, Gentner and colleagues (e.g., Falkenhainer, Forbus, and Gentner, 1989; Gentner, 1989b; Gentner and Forbus, 1991; Gentner et al., 1993,) proposed the "Many Are Called, Few Are Chosen" (MAC/FAC) procedure and the Structure Mapping Engine (SME). The "many are called" (MAC) stage is a cheap, fast (non-structural alignment) process to retrieve a manageable number of possible analogies (including literal similarities) from long term memory. The best match based on the target input, and everything within 10% of it, is then passed on to the "few are chosen" (FAC) stage in which the structural alignment, interpretation and evaluation of the analogies are done. In the FAC stage, the structure-mapping engine (SME) carries out the structural alignment between the descriptions of the target and the base candidate, resulting in an interpretation, a set of candidate inferences, and a structural evaluation (which will reject many of the matches given by the MAC stage). To demonstrate the effectiveness and efficiency of the MAC/FAC procedure and the SME in comparison with human performance and alternative techniques, short stories and fables that varied in their degree of structural and surface similarity were used as stimuli in a series of simulation studies by Gentner and colleagues on analogical retrieval and matching (see Gentner et al. 1993; Forbus, Gentner and Law, 1994).

It should be clear that heuristic problem-solving techniques like analogical reasoning can provide an effective and efficient means for finding a good solution in weakly-structured decision situations (Simon and Newell 1958; Finke et al. 1992). In the next section, we will introduce the concept of Case-Based Reasoning (CBR): a state-of-the-art Artificial Intelligence (AI) technique that mimics analogical reasoning. In line with the MAC/FAC procedure described above, a CBR system can aid the decision maker in the process of accessing, mapping and adapting relevant analogies in order to support weakly-structured problem solving (see also Gentner et al., 1993).

2.4 Case-based Reasoning Systems: History, Philosophy and Applications

Case-based reasoning is a technique that originated from the field of artificial intelligence. Hence, we begin this section with a brief overview of how the field of artificial intelligence has evolved over the years (section 2.4.1). Next, we explain what case-based reasoning is (subsection 2.4.2) and discuss the case-based reasoning process into more detail (subsection 2.4.3). We end this section with a discussion on the contribution of case-based reasoning to weakly-structured decision making (subsection 2.4.4) and a brief overview of classical case-based reasoning systems and applications (subsection 2.4.5) .

2.4.1 Artificial Intelligence and Case-Based Reasoning

One could argue that traces of artificial intelligence can already be found in ancient Greek history. For instance, the Greek Oracle as the world's first expert system, or Hephaestus' human-like creation Talos that incorporates the idea of intelligent robots (McCorduck, 1979). Talos was a very big human shaped robot made of bronze that had to guard the isle of Crete from intruders. He could run very fast (three times a day round the whole island), throw very big rocks, and burn enemies by heating himself red hot. His only weak spot was a vein in his ankle that kept him alive. Eventually, the Argonauts managed to defeat Talos by pulling off a scheme. Medea promised Talos a secret poison that would give him immortality, if he would let her stop on the island in return. Talos agreed and drank the potion which made him fall asleep. While he was sleeping, Medea removed the plug in his ankle, letting him bleed to death from his one and only vein. Although Talos may not look very smart, the positive thing about it is that it leaves enough room for improvement.

Artificial intelligence, as we know it, really took off with the invention and development of the (digital) computer, which dates back to the English mathematicians Babbage (whose ideas inspired Herbert Simon and many others) and Byron, who was also known as Lady Lovelace (and daughter of the illustrious poet Lord Byron). Together they (Babbage and Lady Lovelace) invented the Analytical Engine in 1856, a mechanical calculating machine that nowadays is regarded as the first "computer program". At a conference at Dartmouth College in Hanover, New Hampshire, McCarthy, Minsky, Rochester and Shannon (1955) were the first to coin the term "artificial intelligence" in their proposal for a research project to build machines that can simulate human learning and intelligence. Five years earlier, Turing had published his influential paper on "Computer Machinery and Intelligence" (1950) in which he proposed an operational test for answering the philosophical question: "Can machines think?" This imitation game, in which a "blind" interrogator has to distinguish answers given by a machine from those given by a human subject, became known as the Turing Test and marks the start of the modern history of artificial intelligence research.

Artificial intelligence is not only about intelligence (luckily for Talos), it is more than that. It aims at understanding the working of the human mind by means of simulating the (complex) processes that underlie human perception, thinking, reasoning, learning and problem solving in machines (Turban, 1993). As mentioned in the introduction, Simon was one of the pioneers in the field of artificial intelligence by conducting research on simulating heuristic problem-solving processes by means of computer programs, together with Newell and Shaw. In 1956, this resulted in the first running AI program, the "Logic Theorist", which was not much later followed by the famous "General Problem Solver" (GPS) program (see Newell and Simon, 1961). Their ideas inspired many others, resulting in a stream of AI research denoted as the "Symbolic Processing" approach. However, just like humans have multiple strategies at their disposal to handle complex problems, there exists more than one approach to understand and simulate human cognition (see Luger, 1994; Boden, 1996). The other main stream of AI research tries to mimic the neurophysiologic working of the human brain, and is labeled as the "Connectionism" approach.

The first, classical approach of AI uses symbolic, non-algorithmic methods to create intelligent systems that generate advice or recommend solutions for problems. Knowledge is represented by means of symbols rather than just numbers (like in the modeling approach). Subsequently, these symbols are manipulated using non-algorithmic, heuristic methods for searching and processing information (Turban, 1993). This has led to, for instance, the development of rule-based, expert systems. Expert systems perform logical manipulations (or so-called "productions") on rules of the form of "IF (a given condition is met) THEN (take this action). A typical expert system consists of a so-called "inference engine" that performs the logical manipulations and a knowledge base containing domain specific knowledge including a set of rules, procedures, strategies and explanations (which are usually derived from textbooks and/or human experts). MYCIN (Shortliffe, 1974), a system consisting of about 500 IF-THEN rules for diagnosing and recommending treatment for meningitis and blood infections based on the patient's symptoms, is often acknowledged as one of the first, prototypical expert system (Turban, 1993).

The second perspective on AI, connectionism, takes the neural structure of the human brain as its basic model (Turban, 1993). In this model, no single neuron (or "node", in connectionist terms) possesses any intelligence, but the system (or "neural net") as a whole can act intelligently. A typical neural network consists of three layers of interconnected nodes that operate in parallel (as opposed to sequential in the symbolic processing approach): (1) an input layer (for the incoming stimuli), (2) one (or more) hidden layer(s) (for the processing of information), and (3) an output layer (for the advice or solution). The outcome is determined by the strength of the associations between the nodes, which are calculated based on an initial data set (i.e., the so-called "training set") and automatically updated when new data are fed into the network. Besides a fundamentally different perspective on intelligence, neural networks differ from experts systems in that they can only process numbers (no symbols) and are able to learn (i.e., by updating the connections between the nodes based on new data, just like the human brain is capable of adapting and learning by modifying the relationships between individual neurons). The foundation for neural networks was already laid in the 1940's by McCulloch and Pitts (1943), but their "neural net" still lacked the ability to learn. In the fifties and sixties, many researchers worked on the development of efficient learning algorithms for neural nets (notably are Hebb's (1949) learning rule and Rosenblatt's (1958) "perceptron"), but it was not until the mid 1980's that artificial neural networks really took off by the application of the so-called backpropagation learning algorithm (invented by Werbos (1974)) to multi-layer networks (Parker, 1985; Le Cun, 1986).[7]

Case-based reasoning (CBR) also belongs to the class of AI tools that are capable of learning (through case repair and adaptation, see subsection 2.4.3). However, the CBR approach deviates from the two approaches described above, as it takes an alternative perspective on human reasoning. It is based on two tenets: (1) similar problems have similar solutions, i.e., prior solutions are useful as a starting point for solving new problems (analogical reasoning), and (2) the type of problems one encounters tend to recur, i.e., future problems are similar to current problems. Hence, it is quite useful to remember and reuse solutions to previous problems (Leake, 1996). As Riesbeck and Schank (1989) put it: "humans expert are not systems of rules, they are libraries of experiences". And that is exactly what CBR systems are: libraries of experiences that are brought to bear on problem solving by using analogical reasoning.

The study of CBR is primarily driven by two fields of research, namely cognitive science in its desire to understand and model human behavior, and artificial intelligence in its desire to develop better technology and make AI systems more effective (Leake, 1996). More specifically, research on: (1) dynamic memory and the central role of reminding earlier situations (episodes or cases) in human problem solving and learning (Schank, 1982), and (2) analogical reasoning (Gentner, 1983) have instigated the development of CBR-tools and technology (Aamodt and Plaza, 1994). In the next subsection, we take a closer look at the history of CBR, its philosophy, and its systems and applications.

2.4.2 What is Case-Based Reasoning?

Case-Based Reasoning (CBR) can be viewed as fundamentally analogical (Leake, 1996). In the field of Artificial Intelligence, the term case-based reasoning is

[7] For more detailed information on the history, philosophy, and development of the field of artificial intelligence, we refer the reader to McCorduck (1979), Crevier (1993), Luger (1994), Boden (1996), Nilsson (1998), Russell and Norvig (2003), and Luger (2004),.

commonly used to denote a form of analogical reasoning that primarily uses cases that basically come from the same problem domain (i.e., intra-domain), whereas the cognitive science literature has preserved the term (true) analogical reasoning for using cases that come from fundamentally different domains (i.e., inter-domain) (Aamondt and Plaza, 1994) (see subsection 2.2.2). However, in the context of this dissertation, we prefer to speak of *near analogies* versus *far analogies* for cases that are nearer to or further from the target case, respectively, which is a matter of relative distance. Hence, when we use the term case-based reasoning, we refer to both types of analogies.

As discussed earlier, when confronted with a problem, one of the first things people naturally do is to search their memory for previous experiences that could help to interpret or solve the problem. CBR is a relatively novel, but promising AI tool that mimics exactly this type of experience-based human reasoning. That is, a CBR system solves a new problem by retrieving a previous, similar problem (the base analogy) from its memory and adapting the retrieved solution in order to fit the idiosyncrasies of the new problem situation (the target) (see Riesbeck and Schank, 1989; Kolodner, 1993; Aamodt and Plaza, 1994). The best-matching previous case is taken as the *ballpark solution*. If necessary, the ballpark solution is adapted to resolve specific differences between the old and the current problem situation (Riesbeck and Schank, 1989; Kolodner, 1993; Van Bruggen and Wierenga, 2001). Just like analogical reasoning, case-base reasoning involves the mapping and transfer of existing knowledge, i.e., relevant attributes and relationships, from the base domain to a target domain.

The processes of the classical CBR cycle (Aamodt and Plaza, 1994; see Figure 2.2) match perfectly with the primary cognitive processes that underlie analogical transfer, which are problem representation, search and retrieval, and adaptation (Novick 1988; Finke et al., 1992). The CBR-cycle (Figure 2.2) starts with the initial problem description, which in CBR terminology constitutes the new case. Based on the new case, the CBR system *retrieves* one or more similar cases from the collection of cases stored in its knowledge base, i.e., the so-called "case base" or "case library". The CBR system uses a "similarity metric" to retrieve and rank stored cases in order of their similarity with the new case. A solution suggested by one of the retrieved cases can then be directly *reused*, provided that it perfectly suits the current problem. Otherwise, the retrieved solution (i.e., the so-called "ballpark solution") has to be *revised* to meet all requirements of the new case. Next, the proposed solution is tested for success in the real world or evaluated by an expert judge, and repaired if it fails the test. Finally, during the *retain* phase useful experience is stored in the case-base for future problem solving. Thus, a CBR system is also capable of learning in the sense that it can update its knowledge base by storing new, learned cases and modifying existing cases

(Riesbeck and Schank, 1989; Kolodner, 1993; Aamodt and Plaza, 1994). In sum, the CBR cycle consists of the following processes (see also Figure 2.2).

RETRIEVE the most similar case(s).
REUSE the information and knowledge in it to come up with a solution.
REVISE, if necessary, the proposed solution.
RETAIN the parts of this experience that are useful for future problem solving.

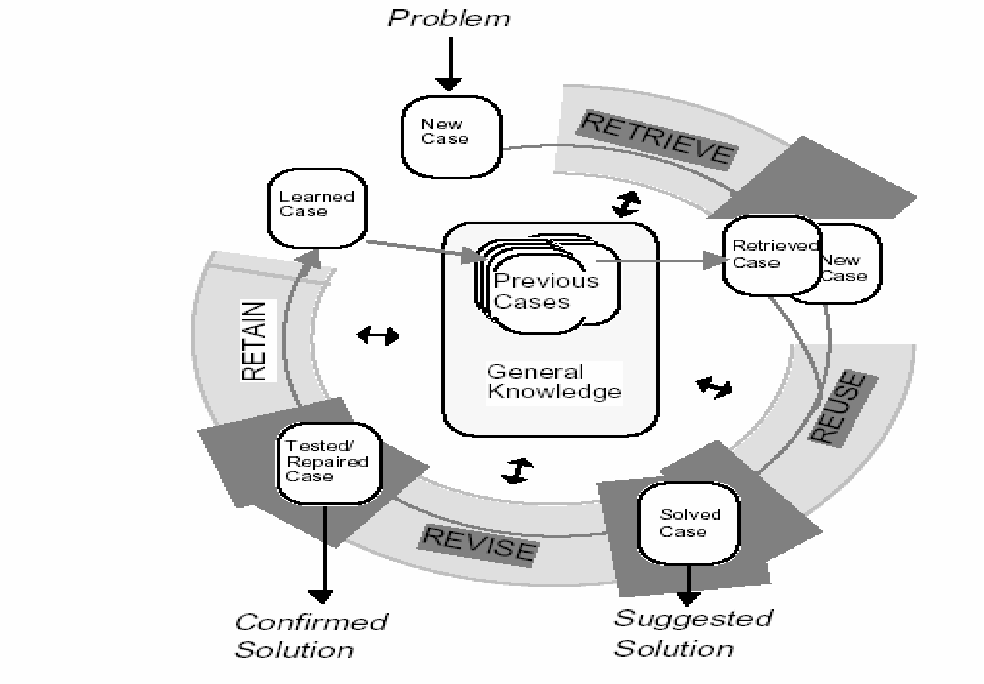

Figure 2.2 The CBR cycle (Aamodt and Plaza, 1994)

Previous cases are at the core of case-based reasoning (see Figure 2.2), just as experiences are at the heart of human problem solving and intelligence. "Virtually whenever there is a prior case available to reason from, people will find it and use it as a model for future decision making" (Riesbeck and Schank, 1989). Cases can be kept as single, concrete experiences, or as a set of similar cases subsumed into one generalized case. Likewise, CBR systems may contain a large amount of diffuse cases, or may only contain a limited number of representative, prototypical cases (Aamodt and Plaza, 1994). Furthermore, cases can be stored as separate knowledge units, or may be divided into smaller parts and distributed within the knowledge structure of the case-base (Aamodt and Plaza, 1994). At the highest level of abstraction, a typical case (for problem-solving purposes) consists of the following elements.

- The Problem Situation.
- The Solution.
- The Outcome.

In some problem domains cases are unavailable or in hard-to-use form (Leake, 1996), which of course is a major problem for CBR system design. Though, cases do not necessarily have to be complete on all parts to be useful, as long as the knowledge they embody is relevant for solving the problem at hand. What is crucial for the success of CBR (and human problem solving), is the ability to remember and retrieve the most relevant case(s) when needed (Riesbeck and Schank, 1989). Knowledge representation, indexing, similarity assessment, solution evaluation, adaptation, and learning are therefore important issues in CBR system design. We briefly discuss these issues here, for a more detailed discussion we refer the reader to Riesbeck and Schank (1989), Kolodner (1993), Aamodt and Plaza (1994), and Leake (1996).

2.4.3 The Case-Based Reasoning Process

In this subsection, we will discuss the process of case-based reasoning in more detail and focus on the sub-processes of *case representation & indexing*, c*ase retrieval & similarity*, and c*ase adaptation & learning.*

Case Representation & Indexing: The success of CBR heavily depends on how the knowledge contained in cases is organized and stored in memory. Unlike expert systems, for which knowledge has to be represented in the form of rules, CBR systems can store complete problem-solving stories as cases and, therefore, do not necessitate decomposition of experiences and the generalization of their parts into rules (Leake, 1996). Representing (tacit) knowledge in the form of complete stories or cases can be particularly helpful for problem domains in which rules are difficult to formalize (e.g., ill- or weakly-structured problem domains). Since a problem is solved by retrieving suitable experiences from memory, the knowledge representation problem in CBR concerns the effective organization and labeling of the specific knowledge embodied in problem-solving episodes (Aamodt and Plaza, 1994). It requires a great deal of general, domain dependent knowledge to assign the right type of indexes that define the search space and aid effective retrieval of cases (Aamodt and Plaza, 1994).

A good index should be distinctive enough to aid effective retrieval of relevant, useful cases only, though common enough to make efficient searching and (future) storage of cases possible (Riesbeck and Schank, 1989). Cases may be indexed by a prefixed or open vocabulary, and within a flat or hierarchical index structure (Aamodt and Plaza, 1994; Leake, 1996). Like the human brain, the knowledge structure or model (i.e., the search indexes) and the content (i.e., the cases) of the problem domain represented in the CBR system should be flexible enough to allow for refining, deleting and adding of indexes and cases (which is part of the learning process) (Aamodt and Plaza, 1994).

Case Retrieval & Similarity: As mentioned before, crucial for the success of a CBR system is the ability to retrieve the right analogies for solving the case at hand. Of course, this not only depends on the CBR system, but it requires also the ability of the decision maker to identify the right problem features in the first place. Based on the input features for the new case, the CBR system uses some kind of metric to calculate the similarity with the cases that are stored in its case-base. This metric can be based on superficial, syntactical similarities or on deeper, semantical similarities between two cases. Furthermore, the CBR system user can assign weights to the input features in accordance with their relative importance for solving the new case. The result of the retrieval process is a ranking of the stored cases based on the calculated similarity metric.
Stored cases in the CBR system that match all input features for the new case are of course good solution candidates, but depending on the strategy (e.g., efficiently constructing a workable solution versus requiring a novel, creative solution) also cases that only match a faction of the problem features may be retrieved (Aamodt and Plaza, 1994). Basically, reusing the retrieved cases hinges on two aspects: (1) what are the differences among the past and current case, and can the differences be solved and (2) which part(s) of the retrieved case can be mapped onto the new case (Aamodt and Plaza, 1994). Moreover, one can reuse the retrieved solution by copying or adapting it (transformational method) or one can only reuse the retrieved solution method and apply it to the new case (derivational method) (Aamodt and Plaza, 1994)

Case Adaptation & Learning. This part involves three aspects: case adaptation, case revision and case retainment. All CBR-software programs offer some kind of functionality for imposing adaptation rules on retrieved cases in order to resolve differences between new and the retrieved case. However, the existence of clear-cut (adaptation or solution) rules is usually what is lacking in weakly-structured problem domains. Hence, CBR-applications in weakly- or ill-structured domains often only use the (artificial) memory function of the CBR system and leave the evaluation and adaptation of the retrieved solution largely to the decision maker, i.e., the so-called *retrieve-and-propose* CBR systems (Leake, 1996). Retrieve-and-propose CBR systems are likely to be used when, for instance, creative solutions are needed (see subsection 2.4.5).
The case revision phase concerns the evaluation of the proposed (adapted) solution, which should preferably be done outside the CBR environment in a real-

life setting. If the solution proves to be successful, then the case can be retained in the CBR system for assisting future problem solving. If the proposed solution fails, then it should be repaired or revised using domain-specific knowledge (Aamondt and Plaza, 1994).

Finally, learning from the success or failure of the proposed solution involves "selecting which information from the case to retain, in what form to retain it, how to index the case for later retrieval from similar problems, and how to integrate the new case in the memory structure" (Aamodt and Plaza, 1994). Case-based reasoning and learning by experience are closely entangled (Leake, 1996). Exploiting successes and avoiding previous failures (trail-and-error) increases the knowledge of a case-based reasoner leading to new experiences that give rise to new cases.

2.4.4 Contribution of Case-Based Reasoning to Decision Support

Unlike database or information retrieval systems, CBR systems do not require an exact match between the search query and the stored information (Leake, 1996). That is, some of the attributes of the retrieved cases may conflict with the attributes that were specified in the search query. Moreover, the input may be incomplete. The goal of CBR is to find the "most similar" case or set of cases in its repository, which do not necessarily have to be exact matching cases. Whether a case should be retrieved does not only depend on the particular case itself, but also on whether there are better competitors available in the system's case base (Leake, 1996). Furthermore, compared to database or information retrieval systems, situation assessment and problem description play a vital and active role in the CBR-process. The input description for the CBR search process can be quite different (e.g., on a more abstract level) from the features that are included in the cases in memory, and it is crucial to determine appropriate retrieval cues (Leake, 1996). A great deal of problem solving is already done by specifying the right search query and, as a consequence, retrieving good solution candidates.

Where traditional AI approaches tend to use general domain knowledge to solve problems on a first-principles basis, CBR utilizes highly specific knowledge (i.e., concrete instances) of past experiences[8]. Kolodner (1993) summarizes a number of advantages and disadvantages of CBR over alternative approaches.

[8] Case-based or (analogical) reasoning can be seen as a form of "transductive" reasoning, i.e. transferring knowledge from one specific instance (the base case or analogy) to another specific instance (the target case or analogy). However, in CBR, inductive reasoning may also occur when from a large number of specific cases general rules (or knowledge) can be derived, while deductive reasoning may occur when general or exemplar cases, such as a prototype design, can be used to derive specific instances from. We would like to thank John Rossiter for this suggestion.

Advantages (taken from Kolodner, 1993)

- CBR allows the reasoner to propose solutions to problems quickly, avoiding the time necessary to derive those answer form scratch.
- CBR allows a reasoner to propose a solution in domains that are not completely understood by the reasoner.
- CBR gives a reasoner a means of evaluating solution when no algorithmic method is available for evaluation.
- Cases are useful in interpreting open-ended and ill-defined concepts.
- Remembering previous experiences is particularly useful in warning of the potential for problems that have occurred in the past, alerting a reasoner to take actions to avoid repeating past mistakes.
- Cases help a reasoner to focus its reasoning on important parts of a problem by pointing out what features of a problem are the important ones.

Disadvantages (taken from Kolodner, 1993)

- A case-based reasoner might be tempted to use old cases blindly, relying on previous experiences without validating it in the new situation.
- A case-based reasoner might allow cases to bias him or her or it too much in solving a new problem.
- Often people, especially, novices are not reminded of the most appropriate sets of cases when they are reasoning (Gick and Holyoak, 1980; Gentner, 1989a).

To sum up, by capitalizing on similar, past problem-solving experiences (i.e., analogies) a CBR system can help to find an appropriate solution candidate in an *effective* and *efficient* way. First, once a problem or case has been solved, it is often more efficient to use that solution (i.e., highly specific case knowledge) as a starting point for solving a similar problem, than to rerun the whole reasoning process that was necessary the first time (i.e., to reason from scratch using general, abstract rules) (Kolodner, 1993; Fowler, 2000). Second, using highly specific case knowledge (as opposed to general knowledge, models or rules) can also be more accurate or effective than using generalizations (Kolodner, 1993; Leake, 1996). More specifically, case-based reasoning will outperform model-based reasoning in weakly-structured, weak-theory domains where rules are imperfect, while the latter will outperform the first in domains that are well enough understood to capture causality in formal rules (Kolodner, 1993; Leake, 1996). Thus, model-based (or rule-based) reasoning is better able to cover the normative and fairly static decision situation, while cases are better able to grasp the more novel decision situation (we note that collecting additional cases may eventually produce generalizations and rules) (Kolodner, 1993).

2.4.5 CBR Systems and Applications

CYRUS (Kolodner, 1983) can be regarded as the first case-based reasoning system. Its development was inspired by Roger Schank's "dynamic memory" theory and, therefore, the system's artificial memory was structured in line with the Schank's theory of MOP's, i.e., memory organization packets (Schank 1982). Memory organization packets "represent knowledge about classes of events, especially complex events" (Riesbeck and Schank, 1989). They are organized in a hierarchical structure linked together by associating features. The higher MOP's contain general feature knowledge of events, actors and goals, the lower MOP's are more specific, and the bottom MOP's contain the concrete cases (cf. frame-based knowledge representation).

The focus of the CYRUS system was on how memory is used to answer question after understanding (Riesbeck and Schank, 1989). The system's "case-base" consists of all Cyrus Vance's diplomatic trips and meetings with people in his capacity as US secretary of state. It is a question-answer system that reads and interprets stories about Cyrus' diplomatic travels. These interpretations are then stored and used for making generalizations in order to be able to answer questions regarding discussion topics, negotiations and participants (Riesbeck and Schank, 1989; Kolodner 1993). The program uses heuristics to search efficiently and effectively its memory for answers. For instance, to answer a particular question about a meeting, such as "when did you last meet Mrs. Begin?", the system will ask itself a series of sub-questions until an answer has been retrieved from the previous meetings stored in memory or until no further elaboration is possible. Examples of useful sub-questions are: "did I ever meet Mrs. Begin?", "when would I meet a spouse of a diplomat?" (e.g., at a state dinner) and "when would I go to a dinner with Mrs. Begin?" (e.g., on a diplomatic visit to Israel) (see Riesbeck and Schank, 1989; Kolodner, 1993). CYRUS case memory structure has served as the basis for several other case-based reasoning systems, such as CHEF, JULIA, and CASEY (see Table 2.5).[9]

[9] For an elaborate discussion on types of CBR systems and specific applications, we refer the reader to Riesbeck and Schank (1989), Kolodner (1993), Aamodt and Plaza (1994), Althoff, Auriol, Barletta and Manago (1995), Leake (1996), Wierenga and Van Bruggen (2000), and Marling, Sqalli, Rissland, Munoz-Avila and Aha (2002).

Table 2.5 Types of CBR and Examples of Classic Applications

Type of CBR	Classic CBR Applications: Area	Classic CBR Applications: Name & Description
Interpretive	Law	HYPO (Ashly, 1991): contains cases (precedents) which are used to interpret a situation in court, and can provide both parties (i.e., prosecution or defense) with plausible arguments in the domain of patent law.
		CABARET (Skalak and Rissland, 1991): supports the role of precedence in legal judgments. Successor of HYPO, combining a case-based and rule-based system.
	Medicine	PROTOS (Bareiss, 1989): classifies hearing disorders. Of its entire 200-case corpus, initially PROTOS correctly classified 90%. In one experiment, its performance is 50% more accurate than generalization-based classification programs. CASEY (Koton, 1989): used for diagnosing heart failure, combines a deep causal domain (heart failure) model with case-based reasoning. On the basis of a patient's symptoms the systems searches for previous cases of diagnosed (i.e., classified) patients with similar symptoms. The system's case library contains about 25 different cases only.
	Diagnosis of Technical Problems	PATDEX (Richter and Weiss, 1991): supports fault diagnosis of complex machines. Case-based part of the MOLTKE workbench, including knowledge about the function and behavior of machines (technical model), diagnostic expert knowledge (mental model), and episodic knowledge of service technicians (cases).
Problem Solving	Technical Support (helpdesk)	CASCADE (Simoudis, 1992): helps technical support engineers to solve problems of customers whose hardware or software has crashed. The case library contains previous failures and suggests solutions to recover new failures.
	Cooking/ Recipes	CHEF (Hammond, 1986): generates new recipes in the domain of cooking (primarily Chinese stir-fry and soufflé recipes) by adapting old recipes, initially contains a library of 20 working recipes. Based on a request like "give me a stir-fry dinner with chicken and broccoli", it produces a recipe, which eventually has to be evaluated by the user. JULIA (Hinrichs, 1992): planning a meal by satisfying constraints, such as the preferences of the guests (e.g., vegetarian), costs, ease-of-preparation, ingredients etc. Cases include prototypical American dinners, European dinners, buffet-served meals, and one-course meals.
	Architecture	FABEL (Voss, 1994): consists of both general and domain specific-tools to support case management, retrieval, assessment and adaptation of architectural designs.
	Creative Explanation	SWALE (Schank and Leake, 1989): has a library of patterns for explaining why animals and people die, such as old age, being run over by a car, etc. SWALE is named after a young, successful, and thus apparently healthy, race horse that died mysteriously. Creative explanations involve for instance "owner kills horse for property insurance" analog to "spouse kills spouse for life insurance".

Case-based reasoning tasks are often divided into two classes: (1) interpretive and (2) problem solving (Kolodner, 1993; Leake, 1996). Interpretive case-based reasoning refers to the process of using cases to classify or characterize new situations based on their resemblance with previous situations (Kolodner, 1993). It is applied to tasks that share the common thread of *classification* and in which the goal is to provide some kind of classification, assessment, diagnosis, argumentation or prediction (Kolodner, 1993). Classical applications can be found, for instance, in law and medicine (see Table 2.5). Problem-solving case-based reasoning refers to the process of using and adapting previous solutions to problems in order to construct solutions that might apply to similar new problems. It is applied to tasks that share the common thread of *synthesis* and in which the goal is to provide some kind of design, planning, or explanation. Classical applications can be found, for instance, in medicine, cooking, and architecture (see Table 2.5). Finally, creative problem solving can be a promising application area for CBR as well (Schank and Leake, 1989; Aamodt and Plaza, 1994; Kolodner, 1994; Leake, 1996). CBR systems may serve as a basis for creativity by retrieving previous cases and applying solutions to new situations or in new ways: see, for example, the SWALE research project in Table 2.5, conducted by Roger Schank, David Leake and colleagues.

With respect to problem-solving CBR, there are two ways of dealing with the adaptation of retrieved ballpark solutions (see, for example, Kolodner, 1993; Leake, 1996). The first approach is called “automated” CBR systems, in which the necessary adaptation is left to the system itself by means of programmed adaptation rules. Consider, for instance, a CBR system for planning meals like JULIA (see Table 2.5). If the user has vegetarian guests coming over for dinner, then - based on this “vegetarian” constraint - the system might adapt a recipe containing meat by replacing the meat component with alternative vegetarian ingredients (e.g., tofu) (Kolodner, 1993). The second approach is called “retrieve-and-propose” CBR systems, in which the adaptation is primarily done by the user based on his personal judgment.

Retrieve-and-propose systems are adequate in situations for which (1) automation is not possible, i.e., if it is hard to formulate clear, unambiguous adaptation rules, or (2) if it is difficult to operationalize existing, but abstract adaptation rules, or (3) if good answers require unusual, and not prescribed adaptation strategies, e.g., when creative solutions are needed (Kolodner, 1993). In both instances, i.e., automated and non-automated CBR systems, the human reasoner of course always maintains control over the final decisions. However, the degree to which the user interacts with the CBR system differs from purely self-contained and automatic CBR systems to CBR systems that heavily interact with the user for support and guidance of its choices (Leake, 1996). It should be noted that the

applications mentioned in Table 2.5 are classics. Of course, new applications are being developed constantly. For instance, Hamburg (2005) developed an application for supporting euthanasia decisions, which was based on Bareiss' system for classifying hearing disorders, and Oskamp (1998) quite recently developed a system for supporting penalty decisions in law.
In marketing - a domain which hardly has any marketing "laws" (only a small number of "law-like" empirical generalizations exist) - quantitative, model-based decision support is dominant, while qualitative, knowledge-driven support tools for weakly-structured decisions, such as CBR applications, are rare (see next subsection 2.3.1). Notable exceptions however are: ADDUCE (Burke, 1991; see also subsection 2.2.2), McCann, Hill, and McCullough (1991) and McIntyre, Achabal, and Miller (1993), who developed CBR-applications for advertising, sales promotion planning, and forecasting retail sales, respectively.

2.5 The Application Domain of this Dissertation: Sales Promotions

In this section, we will introduce the marketing application domain of our studies, viz. sales promotion. First, we describe what we mean by sales promotions (subsection 2.5.1). Next, we discuss the process of designing sales promotions (subsection 2.5.2) and provide figures on the size of the sales promotion business and the developments (subsection 2.5.3). Finally, we emphasize the importance of creativity in sales promotions (subsection 2.5.4).

2.5.1 What are Sales Promotions?

Sales promotions belong to the category of marketing communication tools. Sales promotions are direct, short-term inducements to buy a product or service now (Robinson, 1985; Rossiter and Percy, 1996). In a similar vein, Blattberg and Neslin (1990) define sales promotions as "action-focused marketing events whose purpose is to have a direct impact on the behavior of the firm's customer". The American Marketing Association (AMA) operates a more elaborate and restrictive definition. On its website, it states that sales promotion are "the media and non-media marketing pressure applied for a predetermined, limited period of time at the level of consumer (*consumer promotions*), retailer, or wholesaler (*trade promotions*) in order to stimulate trial, increase consumer demand, or improve product availability"[10] (see also Table 2.6).

[10] see http://www.marketingpower.com and http://www.webster-dictionary.org (Webster's online dictionary).

Table 2.6 Ten Basic Sales Promotion Objectives and Sales Promotion Techniques

Sales Promotion Objectives	Sales Promotion Techniques
• Increasing sales volume • Increasing trial • Increasing repeat purchase • Increasing loyalty • Pre-empting/neutralizing competition • Creating awareness • Reinforcing/ supporting brand image • Introducing new product/brand • Obtaining customer information • Increasing availability/distribution	*Price Promotions (monetary)* • Price Discounts • Coupons • Refunds • Volume Plus *Value Promotions (non-monetary)* • Premiums (in-, on- or near-pack) • Sampling • Loyalty Programs • Sweepstakes, Lotteries & Contests • Events • Trade Deals

Sales promotion techniques, such as price discounts, contests and (cash) refunds (see Table 2.6), are relatively easy to implement and tend to generate a substantial and immediate increase in sales (Blattberg, Briesch, and Fox, 1995; Hanssen, Parson, and Schultz 2001), which makes them quite popular marketing communication tools among managers. Sales promotions may also have a positive *long-term* impact (Boulding, Lee, and Staelin, 1994; Rossiter and Percy, 1996). Schultz, Robinson, and Petrison (1998), for instance, even include it in their definition of sales promotions as "marketing and communication activities that change the price/value relationship of a product or service as perceived by the target, thereby (1) generating immediate sales and (2) altering long-term brand value or equity". The latter can, for instance, be established through thematic sales promotion campaigns that reinforce brand image or by means of loyalty programs that make the consumer less sensitive to price changes (Rossiter and Percy, 1996).Nevertheless, a growing body of research shows that the long-run effects of *price promotions*[11] in particular are not persistent (Dekimpe, Hanssens, Silva-Risso, 1999; Nijs, Dekimpe, Steenkamp and Hanssens, 2001; Pauwels, Hanssens, and Siddarth, 2002) and that frequent price promotions may even have a negative effect on brand image and equity (Blattberg and Neslin, 1990; Jedidi, Mela and Gupta, 1999). As mentioned earlier, in this dissertation we leave *price promotion* campaigns out of consideration and focus on the more creative, brand-image enhancing campaigns, since price promotion decisions are relatively well-

[11] Price promotions are *temporary* price discounts offered to the customer (Blattberg and Neslin, 1990).

structured problems for which suitable support techniques are already available (such as the SCAN*PRO model).
To give an example of a successful and creative SP campaign, consider the Amstel beer campaign in Figure 2.3 (left-hand side). This campaign was organized by the Dutch beer brewery Heineken in connection with the European Championship Soccer 2000. Besides increasing sales, the goals of the campaign were to achieve a "maximum correlation with the brand values", to increase awareness of Amstel as being a "professional sponsor" of the tournament and to have "high visibility at the store level". Consumers who purchased a crate of Amstel beer during the promotion period received a soccer table - which was mounted on the crate – for free (premium promotion). This table-soccer game became a "must have" gadget, which endorsed Amstel's creative brand perception, and resulted in high brand awareness, penetration and increase of sales (source: EFSP Awards, 2001).

Figure 2.3 **Two Sales Promotion Campaigns organized in connection with the EUROCUP soccer tournament**

Left-hand side: Free table soccer game, premium by Amstel Beer (2000)
Right-hand side: Win a pair of sneakers, sweepstake by Pringles Chips (2004)

A more recent, successful and creative campaign is the "Oranjekaas (Orange cheese): Win a pair of Quick Sneakers" campaign (see Figure 2.3; right-hand side[12]). This sales promotion campaign for Pringles chips (manufactured by Proctor & Gamble) - targeted at the Dutch market - was also organized in connection with a European Soccer Championship Tournament (in 2004). We note that the Dutch national soccer team plays in orange shirts, therefore, the orange can and the name for this chips' flavor: Orange Cheese. In 300 out of one million

[12] see also Pringles' website: http://www.pringles.nl/content/actie.htm.

cans of Pringles Orange Cheese (special edition), winning stickers were placed at the can's bottom. Consumers that buy a can containing such a sticker, had to call the number on this sticker and send in the sticker in order to collect their prize: a limited edition pair of (orange) Quick Sneakers. With the (retro) Quick brand being into fashion at the time, this pair of sneakers is certainly a desirable item for the hip and trendy Pringles consumer! People are also allowed to participate without buying a can of Pringles, but instead they have to request and pay for a scratch lottery ticket.

These two recent sales promotion campaigns are examples of creative campaigns that were very successful. However, it may be obvious that it is not easy to come up with campaigns that are creative and successful. Hence, the focus of this dissertation is to see whether analogical or case-based reasoning can help to support decision makers in the process of designing this kind of sales promotion campaigns.

2.5.2 The Process of Designing Sales Promotions

The sales promotion industry broadly comprises the companies that are in need of campaigns to promote their products (i.e., the demand side) and the marketing communications bureaus or sales promotion agencies that are specialized in designing such campaigns (i.e., the supply side). In addition, there are many different companies that have specialized in one particular aspect of a sales promotion campaign, such as handling houses (which take care of the handling of the incentive offered), point of purchase material manufactures (which take care of attracting attention to the promotion at the point of sale), promotional insurers, specialist printer (for leaflets, brochures etc.), field marketing agencies (they provide personnel to support all kinds of promotional activities) and premium sourcing houses (which create, manufacture and ship the promotional item you want, usually from the Far East) (see Cummins and Mullin, 2002). We note that a company can also decide to let the design and execution of a sales promotion campaign be done in-house by its own marketing staff, which in fact is not that uncommon.

The process starts with the business and marketing objectives of a company, which may result in a number of planned marketing activities, including sales promotions. The promotional objectives can be written down in a promotional or creative briefing. In this briefing, the management includes strategic information regarding the positioning and targeting of the product or brand on promotion, the promotional objective, the key performance indicators to measure the success of the campaign, a description of the target group and what you want those people to do and, finally, the operational constraints such as budget, timing location etc. (see Cummins and Mullin, 2002). A company can write this briefing for own usage and develop the campaign in-house, or outsource the design and/or execution to the specialized sales promotion agencies mentioned above. It is important to evaluate and document the campaign afterwards in the light of the objectives set and the marketing accountability. However, these last stages of the promotional process are often neglected, due to tight promotional budgets that do not allow for evaluative research, sales results are used as a simple measure of success (i.e., if the results are analyzed at all), or there is just no time to evaluate because the next promotion is already due (see Van Eunen, 2001; Cummins and Mullin, 2002).

Except for successful campaigns that are sent in to the sales promotion award competitions, it is not common practice in the sales promotion business to document the executed campaigns (Van Eunen, 2001). However, also sales promotion practitioners must and do recognize that there is clearly value in doing this, irrespective of their notion of analogical or case-based reasoning. The following is an example of how a very old campaign could have served as the basis for efficiently developing a "brand new" and effective campaign. The promotional success of the free 3-D glasses at Taco Bell (a popular fast-food chain in the U.S.) for the new Batman movie in the 1990s - over 4 million 3-D glasses were given away – is not different from the promotional campaign with free 3-D glasses that was used in the 1930s to attract American movie goers to the cinema on Saturday afternoons to watch the first movie in 3-D (Robinson and Hauri, 1995). Apparently, despite the huge advance in promotion and consumer understanding that has been made since the 1930s, human nature has not changed that much and "old" techniques still work (Robinson and Hauri, 1995). Thus, there is a great deal to be learned from previous campaigns and one can save a large amount of time and effort by not having to reinvent-the-wheel.

Of course, practitioners keep their own recollection of promotional campaigns in memory and can retrieve and reuse the knowledge contained in these campaigns. But human memory is fallible and people nowadays change jobs frequently, so valuable knowledge might get lost for the company. To facilitate the reuse of (elements from) previous campaigns, they have to be collected and written down in the form of cases. We can apply the Case-Based Reasoning (CBR) technology, as discussed earlier, on cases containing qualitative and quantitative information about sales promotions. By systematically storing sales promotion cases in the case-base of the CBR system, the company can build an infallible, artificial, corporate sales promotion campaign memory. In this way, sales promotion managers can share their experiences (in the form of cases) with their colleagues and are able to learn from previous, similar experiences by retrieving relevant cases from the CBR system.

Recently, there have been a number of initiatives to collect and store cases systematically in the sales promotion business. For instance, since 1996 sales

promotion agency KV Promotional Partners[13] documents and stores the most joint promotion[14] campaigns organized in the Dutch market (over 1200 cases each year). Market research agency NFO Trendbox[15] has selected since 1998 four times per year a number of sales promotion campaigns that are evaluated by a consumer panel (n = 300) in order to gain understanding of the working and effects of sales promotion campaigns and, eventually, develop better campaigns (Hielkema, 2001).
CBR systems, and the above-mentioned digital cases collections, must be seen as complementary to the manager, not as substitutes. A CBR system can provide the manager with experiences he lacks, suggest successful course of actions and warn of potential failures (Leake, 1996). The final decision however remains with the manager. Gut feeling, intuition and subjective judgment will still play an invaluable role in weakly-structured problem solving.

2.5.3 The Developments in Sales Promotions

In the last two decades, there has been a large shift in marketing communication expenditures from advertising to sales promotions. The percentages used to be about 60-40 in favor of advertising, but now this ratio has reversed to almost 40-60 in favor of promotions, and in many consumer goods companies even to 25-75 (see Schultz et al., 1998; Rossiter and Percy, 1996; Cummins and Mullin, 2002; Bunn and Banks, 2004). The drivers of this growing popularity may be manifold, for instance, economic factors (e.g., recessions), marketplace factors and regulations (e.g., advertisement bans), managerial issues (e.g., short-term focus on sales targets), changes in competition (e.g., private labels) and consumer behavior (e.g., zapping behavior). But above all, it is nowadays hard to break trough the clutter of advertisements for manufacturers and retailers, while sales promotions directly grab the consumer's attention and immediately generate sales (Schultz et al. 1998; Cummins and Mullin, 2002).

Below we provide some facts & figures.

- Across Europe, on the vast amount of sales promotion incentives offered to them, consumers currently spend 61 billion Euro buying products on promotion, and this amount is increasing with 5% per year (Bunn and Banks, 2004).
- Nearly all U.S. consumer goods companies reported using a wide variety of sales promotion techniques, including coupons (97% in 1995), samples

[13] see http://www.kvpp.nl/index.php.
[14] a promotion organized in conjunction with an other brand or company.
[15] see http://www.trendbox.nl/assortiment/continu/index.html.

(72%), refunds (66%), sweepstakes (63%), and premium offers (56%) (Schultz et al., 1998).
- In 1995, nearly 300 billion coupons (i.e., 3000 per household) were distributed in the U.S. - up from 40 billion in 1975 - resulting in $4 billion worth of consumer savings by redeeming about 7 billion coupons (Schultz et al., 1998).
- In 2001, 17 billion pound was spend on advertising in the U.K, while 18 billion was spend on sales promotions. Furthermore, over 5 billion coupons were distributed in 2000, i.e., nearly 250 per household (Cummins and Mullin, 2002).
- From 1995 to 2001, the promotional pressure (i.e., the percentage of total sales accounted for by promotional activities) in the Netherlands has increased, for instance, for soft drinks from 11% to 18% and for detergents from 20% to 31%. About half of the promotional activities were price promotions (Verduyn, 2003).

As can be derived from these figures, a vast majority of all sales promotion activities in the world concerns plain price discounts (including coupons). Price promotions - of which numerous examples can be found in supermarkets every day - are easy to implement and can quickly generate huge sales volumes. Among researchers and practitioners there is, however, a growing concern about the negative effects of price promotions, such as the erosion of the brand's image and equity (i.e., consumers might think that the product has to offer these deals because of the product's low quality) . In addition, frequent price promotions tend to make the consumer purchase deal-to-deal and lower the product's reference price, i.e., consumers may be no longer willing to pay the regular price (Blattberg and Neslin, 1990; Schultz et al., 1998; Jedidi et al., 1999; Van Heerde, Leeflang, Wittink, 2000). Therefore, it would wise to shift the focus from plain price-promotions with short-term successes towards more innovative, creative and thematic promotional campaigns that are capable of enhancing brand image and creating long-term brand value (see also Schultz et al., 1998; Chandon, Wansink and Laurent, 2000; Cummins and Mullin, 2002). In this dissertation, we aim at supporting the design of exactly this type of thematic sales promotion campaigns. That is, we focus on the design of non-routine, creative, thematic promotional campaigns that are capable of enhancing brand image and creating long-term brand value, and thus not on the design of routine, plain price promotion campaigns. Thus, if we want to investigate whether analogical or case-based reasoning results in better sales promotion campaigns, we have to look at the extent to which the availability of a CBR system leads to more creative campaigns.

2.5.4 The Importance of Creativity in Sales Promotions

To illustrate and emphasize the importance of creativity in sales promotions, a few statements are taken from the websites of marketing communication agencies:

"We believe in great creative work because we know that's what gets results in the market place" (Saatchi & Saatchi)

"Even in this information age, big ideas are at the heart of everything we do. By translating strategic thinking into big ideas, we develop creative communications that move consumers into deeper, more valuable relationships with a brand. Creativity is our most visible product and is, in many ways, the summation of all our marketing thinking" (OgilvyOne Worldwide)

"Our creative product is at the center of all we do" (Draft Worldwide)[16]

Moreover, every year big award-giving ceremonies are organized to reward to outstanding, effective and creative sales promotion campaigns. To name a few prestigious awards: the ISP Awards (Institute for Sales Promotions, UK), the PRO Awards (PROMO Magazine, USA) the EFSP Awards (European Federation of Sales Promotions), and the Esprix's (Dutch Dialogue Marketing Association, the Netherlands). These awards are highly valued in the business and recognized as a token of an agency's craftsmanship (Cummins and Mullin, 2002). In their practitioners' handbook on how to create campaigns that "really work", Cummins and Mullin (2002, Chapter 5) devote a chapter to the importance of being creative for the success of sales promotion campaigns and describe a number of techniques for stimulating creativity, including the well-known brainstorming technique.

By pointing out the great, highly successful, creative award-winning campaigns, creativity advocates like to assert that creativity is not only a prerequisite for campaigns to break through the clutter, but they even equate creativity with effectiveness. Others argue (e.g., Trout and Ries, 1989) that the mere focus on creativity by marketing communication agencies leads the attention away from effectiveness. In the end, selling more products should be all that matters to the marketing or account manager (see Haberland and Dacin, 1992; Kover, Goldberg and James, 1995; Koslow, Sasser and Riordan, 2003). It is probably safe to say that not all effective campaigns are creative, and certainly not all creative campaigns are effective (see Kover, Goldberg, and James, 1995). Nonetheless, in the consumer's mind creativity and effectiveness are often linked. That is, campaigns that are perceived as being new and exciting and are congruent with the product

[16] Number one sales promotion agency in the US in net revenues over 2003: $338,000,000, see http://promomagazine.com/mag/marketing_getting_back_work

they represent, evoke the most purchase interest and liking (Kover, Goldberg and James, 1995).
Creativity is worth studying in its own right, being indisputably the least scientific (i.e., ill-structured) aspect of marketing communications and arguably the most important one (Reid, Whitehall and DeLorne, 1998). Hence, creativity as a research topic is increasingly being scrutinized in the scientific marketing literature. Articles on creativity are published in the top marketing journals and can, for example, be found in the domain of advertising & advertising research (e.g., Haberland and Dacin, 1992; Zinkhan, 1993; Pieters, Warlop and Wedel, 2002; Koslow, Sasser and Riordan, 2003; Smith and Yang 2004), new product development (Moorman and Miner, 1997; Dahl and Moreau, 2002; Moreau and Dahl, 2005), designing marketing programs (Andrews and Smith, 1996), managerial decision making (Ford and Gioia, 2000), and marketing strategy (Menon, Bharadway, Adidam and Edison, 1999). These articles consider different aspects of creativity, such as its definition and measurement, creative processes, procedures for stimulating creativity, and the effect of the creative product on sales and profits. In Chapter 3 (Theory & Hypotheses) and Chapter 4 (Methodology), we will discuss the concept of creativity and its measurement in more detail.

2.6 Summary

In this dissertation, we will empirically examine the effectiveness and efficiency of analogical reasoning as a principle to develop tools for supporting weakly-structured decisions in marketing. We will use a technique that originated from the field of artificial intelligence (AI), called Case-Based Reasoning (CBR), as a tool for mimicking and supporting human analogical reasoning in weakly-structured problem solving. The way CBR systems can successfully provide decision support is twofold. First, by retrieving similar, previous cases (i.e., analogies), useful knowledge contained in these cases can be readily accessed and transferred to develop effectively and efficiently a solution for the problem at hand. Second, providing the decision maker with (far) analogies may trigger the generation of novel ideas and enhance the creativity of the solution. Our application domain in marketing is the design of sales promotion campaigns, in which we focus on the higher-level, weakly-structured decisions, such as deciding upon the type and the (creative) content of the campaign. In the next chapter, we conceptualize and discuss how exactly analogical reasoning, by means of a CBR system and in conjunction with the decision maker, can improve the design of sales promotion campaigns.

Chapter 3

Analogical Reasoning and the Design of Sales Promotion Campaigns: The Effect on Quality and Efficiency (*Theory & Hypotheses)*

"… Anschauungen ohne Begriffe sind blind" *(Immanuel Kant, 1781)*

3.1 Goal of the Dissertation and Main Research Questions

Analogical reasoning by means of a Case-Based Reasoning (CBR) system is a qualitative method to support decision making. However, we can make this method subject to quantitative, scientific inquiry. There are several ways to measure decision support system effectiveness or success, such as the technical validity of the system, its adoption and use, and the impact on individual and organizational performance (see DeLone and McLean, 1992). The basic premise underlying this dissertation project is that the use of a CBR system should improve the quality of a sales promotion campaigns. Hence, we focus on solution quality as our main dependent variable in this dissertation. However, from the effort-accuracy framework (Payne, Bettman and Johnson, 1993) and empirical decision support research (e.g., Lilien, Rangaswamy, Van Bruggen and Starke, 2004), we learn that decision makers do not necessarily use a decision support system to improve solution quality, but they may also opt for improving solution efficiency (i.e., to reduce the time and effort spent on the solution) keeping the same level of quality (see Figure 3.1).

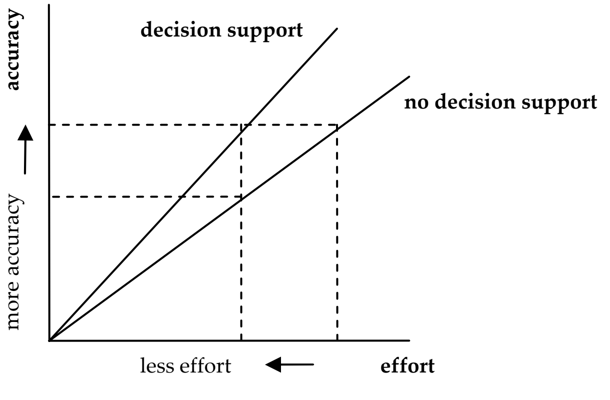

Figure 3.1 Effort - Accuracy Trade-Off

Thus, people can make a trade-off between accuracy and effort. We expect that a CBR system can facilitate both, i.e., improve the effectiveness *and* the efficiency of the decision maker. In our empirical studies, we will test these assumptions. To determine the success of CBR system usage for designing sales promotion campaigns we therefore consider two aspects: (1) *solution quality* (i.e., does CBR system usage lead to sales promotion campaigns of higher quality?) and (2) *solution efficiency* (i.e., does CBR system usage help to come up with a sales promotion campaign quicker?). The main objective of our studies will be to determine empirically the answer to both questions, but with an emphasis on the effects of CBR system usage on the quality of the solution.

In other domains than marketing, such as law and medicine, case-based reasoning has already become quite popular and multiple practical applications have been developed (see previous chapter). Nonetheless, even in these domains evaluation of the performance of CBR systems and applications in terms of their accuracy and efficiency has been limited so far (Kolodner, 1993; Leake, 1996), certainly regarding performance evaluation in comparison with alternative methods of decision support. Next to the bottom-line performance of the CBR system (i.e., in comparison with a situation in which no CBR system is available), we are also interested in the conditions under which CBR system usage (in conjunction with the decision maker) is most effective and efficient. Furthermore, we are interested in how decision makers evaluate the contribution of the CBR system to the solution (i.e., the design of a sales promotion campaign) and how this relates to the objective contribution of the CBR system to the solution.

Hence, the main research questions that we aim to answer in this dissertation project are the following.

1. Does providing decision makers with analogies, by means of a CBR system, result in sales promotion campaigns of higher quality and does it make the design process more efficient?
2. What is the influence of the type of analogies offered to the decision maker? Should they come from the same problem domain (i.e., near analogies) or should they come from more distant domains (i.e., far analogies)?
3. What is the influence of the number of analogies offered to the decision maker? Are more analogies better?
4. In examining the effect of using a CBR system with analogies, what is the role of decision maker characteristics? In particular, is the effect different for decision makers with different innate creative abilities?
5. What is the relationship between the decision maker's subjective evaluations of using a CBR system for designing a sales promotion

campaign and the objective outcomes, i.e., solution quality and solution efficiency?

In addition to these five main research questions, we want to know whether information about the underlying process, such as CBR system usage time and the number and type of analogies that the decision maker has used, can give us more insight into the effects of CBR system availability on the objective outcomes, i.e. the quality of the sales promotion campaigns and the efficiency of the design process, and the subjective evaluations. To accommodate these questions, we develop and discuss a conceptual framework in the next section that shows how the use of a CBR system affects the quality of the sales promotion campaigns, the efficiency of the design process, and its subjective evaluations (see Figure 3.2), in order.

This chapter is organized as follows. In section 3.2, we develop a conceptual framework for the empirical studies in this dissertation. Next, we explain the concept and relations of this framework into more detail. In Section 3.3., we discuss the general effect of providing decision makers with analogies. Section 3.4 and section 3.5 deal with the influence of the type and number of analogies, respectively. In section 3.6, we elaborate on the role of the decision maker's innate creative ability. We continue this chapter with a discussion on the best strategy for matching the CBR-system with the manager, i.e., reinforcement or compensation (section 3.7), and the relation between the decision maker's subjective evaluation of the CBR-system and its objective outcomes (section 3.8). Finally, we briefly indicate a number of characteristics of the system usage process that might play a role (section 3.9). We conclude this chapter with a summary of the topic discussed (section 3.10).

3.2 Conceptual Framework

Developing a sales promotion campaign belongs to the category of design problems (or "synthesis" tasks; see subsection 2.4.5). Design problems are typically constraint problems for which the problem solver has to produce a concrete artifact that satisfies the constraints (Kolodner, 1993; Jonassen, 2000). Due to the usual underspecification of the design problem, or in Reitman's (1965) terminology the presence of "open constraints" (i.e., parameters for which the values are left unspecified), multiple solutions are possible (Voss and Post, 1988; Kolodner, 1993). Also when designing a new sales promotion campaign, marketers have to deal with many degrees of freedom in the problem statement and, as consequence, a large solution space. As a result of the many degrees of freedom in the problem statement (including goals and intentions), the absence of predetermined solution paths, a lack of clear evaluation criteria (i.e., there exists disagreement among the problem solvers on how the open constraints can be best filled in), and a limited or delayed feedback from the real world, design problems are among the most complex, ill-structured and open-ended kind of problems (Voss and Post, 1988; Goel and Pirolli, 1989; Jonassen, 2000). The fact that usually professionals get well paid for designing things (products, commercials, campaigns, etc.) stresses the importance of this type of ill-structured problem solving (Jonassen, 2000).

A design activity can be described as an explorative, goal-oriented, constrained, decision making and learning activity, of which the output is a graphical, numerical and/or textual design description (e.g., a sales promotion campaign proposal) that conveys sufficient information about the designed artifact so that it can be manufactured (Gero, 1990). Experience-based design schemas (i.e., generalized or schematized design knowledge from individual experiences) can aid the designer in the design process (Jonassen, 2000). That is, experienced designers are not likely to proceed from scratch, instead "preexisting" solutions, design schemas and prototypes acquired by experience are stored in memory and can be reused and modified to develop a solution for the problem at hand (Visser, 1992). Although individual design experiences may have been generalized into design schemas or prototypes that can be activated during the problem solving process (Gero, 1990; Fischer and Nakakoji, 1992), much of this knowledge remains tacit. Tacit knowledge is highly personal knowledge that is based on individual experiences. It resides mainly in the minds of people and is thus hard to formalize, articulate and communicate (Polanyi, 1966; Nonaka and Tackeuchi, 1995). To put it differently, designers usually know more than they can say (Fischer and Nakakoji, 1992). Given the importance of experiences, it could be beneficial to make previous design experiences (both individual experiences and those of others) available in the form of case descriptions in order to stimulate the thinking and decision-making processes of the designer (and novices, in particular) (see also subsection 2.5.3).

It has been demonstrated that software designers, for instance, usually do not design a new software program from scratch, but they reuse and adapt current programs or programs that have been written in the past (Visser, 1992). Sales promotion experts are also not likely to proceed from scratch in the process of designing a campaign. They will often reuse and adapt previous solutions retrieved from memory (or a library). In our personal conversations with sales promotion practitioners, they indeed indicate that they usually delve into their "mental library" for examples of successful (or unsuccessful) previous campaigns that were constructed with similar objectives or constraints and use these examples as a starting point (i.e., the so-called ballpark solution) for designing a new campaign.

In the design of sales promotion campaigns, the element of creativity plays an important role (see section 2.5). Sales promotion campaigns that are creative can grab the consumers' attention and are able to stand out in the clutter of advertisements and promotional advertising campaigns. Moreover, given the growing concern about the negative effects of (frequent) price promotions on reference prices, brand image and equity, companies have to shift their focus the design of more creative, thematic promotional campaigns that are capable of enhancing brand image and creating long-term brand value. Creativity often stems from making "novel combinations of old ideas" (Boden, 1994), "using old solutions in a novel ways" (Kolodner and Wills, 1993) or "the forming of associative elements into new combinations which either satisfy requirements or are in some way useful" (Mednick, 1962). All these definitions represent a view on creativity that can be made amenable to scientific scrutiny in the process of creating and designing (e.g., Gero and Mahler, 1991; Bhatta, Goel and Prabhakar, 1994; Wills and Kolodner, 1994), and which is closely associated with analogical reasoning (and case-based reasoning) (Boden, 1994).

A Case-Based Reasoning (CBR) system can make relevant previous solutions (or ideas) available to the designer and, therefore, facilitate the analogical reasoning process, resulting in more creative solutions. The CBR system aids the sales promotion campaign designer in the process of searching the problem and solution space and retrieving analog cases from memory. The knowledge base (or artificial memory) of the CBR system can contain information about the problem situation, the solution and the outcomes of previous sales promotion campaigns, usually in the form of case descriptions. As Kolodner (1993) argues, to find a good solution to a problem it can be extremely helpful to retrieve previously solved cases from memory or from a case library (Kolodner, 1993). Of course, this procedure does not guarantee that one comes up with the best solution possible, but this is true for any type of heuristic problem solving that is applied to weakly-structured problems (see Tversky and Kahneman, 1974; Simon, 1977).

To summarize, we have argued that the design of creative, thematic sales promotion campaigns can be supported by means of analogical reasoning. Hence, we propose the use of a Case-Based Reasoning system as an effective and efficient decision support tool for designing creative sales promotion campaigns. For investigating the success of the CBR system, we developed the general framework depicted in Figure 3.2. This framework shows how the use of a Case-Based Reasoning (CBR) system affects the quality of the Sales Promotion (SP) campaigns, the efficiency of the design process, and its subjective evaluations.

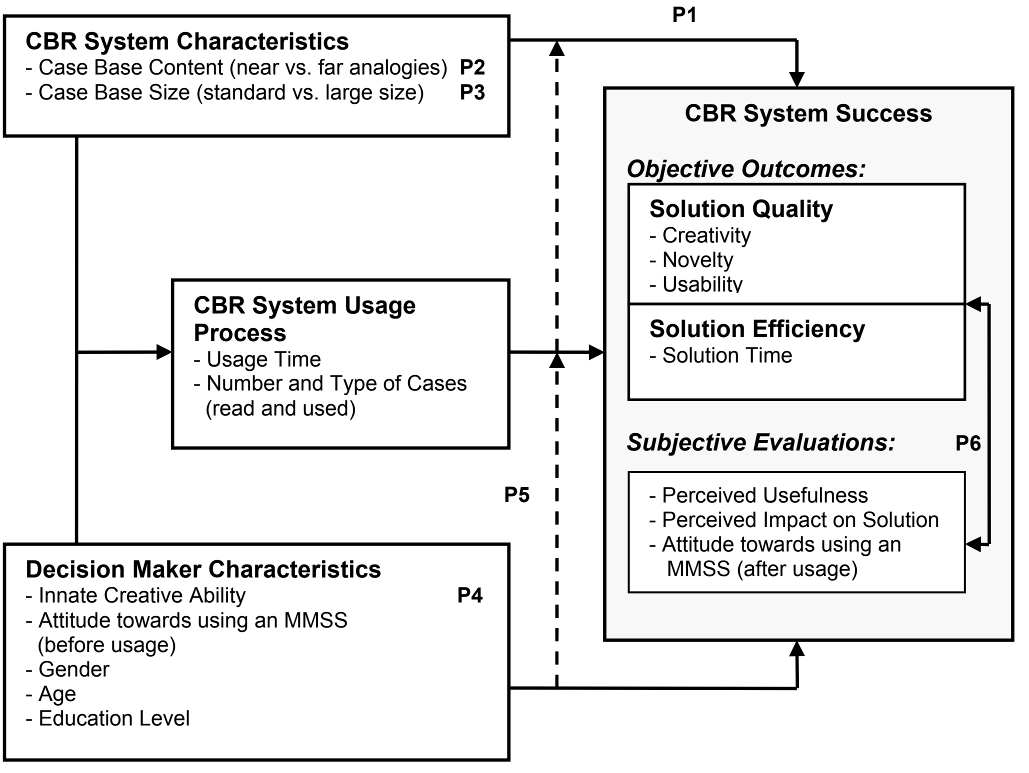

Figure 3.2 Framework of How the Use of a Case-Based Reasoning (CBR) System Affects the Quality of Sales Promotion Campaigns, the Efficiency of the Design Process, and its Subjective Evaluations

In this framework, the dependent variables for assessing the success of CBR system are its *objective* outcomes, i.e., *solution quality* and *solution efficiency*, and its *subjective evaluations* (i.e., as perceived by the decision maker). With respect to solution quality, we look at the *creativity* of the sales promotion campaign (as judged by independent sales promotion experts) (see Figure 3.2). As discussed earlier, creativity plays an important role for the effectiveness of sales promotion campaigns According to the commonly used definition of creativity (see Amabile, 1983; Mumford and Gustafson, 1988; Boden, 1994), an artifact or outcome is considered to be creative when it is both novel (original) and useful (meaningful). Hence, in this dissertation we will equate *solution quality* with *solution creativity*, which comprises both the *novelty* and *usability* of the campaign. Since the novelty and usability dimension of solution creativity may be affected differently by the characteristics of the CBR system, the decision maker and the process, we will also examine these two dimensions separately.

As discussed in section 3.1, there could be a trade-off between *solution efficiency* (i.e., *solution time*, finding a quick solution) and *solution quality* (i.e., finding a creative solution). That is, people could decide to minimize their (cognitive) effort (or take a path-of-least-resistance, see Ward, 1994; Moreau and Dahl, 2005) at the cost of improved accuracy (Payne et al., 1993). We expect that a CBR system can facilitate both, i.e., improve the effectiveness *and* the efficiency of the decision maker.

Regarding the subjective evaluations of CBR system success (i.e., as perceived by the decision maker), we distinguish the following aspects: the *perceived usefulness* of the CBR system for designing a sales promotion campaign, the *perceived impact* of the CBR system on the final solution, and the *attitude towards using MMSSs in general (after usage)* for enhancing marketing decision-making performance.

The conceptual framework basically consists of three elements: (1) characteristics of the CBR system (viz. case-base *size* and *content*), (2) characteristics of the decision maker (viz. *innate creative ability, attitude towards using an MMSS (before usage), gender, age,* and *education level*), and (3) characteristics of CBR system usage process (viz. system *usage time* and *cases read* and *used*) (see Figure 3.1)[17]. Prior to engaging in the design (or problem-solving) process, we can characterize both the decision maker and the CBR system on the basis of these features or traits that may directly influence the quality of the solution and the efficiency of the design process (see Figure 3.1). Supposedly, at the interface of these two entities, i.e., the decision maker and the CBR system, interaction will take place in the problem-solving process, which has an impact on the solution (see Figure 3.1), objectively and subjectively.

In the next sections, we will discuss the framework in more detail and, based on a review of the literature, develop general hypotheses regarding the influence of (1) CBR system characteristics (i.e., the type and number of analogies), (2) decision maker characteristics (i.e., innate creative ability), (3) the interaction between the CBR system and the decision maker (i.e., between CBR system availability and the decision maker's innate creative ability) on solution quality and solution efficiency. Furthermore, we will develop a hypothesis regarding the relationship between the objective outcomes of CBR system usage and the decision maker's subjective evaluations of the contribution of the CBR system to the design of a sales promotion campaign. And finally, we will discuss characteristics of the CBR system usage process (e.g., system usage time and number and type of cases read

[17] Characteristics of the problem can also play a role in the design process, such as problem structuredness, depth of knowledge, data or case availability (see Wierenga and Van Bruggen, 2000). In each empirical study, we concentrate on only one type of problem (e.g., designing a SP campaign for one particular fast-moving consumer good (FMCG)).

and used) that may help to explain the effects of CBR system availability on the objective outcomes and the subjective evaluations.

3.3 The Effect of Providing the Decision Maker with Analogies

The basic premise underlying this dissertation, and most other decision support system research, is that providing decision makers with a decision support tool should result in better decision performance compared to not using such a decision aid. Several studies have indeed shown that the use of decision support systems can lead to, for instance, shorter decision times (i.e., solution efficiency) and improved solution quality, while other studies found no effects or even negative effects (see, for instance, Chakravarti et al., 1979; McIntyre, 1982; Money, Tromp and Wegner, 1988; Sharda, Barr and McDonnell, 1988; Benbasat and Nault, 1990; Lilien et al., 2004). However, most of these decision support studies have been conducted in relatively structured decision environments using data-driven, model-based means of support.

In weakly-structured decision situations, using an analogy can help to impose structure on the problem[18] and to provide coherence (i.e., the systematicity principle, see Gentner 1983, 1989b). For instance, when a problem or decision situation is new to a person, that person will generally know a few features of the problem or decision situation, but will not know how these features are related (Markman and Moreau, 2001). The base domain of an analogy can help to impose structure on the problem representation and enhance solution quality and efficiency, since it contains the relational structure that binds together the features (Markman and Moreau, 2001).

This line of reasoning is consistent with the theory of "structured imagination" in creativity (see Finke et al., 1992; Ward, 1995). This theory posits that when people use their imagination to develop new ideas, the resulting ideas will be strongly affected by the structure and the properties of existing examples. Consider, for instance, the introduction of the graphical desktop interface on the computer that replaced computer language as the means to operate the computer on (cf. MS-DOS). Although this is commonly regarded as a highly innovative, creative breakthrough for the user-friendliness of the computer, the idea itself is largely structured by the analogy with the physical desktop, containing icons, maps with papers and even a recycle bin to throw away stuff. The use of design templates (see, for instance, Goldenberg and Mazurski, 2002) to enhance creativity in product innovation is also illustrative for the principle of structured imagination. These templates are often based on existing products, because these examples can

[18] A great deal of solving weakly-structured or ill-structured problems is about imposing structure on the problem, i.e. "much problem-solving effort is directed at structuring problems, and only a small fraction of it at solving problems once they are structured" (Simon, 1973).

provide viable solutions to several functional and aesthetic goals in product design (Klein, 1987).

Providing people with previous examples is often argued to constrain creativity by fixating people's attention to the solution pathways given in the examples (e.g., "design" or "form" fixation, see Jansson and Smith, 1991; Dahl and Moreau, 2002. This is called the conformity effect (Smith, Ward and Schumacher, 1993) or "unconscious plagiarism" (Marsh, Ward and Landau, 1999). For instance, when given the task to design a new "automotive dining" device, Dahl and Moreau (2002) found that providing the participants with an analogy (e.g., a drive-in window food tray) reduced the originality of their design by fixating the form of the new device to the structure that was present in the example. That is, the salient properties of the example serve as a starting point for the final design. In their studies, Dahl and Moreau (2002) used predominantly near analogies to serve as examples, such as a drive-in window food tray, a cup holder, lunch box and an airplane foldout table. As they argue, the use of far analogies, i.e., examples coming from more distant base domains, might be better to enhance creativity (see also Bonnardel, 2000). Moreover, since creativity is argued to spring from combining old ideas in a novel way (Mednick, 1962; Kolodner and Wills, 1993; Boden, 1994), the danger of unconscious plagiarism may be more prominent when people are only provided with one example instead of multiple examples (although Dahl and Moreau (2002) did not find evidence for this).

Previous support system research (e.g., MacCrimmon and Wagner, 1994; Massetti, 1996; Bonnardel, 2000) has shown that when people are provided with (computer-generated) examples or analogies they come up with significantly more ideas, including creative ones (i.e., "quantity breeds quality" (Rossiter and Lilien, 1994)), than without examples. Other studies have demonstrated that providing people with examples not necessarily constrains creativity due to design fixation (Purcell and Gero, 1992; Marsh, Landau and Hicks, 1996; Marsh, Bink and Hicks, 1999). For instance, Marsh et al. (1999) showed that when features across examples are conceptually related to one another (in this case, the concept of hostility), people's creations (i.e., drawings of aliens) contained (hostile) features that were not part of any of the examples provided. Their results suggest that people will design novel entities that are consistent with the emergent or salient properties of the examples shown to them.

To summarize, when people are given examples they may transfer salient and usefulness properties to the new design, but not necessarily at the expense of including novel elements. In addition, a CBR system can provide multiple ideas or examples to the designer, which he can combine to form novel combinations. Hence, with respect to solution quality, using previous campaigns as the basis for idea generation may result in more creative solutions. Secondly, with respect to efficiency of the design process, we propose that using or copying elements of previous sales promotion campaigns may result in efficient and usable solutions, since the designer can build on previous successes (and/or failures) and does not have to reinvent the wheel.

Hypothesis 1

Decision makers having a CBR system available a) will design sales promotion campaigns of higher quality (i.e., more creative campaigns) and b) will design them more efficiently (i.e., less time needed to design a campaign).

3.4 The Influence of the Type of Analogies in the CBR System

In Chapter 2 (subsection 2.3.4), we discussed the difference between near and far analogies. Within the domain of sales promotions, we can also make a distinction between near and far analogies. A sales promotion campaign for a fast-moving consumer good (FMCG)[19], such as coffee or margarine, is rather different from a campaign for a consumer durable or a service, such as computers or insurances, on a superficial level as well as on a more abstract, relational level. When the target problem and the base problem are more distant from each other, the analogy may not provide clear-cut solutions or specific courses of action but merely provide a framework for thinking about the target problem (Markman and Moreau, 2001).

For near analogies, e.g., within the FMCG domain, the differences between the base domain and the target problem are rather small, i.e., they share many surface attributes and many higher-order relations (i.e., literal similarities) (see subsection 2.3.4). Hence, useful features (or knowledge) can be easily identified and transferred from the base to the target in order to develop a solution effectively and efficiently. The rationale behind this is that near analogies share many surface attributes and can therefore be more easily accessed and retrieved. In addition, near analogies share many useful, effective higher-order relations that can be more easily mapped and transferred from base to target, because they contain a large proportion of alignable differences (as opposed to nonalignable differences that require considerably more cognitive effort and resources to process).

Consider the following example. Assume it is 2003 and the manager of the Amstel beer brand has to start thinking about a new brand-image enhancing sales promotion campaign in connection with the upcoming UEFA Champions League Soccer 2004/2005. One of the first things the manager probably will do is to have a look at the previous Amstel beer campaigns that were organized in connection with soccer tournaments. For instance, the campaign organized in connection with

[19] Also referred to as consumer packaged goods (CPG).

the Euro Cup 2000 Soccer Championship in which consumers received a free table-soccer game (a premium) when purchasing a crate of Amstel beer (see Amstel's "Table Soccer Game" in Figure 3.3, also discussed in subsection 2.5.1). Merely copying this premium promotion campaign and putting in the context of the Champions League 2004/2005 could be an efficient and useful strategy, but the resulting campaign will not be perceived as very novel or creative (at least not to the company).

Another strategy that the brand manager could pursue is to look not only at previous campaigns that are rather close to the new problem (i.e., near analogies), but to use also more distant, far analogies as a source of inspiration. For instance, a campaign that was organized by an Italian online trading company (non-FMCG), called Xelion, in which people could win a VIP-pass to the Grand Prix of Monza (which is also a sports event, but non-soccer) (see Figure 3.3, Xelion's "Win a VIP Pass").

Or a promotion campaign organized by the Dutch internet-site MSN.nl (non-FMCG and not sports event related), in which people were asked to send in a holiday picture that creatively incorporated the MSN logo in order to win a cruise to England (see Figure 3.3, MSN.nl's "Make a Creative Picture). These examples from more distant domains (far analogies) could have inspired the Amstel manager to combine ideas (e.g., VIP pass, "creative picture" contest) and, therefore, add novel elements to the ballpark solution of the Amstel table-soccer premium promotion campaign (near analogy). The resulting campaign (see Figure 3.3, Amstel's "Soccer Bench") consisted of a free Amstel soccer bench with the purchase of a crate of Amstel and a contest in which VIP tickets to the Champions League soccer final in Istanbul (cf., Xelion) could be won by sending in a picture that portrayed the Amstel soccer bench in a creative way (cf., MSN.nl).

Although Amstel's "table-soccer game (2000)" and Amstel's "soccer bench (2005)" campaign are not identical, they obviously share many surface attributes (e.g., same beer brand, FMCG category, use of a premium, same type of event) and many higher-order relations (e.g., enhancing brand-image by means of a premium). Hence, they can be classified as near analogies. If the brand manager just had taken the Amstel table-soccer game campaign (near analogy) as a ballpark solution and slightly adapt it to account for possible differences between the two occasions, such as changing the type of premium offered to the consumer (i.e., a soccer bench instead of a table-soccer game), this would have resulted in an efficient and usable campaign design, but not necessarily a very novel and creative one.

Figure 3.3 Examples of Near and Far Analogies as a Source of Inspiration for Designing Sales Promotion Campaigns

Upper-left: AMSTEL's "Table Soccer Game" (2000) *(near analogy)*
Upper-right: XELION's "Win a VIP Pass" (2000) *(far analogy)*
Middle: MSN.nl's "Make a Creative Picture" (2005) *(far analogy)*
Lower-left: AMSTEL's "Soccer Bench" (2005) *(new campaign)*

As discussed in Chapter 2 (subsection 2.4.3), truly novel and creative ideas will be particularly triggered by using more distant, far analogies (Dahl and Moreau, 2002). Thus, to include more novel, creative elements, the manager might better turn to far analogies as a source for inspiration in order to fill in the gaps between the old and new campaign. However, since far analogies mainly share higher-order, structural relationships and few lower-order relationships and surface attributes, developing concrete action plans based on far analogies requires that both higher-order relations and lower-order relations are worked through (Markman and Moreau, 2001). Working out these relations (which may include a large proportion of nonalignable differences) into concrete action plans takes considerably more time and cognitive effort than using near analogies, for which surface attributes and lower-order relations that provide specific courses of actions can easily be transferred (Markman and Moreau, 2001). Because processing far analogies requires more cognitive effort and resources, the outcome is likely to be perceived as be more novel and less obvious than for near analogies. As a result, developing a solution will take more time when using far analogies. Thus, although the resulting campaign will probably be more creative, the design process will be less efficient when using far analogies instead of near analogies.

To conclude, the campaigns that are stored in the CBR system can be classified as near analogies or far analogies to the extent that they represent different areas within the sales promotion domain (e.g., FMCG versus non-FMCG). The type of analogy that is used by the decision maker might have an impact on the quality of the solution. That is, near analogies are more likely to improve the usability component of campaign quality, while far analogies might help to find more novel solutions. In addition, since knowledge transfer is easier between near analogies than between far analogies, using near analogies will result in a more efficient design process. Hence, we propose that using a CBR system with only near analogies fosters efficiency and usability (i.e., resulting in quick, usable solutions), while the use of a CBR system with only far analogies mainly fosters the novelty component of solution quality (i.e., resulting in more novel solutions, but at the cost of efficiency).

***Hypothesis* 2**

In comparison with a CBR system containing only *near analogies*, decision makers with a CBR system containing only *far analogies* a) will design sales promotion campaigns of higher quality (i.e., more creative campaigns), but b) will design them less efficiently (i.e., more time needed to design a campaign). More specifically, having a CBR system with *far analogies* available will result in c) more novel sales promotion campaigns, but d) less usable, compared to a CBR system with *near analogies*.

3.5 The Influence of the Number of Analogies in the CBR System

In general, we may assume that the more cases that are stored in the CBR system, the higher the likelihood that a closely matching case (or analogy) will be retrieved (see Leake and Wilson, 2000). And the more closely a previous case matches with the current case, the less adaptation is needed (see Rosenman, Gero, and Oxman, 1991; Leake and Wilson, 2000). This may have consequences for the quality of the solution as well as for the efficiency in coming up with a solution. The relationship we propose between the number of cases in the CBR system and the quality of the solution is straightforward. Regarding the usability of the solution, we expect that the less adaptation is needed, the less uncertainty there will be with regard to the outcome (i.e., assuming all other things are equal). Hence, using or copying a previous, successful campaign will result in a usable sales promotion campaign. Furthermore, when there are more cases in the CBR system, the decision maker has the opportunity to take a broader range of possible solutions (or ideas) into consideration. Hence, regarding the novelty of the solution, we expect that the more cases in the CBR system, the more novel and creative the final solution will be due to the consideration and/or combination of more diverse ideas.

For solution efficiency the proposed relationship is also straightforward. Again, the more cases in the CBR system, the larger the probability of finding a closely matching case. As a result, the process of adapting a case in order to resolve differences between the base and the target problem will require less time. Hence, using a CBR system with a larger number of cases will also improve the efficiency of designing a sales promotion campaign. We note that there is some early research on the effects of the size of the case library (see Leake, 1996; Leake and Wilson, 2000), which basically states that having too many (trivial) cases stored in the CBR system places high demands on computer resources when processing a search query and matching the cases. This could substantially slow down the case retrieval and matching procedures and thus reduce solution efficiency. Nowadays, this does not seem to be much of a problem since computers are able to deal with very large case bases (see Leake, 1996).

Large case libraries (e.g., containing thousands of cases) are, however, not necessarily required for satisfactory performance. The number of cases required depends on the task being addressed (Kolodner, 1993; Leake, 1996). Preferably each case that is stored in the CBR system should help to solve some distinct problem and represent likely types of (design) problems. To put it differently, each case should add significantly to the system's problem-solving capabilities (Rosenman et al., 1991; Kolodner, 1993). When deciding on adding or deleting cases one should always keep in mind the technical limits to the case-base size (if any) and the possible trade-off between the problem-solving efficiency and accuracy goals for the CBR system (Smyth and McKenna, 1999; Leake and Wilson, 2000).

However, due to the limited number of (publicly available) sales promotion campaign cases, the size of our CBR system will not exceed (by far) the current processing and computational computer capabilities. Therefore, we propose that using a CBR system with a larger number (and broader range) of analogies will improve the quality of the sales promotion campaigns (i.e., resulting in more creative campaigns) and enhance the efficiency of designing a sales promotion campaign (i.e., less adaptation, less time needed to design a campaign).

Hypothesis 3

Decision makers having a CBR system with a larger number of analogies available a) will design sales promotion campaigns of higher quality (i.e., more creative campaigns) and b) will design them more efficiently (i.e., less time needed to design a campaign) than decision makers having a CBR system with a smaller number of analogies at their disposal.

3.6 The Influence of the Decision Maker's Innate Creative Ability

Creativity can be defined as the process of bringing into being something novel and useful (see Sternberg and O'Hara, 1999). Divergent thinking is commonly regarded as a vital trait for creative problem solving (Amabile, 1983; Runco, 1986; Boden, 1994; Sternberg et al., 1997). Hence, a person's innate creative ability is often assessed by means of his ability to think divergently, i.e., the ability to generate numerous and diverse ideas in response to an open-ended problem (Guilford, 1967; 1968; Torrance, 1974; Runco, 1986; Sternberg and Lubart, 1992). The ability to think divergently comprises the fluency, flexibility and originality facets of creative thinking (see Guilford 1967; 1968; Runco, 1986). Fluency is the person's ability to generate a large number of relevant responses to a certain problem or stimuli (i.e., the quantity of ideas). Previous studies have shown that the ratio of good-quality ideas (i.e., original and valuable) to sheer number of ideas has been found to be constant and high (> 0.7), i.e., quantity breeds quality (e.g., see Rossiter and Lilien, 1994). Originality is the ability to come up with novel and unusual ideas (i.e., the quality of ideas). Flexibility refers to the ability to generate responses that belong to different response-categories (i.e., diversity of idea).

The ability to think divergently is a necessary, but not a sufficient condition for the ability to perform creatively (Runco, 1986; Sternberg and O'Hara, 1999; Vincent, Decker, Mumford, 2002). The moderate correlations between divergent thinking tests and creative achievement that are often found illustrate this (Hocevar, 1980; Runco, 1986; Sternberg and Grigorenko, 2000). Other factors such as intelligence, expertise, motivational and situational factors also play a role in creative problem solving and creative achievement (Sternberg, O'Hara, Lubart, 1997; Amabile, 1998; Vincent et al., 2002). To be able to generate novel ideas is one thing; the ability to work out a novel idea into a meaningful and usable solution is another important aspect of creative ability. This ability is called convergent thinking, i.e., to converge on a single solution (often measured by means of IQ-tests) (Runco and Mraz, 1992; Sternberg and O'Hara, 1999). Hence, for solving well-defined, structured problems for which there is only one allowable solution, convergent thinking is a vital ability.

Divergent thinking and convergent thinking are commonly regarded as ideal traits, not as being mutually exclusive (Sternberg and O'Hara, 1999). A creative individual should be good at both divergent thinking and convergent thinking and, as a consequence, can produce a creative outcome that is both original (as result of a divergent thinking process) and meaningful (as a result of convergent thinking process) (Guilford, 1967; Tardif and Sternberg, 1988). That is, to be able to produce a creative outcome, an individual has to engage in much divergent production on the way to a convergent answer (Guilford, 1967). Therefore, the prominent and widely used Torrance Tests of Creative Thinking (Torrance, 1974) include elaboration in addition to the divergent facets of creative thinking, i.e., fluency, flexibility and originality. Elaboration is the ability to embellish an idea with details. To conclude, it is not enough to produce unusual, novel ideas only (i.e., the divergent or "generative" phase (see Ward, Smith and Finke's (1999) Geneplore model), one should also be able to refine and work out these ideas (i.e., the convergent or "explorative" phase (see Ward et al, 1999)) and translate them into action (Mumford and Gustafson, 1998). Hence, creative individuals need to be fluent, flexible and original in generating ideas, but also elaborate in working out these ideas (Guilford, 1968; Torrance, 1974).

For solution quality, we propose that decision makers with a high innate creative ability (who are supposedly good at both divergent and convergent thinking) will design sales promotion campaigns of higher quality (i.e., more creative campaigns, which are both novel and usable) than decision makers with a low innate creative ability. We note that we do not a priori have a hypothesis about the effect of innate creative ability on solution efficiency.

Hypothesis 4

Decision makers with a high innate creative ability will design sales promotion campaigns of higher quality (i.e., more creative campaign) than decision makers with a low innate creative ability.

3.7 To Reinforce or Compensate? Matching Support System and Manager

Hypothesis 4 refers to the main-effect of innate creative ability, but is not yet related to using a CBR system. To do this, we refer to the ongoing debate in the management support system literature concerning the match between manager and support system, (see Zmud, 1979; Benbasat and Dexter, 1982; Huber, 1983; Hoch and Schkade, 1996; Wierenga and Van Bruggen, 2000). This debate has focused primarily on the fit between the type of support system and the decision maker's cognitive style, and in particular the distinction between analytical and heuristic decision makers[20]. The question is whether a management support system is most helpful when it *reinforces* the decision maker's dominant cognitive style or when it *compensates* the decision maker for not having a particular style. Reflecting on the cognitive style debate, arguments on both sides have been made (see Mason and Mitroff, 1973; De Waele, 1978; Chakravarti et al., 1979; Zmud, 1979; Huber, 1983; Hunt, Krzystofiak, Meindl and Yousry, 1989; O' Keefe, 1989; Wierenga et al., 1999).

The empirical evidence regarding the impact on decision or solution quality, however, seems in favor of a compensation strategy (e.g., Benbasat and Dexter, 1982; 1985; Van Bruggen, Smidts and Wierenga, 1998). That is, when using an *analytical* management support system, the improvement in decision quality between aided and non-aided decision makers was found to be larger for heuristic decision makers than for their analytical counterparts[21]. Thus, in terms of solution quality, heuristic decision makers had most to gain from a system that compensated them for not having an analytical cognitive style. However, all these findings apply to decision tasks that are relatively well-structured, which favors an analytical decision-making style. As Benbasat and Dexter (1982) suggested, in ill- or weakly-structured decision environments, analytical decision makers would no longer have a comparative advantage over heuristic decision makers. Of course, the ideal situation would be a decision aid that is able to draw upon the cognitive strengths of managers as well as to compensate for their weaknesses (Chakravarti et al., 1979).

The sparse empirical evidence with respect to supporting weakly-structured problem solving suggests that "the performance of the more creative individuals is improved most" (MacCrimmon and Wagner, 1994, p.1514) by using creativity-enhancing software. Nonetheless, "the less creative problem solvers also

[20] "Analytical (or so-called systematic, field independent) decision makers reduce a problem to a core set of underlying relationships and direct all effort to detecting and manipulating the decision variables in order to find an optimal solution with respect to the objectives. Non-analytical (or so-called heuristic, field dependent) decision makers look for workable solutions to the total problem situation and search for analogies with familiar, solved problems" (adapted from Wierenga and Van Bruggen, 2000).

[21] Nonetheless, in both conditions analytical decision makers were still able to outperform heuristic decision makers.

improved" using the system (MacCrimmon and Wagner, 1994, p.1530). In their study, MacCrimmon and Wagner (1994) asked students to solve three different business cases. For two randomly chosen cases out of three they could use an idea generation support system (i.e., the GENI system, for more details see MacCrimmon and Wagner, 1994), the other case they had to solve without support (only a word processor was available). Next, MacCrimmon and Wagner inferred the decision makers' innate creative ability from the outcomes of the experiment by looking at the subject's average creativity score for the three business cases. This measure of innate creative ability is likely to be confounded by the effect of the creativity support system, which was used in two out of three cases.

Therefore, we re-analyzed MacCrimmon and Wagner's (1994) data, using the subject's score in the no support condition (only a Word processor available) as a measure of the person's innate creative ability. If we then look at the low creative subjects (based on a median split, $n = 20$), they on average seem to gain more from using the creativity support system than the high creative subjects ($n = 21$), i.e., we find an increase of 0.378 (standardized) creativity points on average for the low creative group versus 0.001 points for the high creative group (One-way ANOVA: $F = 3.113$, $p = 0.086$)[22]. This finding is consistent with the compensation effect found in decision support system studies concerning relatively structured problems (as discussed earlier). Nonetheless, it could be that computers are better at compensating decision makers for their inconsistency and inaccuracy (see Blattberg and Hoch, 1990) - which may hinder finding an optimal solution to well-structured problems - than at compensating them for their lack of creativity. The question "can computers be "creative"?" has not been answered unequivocally yet (see, for example, Boden, 1991; Schank and Cleary, 1995; Cohen, 1999; Buchanan, 2001). However, following the compensation theory and the empirical evidence, it is probably more effective to compensate low creative thinkers, by using a CBR system with analogies (or ideas), for their weakness with respect to idea generation than to reinforce the strength of creative thinkers (who are supposedly good at generating ideas for solving weakly-structured problems).

An explanation for this could be that the fluency aspect of creative thinking is significantly enhanced by providing people with (computer-generated) examples, as demonstrated by a number of studies (e.g., MacCrimmon and Wagner, 1994; Massetti, 1996; Bonnardel, 2000). In these studies, respondents were found to generate significantly more ideas (including novel and creative ones) when they

[22] We calculated the improvement in creativity by subtracting the subjects' creativity score in the no system condition (each subject solved one problem using only the Word processor) from the average creativity score in the GENI-system condition (each subject solved two problem using the system). The low creative group (median split of the scores in the no system condition; n=20) gained on average 0.378 (standardized) creativity points by using the system, while the high creative group (n=21) improved 0.001 points on average (One-way ANOVA: F=3.113, p=0.086).

were given examples. The CBR system contains examples of past, similar solutions (analogies) and, therefore, may stimulate the fluency aspect of creative thinking and trigger multiple ideas about what can be done (or should not be done). Ideational fluency (i.e., the sheer number of ideas generated) is a key component of creativity and, therefore, enhancing this ability is likely to result in more creative solutions. In line with the compensation theory, we thus expect that providing analogies (or examples) by means of a CBR system is particularly helpful for people that have difficulty generating many and novel ideas themselves, i.e., decision makers with a low innate creative ability. We note that Massetti (1996) did not find a significant interaction effect between the use of idea generation software and the fluency of the decision maker on the creativity of the outcome. However, this result should be interpreted with caution, since Massetti's (1996) measure of "innate" fluency is based on the number of ideas generated in response to the experimental task (i.e., solving the homeless problem in cities). The number of ideas generated may be the result of the decision maker's innate creative ability, but also as a result of using the idea generation software.

In general, we expect that the contribution of the CBR system to the creativity of the solution is largest for decision makers with a low innate creative ability, resulting in the following hypothesis.

Hypothesis 5

The effect of using a CBR system on the quality of sales promotion campaigns will be larger for decision makers with a low innate creative ability than for decision makers with a high creative ability.

3.8 The Relation between the Decision Maker's Subjective Evaluations of the CBR System and its Objective Contribution to the Solution

Besides examining the "objective" effect of providing analogies - by means of a CBR system - on the quality of the solution and the efficiency of the design process, we are also interested in the subjective evaluations of the CBR system. First of all, we are interested in questions like "do decision makers have a positive attitude towards using an MMSS in general?", "do they perceive the CBR system as useful?", and "how do they perceive the impact of CBR system availability on their sales promotion campaign proposal?" But, more importantly, we want to know whether there is a relationship between the decision maker's subjective evaluations of the CBR system and the objective contribution of the CBR system to the solution. In other words, are decision makers able to assess correctly the objective impact of the CBR system on their solution, i.e., on solution quality and solution efficiency?

Previous research has shown that decision support systems can objectively improve decision performance (e.g., McIntyre, 1982; Hoch and Schkade, 1996; Lilien et al., 2004) However, decision makers are often not able to evaluate correctly the quality of a decision support system and its impact on decision performance (e.g., McIntyre; 1982, Davis, 1989; Van Bruggen, Smidts, and Wierenga, 1996; Lilien et al., 2004). A recent study by Lilien et al. (2004) has shown that what decision makers perceive (i.e., subjective impact) is not what they actually achieve (i.e., objective impact) by using a decision support system. Lilien et al. (2004) found that decision makers who had access to a high-quality (model-based) decision support system made objectively better decisions than those with access to a simple benchmark system only (i.e., an Excel spreadsheet), but their subjective evaluations of both the decisions and the decision process did not necessarily improve. In other words, decision makers have difficulties in recognizing (or acknowledging) the improvement in the objective decision outcome as a result of the use of a support system. Decision support system training, explanation of the recommendations provided by the system, and feedback with respect to the objective quality of the decision could help the decision maker to appreciate and fully acknowledge the impact of the decision support system and stimulate its future usage (Lilien et al., 2004; Kayande, De Bruyn, Lilien, Rangaswamy, Van Bruggen, 2006).

We expect this appropriation problem to be even more prominent when using analogical reasoning as a principle for decision support. Besides the fact that the CBR system does not suggest specific courses of action and does not provide decision feedback, people also have difficulties in recognizing the influence of analogies on their decision process and outcomes (Markman and Moreau, 2001). However, as Markman and Moreau (2001) argue, the analogy that will be used to represent the target domain does in fact place strong constraints on what decision options are considered and how they are evaluated. These constraints are placed by the nature of the analogy, and not by some set of explicit, external evaluation criteria (Markman and Moreau, 2001). Hence, the analogy can have its effects without the decision maker acknowledging the true impact of the analogy, since it will not be easy to grasp the precise factors that have established the representation of the target domain (Markman and Moreau, 2001).

Therefore, we expect that decision makers who use analogies, by means of a CBR system, in the process of designing a sales promotion campaign are not able to recognize the objective impact of CBR system usage on their solution. More specifically, we expect that subjective evaluations of the CBR system are not related to the objective impact of the CBR system on the solution.

Hypothesis 6

There is no relation between the decision maker's subjective evaluations of the CBR system and the objective contribution of the CBR system to the solution.

Subjective Evaluations of the CBR System. In line with the technology acceptance model (TAM) (Davis, 1989; Davis, Bagozzi and Warshaw, 1989; Venkatesh and Davis, 2000), which has been found to be consistent with much empirical research (see Venkatesh and Davis, 2000), an important evaluative construct for decision support systems and their usage is the *perceived usefulness* of the system. In this dissertation, we define the perceived usefulness of the CBR system as the extent to which the decision maker believes that using the CBR system will enhance the design of sales promotion campaigns. As a second evaluative construct, we take into account the perceived impact of the CBR system on the final solution. We expect that decision makers who perceive the CBR system as useful for designing a sales promotion campaign will attribute a bigger part of their solution to the impact of the CBR system than those who do not perceive the CBR system as useful. A third, less specific evaluative construct for decision support systems is the decision maker's *attitude* towards using Marketing Management Support Systems (MMSSs) in general for decision making. The attitude towards using MMSSs in general can be defined as the extent to which the decision maker believes that using MMSSs in general will enhance decision-making performance (Van Bruggen, 1993). This attitude towards using MMSSs in general for enhancing decision-making performance will be an important determinant for initial CBR system usage and its evaluation by the decision maker. However, after the decision maker has gained some experience with the CBR system, perceived usefulness will be a stronger determinant of CBR system usage. That is, when the decision maker after a brief introduction or training perceives the CBR system as being useful for coming up with a good or quick solution, then he is likely to continue CBR system usage until a satisfactory sales promotion campaign is designed and will evaluate the system positively.

Hence, to be able to test *Hypothesis 6*, we take into account the following three variables regarding the decision maker's subjective evaluations of the contribution of the CBR system to the solution.

1. *Perceived Usefulness* of the CBR system for enhancing the design of a sales promotion campaign.
2. *Perceived Impact* of the CBR system on the Solution.
3. *Attitude towards using Marketing Management Support Systems* (MMSSs) in general for enhancing decision-making performance.

3.9 CBR System Usage Process

We finally discuss a number of variables that can provide more insight into the processes underlying the contribution of the CBR system to the quality of the sales promotion campaign design, the efficiency of the design process and its subjective evaluations by the decision maker. These variables are the following.

1. *CBR System Usage Time.*
2. *The Number and Type of Cases (Read and Used).*

By taking into account CBR system usage time and the number and type of cases that the decision maker has actually read and used, we hope to gain additional insights into the mechanisms underlying the effect of CBR system availability on the solution. For instance, is the effect of CBR system availability on solution quality driven by the sheer number of analogies that have been read and used by the decision maker? Is it the more, the better? Or does it mainly depend on the type of cases that the decision maker has consulted, i.e., near analogies versus far analogies? We might also want to know what the most important determinants are regarding the subjective evaluations of the CBR system. Is it merely the time that the decision maker has spent working with the CBR system and, subsequently, on developing a solution? Or is it the number and type of cases that the decision maker has read and used? We will not formulate specific hypotheses, since these variables are used in a secondary manner, i.e., to get a better understanding of how the effects come about.

3.10 Summary

In this chapter, we formulated our main hypotheses regarding the effects of analogical reasoning, by means of a CBR system, on the quality of sales promotion campaigns and the efficiency of their design (see Table 3.1). We have argued that using a CBR system will help to improve both solution quality and solution efficiency for the weakly-structured problem solving, by aiding the designer in accessing and retrieving relevant analogies from memory.

In the situation of designing sales promotion campaigns, using a CBR system with analogies might help to come up with better, more creative solutions (i.e., improving *solution quality*) and to find a solution quicker and with less effort (i.e., improving *solution efficiency*). Furthermore, we have argued that the effects depend on the type of analogies in the CBR system (i.e., near analogies versus far analogies) and on number of analogies in the CBR system (i.e., a large size case-base versus a small size case-base). The effects of CBR system usage may also depend on the type of decision maker, i.e., decision makers with a low creative ability might benefit more from the availability of a CBR system than decision makers with a high innate creative ability. Finally, we have argued that the decision maker's have difficulties in recognizing the objective impact of the CBR system on the quality of their solution. Hence, we expect no relation between the subjective evaluations of CBR system usage (including the attitude towards using MMSSs in general, the perceived usefulness of the CBR system and the perceived impact of CBR system usage on the solution) and the objective impact of the CBR system. In addition, we have discussed a number of variables (i.e., system usage time and the number and type of cases read and used) that can provide more insight into the mechanisms behind the effects of CBR system availability on the solution.

In the next chapter, we will discuss the basic methodology that is used in our empirical studies in order to test our hypotheses. This methodological chapter basically includes a description of the experimental research design, the method of data-collection and the measures that are used.

Table 3.1 Summary of Main Hypotheses in this Dissertation

Independent Variable	*Dependent Variable*	*Hypothesis*	*Expected Sign*
CBR System: ***Availability*** **(yes versus no)**	Solution Quality *(Creativity)*	H1a	+
	Solution Efficiency *(Solution Time)*	H1b	+
CBR System: ***Case Base Content*** **(far versus near analogies)**	Solution Quality *(Creativity)*	H2a	+
	Solution Efficiency *(Solution Time)*	H2b	-
	Solution Quality *(Novelty)*	H2c	+
	Solution Quality *(Usability)*	H2d	-
CBR System: ***Case Base Size*** **(large versus standard size)**	Solution Quality *(Creativity)*	H3a	+
	Solution Efficiency *(Solution Time)*	H3b	+
Decision Maker: ***Creative Ability*** **(high versus low ability)**	Solution Quality *(Creativity)*	H4	+
CBR System and Decision Maker: ***Availability x Creative Ability***	Solution Quality *(Creativity)*	H5	Negative Moderation
Objective Contribution of CBR System to the Solution	Subjective Evaluations CBR System	H6	No Relation

Chapter 4

Research Design: Methodology and Measurement

"Gedanken ohne Inhalt sind leer…" *(Immanuel Kant, 1781)*

4.1 Conceptual Framework and Research Questions

Before discussing the basic research design of our empirical studies, we again depict the conceptual framework (Figure 4.1) and reiterate the main research questions, as discussed in the previous chapter. As stated in the introduction chapter, the goal of this dissertation project is to investigate the effectiveness and efficiency of analogical reasoning as a principle for marketing management support systems in primarily qualitative, weakly-structured marketing decision domains. In addition, we want to investigate the conditions under which analogical reasoning as a support tool is most effective and efficient. In the empirical studies, we use Case-Based Reasoning (CBR) as a support tool for analogical reasoning and the design of sales promotion campaigns as the weakly-structured application domain in marketing.

The conceptual framework is developed to answer the following main research questions.

1. Does providing decision makers with analogies, by means of a CBR system, result in sales promotion campaigns of higher quality and does it make the design process more efficient?
2. What is the influence of the type of analogies offered to the decision maker? Should they come from the same problem domain (i.e., near analogies) or should they come from more distant domains (i.e., far analogies)?
3. What is the influence of the number of analogies offered to the decision maker? Are more analogies better?
4. In examining the effect of analogies, what is the role of decision maker characteristics? In particular, is the effect different for decision makers with different innate creative abilities?
5. What is the relationship between the decision maker's subjective evaluations of using a CBR system for designing a sales promotion campaign and the objective outcomes, i.e., solution quality and solution efficiency?

Next to these five main research questions, we will also examine whether information about the underlying process, such as CBR system usage time and the number and type of analogies that the decision maker has used, can give us more insight into effects of CBR system availability on the objective outcomes, i.e., the quality of the sales promotion campaigns and the efficiency of the design process, and the subjective evaluations.

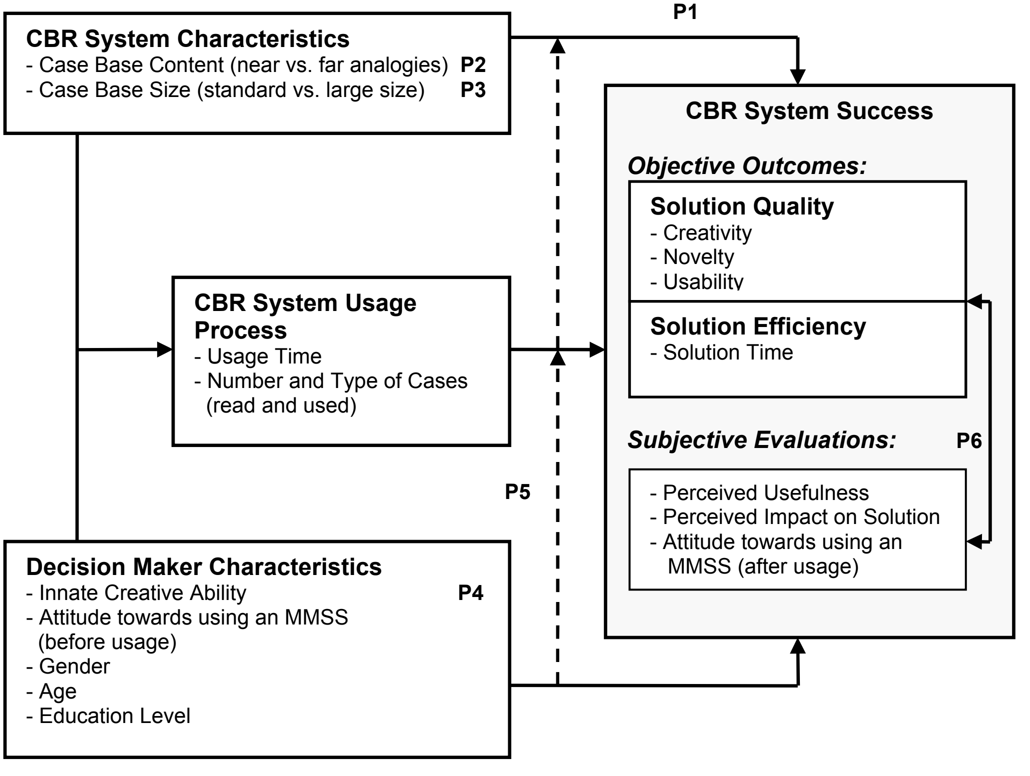

Figure 4.1 Framework of How the Use of a Case-Based Reasoning (CBR) System Affects the Quality of Sales Promotion Campaigns, the Efficiency of the Design Process, and its Subjective Evaluations

To test empirically our conceptual model and answer these research questions, we set up a series of experiments. The results of three studies will be discussed in the empirical part of this dissertation (Chapter 5 to 7). In this chapter, we elaborate on the basic research design applied in the experiments, including a section on methodological issues (section 4.2) and a section on measurement issues (section 4.3). At the end of each section, we present a brief overview of how previous, related studies have tackled these issues.

4.2 Research Methodology

The first methodological issue that we will deal with in this section is the experimental design (subsection 4.2.1). In the next subsection (4.2.2), we briefly discuss the generic task that we will use in the empirical studies. In subsection 4.2.3, we discuss the software, structure and content of the different CBR systems in more detail. The expert system condition and the no system condition are discussed in subsection 4.2.4. In subsection 4.2.6, we elaborate on the respondent population of our studies. As mentioned, the section ends with an overview of how related studies have handled these issues (subsection 4.2.6).

4.2.1 The Experimental Design

In order to answer the questions related to the effectiveness and efficiency of providing analogies under different conditions, in our empirical studies we had participants design a sales promotion campaign with the use of a CBR system (see Figure 4.2). To be able to assess the impact of CBR system availability on the quality of the solution and the efficiency of the design process, we also had participants solve the sales promotion campaign design task under alternative conditions of decision support, including an expert system and no system at all (see Figure 4.2). To be able to answer the questions regarding the conditions under which providing analogies by means of a CBR system is most effective and efficient, we manipulate the number and type of analogies contained in the CBR system (see Figure 4.2). This results in six different experimental treatments, as shown in Figure 4.2, which will be used throughout the empirical studies.

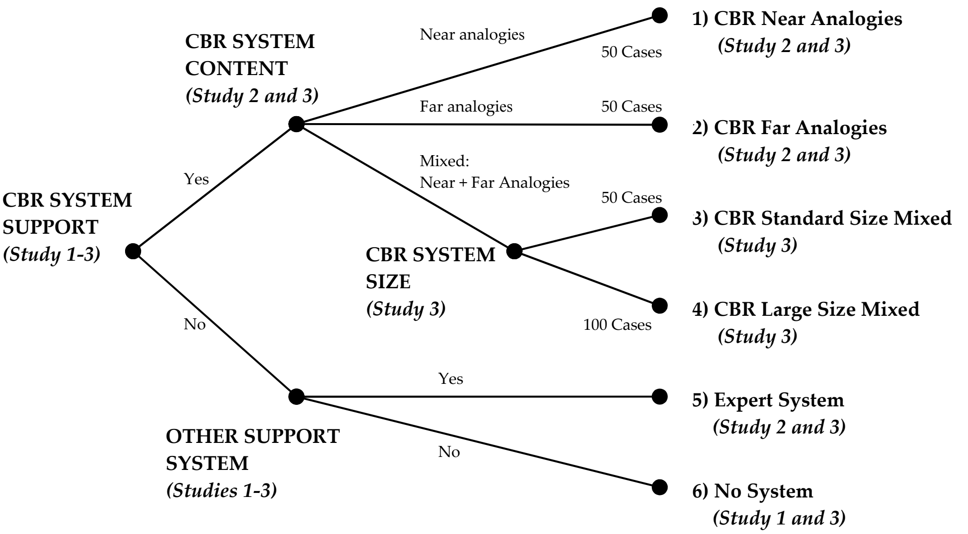

Figure 4.2 **The Research Design: Experimental Conditions**

Thus, in Figure 4.2 we first consider a *CBR system* condition versus a *no CBR system* condition. Within the CBR system condition, we distinguish between three different *CBR Content* conditions: (1) *CBR Near Analogies*, (2) *CBR Far Analogies*, and (3) *CBR Mixed* (containing 50% near analogies and 50% far analogies). For the CBR mixed content condition, we further distinguish between a *CBR Standard Size Mixed* (containing 50 cases, which is equal to the number of cases in the CBR near analogies and CBR far analogies systems) and a *CBR Large Size Mixed* (containing 100 cases). Finally, in the no CBR system condition we distinguish between the availability of an *Expert System* or *No System* at all.

4.2.2 The Decision Task

The generic decision task for the participants in our studies is to design a sales promotion campaign for a given situation, which is explained in a short briefing. Designing a sales promotion campaign requires multiple decisions regarding the theme of the campaign, the most suitable sales promotion technique given the campaign objectives and the value and attractiveness of the promotional offer, etcetera. The decision maker has to dispose of a large problem and solution space, which is broadly defined by the information and limitations provided in the briefing. Each decision within the design process has consequences for the other decisions and, therefore, further narrows down the solution space until a satisfactory solution has been found. Because of the weakly-structured nature of the decision task, there are multiple ways to reach a solution and there exist multiple satisfactory solutions (i.e., there are no wrong or right answers, we can only speak of better or worse).

In our studies, the design task will be presented in the form of a company's briefing directed at a sales promotion agency. In this briefing, the company outlines the current problem situation, the campaign objectives and some constraints (see Appendices 2 and 3). The participants are then asked to write a short sales promotion campaign proposal based on the briefing provided by the company. Furthermore, in order for the research project to succeed, participants are instructed not to exchange information about the task with other participants, not to copy a previous campaign of the company, but to be original and that advertising only does not qualify as a promotional campaign. The campaign proposal had to contain a brief description and motivation of at least the design elements that are listed in Table 4.1.

The participants are instructed to write a campaign proposal of 1 or 2 pages (size A4, Times New Roman 12). The criteria on which the proposal will be judged (by sales promotion experts) are also provided in the assignment.

- The degree of *creativity/ novelty* of the campaign.
- The degree of *usefulness/ feasibility* of the campaign.

- The potential to *reach the campaign's objectives.*
- The consistency of the campaign with the *desired brand image.*

Table 4.1 Required Design Elements in the Campaign Proposal

Campaign Proposal Elements	*Brief Description*
Basic Idea	*What is the basic idea underlying the sales promotion campaign, such as the main theme and other unique or remarkable features.*
Sales Promotion Technique & Execution	*What is exactly offered to the consumer and how can he obtain this promotional offer?*
Supporting Activities & Communication	*How to attract the consumers' attention for the campaign?*
Estimated Costs of the Promotional Offer	*Give an estimation (or educated guess) of the magnitude of the most important costs for the campaign.*

4.2.3 The Case-Based Reasoning System Conditions

The Software. There are a number of commercially available CBR software programs (or shells) on the market, such as *The Easy Reasoner* (The Haley Enterprise Inc.), *Kate* (Aknosoft), *CBR Works* (Empolis/TecInno GmbH), *ReCall* (Isoft). Haque, Belecheanu, Barson and Pawar (2000) compared the performance of these commercially available CBR-shells on a number of dimensions, such as the ability to represent cases, the reasoning mechanism and speed, possibilities for customization, database support, operating system platforms, and costs. The CBR-Works 4 Professional software developed by TecInno GmbH (nowadays part of Empolis GmbH[23]) that we decided to use for building our sales promotion application was evaluated positively on all dimensions (see Haque et al., 2000). Although an online interface was optional in the CBR-Works program, we decided to use the regular, more easily adaptable, but not so fancy interface (see, for instance, Figure 4.3) for developing a prototypical Case-Based Reasoning sales promotion application to conduct our experiments with.

The Structure. As mentioned, we built a sales promotion application using existing case-based reasoning system software, viz. CBR-Works 4 Professional. Within the

[23] In 2001, TecInno became part of Empolis GmbH. Empolis is an Arvato AG subsidiary and part of Bertelsmann AG. As they claim on their website, "empolis - The Information Logistics Company - is the leading supplier of enterprise content and knowledge management solutions." (see: http://www.empolis.com)

CBR-Works shell (see Figure 4.3) we created a hierarchical knowledge-base structure that is flexible enough (i.e., modular and multi-layered), though explicit and complete enough on important issues (Buchanan, 2001), for effective and efficient retrieval and storage of sales promotion campaigns. The initial design for the sales promotion case-base structure was verified by sales promotion experts and, where necessary, adjusted. Basically, the sales promotion case-base structure includes variables related to the problem situation, the solution and the outcomes, next to some general information about the case (see Table 4.2). The resulting top-layer structure of the system looks as follows (also depicted in Figure 4.3).

a) ***General Information*** about the case (no. 1)
b) ***Problem Situation***, including *market situation* (no. 2), *campaign objectives* (no. 3) and *constraints* (no. 4)
c) ***Solution***, including *campaign design* (no. 5) and *campaign execution* (no. 6)
d) ***Outcomes*** (no. 7)

We label our CBR-application for sales promotions *LEAPS*, which is an acronym for *LEA*rning *P*romotion *S*ystem. This acronym refers to 1) the creative, mental leaps that a decision maker can make by means of analogical reasoning (see subsection 2.3.4), and 2) the ability to learn from previous sales promotion campaigns by storing them in a CBR system and making them available for future decision making. In Appendix 4, an excerpt of the technical specifications, i.e., the type of variables and their corresponding values, is provided for layer 2.1 "Product Category Situation" in Figure 4.3.

In total, the sales promotion domain structure within the LEAPS-system consists of over 60 different variables. The (range of) values that can be assigned to these variables are pre-specified and qualitative in nature (see Appendix 4 and Table 4.3). For instance, a variable such as campaign budget contains three broad levels: low, medium, or high. In the process of searching for previous, similar campaigns (i.e., the analogies), the user can also assign weights to the variables (ranging from very low to very high) in correspondence with their level of importance for designing the new campaign (i.e., based on the information provided in a briefing). Moreover, not for all the variables in the CBR system values have to be specified, only for the ones that the decision maker deems important for solving the new case. Nonetheless, all variables from the sales promotion domain structure can be used to serve as input variables for retrieving previously stored, similar cases (see Figure 4.3 and Table 4.3). Thus not only variables related to the problem situation may serve as input criteria or constraints to search for analog cases, but also campaign design characteristics (e.g., search for previous campaigns that had "music" as their main theme) or even the outcome variables (e.g., search for previous campaigns that had a response rate of more than 50%) can be used as search criteria.

Table 4.2 Basic Structure of the CBR System Sales Promotion Application: LEAPS

Basic Structure	*Description*
General Information	*Includes general information about the case, such as the title of the campaign, start and end date of the campaign, a brief summary of the case, and a reference to the full case description (see "1. General Information" in Figure 4.3). These variables do not intentionally serve for retrieval purposes, but merely for storing and documenting previous campaigns.*
The Problem Situation	*Includes information on what is happening in the market (see "2. Market Situation" in Figure 4.3, including variables such as product life cycle phase and competition), what are the targets for the campaign that is to be designed to change the current market situation (see "3. Campaign Objectives" in Figure 4.3, with options to choose from like "increase awareness", "new product introduction", etc.), and what are the limitation for this campaign (i.e., see "4. Constraints" in Figure 4.3, including variables such as budget, time period and duration of the campaign).*
The Solution	*Includes information on what the campaign looks like (see "5. Campaign Design" in Figure 4.3, including variables such as the main theme, the sales promotion technique used, communication and supporting activities), and information on how the campaign was executed (see "6. Campaign Execution", including variables such as the sales promotion agency and running time of the campaign).*
The Outcomes	*Includes information on the results of the campaign (see 7. Outcomes" in Figure 4.3, including variables like "main objectives reached", "response" or "redemption rate", (short-term) "sales increase", "competitive reactions")*

Assigning values to one or more variables will define the new case and start the CBR cycle, i.e., the process of retrieving, reusing, revising and retaining cases (see subsection 2.4.2). Based on the values for the new case, the system uses a metric to calculate the similarity of the cases stored in its case-base (for more details, see manual TecInno, 1999). The cases are retrieved and ranked in order of similarity, ranging from a score of 1 (perfect match) to 0 (no match at all). Since designing a sales promotion campaign involves weakly-structured problem solving, we do not impose adaptation rules upon the retrieved cases to resolve any dissimilarity between the new and the retrieved cases. To put it differently, current sales promotion knowledge does not warrant the formulation of clear-cut design rules, except maybe for some structured sub-problems such as determining the optimal level of a price discount. Hence, the CBR applications for designing sales promotion campaigns are merely retrieve-and-propose systems (see subsection 2.4.3). That is, the necessary adaptations are left to the judgment and creativity of decision maker.

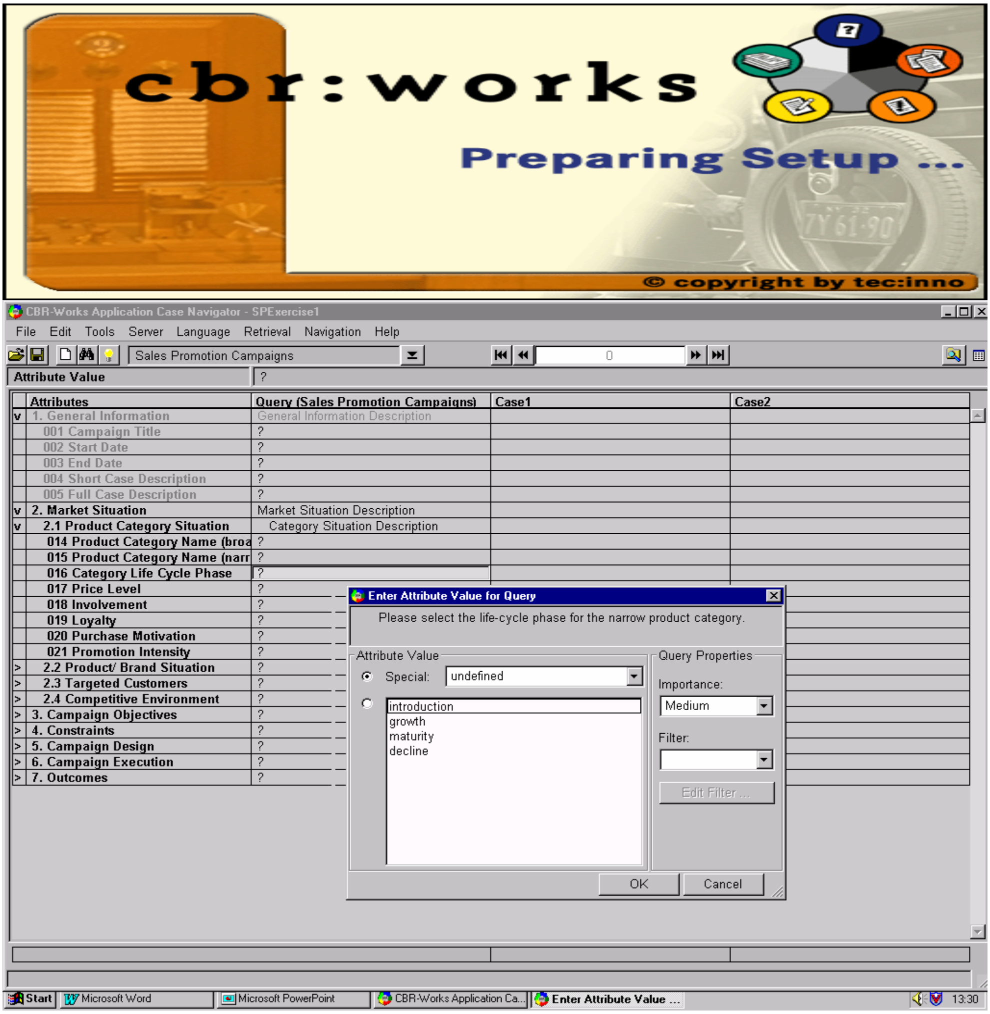

Figure 4.3 **Screendump of Top-Layer Structure of LEAPS: A Case-Based Reasoning Sales Promotion Application (built on CBR-Works 4 Professional© Software)**

The Content. The knowledge-base for our CBR-applications consists of 100 cases that comprise a collection of prize-winning SP campaigns in Europe from the 1980s up to the first half of the 1990s. The cases are taken from two sales promotion casebooks, viz. "Scoren" (Meetlatcomité Nederland, 1994) and "European Sales Promotion: Great Campaigns in Action" (Toop, 1992), which bundle the best, award-winning sales promotion campaigns from the above-mentioned period in the Netherlands and Europe, respectively. Each case described in these books contains information about the problem situation (including the objectives for the campaign), the solution (e.g., the SP technique that was chosen and how the campaign was executed) and the outcomes (e.g., the impact on sales and market share and objectives reached).

Depending on the available information in the case descriptions, the cases were stored in the case-base as completely as possible (see Table 4.3). The variables for which no information was available in the case descriptions were left unspecified. Summaries (in English) of the case descriptions were available in the CBR system and a link to the full case descriptions in the casebook was also provided.

From these two sales promotion casebooks, we selected 100 cases that were described in sufficient detail to be useful (at least 1 or 2 pages). We ascertained that of these 100 cases, 50 cases were designed in the context of fast-moving-consumer-goods (FMCG's) and that the other 50 cases were designed in the context of non-FMCG cases, including cases that were developed for consumer durables, services, and the non-profit sector.

The distinction between FMCG and non-FMCG is commonly made in marketing, because of the fundamental differences between the two categories for designing marketing programs, such as purchase frequency, unit value, consumption and usage situation. Hence, depending on whether the task is to design a campaign for a FMCG or a non-FMCG, the FMCG and non-FMCG cases will be classified as either *near analogies* or *far analogies,* respectively. For constructing the *standard size mixed CBR system*, we selected a random sub sample of 25 FMCG cases and 25 non-FMCG cases. The *large size mixed CBR system* includes all 100 cases, i.e., 50 FMCG cases and 50 non-FMCG cases.

Table 4.3 Case Base Structure of LEAPS: An excerpt of the "Megapool" Case

Basic Structure	*Attributes*	*Value*
1. General Information	001 Campaign Title	"Megapool Cash Refund 2000"
	002 Start Date	'October 17, 1990'
	004 Short Case Description	"Megapool… amply reached its objectives (increase sales and awareness) with a simple cash-refund campaign… Megapool guaranteed a full refund of the purchase price for televisions, washing machines, refrigerators, etc. after 10 years (in 2000)… "
	005 Full Case Description	'See casebook: no. 1'
Problem Situation		
2. Market Situation		
2.1 Product Category Situation	007 Product Category	'consumer electronics & household appl.'
	008 Category Life Cycle	'maturity'
	009 Price Level Ranges	'50 - 999 euro, 1000 - 4999 euro'
2.2 Product/ Brand Situation	014 Product/ Brand Name	'Megapool'
	015 Life Cycle Phase	'growth'
	016 Relative Price	'average'
2.3 Targeted Customers	023 Age Category	'young adults, adults, middle-aged'
2.4 Competitive Environment	028 Company Name	'Megapool'
	030 Competition Intensity	'high'
3. Campaign Objectives	032 Main Objective(s)	'attract new customers, increase awareness'
4. Constraints	035 Campaign Duration	'short-term (several days/ weeks)'
	036 Campaign Frequency	'single campaign'
Solution		
5. Campaign Design	038 SP Theme	'current events, sports & entertainments"
	039 SP Technique	'cash-refund (long-term)'
	041 SP Support	"advertisement, mailing…"
6. Campaign Execution	045 Executive Agency	"Saatchi & Saatchi"
	047 Planned Running Time	'1 week – 1 month'
Outcomes		
7. Outcomes	049 Number of Respondents	'25000'
	054 Customer Information	'yes'
	062 Competitive Reaction	'imitation promotion, lawsuit'
	064 Product/ Brand Sales	'major increase'

4.2.4 The No Case-Based Reasoning System Conditions

The Expert System Condition. As the benchmark support system, we use an expert system that is designed for sales promotion technique recommendation, which we from now on in brief refer to as the *Expert System*. This Expert System is part of one of the five modules of BRANDFRAME, which is a knowledge-driven, predominantly qualitative marketing management support system that is developed to improve the efficiency and effectiveness of the brand manager's decisions (see Dutta et al., 1997; Wierenga et al., 2000; Wierenga and Van Bruggen, 2001). The marketing knowledge incorporated in this system is rule-based and derived from theory, textbooks, and marketing experts. The five BRANDFRAME modules are: (1) "Define/change Brand Situation", (2) "Set Target and Budgets", (3) "Report Market Data", (4) "Analysis of a Specific Period", and (5) "Design a Marketing Program". For detailed information about these five modules, we refer the reader to Dutta et al. (1997), Wierenga et al. (2000) and Wierenga and Van Bruggen (2001).

From the "Design a Marketing Program" module, we isolated the "Sales Promotion Designer" part by making a few adjustments to the software written in the object-oriented KAPPA-PC language (see Dutta et al., 1997; Wierenga et al., 2000; Wierenga and Van Bruggen, 2001). This "Sales Promotion Designer" gives advice about the most appropriate sales promotion technique to use in a given situation, which is based on (1) the goals of the campaign, (2) the constraint of the campaign, and (3) the relative importance of each goal and constraint (see Table 4.4). Based on this input, rules that are derived from textbooks and expert knowledge are used to calculate an appropriateness score for each sales promotion technique. Finally, the system's output is a ranking in descending order of appropriateness of all possible sales promotion techniques plus a brief the description of the technique (see Appendix 5)[24].

Table 4.4 Input and Output Variables of the Expert System

Sales Promotion Objectives	Sales Promotion Constraints	Sales Promotion Techniques
• Increase Use	• Predictability of Costs	• Product Plus
• Attraction of New Customers	• Low Handling Costs	• Premium
• Increasing Loyalty	• Low Direct Costs	• Sampling
• Generation of Awareness	• Short Implementation Time	• Self-Liquidating Premium
• Support Advertising	• Low Implementation Complexity	• Contest
• Improve Image		• Stamps
• Improve Trade Relations		• Price Discount
• Increase of Distribution		• Coupon
• Improve Display Position		• Cash Refund

[24] Participants in the experiments are instructed that they are not obliged to follow the advice given by the support system that they have at their disposal (i.e., either one of the CBR systems or the Expert System).

The No System Condition. The second benchmark that is used in our experimental studies is a so-called "paper and pencil" condition. In this control condition, participants only have a *Sales Promotion Technique Inventory* (see Appendix 6) on paper at their disposal. This inventory includes the most prominent sales promotion techniques and a brief description of each technique. Participants that only have the SP technique inventory at their disposal, of course, have to decide themselves upon the most suitable SP technique given the problem situation. We note that in all the other experimental conditions, this SP technique inventory was also made available to the participants.

4.2.5 The Respondent Population

This dissertation is about supporting (managerial) decision making in weakly-structured problem domains. Hence, our object of study is the decision maker. Or, more specifically, the object of study is the decision maker who is familiar with the concept of sales promotions within the marketing context and, therefore, able to design a sales promotion campaign. Decision makers may vary in their level of experience and expertise within a particular decision domain, which may have consequences for their need for decision support and the potential impact of support systems.

We can make a broad distinction between expert and novice sales promotion campaign designers. For the empirical part of this dissertation project, we will use graduate and undergraduate marketing students (knowledgeable about sales promotions) from the faculties of Business Administration and Economics as substitutes for the novice sales promotion campaign designer. Students have been found to be reasonable surrogates for real managers in managerial decision-making experiments (Remus, 1987).

To motivate marketing students to participate in the experiment, we either provide extra course credit or pay them for their participation. Since the experiments were also part of an international course on "Marketing Strategies and Marketing Intelligence in the Era of IT", a number of non-Dutch speakers participated. Besides the full case descriptions that were taken from the Dutch "Scoren" book, all materials were in English. Nonetheless, before testing our hypotheses we will check whether there is significant difference in performance for "paid" versus "course credit" participants and "Dutch" versus "non-Dutch" participants.

4.2.6 Research Design in Previous Experimental Decision Support Studies

In Table 4.5, we present an overview of the methodology applied in a number of recently published experimental studies regarding support systems for weakly-structured, qualitative decisions. There is also a long research tradition in experimental, quantitative, data-driven decision support (e.g., Chakravarti et al., 1979; Todd and Benbasat, 1992; Van Bruggen, 1993; Lilien et al., 2004). The studies in Table 4.5 can be considered as their counterparts in the area of weakly-structured problems. This list is not exhaustive, but we believe that it captures the most prominent and representative publications from the top journals in decision support systems and marketing. This methodological overview provided the basis for the design of our empirical research. For a more detailed overview, we refer the reader to Appendix 1a.

From Table 4.5, we may conclude that with respect to the experimental task, the participants are usually given one focal problem-solving task and this task typically involves solving a management case (e.g., in the domain of business or public policy). In two studies (i.e., Dahl and Moreau, 2002; Moreau and Dahl, 2005), participants are confronted with a design problem like in our studies. In these two studies, the design task was about new product development, i.e., a new automotive dining device (Dahl and Moreau, 2002) and a new toy (Moreau and Dahl, 2005). Next to some kind of support condition (e.g., a specific support system/software), most studies also include a control condition, whether this is an alternative support system or no system at all (or both). The experimental sessions last from 5 minutes (Moreau and Dahl, 2005) to as long as 3 hours (MacCrimmon and Wagner, 1994), depending on the number of tasks and the presence of a time constraint or not. As one can read from Table 4.5, it is common practice to pay students for participation (e.g., MacCrimmon and Wagner, 1994) or to give them (extra) course credit (e.g., Moreau and Dahl, 2005). In addition, most experimental, weakly-structured decision support studies (e.g., MacCrimmon and Wagner, 1994; Dahl and Moreau, 2002) use graduate or undergraduate students as subjects. Only, a few studies used professionals (e.g., Elam and Mead, 1990) or a combination of students and professionals (e.g., Marakas and Elam, 1997). In the last row of Table 4.5, we listed the characteristics of the studies reported in this dissertation to put our studies into perspective.

Table 4.5 Research Design of Experimental Decision Support Studies in Weakly-Structured Problem Domains

	Sample		*Research Design*			
Study	*Sample Size*	*Student or Professional*	*Decision Task(s)*	*Type of Task*	*Decision Support Conditions*	*Time Frame*
Connoly, Jessup and Valacich (1990)	23 teams of 3-4 persons	Students (course credit)	1 Task: Parking Lot Case	Case Analysis & Creative Solution	electronic brainstorming system no system (control)	10 min. system usage instruction 30 min. for solution
Elam and Mead (1990)	12	Professionals	2 Tasks: 1) Business Case 2) Public Policy Case	Case Analysis & Creative Solution	system focus on causes & effects system focus on practical solutions paper and pencil (control)	+/- 15 min. per task (no time limit)
MacCrimmon and Wagner (1994)	48	Students (paid)	3 Tasks: 3 Business Cases	Case Analysis & Creative Solution	idea generation system word-processor (control)	3-hour sessions (30 min. per task plus warm-up task and system usage instruction)
Massetti (1996)	44	Professionals (MBA Students)	1 Task: Public Policy Case (*Homeless Problem*)	Case Analysis & Creative Solution	idea generation system idea elaboration system word/graphics processor (control) paper and pencil (control)	2 sessions: training session (+/- 1 hour) task session (30 min.)
Marakas and Elam (1997)	40	Professionals and Students	1 Task: Business Case	Case Analysis & Creative Solution	system focus on causes & effects paper and pencil (control)	no info
Dahl and Moreau (2002)	4/ 104 / 119	Professionals and Students (paid)	New Product Development (Automotive Dining)	Design	single analogy multiple analogies no analogies (control)	+/- 1hour
Moreau and Dahl (2005)	96 / 72/ 131	Students (course credit)	New Product Development (A Toy for Children)	Design	different sets of exemplar shapes	no time limit (study 1-2) 5 min. vs. 50 min. (study 3)
Althuizen and Wierenga (this dissertation)	***17 / 23/ 120***	***Students (course credit and paid)***	***Sales Promotion Campaign Proposal***	***Design***	***case-based reasoning systems*** ***expert system (control)*** ***no system (control)***	***no time limit (i.e., max. 5 days, study 1)*** ***max. 3 hours (study 2 and 3)***

4.3 Measurements

This section concerns the operationalization and measurement of the theoretical concepts that are depicted in our conceptual framework (see Figure 4.1). The first concept that will be operationalized is the decision-maker's innate creative ability (see subsection 4.3.1). In the next subsection (4.3.2), we discuss the measures we use for the CBR system process variables in the conceptual framework. Next, we discuss the operationalization of the main dependent variables, viz. solution quality and solution efficiency (see subsection 4.3.3). The other dependent variable in the framework, i.e., the subjective evaluations of CBR system usage, is discussed in subsection 4.3.4. Finally, the covariates are mentioned in subsection 4.3.5 and this section ends with an overview of how related studies have handled these issues (subsection 4.3.6).

4.3.1 Decision Maker Characteristics: Innate Creative Ability

As depicted in our conceptual model of "how the use of a CBR system affects the solution quality of sales promotion campaigns and the efficiency of their design (see Figure 4.1), we are particularly interested in the following characteristics of the decision maker.

- *Innate Creative Ability* (discussed in this subsection).
- *Attitude towards using MMSSs (before usage)* (see subsection 4.3.4).
- *Covariates: Gender, Age, and Education Level* (see subsection 4.3.5).

Below, we will discuss the operationalization and measurement of the innate creative ability of the decision maker characteristics in more detail. In the empirical studies, we use different methods to assess a person's innate creative ability. In the main study, we measure a person's creative ability by means of the abbreviated version of the widely used and extensively validated Torrance Tests of Creative Thinking (Torrance, 1974), i.e., the Abbreviated Torrance Test for Adults (ATTA) (Goff and Torrance, 2002). Before the main study we did not have the ATTA-test at our disposal, since it was first published in 2002. Hence, in the first three studies we applied two easy-to-administer, self-assessed creative ability questionnaires, namely a creativity checklist (Study 1) (Hellriegel and Slocum, 1992) and a multiple-choice creativity questionnaire (Study 2) (Abedi, 2000). These three measurement instruments to assess a person's innate creativity ability are discussed below.

Creative Ability Test: The Abbreviated Torrance Test for Adults© (ATTA. The Torrance Tests of Creative Thinking (TTCT) have become the most prominent test for the assessment of creative abilities, since it was first published in mid 1960s. The Torrance Tests have been applied in over 2000 studies (Goff and Torrance, 2002) in many different domains, such as psychology, child development, and education.

Repeated longitudinal studies have established strong evidence of relationships between the TTCT-test scores and real-life creative achievement (see for a review: Torrance, 2000). However, taking the Torrance tests requires considerable testing time (45 minutes for the verbal tasks and 30 minutes for the figural tasks) and administration time and effort (approximately 20 minutes per form after careful study of the manual and practice). Hence, a less time-consuming, short version of the Torrance tests was developed by Goff and Torrance (2002), particularly for assessing the creative ability of adults: the Abbreviated Torrance Test for Adults (ATTA) (Goff and Torrance, 2002).
In Table 4.6, the four aspects of creative thinking ability that are measured in the ATTA-test are shown, i.e., fluency, flexibility, originality and elaboration (definitions are taken from Goff and Torrance, 2002).

Table 4.6 Definitions of the Four Creative Abilities measured in the ATTA-test

Construct	*Definition & Operationalization*
Fluency	*The ability to produce quantities of ideas that are* ***relevant*** *to the task instruction. The creative person typically evidences the ability to generate multiple or alternative ideas and solutions, both verbally and figurally.*
Flexibility	*The ability to process information or objects in different ways, given the same stimulus. Flexible thinking is especially important when logical approaches fail to produce satisfactory results.*
Originality	*The ability to produce uncommon ideas or ideas that are totally new or unique. A creative person tends to produce such new ideas rather than to follow the more common path.*
Elaboration	*The ability to embellish an idea with details. Rather than being restricted to the core idea, a creative person tends to provide such embellishment.*

The abbreviated test uses three tasks from the full Torrance tests (which includes 12 tasks) to measure the fluency, flexibility, originality and elaboration aspects of creative thinking, along with fifteen creativity indicators (i.e., creative strengths). The ATTA-test consists of one verbal response task and two figural response tasks (see Goff and Torrance, 2002). For each task the experimenter reads aloud the instructions from the manual and allows exactly three minutes to complete the task. In total, it takes about 15 minutes to administer the abbreviated version of the Torrance tests, including filling in the personal details (i.e., name, gender, date, year of birth, and education level), reading aloud the instructions from the manual and administering the three tasks. Scoring the completed tests (consistent with the scoring instructions provided in the manual) takes an experienced rater about 5 to 15 minutes per test booklet.

The first task of the ATTA-test is a verbal "*Just suppose*…" task, in which the respondent has to imagine a hypothetical situation (e.g., *that you could walk on air*) and list as many problems as possible that might occur in that situation. The responses to this verbal task are scored on: (1) fluency (i.e., a simple count of *relevant* responses), and (2) originality (i.e., a simple count of responses that are not on the list of common responses for this task). In addition, the verbal task is rated on the presence or absence of five creativity indicators, such as "richness and colorfulness of imagery" and the use of "humor (or conceptual incongruity)". The creativity indicators are rated on a three-point scale (i.e., 0 = no evidence of indicator, 1 = single instance of indicator, 2 = multiple instances of indicator). These ratings are then added to obtain a total score for the five creativity indicators for Task 1 (ranging from 0-10).

The two other tasks ask for figural responses in the form of drawing (unusual) pictures with the use of two incomplete figures (Task 2) and nine triangles (Task 3). The respondents are also asked to give each picture a title. The pictures produced in response to Task 2 are scored on: (1) fluency (i.e., the number of meaningful pictures), (2) originality (i.e., the number of pictures not on the list of common responses), and (3) elaboration (i.e., the number of details added to the basic or primary response to the stimulus figure, such as the use of color or deliberate shading). Next to fluency, originality and elaboration, the pictures that are produced in Task 3 are also scored on flexibility (i.e., the number of different ways in which the triangles are used, such as 2-dimensional and 3-dimensional pictures). The two figural tasks are scored on ten creativity indicators, such as "resistance to premature closure" and use of "fantasy" (see Goff and Torrance, 2002), using the same three-point scale as for the verbal task. Adding the ratings on these ten indicators, results in a total creativity indicator score for Task 2 and 3 (ranging from 0-20).

For fluency, flexibility, originality and elaboration, the individual task scores are summed to obtain a raw total score for each aspect. These raw scores are then converted into a normalized standard score (i.e., scaled scores from 11 = low to 19 = high) to allow for relative assessment of these creative thinking facets on comparable scales (Goff and Torrance, 2002). Next, the normalized scores for fluency, flexibility, originality and elaboration add up to a total score. Together with the creativity indicator scores, this total score for fluency, flexibility, originality and elaboration forms a creative ability index. Finally, this index score is converted into a normalized creative ability level, ranging from 1 (minimal creative ability, representing the bottom 4% of the adult population) to 7 (substantial creative ability, representing the top 4% of the adult population). The average level of creative ability is 4, which represents 26% of the adult population (see also Table 4.7: taken from Goff and Torrance, 2002).

Table 4.7 Normalized Scores and Interpretation for the Abbreviated Torrance Test for Adults

Creative Ability Index	1 – 50	51 - 59	60 - 70	68 - 73	74 - 77	78 - 84	85+
Creative Ability Level	1	2	3	4	5	6	7
Verbal Assessment	Minimal	Low	Below Average	Average	Above Average	High	Substantial
% of Adults	4%	12%	20%	26%	20%	12%	4%

The norms for the ATTA scales are based on 175 records (see Goff and Torrance, 2002)[25]. This sample includes adults from different states in the US, ranging in age from 19 to 89, and represents for instance retirees, college students and business. Since the abbreviated Torrance test (ATTA) was developed quite recently, the reliability and validity of the ATTA-test are not yet as well-documented as for the original Torrance tests (TTCT). To our best knowledge, no validation studies with the full TTCT-test or application studies of the ATTA-test are published yet. There is of course a trade-off between the number of tasks (cf. items) in the abbreviated test and the reliability of the test. Nonetheless, we can make a few remarks about the reliability and validity of the ATTA-test. First, the selected tasks for the ATTA-test are directly taken from the well-validated full version of the Torrance Tests (TTCT). As mentioned, the full version of the Torrance tests has also proven to possess considerable predictive validity with respect to real-life creative achievement (see for a review: Torrance, 2000). Second, in the instruction manual of the ATTA-test reliability coefficients and standard errors of measurement for the normative sample are reported (see Goff and Torrance, 2002, p. 34). The reliability coefficient (KR21) for the raw score for the four abilities (fluency, originality, flexibility, and elaboration) is 0.84 and 0.90 for the total raw score including the creativity indicators.

Creative Ability Questionnaire (Self-Assessment): The Abedi Test of Creativity© (ATC). This self-administered, 56-item, multiple-choice questionnaire[26] (Abedi, 2000) is intended to measure the same four aspects of creative thinking as included in the Torrance tests. Each multiple-choice item has three answer categories (see Table 4.8). A respondent who ticks the box with the most creative response receives a

[25] The norms for the original Torrance Tests (TTCT) are based on ten thousands of (US–based) records.
[26] The Abedi Test of Creativity (ATC©) is available upon request from the author Jamal Abedi (e-mail: jabedi@cse.ucla.edu).

score of 3 points, choosing the least creative option results in a score of 1 point. Adding the scores for all construct items, results in a total scale score for fluency (17 items; scale ranging from 17 to 51), flexibility (13 items; scale ranging from 13 to 39), originality (16 items; scale ranging from 16 to 48) and elaboration (10 items; scale ranging from 10 to 30).

Table 4.8 Sample Items and Item Scores for the Creative Ability Questionnaire (Abedi, 2000)

Construct	*Sample Items & Item Scores*		
Fluency (17 items)	*"If you had to participate in a contest in which you were asked to come up with as many words as possible which began with the letter "J", how would you do?"*		
	O	I would do poorly.	*(1 point)*
	O	I would do okay.	*(2 points)*
	O	I would do very well.	*(3 points)*
Flexibility (13 items)	*"How do you approach a complex task?*		
	O	I come up with a single approach.	*(1 point)*
	O	I may be able to come up with few approaches.	*(2 points)*
	O	I will be able to come up with a variety of approaches.	*(3 points)*
Originality (16 items)	*"Do people think that you come up with unique ideas?"*		
	O	No, they don't.	*(1 point)*
	O	Sometimes, they do.	*(2 points)*
	O	Often, they do.	*(3 points)*
Elaboration (10 items)	*"When you get interested in something, how much attention do you pay to the details?"*		
	O	I do not pay much attention to the details.	*(1 point)*
	O	I pay attention to some of the details.	*(2 points)*
	O	I pay attention to all of the details.	*(3 points)*

Hitherto, two validation studies have been published (Auzmendi, Villa, and Abedi, 1996; Abedi, 2002) for this quite recently developed multiple-choice, creative ability questionnaire. In a study with 2,264 Spanish students (age 13 to 20), Auzmendi et al. (1996) found internal consistency (Cronbach's alpha) coefficients for the items of the four subscales ranging from 0.61 (for both elaboration and originality) to 0.75 (for fluency). To assess the convergent validity of the creative ability questionnaire, Auzmendi et al. (1996) also administered the Torrance Tests (TTCT) to the same sample of students (n = 2,264). The correlations coefficients of the fluency, originality, flexibility and elaboration subscales with their Torrance tests equivalents are positive, and for most of the coefficients significant beyond the 0.01 level. However, the correlation coefficients are rather small, ranging from r = 0.047 for flexibility to r = 0.235 for fluency. The second validation study (Abedi, 2002) is based on the same data as for the Auzmendi et al. (1996) study, but instead of the traditional approach it uses a structural equation modeling approach to assess the reliability and validity of the creative ability questionnaire.

Creative Ability Checklist (Self-Assessment): Hellriegel and Slocum's Creative Ability Checklist. Hellriegel and Slocum's (1992) "Personal Barriers to Creative Thought and Innovative Action" checklist consists of 36 self-administered items that are intended to measure the decision maker's creative ability. The checklist consists of six dimensions and each dimension is measured by six items (see Table 4.9). The 6-point Likert-scale items in the checklist are positively stated, i.e., in the direction of the absence of creative barriers. High scores on these scales indicate the presence of a creative barrier, because the answer categories range from 1 (*"strongly agree"*, meaning no barrier) to 6 (*"strongly disagree"*, indicating the presence of a barrier). By reversing the scale scores, i.e., a score of 1 meaning strong disagreement with the statement and a score of 6 meaning strong agreement, high scores denote the absence of creative barriers. In Study 1, we used the reverse coded scale, because we are interested in the creative ability of the decision maker and not in barriers.

Table 4.9 Sample Items of the "Personal Barriers to Creative Thought and Innovative Action" Checklist (Hellriegel and Slocum, 1992)

Construct	*Sample Items*
Self-Confidence and Risk-Taking (6 items)	*"I evaluate criticism to determine how it can be useful."* *"I would modify an idea, plan, or design, even if doing so would meet with opposition."*
Need for Conformity (6 items)	*"When solving problems, I attempt to apply new concepts or methods."* *"I feel comfortable in expressing my ideas even if they are in the minority."*
Use of the Abstract (6 items)	*"I translate symbols into concrete ideas or action steps."* *"I enjoy participating in nonverbal, symbolic, or visual activities."*
Use of Systematic Analysis (6 items)	*"I seek many ideas because I enjoy having alternative possibilities."* *"I know how to simplify and organize my observations."*
Task Achievement (6 items)	*"I always give a problem my best effort, even if it seems trivial or fails to arouse enthusiasm."* *"I consciously attempt to use new approaches to routine tasks."*
Physical Environment (6 items)	*"I set aside periods of time without interruptions."* *"I determine whether the imposed limitation is reasonable or unreasonable."*

In a study into the value of creativity support system on idea generation, Massetti used a (not reported) subset of the Hellriegel and Slocum (1992) items to "provide a general determination of each subject's ability to perform creatively" (Massetti, 1996, p. 87) (see also Table 4.11). However, there is no evidence on the reliability (or internal consistency) and validity of the checklist items reported. Therefore, we decided to administer all original 36 items of the checklist. After a factor analysis and reliability analysis, 5 items of the checklist were used in Study 1 to represent a person's creative ability (including three items on divergent thinking and 2 items on convergent thinking) (see subsection 5.3.4).

4.3.2 CBR System Usage Process Measures

In retrospect, that is, immediately after the participant has finished the task, we measure the following characteristics of the problem-solving process in a post-experimental questionnaire (see Appendix 8).

- *Time*, including *Total Task Time* and *Support System Usage Time.*
- *Number and Type of Analogies Read and Used.*

Next, we will discuss the operationalization and measurement of these process characteristics in more detail.

CBR System Usage Time. "Support system usage time" is measured by the number of minutes that the decision maker has worked with the support tool, i.e., the CBR system, the expert system or the SP technique inventory, in the process of finding a solution. Since in our experiments it is the first time that the decision maker has used the support system, system usage time will also include the time that is needed to get acquainted with how the system works. Hence, training and learning will reduce support system usage times for subsequent tasks.

We also measure "total task time", which is defined as the number of minutes that the decision maker has worked on the whole task, i.e., designing a sales promotion campaign, including support system usage time and writing the campaign proposal.

Both total time and support system usage time are measured as straightforward, self-reported, single items: "*how long have you worked with the system?* (in minutes)" and "*how long have you worked on the task in total?* (in minutes)" (see Appendix 8). In Study 2 and 3, we use computer log-files to register system usage time and the total time worked on the task in addition to the self-report measures.

Number and Type of Analogies Read and Used. In the questionnaire on the problem-solving process completed immediately after finishing the task, we ask the participant to list all the cases that they have read in the "cases read" section of the questionnaire (see Appendix 8a), also the cases that they eventually did not use for designing their own sales promotion campaign. However, if a participant actually did use a case, or elements or ideas from a case, then we ask the participant to list these cases in the "case used" section of the questionnaire (see Appendix 8a) and to provide a reference to the case in the campaign proposal (just like the use of references in scientific articles)[27]. If a participant did not use the cases at all, then he is asked to explain briefly why not (see Appendix 8a). In addition, as a validity check and in order to gain more insight into how the participants have searched for analogies, the users of the CBR system are asked to make a screendump (i.e., a copy of the computer screen) of their most prominent search result, containing the input variables and values for their search process and the two best-matching analogies (see for an example Appendix 9).

4.3.3 The Measurement of Solution Quality and Solution Efficiency

We consider the following two focal dependent variables in our studies into the impact of analogical reasoning, by means of a CBR system, on the quality of sales promotion campaign designs.

- *Solution Quality,* i.e., the creativity of the outcome (comprising the novelty and the usability of the solution).
- *Solution Efficiency,* i.e., the time needed to work out a solution.

The precise operationalization and measurement of these constructs will be discussed below.

Solution Quality: The Creativity of the Outcome. For measuring solution quality with respect to designing sales promotion campaigns, we have to consider two aspects. First, we have to decide which dimensions and items are eligible for rating the creativity of a campaign proposal (see also Table 4.11). Second, we have to determine which people qualify as judges for performing the rating task. Thus, below we will briefly discuss the following issues.

1) Rating Scales.
2) Judges.

1) Rating Scales. As mentioned earlier, the sales promotion campaign proposals will be judged on their creativity which, according to the widely used definition of creativity (see Amabile, 1983; Boden, 1994), is something that is both novel and useful. Previous studies (e.g., Elam and Mead, 1990; Marakas and Elam, 1997; Dahl and Moreau, 2002) have operationalized creativity as a single-item construct (typically on a scale from 1 = "not at all creative" to 7 = "very creative"). However, most studies (e.g., Connoly, Jessup and Valacich, 1990; Haberland and Dacin,

[27] All references are removed before sending the campaign proposals to the expert judges.

1992; MacCrimmon and Wagner, 1994; Massetti, 1996; Ford and Gioia, 2000) have measured the novelty (or originality) and the usability (or value) dimension of the "creativity of the outcome" construct separately, either by means of single-item scales or multiple-item scales (such as the Creative Product Semantic Scale (Besemer and Quinn, 1986) (see also Table 4.11). Usually, the average of the separate novelty and usability ratings is then taken as the final score for the creativity of the outcome. Throughout our studies, we use both single-item and multiple-item scales for measuring creativity, novelty and usability (for the exact items used in each study, see Appendix 10). In our comprehensive study (Study 3), we use multiple-item scales for measuring the novelty and usability of the solution (see Appendix 10c) and take the average of both measures as the final creativity score. More detailed information about the outcome measures in each study (e.g., internal consistencies) will be given in the corresponding chapters in the empirical part of this dissertation (Part II).

2) Judges. The important point to make here about solution quality for ill-structured or weakly-structured problems is that there generally is no "right answer", that is, we can only speak about "better" or "worse" (Voss and Post, 1988; Jonassen, 2000). But who is to judge whether something is better or worse? Voss and Post (1988) provide a pragmatic answer in that the judgment should be made by "other members of the problem-solving community". This is in line with the Consensual Technique for Creativity Assessment proposed by Amabile (1983), which can be applied to weakly-structured, open-ended (heuristic) tasks that produce a clearly observable outcome (e.g., judging the creativity of an artifact).
The rationale behind the consensual assessment technique is that a product or response is creative to the extent that appropriate observers independently agree that it is creative, using their own implicit, subjective definition of creativity. Appropriate observers are those who are familiar with the domain in which the product (or response) was created (or articulated). However, their level of experience with the domain in question need not be identical (Amabile, 1983). Furthermore, judges should be instructed to make relative judgments instead of judging each solution against some absolute domains standard and the judges should view the solutions in a different random order to be sure that high levels of inter-rater reliability do not reflect method artifacts (Amabile, 1983). Hence, "if judges independently agree that a given product is highly creative, then it can and must be accepted as such" (Amabile, 1983). Following this commonly used consensual assessment technique, we asked sales promotion experts to judge independently the proposals on the novelty-related and usability-related items described earlier.

For the empirical studies reported in this dissertation, we asked two experts from two different sales promotion agencies to judge the campaign proposals. Both judges are very familiar with the sales promotion domain, but differ in their experience and background. One judge has many years of experience in the sales promotion business as a consultant and has recently founded his own marketing consultancy bureau. He has written many books for practitioners on this topic (in Dutch) and has served several times as the chairman of the jury for the annual Dutch Sales Promotion Awards (the "Esprix's", formerly known as the "Zilveren Meetlat"). The other judge is the commercial director of a sales promotion agency specialized in joint promotions[28], a closely related, though distinct field within the sales promotion business. He has many years of experience in designing joint promotion campaigns, he has also written books on this specific topic and is organizer of an annual, one-day event on developing creative joint promotions.
For each study, we also asked one marketing manager from the company that provided us with the sales promotion campaign briefing to act as an expert judge for that particular study. By doing this, we are able to incorporate the company's perspective in the novelty and usability ratings, since the company's marketing managers are eventually the ones that decide on whether the quality of a proposed campaign is good enough to warrant execution or not. So, in total we have three independent expert judges per study who were blind to the experimental conditions under which the campaigns had been designed.

Solution Efficiency: Time Needed to Work Out a Solution. For measuring solution efficiency, we subtract the time that the decision maker has worked with the support tool (i.e., the CBR system, the Expert System or the SP Technique Inventory) from the total time that he worked on the task (see Appendix 8a: items 2 and 3). The residual *solution time* gives an indication of how the use of a particular support tool facilitates working out a solution. That is, the less time that the decision maker needs to work out and write up a campaign after having worked with the support tool, the more that tool helps to quickly construct a satisfactory solution (to which we refer as solution efficiency).

4.3.4 Subjective Evaluation Measures

We consider three subjective evaluation measures with respect to using Marketing Management Support Systems (MMSSs) for enhancing decision-making performance, namely the decision maker's.

- *Perceived Usefulness of the MMSS (after experiment).*

[28] Promotions can also be done in a mutual effort by two or more companies: a joint promotion. In a joint promotion, one company usually takes care of communicating the campaign, while the other company provides the promotional offer.

- *Perceived Impact of MMSS Usage on the Solution (after experiment).*
- *Attitude towards Using an MMSS in general (before and after experiment).*

In essence, both the "attitude" and "perceived usefulness" construct consist of formative indicators (see Diamantopoulos and Winklhofer, 2001; Rossiter 2002a) as the construct items evaluate different aspects of support system usage, such as decision-making quality, speed, and insight, which do not necessarily go together. However, in the past these scales have been commonly treated as reflective indicators of an underlying, general disposition towards support system usage (see, for instance, Schultz and Slevin, 1975; Davis, 1989; Van Bruggen, 1993). Hence, for reasons of comparison, we also calculate the internal consistency of the scale items (Cronbach's alpha) and check the dimensionality of the scales. Perceived impact is measured by a single-item.

Perceived Usefulness of the MMSS. This six-item, 7-point Likert-scale (see Appendix 8a: items 6-11) is taken from Van Bruggen's (1993) scale for measuring the "perceived usefulness of Marketing Management Support Systems" (MMSS). The items of this scale are based on the work of Davis (1989), who conducted research into the measurement of the perceived usefulness of information technology applications. In our empirical studies, we will use items like *"using the system increased the quality of the SP campaign"* and *"using the system enabled me to design the SP campaign more quickly"* (measured on a scale from 1 = completely disagree and 7 = completely agree). Perceived usefulness will be measured after the decision maker has experienced using an MMSS for decision making ("after" measure). In Study 2 and 3, we included an extra item in this questionnaire asking directly for the perceived usefulness of the system to enhance creativity (see Appendix 8a: item 12).

Perceived Impact of MMSS Usage on the Solution. We measure perceived impact as the extent to which the decision maker believes that the use of an MMSS has contributed to his final solution. This construct is measured by the following single item: *"Assess the impact of the use of the Marketing Management Support System on your solution."* The respondent is asked to fill in a percentage that best expresses this impact on a scale from 0% (= no impact at all) to 100% (= the solution is completely due to the system) (see Appendix 8a: item 1).

Attitude towards using MMSSs in General. This scale consists of eight items (see Appendix 7) and is largely based on an attitudinal scaling instrument introduced and validated by Schultz and Slevin (1975) for conducting implementation research. Van Bruggen (1993) translated and tested these scale items in the context of management support systems. For example, *"I think that by using an MMSS, I* *will be able to make marketing decisions quicker"* or *"I think marketing decisions made using an MMSS will be better"*. The items are measured on a Likert-scale, ranging from 1 (= completely disagree) to 7 (= completely agree). We measure the decision maker's attitude towards using an MMSS both *before* and *after* he has worked with the support system (i.e., a "before" and "after" measure).

4.3.5 Covariates

In our studies, we also measure a number of covariates that could play a role in the impact of using analogies for designing sales promotion campaign (see section 3.8). The most important ones are: the demographic characteristics of the participant, such as gender, age and education level, and the length of the campaign proposal (see Table 4.10 and also Table 4.11).

Demographic Characteristics. We will use the information we have about the respondent's background and qualifications such as gender, age, and education level (see, for example, Connoly et al., 1990; MacCrimmon and Wagner, 1994; Marakas and Elam, 1997; Lilien et al, 2004) to (1) check (post-hoc) whether the respondents are equally distributed over the various experimental conditions, and (2) as covariates in our regression analyses. For the exact measures, see Table 4.10.

Length of the Campaign Proposal. Previous research has shown that the length of a response may bias solution quality ratings provided by expert judges. Lilien et al. (2004) found in a decision support experiment that report length (i.e., number of words) was, by far, the most significant factor explaining expert ratings regarding the quality of the solutions for two business cases. That is, the more words the subjects used to explain their recommendation, the higher experts evaluated that recommendation regardless of the experimental condition to which the subjects belonged (Lilien et al., 2004). Lilien et al. (2004) suggest that in the absence of objective performance indicator judges rely on potentially biasing cues, such as the length of a response, in assessing solution quality. In contrast, Marakas and Elam (1997), did not find an effect for the length of the response on the judges' creativity rankings. However, to be able to correct for this possible confounding influence of report length, we take the length of the sales promotion campaign proposals into account by performing a simple word count on the proposals (i.e., after all identifying information is removed from the proposal and after they are provided with exactly the same lay-out) (see Marakas and Elam, 1997).

Table 4.10 Measurement of the Covariates used in the Empirical Studies

Covariate	*Measure*
Gender	Gender is registered when the participant subscribes for one of the experimental sessions and is also established with a single-item (sex) measure in the ATTA-test.
Age	Age is straightforwardly measured by a person's year-of-birth. For technical reasons, age is only measured in Study 3 (as part of the ATTA-test).
Education Level	We recruited our participants within three levels of education: (1) graduate level (university), (2) undergraduate (university), (3) undergraduate (HBO). The level of education of the participant is verified when signing up for the experiment.
Length of Proposal	Simple word count (by computer or by hand) on coded and uniform proposals.

4.3.6 Measurements in Previous Creativity Related Studies

In Table 4.11, we presented an overview of the empirical studies in marketing and management that tackle the same creativity measurement issues as we have to deal with in our studies. These issues are related to the measurement of decision maker characteristics (the person), process measures (the process), and the quality of the solution for weakly-structured problems (the outcome). We focus here on the measurement of creativity, since this is a relatively new topic within the marketing management domain. The list in Table 4.11 is not meant to be exhaustive, but we believe it captures the most prominent and representative publications from the top journals in the marketing (management) domain. The examples are meant to be illustrative of the aspects of creativity that are typically measured and how they are measured. For a more detailed overview, we refer the reader to Appendix 1a and 1b. In the final row in Table 4.11, we listed the measures applied in the studies reported in this dissertation.

First of all, a distinction has to be made between the measurement of the *creativity of the person* and the *creativity of the output*. Most studies listed in Table 4.11 measure only the creativity of the output (see third and seventh column). However, when assessing the impact of support system usage, one preferably should measure both the decision maker's innate creative ability and the creative of the output (Wierenga and Van Bruggen, 1998). Consider, for instance, using the number of ideas as a measure of the creative of the output (e.g., Connoly et al., 1990; MacCrimmon and Wagner, 1994; Massetti, 1996). Number of ideas or ideational fluency is also commonly regarded as an aspect of a person's innate divergent thinking ability (including ideational fluency, flexibility and originality) (Guilford, 1968; Torrance, 1974; Runco, 1986). Hence, if one only looks at the number of ideas as a measure of the creativity of the output, the impact of creativity support (system) is likely to be confounded with the manifestation of the "ideational fluency" personality trait. In order to correct for this confounding effect, it would be advisable to also include a measure of the decision maker's innate creative ability (Wierenga and Van Bruggen, 1998).

Four studies listed in Table 4.11 measured a person's innate creative ability (see third column). Of these studies, three out of four used a self-assessment method (Elam and Mead, 1990; Massetti, 1996; Marakas and Elam, 1997). Only Burroughs and Mick (2004) measured "creative ability" by means of an actual test. That is, they developed a test to assess a person's metaphoric thinking ability (i.e., the Metaphoric Thinking Ability Sentence Completion Test (MTA-SC), which is closely related to analogical reasoning ability (see Gentner and Markman, 1997; Gentner, Bowdle, Wolff, Boronat, 2001), but not completely similar to creative ability. In this test, respondents have to complete sentences in order to describe vividly an abstract concept. For instance, people have to complete the sentence "being deceived is, like…" and can provide answers, such as "making a deal with the devil" or "equal to playing cards with someone who has an ace up their sleeve". In our empirical studies, we use the abbreviated version of the prominent Torrance tests to measure innate creative ability as well as self-assessment methods.

Most studies in Table 4.11 operationalize creativity as a 2-dimensional construct, consisting of a novelty and usability dimension (see sixth column). The measurement scales used for assessing the creativity, novelty and usability of the output either consist of multiple items (e.g., Haberland and Dacin, 1992; Moorman and Miner, 1997; Moreau and Dahl, 2005) or a single item (e.g., Massetti, 1996; Dahl and Moreau, 2002) (see eighth column in Table 4.11). The large majority of the studies in Table 4.11 applies the consensual technique for the assessment of the creativity of the output (see Amabile, 1983) and calculates inter-rater reliabilities (see last column in Table 4.11). That is, multiple domain experts are asked to judge independently the creativity of the outcome, using their own implicit definition of creativity (see also subsection 4.3.3). Typically two to four experts are asked to judge the creativity of the output (see ninth column in Table 4.11)[29]. The average rating across judges is used as the final creativity rating. Dahl and Moreau (2002) do not follow this procedure of aggregating scores across judges, instead they include judge dummies in the regression equation in order to correct for possible judge effects (i.e., correct for differences in rating levels).

[29] That is, creativity judgments relative to the other solutions, thus not against the domain standard.

Finally, to gain deeper insight into the creative process behind the outcomes, a number of studies (e.g., Connoly et al., 1990; Marakas and Elam, 1997; Moreau and Dahl, 2005) also include methods such as "think-aloud" or written protocols, questionnaires (e.g., on motivation, attitudes and working time) and computer log-files (see fourth and fifth column in Table 4.11).

In this chapter, we have dealt with the basic methodological issues and the measurement instruments that will be used in our studies. In the next part of this dissertation (Part II), we will describe and discuss the outcomes of three empirical studies into the effects of CBR system availability for supporting weakly-structured sales promotion campaign design tasks (see Chapter 5 to 7).

Table 4.11 Creativity Measurement in Marketing and Management Studies: The Person, Process and Outcome

	The Person		The Process		The Outcome				
Study	*Measured*	*Test or Self-Assessment*	*Measured*	*Process Characteristic*	*Dimensionality Construct*	*Rating Dimensions*	*Multiple Item Rating Scales*	*# Judges*	*Inter-rater Reliabilities*
Connoly, Jessup and Valacich (1990)	No	-	Yes	Questionnaire	3-dimensional	Fluency (trait) Novelty Usability	No	3	$\alpha = 0.83$ (solution quality)
Elam and Mead (1990)	Yes	Self-Assessment (Adjective Checklist)	Yes	Protocols Time Worked	1-dimensional	Creativity	No	3 / 4	$\alpha = 0.83$ (task 1) $\alpha = 0.72$ (task 2)
Haberland and Dacin (1992)	No	-	No	-	4-dimensional	Novelty Usability Reformulation Condensation	Yes	102	n.a.
MacCrimmon and Wagner (1994)	No	-	No	-	3-dimensional	Fluency (trait) Novelty Usability	Yes	3	$\alpha = 0.73$ (task 1) $\alpha = 0.69$ (task 2) $\alpha = 0.48$ (task 3)
Andrews and Smith (1996)	No	-	-	-	2-dimensional	Novelty Usability	Yes	60 / 193	n.a.
Massetti (1996)	Yes	Self-Assessment (Creative Behavior Inventory)	No	-	3-dimensional	Fluency (trait) Novelty Usability	No	2	$\alpha = 0.88$ (novelty) $\alpha = 0.74$ (value)
Marakas and Elam (1997)	Yes	Self-Assessment (Adjective Checklist)	Yes	Questionnaire Computer Logs Word Count	1-dimensional	Creativity	No	3	$\alpha = 0.77$
Moorman and Miner (1997)	No	-	-	-	-	Novelty Usability	Yes	92	n.a.
Menon, Bharadwaj, Adidam, and Edison (1999)	No	-	-	-	2-dimensional	Novelty Usability	Yes	212	n.a.
Ford and Gioia (2000)	No	-	-	-	2-dimensional	Novelty Usability	Yes	4	n.a.
Dahl and Moreau (2002)	No	-	Yes	Protocols	2-dimensional	Novelty Usability	No	19 / 7 / 16	Use of Judge Dummies
Burroughs and Mick (2004)	Yes	Test (MTA-SC)	No	-		Novelty Usability	Yes	2	$\alpha = 0.94$
Moreau and Dahl (2005)	No	-	Yes	Protocols Time worked	2-dimensional	Novelty Usability	Yes	3	all α's > 0.80 (for novelty and usability)
Althuizen and Wierenga (this dissertation)	***Yes***	***Test (ATTA) Self-Assessment (Creative Ability Questionnaires)***	***Yes***	***Questionnaire Computer Logs Word Count***	***1-dimensional 2-dimensional***	***Creativity Novelty Usability***	***Yes***	***3***	***See studies in the empirical part***

Part II

Empirical Studies

II.0 Outline of the Empirical Part

In this section, we will briefly outline the evolution of the methodology and the measures applied in the empirical studies (see Table II.0). We refined and updated the research design and measurement procedures after each study. This resulted in a comprehensive, large-scale, laboratory experiment (n = 120; see Table II.0, Study 3), which provides the final test for the hypotheses formulated in Chapter 3. As such, Study 3 (Chapter 7) constitutes the core of the empirical part of this dissertation and can be read without detailed knowledge of the other two studies (i.e., Chapter 5 and 6). All studies have been written in such a way that they can be read independently.

Methodology. At the time of the first study, we let the participants work in teams instead of individually as in Study 2 and 3 (see Table II.0). Furthermore, we did not have a computer laboratory with isolated cubicles at our disposal like in the other two studies. The noise introduced as a consequence of the uncontrolled research setting in the first study might make it more difficult to find significant effects. Regarding the experimental conditions (see Table II.0), in the first study we compared CBR system availability to having no system available, whereas in the second study and third study we also manipulated the type of cases in the CBR system (i.e., near analogies versus far analogies). Moreover, in the third study we included two extra experimental conditions to investigate the effect of the number of cases in the CBR system (i.e., a standard size versus a large size case-base). To enhance the external validity of the studies, we used real-life sales promotion briefings. In order to reduce the variation in the nature and complexity of the task as much as possible, we used briefings for fast-moving consumer goods only. Finally, for the comprehensive study, we used exactly the same task as in Study 2 (which served as a pilot study).

Measures. Throughout the studies, we updated our measure for the decision maker's innate creative ability. That is, from a 5-item, self-assessed creativity ability *checklist* with unknown reliability and validity in Study 1, to an abbreviated and validated version of the widely accepted Torrance Tests of Creative Thinking (TTCT), viz. the Abbreviated Torrance Test for Adults (ATTA), in Study 3. In between, i.e., in Study 2, we used a 56-item, self-assessed, multiple-choice creative ability *questionnaire*, which is intended to measure the same dimensions of creative ability as the Torrance Tests (i.e., fluency, flexibility, originality, and elaboration). At the time of Study 1, we did not have access to either the multiple-choice measure (Abedi, 2000; 2002) or the abbreviated creative ability test (ATTA; Goff and Torrance, 2002). Finally, based on the particular briefing that was used and the feedback of the judges, we also refined the instrument for measuring the creativity of the outcome after each study.

Table II.0 Overview of Evolution of Methodology and Measures of the Empirical Studies reported in this Dissertation

	Study 1	Study 2	Study 3
Number of Observations	*N* = 17	*N* = 23	*N = 120*
Unit of Analysis	Team (2 persons)	Individual	Individual
Research Environment	Uncontrolled	Controlled (lab)	Controlled (lab)
Experimental Conditions	1. CBR System *2. No System*	1. CBR System Near Analogies *2. CBR System Far Analogies* 3. Expert System	1. CBR System Near Analogies *2. CBR System Far Analogies* 3. CBR System Standard Size *4. CBR System Large Size* 5. Expert System *6. No System*
Nature of Task	FMCG (Uno Noodles)	FMCG (Grolsch beer)	FMCG (Grolsch beer)
Time Period to Work on Task	5 days	3 hours	3 hours
Innate Creative Ability Measurement	Self-Assessed *(Hellriegel & Slocum, 1992)* *(5-item questionnaire)*	Self-Assessed *(Abedi, 2000)* *(56-item multiple-choice questionnaire)*	Test *(Goff & Torrance, 2002)* *(ATTA: Abbreviated Torrance Test for Adults)*
Outcome Measures & Scales	Creativity (single-item) *Novelty (single-item)* Usability (4 items) *Creativity Composite* Solution Quality (relative) *all 7-point, unipolar scales*	*Novelty (2 items)* Usability (6 items) *Creativity Composite* *all 7-point, unipolar scales*	*Novelty (3 items)* Usability (4 items) *Creativity Composite* *all 11-point, unipolar scales*
Judges and Ratings	3 *Creativity Composite:* Novelty (2 judges) Usability (1 judge) *Creativity (single-item; 3 judges)* *Solution Quality (single item: 1 judge)*	3 *Creativity Composite:* Novelty (all 3 judges) Usability (all 3 judges)	3 *Creativity Composite:* Novelty (all 3 judges) Usability (all 3 judges)

Chapter 5

Analogical Reasoning as a Principle for Supporting the Design of Sales Promotion Campaigns: An Exploratory Study

5.1 Research Questions of Study 1

The first study (see also Althuizen and Wierenga, 2003) is intended to obtain insight into the potential effect of analogical reasoning, by means of a Case-Based Reasoning (CBR) system, for supporting the design of sales promotion campaigns; a weakly-structured decision domain in marketing. In addition, the outcomes of this study should guide us in refining our data-collection procedures and measurement instruments for the subsequent studies.

The basic questions that we address in the first study are: (1) does the use of a CBR system improve solution quality compared to not using such as system, and (2) who benefits most from CBR system usage? In particular, we are interested in the question whether CBR system usage is most beneficial for decision makers who are compensated for their problem-solving weaknesses or for decision makers whose strengths are reinforced. Furthermore, we want to know how decision makers evaluate the contribution of the CBR system to the design of a sales promotion campaign and how this relates to the objective contribution of the CBR system to the solution. That is, we are interested in whether or not decision makers are able to recognize the "objective" impact of the CBR system on the quality of their solution and the efficiency of the design process.

The focal research questions in this study are the following.

1. Does providing decision makers with analogies, by means of a CBR system, result in sales promotion campaigns of higher quality (i.e., more creative campaigns) and does it make the design process more efficient?
2. In examining the effect of analogies, what is the role of decision maker characteristics? In particular, is the effect different for decision makers with different innate creative abilities?
3. What is the relationship between the decision maker's subjective evaluations of CBR system usage for designing a sales promotion campaign and the objective outcomes, i.e., solution quality and solution efficiency?

In addition to these research questions, we are interested in whether information about the underlying process, such as CBR system usage time, can help to explain the effects of the CBR system availability on the objective outcomes, i.e., the quality of the sales promotion campaigns and the efficiency of the design process, and the subjective evaluations.

This chapter is organized as follows. In section 5.2, we recapitulate the - for this study - relevant theory and hypotheses as discussed in Chapter 3. Next, we explain the methodology and measures applied in this study (see section 5.3). In section 5.4, we discuss results of the analyses. This chapter ends with a conclusions and discussion section (see section 5.5).

5.2 Theory and Hypotheses

As depicted in Figure 5.1, we stylized our general framework for explaining "how the use of a CBR system affects the quality of sales promotion campaigns, the efficiency of the design process, and its subjective evaluations" (as discussed in Chapter 3), to accommodate only the above-mentioned research questions. For an elaborate discussion of the framework, we refer the reader to Chapter 3.

In this framework, the dependent variables for assessing the success of CBR system are its *objective outcomes*, i.e., *solution quality* and *solution efficiency*, and its *subjective evaluations* (as perceived by the decision maker). As discussed in Chapter 3, we look at the creativity of the sales promotion campaign, comprising both the novelty and the usability of the campaign, as a measure of solution quality (see Figure 5.1). We also examine the novelty and usability dimension of solution creativity separately, since these dimensions may be affected differently by the availability of the CBR system, the decision maker and the CBR system usage process. Moreover, we are interested in the effect of CBR system availability on the efficiency of the design process, which is measured by the solution time. Regarding the subjective evaluations of CBR system success, we distinguish the following aspects: the *perceived usefulness* of the CBR system for designing a sales promotion campaign, the *perceived impact* of the CBR system on the final solution, and the *attitude towards using MMSSs in general (after usage)* for enhancing marketing decision-making performance.

All participants in this study used exactly the same CBR system, so we have no variation with respect to the CBR system characteristics. Hence, the framework to assess the success of the CBR system for supporting the design of sales promotion campaigns basically consists of two variables: (1) characteristics of the decision maker (i.e., *innate creative ability)*, and (2) characteristics of decision-making process (i.e., CBR system *usage time*, *cases used*) (see Figure 5.1). These elements may directly or indirectly affect the quality of the solution and the efficiency of the design process.

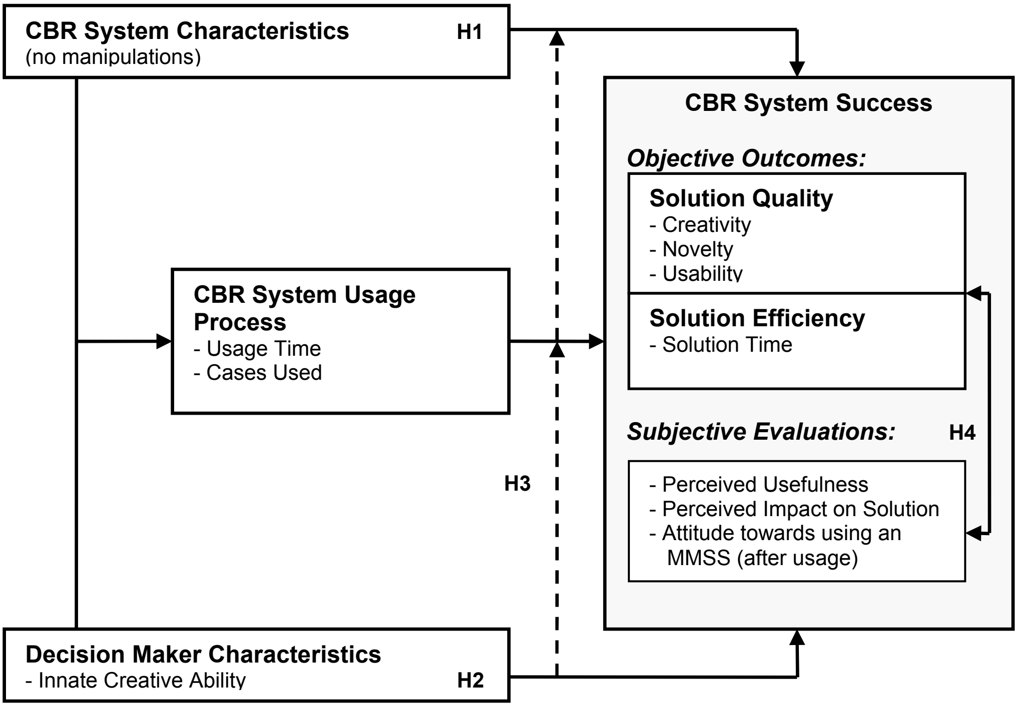

Figure 5.1 Framework of How the Use of a Case-Based Reasoning (CBR) System Affects the Quality of Sales Promotion Campaigns, the Efficiency of the Design Process, and its Subjective Evaluations (Study 1)

In the remainder of this section, we briefly discuss the hypotheses that will be examined in this study. It should be noted that the numbers of the hypotheses in this study correspond with the numbers of the hypotheses formulated in Chapter 3.

CBR System Availability versus No System. The basic premise underlying this study is that providing decision makers with a decision support tool results in better decision performance than without the use of such a decision aid. Several studies have indeed shown that the use of decision support systems can lead to, for instance, shorter decision times and improved solution quality (see for a review, e.g., Money et al., 1988; Sharda et al., 1988; Benbasat and Nault, 1990; Lilien et al., 2004).

Consistent with the theory of structured imagination (see Finke et al., 1992; Ward, 1995), we expect that when people are given examples (or analogies) they may transfer salient and usefulness properties to the new design, but not necessarily at the expense of including novel elements. Hence, with respect to solution quality, our first hypothesis is that using previous campaigns as the basis for idea generation results in more creative solutions. With respect to efficiency of the design process, we hypothesize that using or copying elements of previous sales promotion campaigns may result in efficient and usable solutions, since the designer can build on previous successes (and/or failures) and does not have to reinvent the wheel. Thus, in line with *Hypothesis 1* formulated in Chapter 3, we conjecture the following.

H1: Decision makers having a CBR system available a) will design sales promotion campaigns of higher quality (i.e., more creative campaigns) and b) will design them more efficiently (i.e., less time needed to design a campaign) than decision makers who do not have a CBR system at their disposal.

Innate Creative Ability of the Decision Maker. Next to CBR system availability, we identify the innate creative ability of the decision maker as variable that may have a direct impact on the quality of the solution (i.e., the creativity of the solution) (see Figure 5.1). The decision maker's innate creative ability comprises the ability to generate many, diverse ideas in response to a problem (i.e., divergent thinking) and the ability to work out this idea into a usable solution (i.e., convergent thinking) (Guilford, 1968; Torrance, 1974).

We expect that decision makers with a high innate creative ability (i.e., good at both divergent thinking and convergent thinking) will design sales promotion campaigns of higher quality, i.e., more creative campaigns (both novel and usable). We do not have a hypothesis about the effect of innate creative ability on solution efficiency. Thus, in line with *Hypothesis 4* formulated in Chapter 3, we posit the following.

H4: Decision makers with a high innate creative ability will design sales promotion campaigns of higher quality (i.e., more creative campaign) than decision makers with a low innate creative ability. [30]

Interaction between the CBR System and the Creative Ability of the Decision Maker. Hypothesis 4 refers to the direct effect of innate creative ability on solution quality, and is not yet related to the effect of using a CBR system. Providing decision

[30] As will become clear in the remainder of this chapter, we cannot properly test hypothesis 4 and 5 in this study due to methodological constraints. Nonetheless, we believe it is instructive to mention them here, since this study will provide us with a first indication of the presence and the direction of the hypothesized effects, which will be further explored and tested in the subsequent studies (Chapter 6 and 7).

makers with a CBR system for solving weakly-structured problems would reinforce the strength of creative thinkers (who are supposedly good at solving ill-structured or weakly-structured problems). Decision makers with a low creative ability could be compensated by the CBR system for their weakness in idea generation in weakly-structured problem solving. As discussed in Chapter 3, we expect that providing analogies (or examples) by means of a CBR system is particularly helpful for decision makers with a low innate creative ability, i.e., people who have difficulties in generating many and novel ideas themselves. In general, we thus expect that the contribution of the CBR system to the creativity of the solution is largest for decision makers with a low innate creative ability (i.e., a compensation effect). Thus, in line with *Hypothesis 5* formulated in Chapter 3, we expect the following.

H5: The positive effect of using a CBR system on the quality of sales promotion campaigns (i.e., resulting in more creative campaigns) will be larger for decision makers with a low innate creative ability than for decision makers with a high creative ability. [29]

Subjective Evaluations versus Objective Contribution of the CBR System to the Solution. A recent study by Lilien et al. (2004) has shown that what decision makers perceive (i.e., subjective impact) is not what they actually achieve (i.e., objective impact) by using a decision support system. In other words, decision makers have difficulties in recognizing (or acknowledging) the improvement in the objective decision outcome as a results of the use of a support system (see also McIntyre, 1982; Davis, 1989; Van Bruggen et al., 1996).

We expect this appropriation problem to be even more prominent when using analogical reasoning as a principle for decision support. People have difficulties in recognizing the influence of analogies on their decision process and outcomes (Markman and Moreau, 2001). The constraints that an analogy places on the decision options that are considered (and on the way they are evaluated) are placed by the nature of the analogy and not by some set of explicit, external evaluation criteria (Markman and Moreau, 2001). Hence, the analogy can have its effects without the decision maker acknowledging the true impact of the analogy, since it will not be easy to grasp the precise factors that have established the representation of the target domain (Markman and Moreau, 2001).

Therefore, we expect that decision makers who use analogies, by means of a CBR system, in the process of designing a sales promotion campaign are not able to recognize the objective impact of CBR system usage on their final solution. More specifically, we expect that subjective evaluations of the CBR system are not related to the objective impact of the CBR system on the solution. Thus, in line with *Hypothesis 6* formulated in Chapter 3, we expect the following.

H6: There is no relation between the decision maker's subjective evaluations of the CBR system and the objective contribution of the CBR system to the solution.

5.3 Methodology and Measurement

In this section, we will deal with the particular methodological and measurement issues of this study. In subsection 5.3.1, we explain the task that has to be performed by the participants in this study. This subsection is followed by a description of the experimental conditions (see subsection 5.3.2). Next, we describe the participants and the data-collection procedure (see subsection 5.3.3). Finally, we discuss the measurement instruments and perform reliability and validity checks in subsection 5.3.4.

5.3.1 The Task

The sales promotion problem presented to the participants was identical to an actual contest that had been organized and executed in the year 2000 by Unilever, a well-known Dutch/British fast-moving consumer goods company. The company announced a SP design contest on the internet to which (student) teams could subscribe. To subscribe, teams had to send in a design for an original, attention-grabbing SP campaign to introduce one of the four new flavors of a ready-made food product, i.e., Uno Noodles, on the Dutch market. For each flavor the best proposal was to be executed.

Briefing Sales Promotion Campaign Unilever N.V.
"Uno Noodles: Ketjap Flavor"

Goal: The British/Dutch FMCG company Unilever wants to introduce four new flavors of "Noodles" on the Dutch market. The objective of the campaign is to generate as much awareness among Dutch consumers (especially adolescents and young adults) as possible. The campaign also has to convey the desired image of the brand and flavor. The desired image of the Noodles brand is: "ready-made food that is very well edible". Your task is to design a sales promotion campaign for the "Ketjap" (i.e., soy sauce) flavor, which is honest and exotic. People that have a liking for "Ketjap" are mysterious types, which should be expressed in an exotic & exciting campaign."

Keywords:	easy food, quality, honest, mysterious exotic and exciting
Target group:	Dutch consumers, particularly adolescents and young adults
Objectives:	generate awareness and convey the desired image of the brand and flavor
Constraints:	- budget €9,000
	- 4,000 free sample packages
	- period August-September
	- running time: min. 1 day to max. 1 month
Execution:	by the winning team

Additional information was given about the budget (as low as 9,000 Euro), the availability of 4,000 free "Noodles" sample packages, the execution period (August/ September) and the running time of the campaign (between one day and one month). The Unilever marketing manager in charge of the contest determined the overall winner based on an assessment of the effectiveness of the executed campaigns for the four flavors. The team of the flavor "Ketjap" eventually won the contest. Hence, we formulated our problem statement similar to the one used by Unilever for the "Ketjap" flavor. The constraints were also exactly the same as in the original contest. In abbreviated form, the assignment was as described as follows (see Appendix 2a for the full version).

5.3.2 The Experimental Conditions

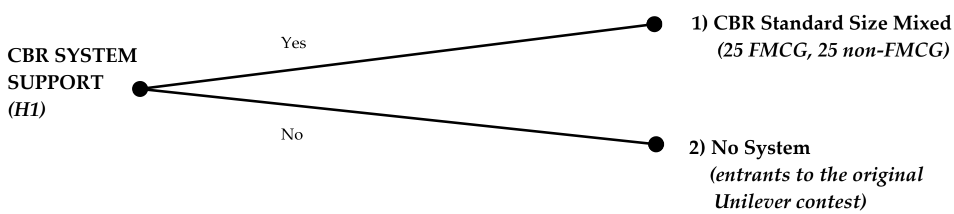

Figure 5.2 The Research Design: Experimental Conditions

The CBR System: LEAPS. The knowledge base of *LEAPS* (*LE*arning *P*romotion *S*ystem) in this first study contained 50 cases, which comprised prize-winning SP campaigns in the Netherlands from 1981 up to the first half of 1993 (Meetlatcomité Nederland, 1994). Within this CBR system the participants can search for previous, similar campaigns using a large number of attributes related to the problem situation (e.g., campaign objectives and product category), the solution (e.g., campaign theme and sales promotion technique used) and even the desired outcome (e.g., response rate). For instance, the decision maker could search previous campaigns that had the same objective of generating awareness or had the same target group of adolescents and young adults, or a combination of both. The CBR system's output is ranking of the ten most similar campaigns in its case-base, based on their similarity score with the input (i.e., the search query) provided by the system user. The retrieved analogies may serve as a source of inspiration for generating novel ideas and/or elements (or parts) of these previous campaigns may be directly reused for designing a campaign for the Uno Noodles Ketjap flavor. The participants are asked to briefly describe their search process (i.e., the variables and values they have used, and the weights they have assigned to these variables) and to list the retrieved campaigns from which they have actually used elements (if any). For a detailed description of *LEAPS*, we refer the reader to subsection 4.2.3.

The Benchmark. In this study, the solutions of the participating teams in the original Uno Noodles contest organized by Unilever were taken as the benchmark. To enter the contest the participating teams had to send in a brief proposal for a sales promotion campaign for introducing one of the four new flavors of Uno Noodles on the Dutch market. The prize-winning “Ketjap” team consisted of Dutch university students, just like the participants in our study (see next subsection 5.3.3). To our best knowledge, neither the winning team nor the 49 other entrants for the “Ketjap” flavor have had some kind of support system at their disposal.

5.3.3 Participants and Procedure

An international class of 34 third-year students, who were enrolled in a course on “Marketing Strategies and Marketing Intelligence in the Era of Information Technology”, participated in the experiment. All participants are in the same age category and have the same level of education. In total, 17 teams of two persons were asked to write a proposal for a sales promotion campaign. Before class, the students had made the teams. In class, the teams received the task and could use the CBR system for three hours. After class, the teams could use the CBR system without supervision for the next two days. All teams had exactly the same CBR system (i.e., standard size mixed, see section 4.2) at their disposal. However, the teams could decide themselves upon the number of minutes/ hours that they used the CBR system. The method of data collection is depicted in Table 5.1.

In the next class (i.e., five days after they had used the CBR system in class), the teams (n = 17) handed in their campaign proposal (max. 2 pages A4, Times New Roman, 12) together with questionnaires on their operating procedure (e.g., system usage time, see Appendix 8a) and their subjective evaluations of CBR system usage, i.e., the perceived usefulness of the CBR system (see Appendix 8a) and their attitude towards using a Marketing Management Support System (“after” measure, see Appendix 8a). After handing in the proposal and questionnaires, the creative ability checklist was administered to the participants in class.

Table 5.1 Summary of the Data-Collection Procedure (Study 1)

Data-Collection Procedure
1. *The Task*. Before class, the students made teams of two persons each. In class, the teams received the task (see Appendix 2a) and could use the CBR system for three hours. After class, the teams could use the CBR system without supervision for the next two days.
2. *Post-questionnaires.* After having five days to work on the assignment, the teams hand in their campaign proposal (*max. 2 pages* A4, Times New Roman, 12), together with questionnaires on their operating procedure (see Appendix 8a), the perceived impact of the system on their solution, the perceived usefulness of the CBR system (see Appendix 8a) and the team's attitude towards using a Marketing Management Support System ("after" measure, n = 17) (see Appendix 7). In class after handing in the proposal and process questionnaire, the participants individually filled in the creative ability checklist (n = 34) (see subsection 4.3.1).
3. *Judges and Ratings.* The 17 campaign proposals were cleared from all identifying information, coded and then sent to three sales promotion expert judges (i.e., 2 directors of sales promotion agencies and 1 manager of Unilever). The judges rated all campaign proposals on one single-item creativity measure, one single-item novelty measure, and a four-item usability measure (see Appendix 10a). The Unilever manager also rated the proposals on their relative quality in comparison with the quality of the winning Ketjap campaign that had been executed.
4. *Participants* receive their grade for their sales promotion proposal and can finish the course.

5.3.4 Measures

Innate Creative Ability (Self-Assessment). After a content and statistical analyses of the 36 items from Hellriegel and Slocum's (1992) "Personal Barriers to Creative Thought and Innovative Action" checklist (see subsection 4.3.1 for a more elaborate discussion), we used 5 items that best reflected the dominant perspective on creativity ability (e.g., Guilford, 1968; Torrance, 1974). That is, creative individuals should be able to think divergently (i.e., fluent, flexible and original in generating ideas) and convergently (i.e., elaborate in working out these ideas) (see also section 3.6). Hence, we selected three items that relate to the divergent facets of creative thinking and two items that relate to the convergent facets of creative thinking.

- Divergent Thinking Ability (item 1-3 in Table 5.2)
- Convergent Thinking Ability (item 4 and 5 in Table 5.2)

To the best of our knowledge, the creative ability items from this checklist have not been tested on their validity and reliability. Hence, to check the dimensionality

and internal consistency of the items (or eliciting attributes, see Rossiter, 2002a) for measuring innate creative ability (self-reported), we conducted a factor analysis and a reliability analysis (Cronbach's alpha).
The factor analysis on the 5 items yielded a one-dimensional solution (all factorloadings >0.50), which we labeled as the innate creative ability of the decision maker (see Table 5.2)[31]. The internal consistency of the scale is sufficient (α = 0.76, see Table 5.2). Hence, in the subsequent analyses, we use the average score on the 5 items as a measure for the decision maker's innate creative ability (self-reported). The average individual score on creative ability (M = 4.6, SD = 0.69) is significantly (one sample t-test: t = 10.024, p = 0.000) above the midpoint of the scale, with the maximum score of 6 denoting a high self-reported creative ability.

Table 5.2 Creative Ability (Hellriegel and Slocum (1992) items): Factor Analysis and Reliability Analysis

Scale Items	*Dimension*	*Factor 1 (Creative Ability)*
Creative Ability (self-assessed)		
1. I consciously attempt to use new approaches toward routine tasks.		**0.80**
2. I seek many ideas because I enjoy having alternative possibilities.		**0.80**
3. When solving problems, I attempt to apply new concepts or methods.		**0.77**
4. I feel the excitement and challenge of finding a solution to problems.		**0.64**
5. I know how to simplify and organize my observations.		**0.56**
Explained Variance		***52%***
Cronbach's Alpha		***0.76***

* Principal components analysis; n = 34

Attitude towards using MMSS (after). The first questionnaire (see Appendix 7) concerned the team's attitude towards using an MMSS in general for decision making ("after" measure, Cronbach's α = 0.89 (eight items, 7-point scale). Given the high internal consistency of the items, we combined them into an average scale score for the attitude towards using an MMSS. The average score (M = 4.7, SD = 0.98) on the attitude towards MMSS usage is significantly (one sample t-test: t =

[31] If we force a (non-orthogonal) two-dimensional structure upon the data, then we find a "divergent thinking" sub-dimension (item 1, 2, and 3) and a "convergent thinking" sub-dimension (item 4 and 5), which are moderately correlated (r = 0.40) (oblique rotation: Oblimin) and together explain 71% of the variance.

3.122, $p = 0.007$) above the midpoint of the scale ($M = 4.7$, $SD = 0.98$), indicating an overall positive attitude of the team's towards MMSS usage for decision making.

Perceived Usefulness of the CBR System. The other questionnaire (see Appendix 8a (CBR)) concerned the perceived usefulness of the CBR system (Cronbach's $\alpha = 0.94$ (six items, 7-point scale)). Given the high internal consistency of the items, we combined them into an average scale score for perceived usefulness of the CBR system. The average team score on perceived usefulness is not significantly (one sample t-test: $t = 1.569$ $p = 0.136$) above the midpoint of the scale ($M = 4.6$, $SD = 1.49$), indicating an overall neutral perception of usefulness of the CBR system for designing the sales promotion campaign. We note that the correlation between perceived usefulness and attitude is significant and substantial ($r = 0.60$, $p = 0.011$).

Process Measures. The latter questionnaire also contained a number of single-item process measures (self-reported), such as system usage time and perceived impact of the CBR system on the final solution. More specifically, the teams had to answer the following questions on the problem-solving process: (1) how long they used the CBR system (in minutes), (2) how long they worked on the assignment in total, and (3) how much impact the use of the CBR system had on their solution (in percentages), and (4) which variables they had used for searching for cases and which cases they had eventually used (if any). The total time that the teams had worked on the assignment ranged from 180 minutes to 500 minutes ($M = 280$, $SD = 94$). Of this total working time, teams had on average spent 106 minutes ($SD = 38$) on working with the CBR system, ranging from 60 minutes to 180 minutes. Finally, the percentage of the final solution that the teams attributed to the impact of working with the CBR system was on average 50% ($SD = 28$), ranging from a low 5% to the full 100%.

Before sending the teams' campaign proposals to the three expert judges, all identifying information was removed from the proposals (for an example of a solution, see Appendix 12a). Furthermore, a simple word count was performed to be able to correct for the influence of the length of the proposal (see subsection 4.3.5). The average length of the proposals is 850 words, with a minimum of 450 words and a maximum of 1379 words ($SD = 270$). The proposals were sent to three sales promotion experts in one batch with a randomized order of the proposals for each judge. Eventually, after evaluation by the judges, the proposals were graded and contributed to the students' final grade for the course.

Solution Quality. In this exploratory study, we measure solution quality by means of one single-item creativity rating, one single-item novelty rating, and four items related to the usability of the campaign proposal for introducing the Uno Noodles

Ketjap flavor, i.e., "usefulness", "feasibility", "potential to reach the target group" and "the campaign's association with Uno Noodles brand and Ketjap flavor" (see also Appendix 10a). All these items are rated on a 7-point, unipolar scale ranging from 1 (very low) to 7 (very high). Since the campaign for the Ketjap flavor was executed in real-life, we added one item to compare the quality of the campaign proposals with the real campaign, i.e., "how does this campaign compare to the campaign that was actually executed for the Uno Noodles Ketjap flavor". This item is rated on a 7-point scale ranging from 1 (much worse) to 7 (much better). Following Amabile's (1983) consensual technique for creativity assessment (see subsection 4.3.3), three experts are asked to independently judge all 17 campaign proposals on all items. Two expert judges (Judge 1 and Judge 2) come from different, renowned Dutch sales promotion agencies (see subsection 4.3.3). The other judge (Judge 3) is the executive Unilever sales promotion manager responsible for the real-life Uno Noodles sales promotion campaign design contest.

Table 5.3 Correlation Matrix of SP Campaign Ratings Judges*

*Ratings**	*1*	*2*	*3*	*4*	*5*	*6*
1. Novelty (Judge 1)	-					
2. Novelty (Judge 2)	**.58**	**-**				
3. Novelty (Judge 3)	.06	.08	-			
4. Usability (Judge 1)	**.77**	.33	.24	-		
5. Usability (Judge 2)	**-.54**	.10	.24	-.30	-	
6. Usability (Judge 3)	**.52**	.32	**.68**	**.55**	-.08	-

* correlations in bold are significant at the 0.05 level; $n = 17$

First, the four usability-related items were checked for their internal consistency per judge. The reliability coefficients (Cronbach's alpha) for the four items are substantial ($\alpha = 0.88$ (Judge 1) and $\alpha = 0.80$ (Judge 3)), except for Judge 2 ($\alpha = 0.20$). The low item-reliability coefficient for Judge 2 is mainly caused by the negative correlation coefficient of the "potential reach" item with the "feasibility" item ($r = -0.49$). Nonetheless, because all four evaluation criteria for usability were explicitly mentioned in the assignment, we combined the four items into one average usability rating per judge (i.e., in essence usability is a formative construct, see Rossiter 2002a).

Second, we assessed the level of consensual agreement among the judges (see Amabile, 1983) for the constructed usability rating and the single-item novelty score. The (alpha[32]) inter-rater reliability coefficients[33] for novelty ($\alpha = 0.31$) and

[32] The intra-class correlation coefficient is algebraically equivalent to the alpha coefficient when there is only one rating variable and the judges' ratings are to be averaged to produce a composite rating (i.e.,

usability (α = 0.40) are low. This also reflected in a number of low and even negative correlation coefficients between the judges (see Table 5.3).

Given the different backgrounds and perspectives of the judges (e.g., a company perspective (Unilever) executive versus a sales promotion agency perspective), reflected in the moderate inter-judge correlation coefficients, we decided not to aggregate the ratings of all judges. For determining the novelty of the campaign, we will only use the ratings of the two sales promotion experts (who are supposedly most knowledgeable of what is new). For usability, we will only use the ratings of the Unilever executive marketing manager (who is supposedly most knowledgeable of the desired brand image, etc.).

Thus, we combined the novelty ratings of the two sales promotion experts (α = 0.71) by taking the average novelty score of the two judges (no. 4 in Table 5.4). Finally, we combined this average novelty rating and the usability rating of Judge 3 only (no. 5 in Table 5.4) into a creativity score for each campaign (no. 1 in Table 5.4).

Apart from this composite creativity score, we have two additional measures for solution quality, viz. the single-item creativity ratings (for all judges) and a direct solution quality rating (i.e., solution quality in comparison with the executed Unilever campaign for the ketjap flavor; for Judge 3 only; no. 3 in Table 5.4). For the single-item creativity ratings, we assessed the level of consensual agreement between the three judges, which is rather low but the intra-class correlation coefficient (ICC) is significant at the 0.10 level (α = 0.42; ICC value (average of raters) = 0.42: F = 1.725, p = 0.0925). Hence, we aggregated the single-item creativity ratings of the three judges into an average (single-item) creativity rating per campaign proposal (no. 2 in Table 5.4).

Table 5.4 Correlation Matrix of the Different SP Campaign Quality Ratings*

*Quality Ratings**	*1*	2	*3*	*4*	*5*
1. Composite Creativity Score (novelty + usability)	-				
2. Novelty Rating (single-item; Judge 1 and 2)	**.89**	-			
3. Usability Rating (multiple-items; Judge 3)	**.84**	**.49**	-		
4. Creativity Rating (single-item; all judges,)	**.84**	**.60**	**.83**	-	
5. Quality Rating (relative to executed campaign; Judge 3)	**.49**	.07	**.72**	**.73**	-

* correlations in bold are significant at the 0.05 level; n = 17

As can be seen in Table 5.4, all correlation coefficients between the different measures for the quality of the campaign are positive and highly significant,

if we are interested in the question how reliable, or internally consistent, the judges' ratings are as a whole).

[33] Intra-class correlation coefficient (ICC): two-way random effects model, consistency definition.

except for the correlation coefficient between the novelty rating and the quality rating in comparison with the executed Unilever campaign, which is not significant (r = 0.07, p = 0.789). Apparently, what the sales promotion experts recognize as novel is not necessarily valued by the Unilever manager in making his (relative) quality judgments. The correlation coefficient between the averaged single-item creativity ratings of all judges and the composite creativity rating (i.e., the average score of solution novelty (Judges 1 and 2) and solution usability (Judge 3) is 0.84 (p = 0.000). Finally, we note that the usability of the solution and the novelty of the solution are both significantly correlated to the averaged single-item creative ratings across judges (r = 0.83 and r = 0.60, respectively; see Table 5.4). This seems to be in line with the common notion that an artefact has to be both novel and useful in order to be perceived as creative (see Amabile, 1983; Sternberg and Lubart, 1992).

5.4 Results

In this section, we will discuss the results of the analyses. In subsection 5.4.1, we deal with the main effect of CBR system availability versus no system. Next, we analyze and discuss the role of the decision maker's innate creative ability (see subsection 5.4.2.). Finally, we investigate the relation between the decision maker's subjective evaluations of the CBR system and its objective contribution to the solution (see subsection 5.4.3).

5.4.1 CBR System Availability versus No CBR System

Solution Quality. To assess whether CBR system usage helps to improve the quality of the solution, we asked the marketing manager of the FMCG company to rate the overall quality of our student teams' SP campaign proposals in comparison with the winning "Ketjap" campaign from the original contest. We realize that this is not a perfect measure to test our first hypothesis regarding CBR system effectiveness, but given the context of this study it provides a good approximation.

In total, there were 50 entrants for the Ketjap flavor in the original contest. Let us assume that our student teams and the entrants to the original SP campaign design contest of the FMCG company come approximately from the same population and that the only difference between the two samples is the use of the CBR system.[34] Now, the probability that exactly k campaigns out of n campaigns of one sample are of better quality than the best campaign out of m campaigns

[34] Sales promotion practitioners were excluded from participation in the original contest. Moreover, the prize-winning "Ketjap" team consisted of undergraduate university students like the participants in our study. To the best of our knowledge, neither the winning team nor the 49 other entrants for the "Ketjap" flavor had a support system at their disposal.

(probability: $\pi = 1/m$) of a second sample follows a binomial distribution ($\underline{k}$ ~ Binomial (n, π)).
Eventually, 5 out of the 17 student team proposals were judged to be of better quality than the original, prize-winning "Ketjap" campaign. Furthermore, three proposals were of comparable quality. The probability that 5 or more SP campaign proposals from a sample of 17 proposals are of better quality than the best campaign from a sample of 50 proposals for the Ketjap flavor from the same population is negligible[35]. This result provides evidence that CBR system usage does improve the quality of the solution (*H1a*).

Solution Efficiency. We do not have information on the time that the teams participating in the original contest needed to design their campaign proposal. Hence, strictly speaking we cannot test hypothesis *H1b*. If we look at some descriptive statistics, we see that the teams on average spend 280 minutes (SD = 94) in total working on their campaign proposal, of which on average 106 minutes (SD = 38) are used to work with the CBR system. We defined solution efficiency as the "time needed to work out a solution", which is measured by the residual *solution time*, i.e., by subtracting the "time that the respondent has worked with the available support tool" from the "total time worked on the task" (both self-reported measures) (see also subsection 4.3.3). After correcting total time for CBR system usage time, the teams on average needed 174 minutes (SD = 91) to work out the proposal for their sales promotion campaign.
If we perform a median-split on the number of minutes worked with the CBR system, we do not find a significant difference (independent samples t-test: t = 0.192, p = 0.850) in the average solution efficiency between the group that used the system for a relatively short period of time (i.e., 90 minutes or less, n = 8) and the group that used it for a relatively long period of time (i.e., more than 90 minutes, n = 9). The average solution times are 178 minutes and 170 minutes, respectively. Although the team with the lowest solution time (i.e., 40 minutes) also had the highest CBR system usage time (i.e., 180 minutes), we cannot statistically confirm a difference between the "extensive" and the "limited" CBR system usage group in average solution times. If extensive and prolonged usage of the CBR system had

[35] In general, the probability that exactly k campaigns out of n campaigns of one sample are of better quality than the best campaign out of m campaigns of a second sample: $\underline{k}$ ~ Binomial (n, π)

$$P(\underline{k} = k) = \binom{n}{k} . \pi^{k} . (1 - \pi)^{n-k} ,$$

Under the null-hypotheses of equality between the samples the π=0.02 (i.e., 1 out of 50 campaigns). For k = 5, n = 17, and π = 0.02, P($k \geq 5$) = 1-P($k < 5$) = 1-0.9999839 = 0.00001061 and E(*number of times that a solution developed by using the CBR system is better*) = 0.02*17 = 0.34

resulted in significantly lower solution times, then it could be an indication that CBR system availability leads to a more efficient design process (see *H1b*).

5.4.2 The Role of the Decision Maker's Innate Creative Ability

Before testing the hypothesis regarding the type of decision maker for which CBR system usage is most beneficial (*H5*), we first have the hypothesis about the direct effect of the decision maker's innate creative ability on the quality of the solution, i.e. solution creativity (*H4*). Because all teams in this study have worked with the system, we cannot isolate the effect of innate creative ability from the effect of CBR system availability on the creativity of the solution. For the teams that entered the original Unilever competition and who have thus not worked with the CBR system, we have no information on their creative ability. However, in later studies we will be able to disentangle these two effects. We note that if we have a directed hypothesis, we will use a one-sided test ($\alpha = 0.05$) (p_{+} = one-sided positive and p_{-} = one-sided negative). The other reported p-values in the next subsections are two-sided.

To assess the impact of creative ability (in conjunction with CBR system availability) on the quality of the solution, we performed a series of regression analyses using different measures for solution quality (see subsection 5.3.4). Next to creative (team) ability, we included the covariate "length of the campaign proposal" as an explanatory variable in the regression equation. Again, the estimated effect of creative ability on solution quality may be confounded with the (hypothesized) interaction effect between creative ability and CBR system availability, since all teams included in the regression analyses had the CBR system at their disposal. In fact, what we estimate is not the direct effect of creative ability on solution quality, but the effect in conjunction with CBR system availability. We included the highest score of the team members on innate creative ability as the team score. We find that using the highest scores per team produces better results than using the average team score. This is consistent with Malter and Dickson (2001) who found that the (learning) ability of the best member of management teams was closely related to team performance.

The results of the regression analyses for the different measures of solution quality are depicted in Table 5.5. We do not find significant effects for the creative ability (in conjunction with CBR system availability) and the length of the campaign proposal on any of the five different solution quality measures. The sign of the coefficient for creative ability is however consistently negative. This means that, given the availability of the CBR system, decision makers with a high creative ability perform worse than low creative decision makers in terms of the quality of their solution (including creativity, novelty and usability).

Table 5.5 Regressions of Solution Quality (for five different dependent variables): The Effect of Innate Creative Ability (in conjunction with CBR System Availability)

Dependent Variable / *Independent Variables*	*Solution Quality* unstandardized coefficients (B)	standardized coefficients (b)	t-value	p-value
1. Composite Creativity Score				
- Intercept	4.657	-	1.616	0.128
- Creative Ability	-0.159	-0.095	-0.335	0.372+
- Length of Campaign Proposal	0.000	0.063	0.222	0.827
	R^2=0.017	**R^2_{adj}=-0.123**	**F=0.123**	**(p=0.885)**
2. Creativity Rating				
- Intercept	5.041	-	1.445	0.170
- Creative Ability	-0.271	-0.131	-0.471	0.325+
- Length of Campaign Proposal	0.001	0.145	0.520	0.611
	R^2=0.18	**R^2_{adj}=0.18**	**F=4.714**	**(p=0.000)**
3. Quality Rating				
- Intercept	7.495	-	1.590	0.134
- Creative Ability	-0.846	-0.297	-1.089	0.147+
- Length of Campaign Proposal	0.000	0.025	0.092	0.928
	R^2=0.094	**R^2_{adj}=-0.035**	**F=0.727**	**(p=0.501)**
4. Novelty Rating				
- Intercept	4.793	-	1.560	0.141
- Creative Ability	-0.054	-0.030	-0.106	0.459+
- Length of Campaign Proposal	0.000	-0.015	-0.052	0.959
	R^2=0.029	**R^2_{adj}=-0.142**	**F=0.006**	**(p=0.994)**
5. Usability Rating				
- Intercept	4.521	-	1.263	0.227
- Creative Ability	-0.264	-0.126	-0.448	0.331+
- Length of Campaign Proposal	0.001	0.113	0.402	0.694
	R^2=0.039	**R^2_{adj}=-0.099**	**F=0.282**	**(p=0.758)**

+ one-sided test; n = 17

In line with hypothesis *H5*, the negative sign for the coefficient for creative ability (in conjunction with CBR system availability) suggest that a compensation process produces the best outcomes, i.e., highly creative decision makers get the least out of the CBR system. An explanation for this finding is that CBR system availability enhances the fluency (i.e., the ability to generate ideas) of low creative decision makers, which subsequently improves the quality of their solution. Of course, an alternative explanation could be that the five items we used from the creative ability checklist measure something differently than innate creative ability. To be able to perform a more conclusive test of hypothesis H5, additional studies have been carried out using better validated measures of innate creative ability (see Chapter 6 and 7).

5.4.3 The Relation between the Decision Maker's Subjective Evaluations of the CBR System and its Objective Contribution to the Solution

Having examined the effects of providing analogies by means of a CBR system on the quality of the solution, in this subsection we take a look at the subjective evaluations of the CBR system. That is, how do decision makers perceive the usefulness and the impact of CBR system availability on their sales promotion campaign proposal? More specifically, we are interested in the relationship between the subjective evaluations of the CBR system and the objective contribution of the CBR system to the solution. For a more elaborate discussion, we refer the reader to section 3.8 and to subsection 4.3.4 for information on the measurement instruments.

In subsection 5.4.1, we found that the teams that had a CBR system at their disposal (statistically) outperformed the teams in the no system benchmark situation, in terms of the quality of their solutions. The question now is: do the teams recognize this "objective contribution" of the CBR system to their solution? Therefore, we will first have a look at the descriptive statistics for the subjective evaluations of the CBR system.

Table 5.6 Means and Standard Deviations for Subjective Evaluations of the CBR System

Dependent Variable	*Condition*	*n*	*Mean*	*Std. dev.*
- Perceived Usefulness of CBR System (scale 1-7)	*CBR standard size mixed*	17	4.6	1.49
- Perceived Impact of CBR System on Solution (scale 0% - 100%)	*CBR standard size mixed*	17	50.3	27.8
- Attitude towards using MMSSs (after) (scale 1-7)	*CBR standard size mixed*	17	4.7	0.98

The means and standard deviation of the perceived usefulness of the CBR system for designing a sales promotion campaign, the perceived impact of the CBR system on the final solution, and the attitude towards using support system in general for enhancing decision-making performance (after usage) are shown in

Table 5.6. Overall, it seems that the participating teams positively evaluate the availability of a CBR system for designing their sales promotion campaign proposal. That is, for the perceived usefulness of the CBR system, the average score is above the midpoint of the scale, but the difference is not significant (one-sample *t*-test (test value = 4): $M = 4.6$ ($SD = 1.49$), $p = 0.139$). However, for the attitude towards support system usage in general, the difference is significant and positive (one-sample *t*-test (test value = 4): $M = 4.7$ ($SD = 0.98$), $p = 0.007$).

Table 5.7 Correlations between Subjective Evaluations of the CBR System and Objective Outcomes & Process Variables*

Objective Outcomes / *Subjective Evaluations*	*Solution Quality (comparison rating)*	*Solution Efficiency (solution time)*	*CBR System Usage Time*
1. *Perceived Usefulness CBR System*	.28	-.34	0.48
2. *Perceived Impact CBR System*	.16	-.17	**0.66**
3. *Attitude towards using MMSSs (after)*	.37	-.11	0.37

* correlations in bold are significant at the 0.05 level; $n = 17$

Next, we inspect the relations between the subjective evaluations of the CBR system and the objective outcomes. We therefore calculated the correlation coefficients between the evaluative measures, i.e., "*perceived usefulness of the CBR system*"[36], "*perceived impact of the CBR system*" (in percentages) and the general *attitude towards using MMSSs*, and the objective outcomes of CBR system availability, i.e., *solution quality* and *solution efficiency* (see Table 5.7). Notice that for solution quality, we use the quality comparison rating that was also used in subsection 5.4.1 for comparing the CBR system solutions to the no system solution.

Relationship between Subjective Evaluations and Objective Outcomes. Neither of the outcome variables, i.e., the quality of the final solution ($r = 0.28$, $p = 0.279$) and the times it takes the teams to design a campaign (after CBR system usage) ($r = -0.34$, $p = 0.177$), is significantly related to the perceived usefulness of the CBR system (see Table 5.7). Furthermore, the correlation coefficients between the perceived impact of the CBR system and solution quality ($r = 0.16$, $p = 0.547$) and between perceived impact and solution time ($r = -0.17$, $p = 0.526$) are not significant either (see Table

[36] This measure comprises items like "using the CBR system increased the quality of the SP campaign" *(solution quality)* and "using the system enabled me to design the SP campaign more quickly" *(solution efficiency)*, see Appendix 8a: items 6 and 7.

5.7). This is also true for our third subjective evaluation measure, i.e., the team's "attitude towards using MMSSs in general for enhancing decision making" after they have used the CBR system (r = 0.37, p = 0.147 and r = -0.11, p = 0.672, for solution quality and solution time, respectively; see Table 5.7)[37]. In general, the signs of the correlation coefficients do suggest that higher subjective evaluations are associated higher solution quality and lower solution time (i.e., higher solution efficiency) (see Table 5.7), but none of the relationships is significant.

In subsection 5.4.1, we saw that the availability of a CBR system has a positive objective impact on the quality of the solution (as measured in comparison with the actual Unilever campaign). Hence, it would be logically to expect that better solutions are associated with higher subjective evaluations of the CBR system (i.e., higher perceived usefulness, perceived impact and attitude towards using MMSSs in general). However, in line with hypotheses *H4*, the results show that that there is no significant relationship between the subjective evaluations of the CBR system and the objective outcomes. That is, overall the results suggest that the teams are not able to fully recognize the objective contribution of the CBR system to the solution, neither in terms of enhanced solution quality nor in terms of the time saved for designing a campaign.

Relationship between Subjective Evaluations and Process Variables. Finally, we also look at the relationship between the subjective evaluations and the process variables, such as CBR system usage time. The perceived impact of the CBR system is highly correlated (r = 0.66, p = 0.004) with the time that the team has worked the CBR system (see Table 5.7). That is, the longer the team worked with the CBR system before eventually designing their campaign, the higher the percentage of the final solution that is being attributed to the use of the CBR system. Since we only have anecdotal information on the number and type of cases from the CBR system that are read and used by the teams (i.e., this information was not reported by all teams), we are not able to link this information to the perceived impact of the CBR system.

However, based on this anecdotal evidence, among the most useful cases in the CBR system were 7 near analogies (e.g., AH's Chinese Chef, seven times mentioned) and 5 far analogies (e.g., Top Lease, five times mentioned) (see also the overview of all the cases included in the main study in Appendix 13, no. 20 and no. 4, respectively). Common elements that teams used in their campaign proposals were a contest (as the sales promotion technique) and prizes such as exotic holidays, however there were also a number of non-obvious, original

[37] The correlation coefficients between the composite creativity measure (i.e., the average score of novelty and usability) and perceived usefulness (r = -0.26, p = 0.320), perceived impact (r = -0.28, p = 0.278) and attitude (r = 0.01, p = 0.958), are also not significant.

(novel) elements added to the proposals, such as on-the-spot preparation of UNO Noodles at a music festival by promotion teams carrying containers with hot water on their back.
To conclude, the subjective evaluations of the CBR system are more strongly correlated with the CBR system usage process variables, i.e., system usage time, than with its objective outcomes, i.e., solution quality and solution efficiency.

5.5 Conclusions and Discussion

This study was a first attempt to gain insight into the potential effect of analogical reasoning, by means of a Case-Based Reasoning (CBR) system, for supporting weakly-structured marketing decisions, such as designing a sales promotion campaign. The basic questions that we addressed in this study are: (1) does the use of a CBR system improve solution quality compared to not using such as system?, (2) who benefits most from CBR system usage?, and (3) are decision makers able to recognize the objective contribution of the CBR system to their solution? We will now briefly summarize the main findings of this study (see subsection 5.5.1) and relate them to the hypotheses formulated in Chapter 3 (see subsection 5.5.2). Finally, we discuss the limitations of this study and outline the improvements that can and will be made in subsequent studies (see subsection 5.5.3).

5.5.1 Main Findings

First of all, we find preliminary evidence that CBR system availability improves the quality of solutions in a weakly-structured marketing decision domain, viz. the design of sales promotion campaigns. That is, compared to a similar situation in which the participating teams had no CBR system at their disposal, the teams in this study who did have a CBR system available were able to design sales promotion campaigns of a higher quality level. We could not test for the presence of an interaction effect between the decision maker's creative ability and CBR system availability on the quality of the solution. However, the negative sign for the coefficient of creative ability (in conjunction with CBR system availability) suggests that CBR system availability is most helpful for decision makers with a low innate creative ability (i.e., a compensation effect). Finally, it appears that the teams are not able to fully recognize the objective contribution of the CBR system to the solution and are, therefore, more likely to assess the system's contribution based on the characteristics of the usage process, such as CBR system usage time. Nonetheless, the participating teams in this study still have a favorable attitude towards using MMSSs for decision making after the use of the CBR system for designing a sales promotion campaign.

5.5.2 Final Conclusions

To sum up, in line with *Hypothesis 1* (see Chapter 3), we find evidence that, compared to a no system benchmark, CBR system availability results in sales promotion campaigns of better quality. However, we did not find a significant positive relationship between the quality of the solution and the subjective evaluations of the CBR system by the respondents, which is consistent with *Hypothesis 6* (see Chapter 3). In general, the respondents do not fully recognize the objective contribution of the CBR system to their solution, neither in terms of solution quality nor in terms of solution efficiency.

In this study, we were not able to test properly for the effect of CBR system on solution efficiency. Regarding *Hypothesis 4* (see Chapter 3), we have an indication that, in terms of solution quality, the availability of a CBR system might help more for decision makers with a low creative ability than for highly creative decision makers In the next two chapters, we will further test the hypotheses formulated in Chapter 3.

5.5.3 Limitations and Suggestions for Further Research

There are a number of methodological limitations in this study. First, we mention the use of teams (for pedagogical reasons) instead of individual decision makers. In practice, design problems, such as designing a sales promotion campaign, are often solved in teams (external validity). However, to be able to assess the impact of decision maker characteristics such as innate creative ability, it would be better to let the campaigns be designed be individuals rather than teams (internal validity). Second, despite the fact that we find some support for our hypotheses, the sample size used in this study is rather small. However, such sample sizes are not uncommon for this type of experimental research (e.g., Connolly et al., 1990; Elam and Mead 1990, see also Table 4.5). In order to gain statistical power, we will enlarge the sample size in subsequent studies. Moreover, in the next study we will measure the decision maker's innate creative ability by means of a validated 56-item, multiple-choice questionnaire (see for example Abedi, 2002), which is based on the widely accepted Torrance Tests of Creative Thinking (Torrance, 1974) and, therefore, includes items for measuring the elaboration (convergent), fluency, originality, flexibility (divergent) facets of creative thinking.

Based on this study, we are not able to draw any conclusions regarding the effect of near versus far analogies, since we only have anecdotal, non-systematic information on the cases that the teams have read and used. However, the effectiveness of the CBR system is likely to be dependent on the content and the size of the case-base. Hence, to gain deeper insight into the conditions under which CBR system usage is most effective, additional studies have been carried out. In Study 2 and 3, we further explore the factors that may have driven the findings in this study, such as the influence of the following variables.

1) *Type of Cases* in the CBR system (i.e., case-base *content*: see Study 2 and 3).
2) *Number of Cases* in the CBR- system (i.e., case-base *size*: see Study 3).

Chapter 6

Designing Sales Promotion Campaigns with Analogical Reasoning: A Laboratory Experiment

6.1 Methodological Improvements and Additional Conditions

The study described in the previous chapter (Study 1) was an exploratory study to gain insight into the potential effect of analogical reasoning, by means of a Case-Based Reasoning (CBR) system, for designing sales promotion campaigns. In this study, we use a controlled laboratory setting to rule out alternative explanations as much as possible. Furthermore, based on an evaluation of the results of Study 1, we made a number of methodological changes. The main differences with Study 1 are the following.

- Use of laboratory setting (i.e., computer laboratory with isolated cubicles)
- Maximum of three hours to work on task (in the computer laboratory only).
- Use of a self-reported creative ability questionnaire that is based on the Torrance Tests of Creative Thinking (TTCT);
- Improving the scale for measuring the quality of the sales promotion campaign proposal.

In the previous study (Study 1), the CBR system contained near analogies as well as far analogies and the information we gathered about the type of cases the decision makers consulted was merely anecdotal. To gain deeper insight into the conditions under which the CBR system is most effective and efficient, we therefore manipulated *CBR system Content* in a laboratory setting to investigate the role of the type of analogies provided to the decision maker. That is, we make a distinction between a CBR system containing only near analogies and a CBR system containing only far analogies. Furthermore, we will use an *Expert System* (i.e., a rule-based, SP technique recommendation system) as a benchmark for assessing the impact of CBR system availability. Thus, the differences with the first study regarding the experimental conditions are the following.

- Inclusion of a “CBR system near analogies” (50 FMCG cases) and a “CBR system far analogies” (50 non-FMCG cases) condition;
- Inclusion of a “no CBR system” benchmark condition (i.e., use of an expert system).

Finally, as in the previous study, we want to know how decision makers evaluate the contribution of the CBR system to the design of a sales promotion campaign and how this relates to the objective contribution of the CBR system to the solution. Hence, the focal research questions in this study are the following.

1. Does providing decision makers with analogies, by means of a CBR system, result in sales promotion campaigns of higher quality and does it make the design process more efficient?
2. What is the influence of the type of analogies offered to the decision maker? Should they come from the same problem domain (i.e., near analogies) or should they come from more distant domains (i.e., far analogies)?
3. In examining the effect of analogies, what is the role of decision maker characteristics? In particular, is the effect different for decision makers with different innate creative abilities?
4. What is the relationship between the decision maker's subjective evaluations of CBR system usage for designing a sales promotion campaign and the objective outcomes, i.e., solution quality and solution efficiency?

As in the previous chapter, we are also interested in whether information about the underlying process can help to explain the effects of the CBR system availability on the objective outcomes, i.e., the quality of the sales promotion campaigns and the efficiency of the design process, and the subjective evaluations. In this study, we will look at CBR system usage time and the number and type of analogies that the decision maker has read and used, as process variables.

This chapter is organized as follows. In section 6.2, we recapitulate the - for this study - relevant theory and hypotheses as discussed in Chapter 3. Next, we explain the methodology and measures applied in this study (see section 6.3). In section 6.4, we discuss the results of the analyses. This chapter ends with a conclusions and discussion section (see section 6.5).

6.2 Theory and Hypotheses

Study 2 concentrates mainly on the impact of providing near analogies versus far analogies on the quality of the campaign design and the efficiency of the design process. We also examine the other hypotheses formulated in Chapter 3, except for the effect of case base size. Hence, for an elaborate discussion of the conceptual framework and hypotheses, we refer the reader to Chapter 3.

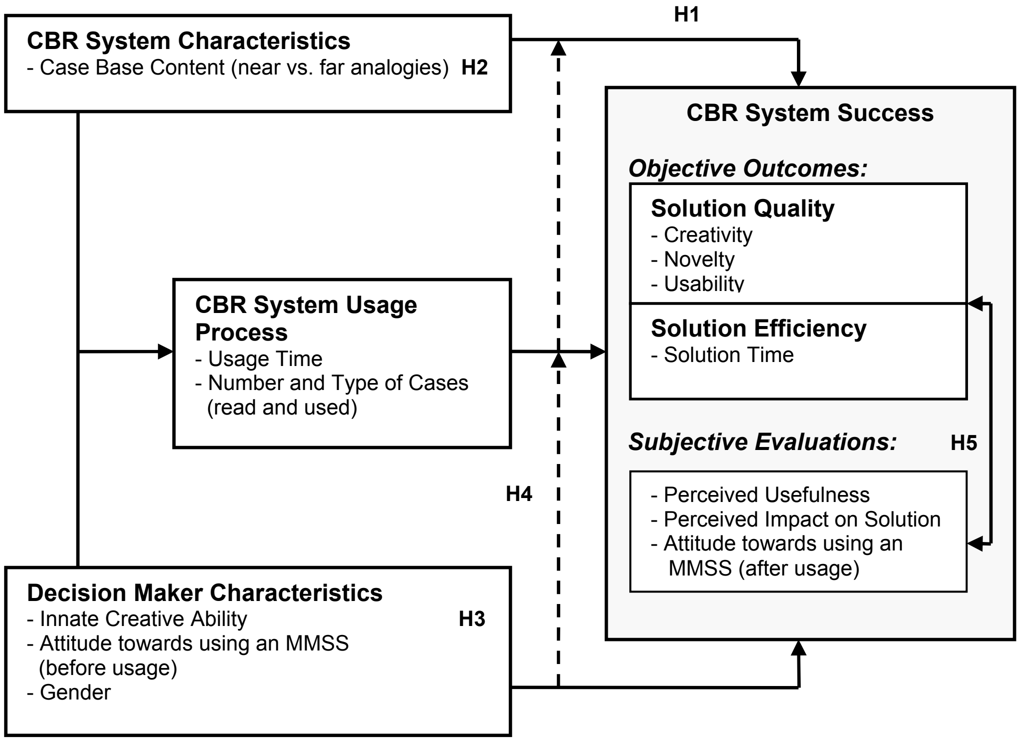

Figure 6.1 Framework of How the Use of a Case-Based Reasoning (CBR) System Affects the Quality of Sales Promotion Campaigns, the Efficiency of the Design Process, and its Subjective Evaluations (Study 2)

To recapitulate, in this framework the dependent variables for assessing the success of a CBR system are (1) its *objective outcomes*, i.e., *solution quality* and *solution efficiency*, and (2) its *subjective evaluations* (as perceived by the decision maker). For measuring solution quality, we look at the creativity of the sales promotion campaign, comprising both the novelty and the usability of the campaign (see Figure 6.1). We also examine the novelty and usability dimension of solution creativity separately, since these dimensions may be affected differently by the characteristics of the CBR system, the decision maker and the process. Moreover, we are interested in the effect of CBR system availability on the efficiency of the design process, which is measured by the solution time. Regarding the subjective evaluations of CBR system success, we distinguish the following aspects: the *perceived usefulness* of the CBR system for designing a sales promotion campaign, the *perceived impact* of the CBR system on the final solution, and the *attitude towards using MMSSs in general (after usage)* for enhancing marketing decision-making performance.

The framework to investigate the success of the CBR system for supporting the design of sales promotion campaigns basically consists of three elements: (1) characteristics of the CBR system (in this study: case-base *content*), (2) characteristics of the decision maker (i.e., *innate creative ability*, *gender*, and *attitude towards using MMSSs in general (before usage)*), and (3) characteristics of decision-making process (i.e., system *usage time*, and *cases read* and *used*) (see Figure 6.1). These features or traits may directly or indirectly influence the solution.

We will now briefly discuss the main hypotheses that will be tested in this study. For an elaborate discussion on the variables and their relationships, we refer the reader the corresponding sections in Chapter 3. It should be noted that the numbers of the hypotheses in this study correspond with the numbers of the hypotheses formulated in Chapter 3.

CBR System Availability versus No CBR System. The first study reported in this dissertation (Chapter 5) has yielded preliminary support regarding the positive effect of CBR system availability on solution quality. That is, compared to a situation in which no CBR system was available, participants who had a CBR system at their disposal designed significantly more sales promotion campaigns of higher quality.

This preliminary finding is consistent with the theory and hypotheses outlined in Chapter 3 and with previous empirical research (e.g., MacCrimmon and Wagner, 1994; Massetti, 1996), which has demonstrated that providing people with examples or analogies enhances the fluency aspect of creative thinking, resulting in the generation of significantly more ideas, including creative ones (i.e., the principle of "quantity breeds quality" (Rossiter and Lilien, 1994)).

The downside of providing people with previous examples could be the so-called "conformity effect" or "unconscious plagiarism", which may constrain creativity (e.g., Smith, Ward, and Schumacher, 1993; Dahl and Moreau, 2002). However, results of studies by Marsh, Landau, and Hicks (1996) and Marsh, Bink, and Hicks (1999) suggest that when people are given examples they may indeed transfer or copy salient properties to the new design, but not necessarily at the expense of including novel elements.

A CBR system provides multiple ideas or examples to the decision maker, which may stimulate the generation of more ideas and/or can be used to form novel combinations. Hence, with respect to solution quality, our first hypothesis is that using previous campaigns as the basis for idea generation results in more creative solutions. Second, with respect to efficiency of the design process, we hypothesize that using or copying elements of previous sales promotion campaigns may result in efficient and usable solutions, since the designer can build on previous successes (and/or failures) and does not have to reinvent the wheel. Thus, in line with *Hypothesis 1* formulated in Chapter 3, we posit the following.

H1: Decision makers having a CBR system available a) will design sales promotion campaigns of higher quality (i.e., more creative campaigns) and b) will design them more efficiently (i.e., less time needed to design a campaign) than decision makers who do not have a CBR system at their disposal.

CBR System Content: Near Analogies versus Far Analogies. When the target problem and the base problem are more distant from each other, the analogy may not provide clear-cut solutions or specific courses of action but merely provide a framework for thinking about the target problem (Markman and Moreau, 2001). For near analogies, the differences between the base domain and the target problem are small. Near analogies share many surface attributes and many higher-order relations (i.e., literal similarities) (see subsection 2.3.4). Hence, useful features (or knowledge) can be easily identified and transferred from the base to the target in order to develop a solution effectively and efficiently.

In contrast, novel ideas will be triggered in particular by far analogies, which mainly share "deep, structural similarities". Far analogies are usually perceived as less obvious and more novel because of the amount of cognitive effort that is required to draw the analogy ("mental leaps", see Holyoak and Thagard, 1995). However, since transferring elements from more distant domains requires more cognitive effort, developing a solution will take more time.

In sum, we propose that using near analogies will foster efficiency and contribute mainly to the usability of the campaign (i.e., resulting in quick, usable solutions, but not necessarily very novel and creative ones), while the use of far analogies will result in more novel campaigns and - provided that the campaign is not completely useless - also in more creative solutions. Thus, in line with *Hypothesis 2* formulated in Chapter 3, we conjecture the following.

H2: In comparison with a CBR system containing only *near analogies*, decision makers with a CBR system containing only *far analogies* a) will design sales promotion campaigns of higher quality (i.e., more creative campaigns), but b) will design them less efficiently (i.e., more time needed to design a campaign). More specifically, having a CBR system with *far analogies* available will result in c) more novel sales promotion campaigns, but d) less usable, compared to a CBR system with *near analogies*.

Innate Creative Ability of the Decision Maker. The decision maker's innate creative ability comprises the ability to generate many, diverse ideas in response to a problem (i.e., divergent thinking) and the ability to work out this idea into a usable solution (i.e., convergent thinking) (Guilford, 1968, Torrance, 1974). From the widely used “Torrance Tests” perspective (see subsection 4.3.1), creative individuals are therefore supposed to be *fluent*, *flexible,* and *original* in their development of ideas, as well as *elaborate* in working out their ideas into a useful solution (Guilford, 1968; Torrance, 1974).

We expect that decision makers with a high innate creative ability (i.e., profound in fluency, flexibility and originality (i.e., divergent facets of creative thinking) and elaboration (i.e., a more convergent aspect of creative thinking) will design sales promotion campaigns of higher quality, i.e., more creative campaigns (which are both novel and usable). We do not have a hypothesis about the effect of innate creative ability on solution efficiency.

In the first study, we could not separate the effect of creative ability from the effect of CBR system availability on the quality of the solution, since all the participants had the CBR system at their disposal. Moreover, in the first study we worked with teams instead of individuals. Hence, we were not able to assess the direct effect of a decision maker’s innate creative ability on the creativity of the solution. In this study, we will therefore work with individuals and include a “no CBR system” control condition in order to test the following hypothesis. Thus, in line with *Hypothesis 4* formulated in Chapter 3, we posit the following.

H4: Decision makers with a high innate creative ability will design sales promotion campaigns of higher quality (i.e., more creative campaign) than decision makers with a low innate creative ability.

Interaction between the CBR System and the Creative Ability of the Decision Maker. Hypothesis 4 refers to the main-effect of innate creative ability, and is not yet related to the effect of using a CBR system. We expect that the contribution of a CBR system is largest when it compensates the decision maker for his weaknesses. In Study 1, we found a consistently negative regression coefficient for creative ability (in conjunction with CBR system availability) on our solution quality measures.

The CBR system contains examples of past solutions to similar problems (analogies) and, therefore, may stimulate the decision maker’s fluency, and trigger ideas about what can be done (or should not be done) in the future. Hence, in line with the compensation theory (see section 3.7) and based on the results of the first study, we expect that providing analogies (or examples) by means of a CBR system is particularly helpful for decision makers with a low innate creative ability, i.e., people who have difficulty generating many and novel ideas themselves. In general, we thus expect that the contribution of the CBR system to the creativity of the solution is largest for decision makers with a low innate creative ability (i.e., a compensation effect). Thus, in line with *Hypothesis 5* formulated in Chapter 3, we posit the following.

H5: The positive effect of the availability of a CBR system on the quality of sales promotion campaigns (i.e., resulting in more creative campaigns) will be larger for decision makers with a low innate creative ability than for decision makers with a high creative ability.

Subjective Evaluations versus Objective Contribution of the CBR System to the Solution. In Study 1, we found an indication that decision makers are not able to recognize the impact of the CBR system on the solution. Moreover, the results reported in Study 1 suggest that decision makers measure the impact of the CBR system by the time it takes them to design a solution, after the use of the CBR system.

This finding is consistent with a recent study by Lilien et al. (2004), which has shown that what decision makers perceive (i.e., subjective impact) is not what they actually achieve (i.e., objective impact) by using a decision support system. In other words, decision makers have difficulties in recognizing (or acknowledging) the improvement in the objective decision outcome as a results of the use of a support system (see also McIntyre, 1982; Davis, 1989; Van Bruggen et al., 1996).

We expect this appropriation problem to be even more prominent when using analogical reasoning as a principle for decision support. People have difficulties in recognizing the influence of analogies on their decision process and outcomes (Markman and Moreau, 2001). The constraints that an analogy places on the decision options that are considered (and on the way they are evaluated) are placed by the nature of the analogy and not by some set of explicit, external evaluation criteria (Markman and Moreau, 2001). Hence, the analogy can have its effects without the decision maker acknowledging the true impact of the analogy, since it will not be easy to grasp the precise factors that have established the representation of the target domain (Markman and Moreau, 2001).

Therefore, we expect that decision makers who use analogies, by means of a CBR system, in the process of designing a sales promotion campaign are not able to recognize the objective impact of CBR system usage on their final solution. More specifically, we expect that subjective evaluations of the CBR system are not related to the objective impact of the CBR system on the solution. Thus, in line with *Hypothesis 6* formulated in Chapter 3, we expect the following.

H6: There is no relation between the decision maker's subjective evaluations of the CBR system and the objective contribution of the CBR system to the solution.

6.3 Methodology and Measurement

In this section, we will deal with the particular methodological and measurement issues of this study. In subsection 6.3.1, we explain the task that has to be performed by the participants in this study. This subsection is followed by a description of the experimental conditions (see subsection 6.3.2). Next, we describe the participants and the data-collection procedure (see subsection 6.3.3). Finally, we discuss the measurement instruments and perform reliability and validity checks in subsection 6.3.4.

6.3.1 The Task

The participant's task is to write a 1-page proposal (+/- 500 words) for a sales promotion campaign that boosts brand loyalty and brand image, targeted at the "heavy-user" consumer segment of the well-known Dutch beer brand Grolsch. Moreover, the campaign has to be organized around the theme *live music*. This real-life briefing (see the brief description below) had actually been used for a campaign developed and executed in 2002 by the Grolsch marketing department.[38,39]

Briefing Sales Promotion Campaign Royal Grolsch N.V.
"Live Music Campaign"

Goal: Design a promotional campaign that is based on 'Live Music' and connects to the Grolsch's brand values (e.g., self-conscious, active in life, supreme quality, tasteful, original and passionate). In addition, outline some ideas for communicating the campaign. A TV commercial and a (swing top) premium are among the possible options).

Keywords:	original, fun, functional, (live) music
Target group:	'heavy users'
Objectives:	enhance brand image and loyalty
Constraints:	- promotion applies to purchase of crates only (i.e., both 30cl and 45cl bottle crates) - no promotional items attached to the sides of the crate - the value of the promotional offer should preferably not exceed € 5 per crate (i.e. total of retail-price crate (€10) and the value of the promotional offer $\leq$ € 15)
Execution:	by Grolsch

[38] The full version of the briefing can be found in Appendix 3. For a discussion of the generic task that is used in our empirical studies, we refer the reader to section 4.2.2).
[39] The task is identical to the task used in Study 3 (Chapter 7).

The campaign proposal has to include a brief description and motivation of at least the following elements: (1) the basic idea behind the campaign, (2) sales promotion technique and execution, (3) supporting activities/ communication, and (4) an estimation of the costs (for an example of a solution, see Appendix 12b).

6.3.2 The Experimental Conditions

In this study, we manipulate case-base *content* (i.e., near analogies versus far analogies). Moreover, we test the *CBR System Availability* condition against a *Non-CBR System* condition (see Figure 6.2). The non-CBR system condition concerns the availability of an *Expert System*, i.e., a rule-based SP technique recommendation system.

Within the CBR system availability condition, we thus manipulate *CBR System Content* (near analogies versus far analogies) (see Figure 6.2). Since this study is about designing a sales promotion campaign for a fast-moving consumer good (FMCG), namely the Dutch beer brand Grolsch, we classify all FMCG cases as *Near Analogies* (i.e., coming from basically the same problem domain) and all non-FMCG cases as *Far Analogies* (i.e., coming from more distant domains).

This finally results in three different experimental conditions: (1) a CBR system with only *near analogies* (i.e., 50 FMCG cases), (2) a CBR system with only *far analogies* (50 non-FMCG cases) and (3) a non-CBR system benchmark condition in the form of an *expert system* (see Figure 6.2). An inventory of SP techniques on paper (see Appendix 6) is available on paper to the participants in all conditions.

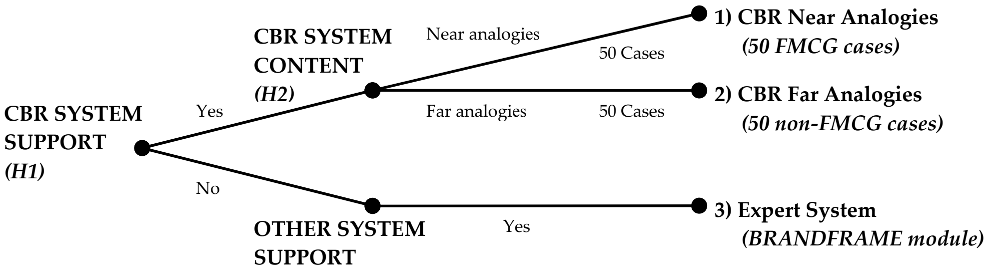

Figure 6.2 The Research Design: Experimental Conditions

The CBR Systems: LEAPS. Within the *LEAP*S (*LE*arning *P*romotion *S*ystem) the participants can search for previous, similar campaigns using a large number of attributes related to the problem situation (e.g., campaign objectives and product category), the solution (e.g., campaign theme and sales promotion technique used) and even the desired outcome (e.g., response rate). For instance, the decision maker could search previous campaigns that had the same objective of increasing loyalty or had the same main theme of (live-) music, or a combination of both. The CBR system's output is ranking of the ten most similar campaigns in its case-base, based on their similarity score with the input (i.e., the search query) provided by the system user. Participants are asked to make a screendump of their most helpful search query. The retrieved analogies may serve as a source of inspiration for generating novel ideas and/or elements (or parts) of these previous campaigns may be directly reused for designing a campaign for the new Grolsch campaign. Participants are asked to list the campaigns from the CBR system that they have read and also the ones that they have actually used (if any). For a detailed description of *LEAPS*, we refer the reader to subsection 4.2.3.

The Benchmark. As a benchmark we use an expert system, i.e., a rule-based SP technique recommendation system (see subsection 4.2.4). Based on the campaign's goals (e.g., increase loyalty) and constraint (e.g., low implementation complexity) and their relative importance, the system's output consists of recommended sales promotion techniques in decreasing order of appropriateness (including a brief the description of the proposed SP technique).

6.3.3 Participants and Procedure

Twenty-three Dutch undergraduate students (15 males, 8 females) participated in an experiment in the Erasmus Behavioral Laboratory (EBL). The laboratory consists of 10 isolated cubicles equipped with fast, state-of-the-art, flat-screen computers. The students participated for extra course credit, since the experiment was part of an undergraduate course on "Knowledge-driven Support Systems in Marketing". For an overview of the data-collection procedure, see Table 6.1.
Before the experiment, participants had to complete a questionnaire regarding their attitude towards support system usage (before). In the laboratory, the participants were instructed to read the assignment carefully (see Appendix 2b), the campaign briefing (see Appendix 3) and a 2-page manual on how to use the Marketing Management Support System (see Appendix 11a (CBR) and 11b (Expert System)). Next, the remaining time could be used to work on the assignment using the available support. When the participant had finished the task, he was asked to save the SP campaign proposal on the computer and to complete two more questionnaires. One questionnaire concerned the attitude towards support system usage (after) and the other questionnaire concerned the perceived usefulness of the system and the self-reported process measures. After handing in these questionnaires, the participant could leave the laboratory.

Table 6.1 Summary of the Data-Collection Procedure (Study 2)

Data-Collection Procedure
1. *Pre-questionnaires.* Before coming to the laboratory, the participants completed two questionnaires regarding their creative ability (i.e., self-assessed, multiple-choice questionnaire, see subsection 4.3.1) and their attitude towards using Marketing Management Support Systems ("before" measure", see Appendix 7). Next, the participants were equally distributed over one of the three experimental conditions based on a median split of their scores on the creative ability questionnaire.
2. *The Task*. Before the start of each 3-hour laboratory session, the participants were instructed to carefully read the assignment (see Appendix 2b), the campaign briefing (see Appendix 3) and a 2-page manual on how to use the Marketing Management Support System (see Appendix 11a (CBR) and 11b (Non-CBR System: Expert System). The remaining time could be used to finish the task.
3. *Post-Questionnaires*. When ready, the participants were asked to save their campaign proposal on the computer and to fill in a questionnaire about their attitude towards using a Marketing Management Support System ("after" measure, see Appendix 7). Furthermore, the participants were asked to complete a questionnaire on their operating procedure (e.g., support tool usage time, number of cases read and number of cases used) and their evaluation of support tool usage (i.e., perceived impact and perceived usefulness of the support tool) (see Appendix 8a (CBR) and 8d (no CBR)).
4. Judges and Ratings. The 23 campaign proposals were coded (for an example of a solution, see Appendix 12b) and sent to four sales promotion expert judges who rated all campaign proposals (in random order) on two novelty-related items and eight usability-related items (see Appendix 10b).
5. *Participants* receive their grade for their sales promotion proposal and can finish the course.

After each three-hour session, all cubicles and materials were checked and the saved campaign proposals were collected on a central computer (and removed from the computers in the cubicles). Before sending them to the judges, all 23 proposals were coded and provided with the same lay-out (for an example of a solution, see Appendix 12b). Furthermore, all identifying information with respect to the person and the experimental condition was removed and a simple word count was performed to be able to correct for the influence of the length of the proposal (see subsection 4.3.5). The average length of the proposals is 465 words, with a minimum of 208 words and a maximum of 874 words (SD = 184). There is no significant overall difference between the system usage conditions in the average length of the proposals (One-Way ANOVA; F = 2.695, p = 0.092). The proposals were sent to three sales promotion experts in one batch with a randomized order for each judge.

6.3.4 Measures

Innate Creative Ability (Self-Assessment). Before the experiment all participants completed the creative ability questionnaire (Abedi, 2000). This self-administered, 56-item, multiple-choice questionnaire[40] is intended to measure the same four aspects of creative thinking as included in the abbreviated Torrance test (see Abedi, 2002).

1) Fluency, i.e., the ability to produce a large number of relevant ideas (17 items).
2) Originality, i.e., the ability to produce uncommon or totally new ideas (16 items).
3) Flexibility, i.e., the ability to process information in different ways (13 items).
4) Elaboration, i.e., the ability to embellish an idea with details (10 items).

For a more elaborate discussion on this self-assessed creative ability questionnaire, we refer the reader to subsection 4.3.1.

Adding the individual item scores (ranging from 1 = low to 3 = high) per construct results in total scores for fluency (17 items; M = 37.4, SD = 5.6), flexibility (13 items; M = 30.1, SD = 2.9), originality (16 items; M = 36.8, SD = 4.0), and elaboration (10 items; M = 22.4, SD = 1.5). A factor analysis on the four subscales yielded a one-dimensional solution (i.e., one factor with an eigenvalue greater than one and all factor loadings above 0.5, except for the elaboration subscale).[41] We labeled this factor as the innate creative ability of the decision maker (see Table 6.2).

Hence, to calculate an overall creative ability score, we added the scores of the four subscales (Cronbach's $\alpha = 0.78$, see Table 6.2). In the subsequent analyses, we use this score as a measure for the decision maker's innate creative ability. The average individual score on creative ability (M = 126.9, SD = 11.9) is significantly (one sample t-test: $t = 6.011$, $p = 0.000$) above the midpoint of the scale, with a theoretical range for the total scores on the 56, self-reported items from 56 (which denotes a low creative ability) to 168 (which denotes a high creative ability).

[40] The Abedi Test of Creativity Test (ATC©) is available upon request from the author Jamal Abedi (e-mail: jabedi@cse.ucla.edu).

[41] If we force a (non-orthogonal) two-dimensional structure upon the data, then we find a "divergent thinking" sub-dimension (the fluency, flexibility, and originality subscales) and a "convergent thinking" sub-dimension (the elaboration subscale), which are moderately correlated ($r = 0.24$) (oblique rotation: Oblimin) and together explain 89% of the variance.

Table 6.2 Creativity Ability Questionnaire: Factor Analysis and Reliability Analysis

Subscales	*Dimension*	*Factor 1 (Creative Ability)*
Creative Ability (self-assessed)		
1. Fluency		***.86***
2. Flexibility		***.91***
3. Originality		***.92***
4. Elaboration		***.45***
	Cronbach's Alpha	**0.78**
	Explained Variance	**65.0%**

* Principal components analysis; $n = 23$

Since the participants handed in the creative ability questionnaire well before the experiment, we were able to distribute "high" and "low" creative participants equally over the experimental conditions, based on a median split of their score on the creative ability questionnaire. As a result, there are no significant differences ($F = 0.124$, $p = 0.884$) between the experimental conditions regarding the average self-assessed creative ability level (nor for the elaboration, fluency, originality, and flexibility subscales).

Attitude towards using MMSS (before and after). This questionnaire concerns the respondent's attitude towards using Marketing Management Support Systems (MMSSs) in general for enhancing decision-making performance (Van Bruggen, 1993), measured by eight items on a 7-point Likert scale ranging from 1 (completely disagree) to 7 (completely agree)). For instance, "I think marketing decisions made using an MMSS will be better" (see Appendix 7 for the other items, and subsection 4.3.4 for a discussion). The internal consistency of the "before" measure is moderate (Cronbach's α = 0.56). However, for reasons of comparison with the "after" measure and the other studies reported in this dissertation, we decided to keep all items and combine them into an average scale score. There is no significant overall difference in the average attitude towards using an MMSS between the different system user groups before the experiment (One-way ANOVA, $F = 0.231$, $p = 0.796$). Overall, the participant's attitude towards using an MMSS before the experiment (M = 5.0 on a 7-point scale; SD = 0.50) is significantly (one-sample test (test-value = 4), $t = 9.815$, $p = 0.000$) above the scale's mid-point, indicating an overall positive attitude towards MMSS usage for decision making. The internal consistency of the "after" measure is sufficient (Cronbach's α = 0.79). For further analysis of the "after" measure, we refer the reader to subsection 6.4.3.

Perceived Usefulness of the CBR System and Process Measures. The other questionnaire that the participants had to complete after the experiment concerned the perceived usefulness of the system (Cronbach's α = 0.96 (six items, 7-point scale)) and a number of self-reported process measures (see Appendix 8a (CBR) and 8d (no CBR)). These process measures are: system usage time in minutes (single item), total time worked on the assignment in minutes[42] (single item), perceived impact of system usage on the final solution in percentages (single item), and the SP cases that were read and used. In the benchmark condition, we asked for the SP technique that the system advised and which technique they eventually have chosen. For further analysis of these measures, we refer the reader to section 6.4.

Solution Quality. In this study, we measure solution quality by means of two novelty-related items (instead of a single novelty item as used in Study 1), i.e., "novelty", and "originality", and eight items that are related to the usability of the sales promotion campaign proposal for Grolsch (see Appendix 10b). These eight items are partly based on the usability items used in the previous study and partly based on the campaign goals as formulated in the Grolsch briefing, such as the "consistency with the brand image", "handling complexity", "cost effectiveness", "potential to reach the objectives" and "potential to reach the target group" (see Appendix 10b for the other items). All items were rated on a 7-point, unipolar scale ranging from 1 (very low) to 7 (very high). Following Amabile's (1983) consensual technique for creativity assessment (see subsection 4.3.3), three sales promotion experts were asked to independently judge all 23 proposals on all ten items. Two expert judges come from different, renowned Dutch sales promotion agencies (see subsection 4.3.3). The third expert judge is the marketing manager in charge of the promotional activities for the Grolsch beer brand. He is also a recognized expert in sales promotions and has acted several times as the chairman of the jury for the Dutch sales promotion awards.

The two novelty-related items were combined into an average solution novelty score for each judge (all Cronbach's αs>0.85). To construct an average score for the usability-related items, two items, i.e., handling complexity (phrasing and scoring of this item was not unambiguous) and cost effectiveness (which was

[42] We also asked the respondent about the time pressure they perceived (on a 7-point Likert scale, ranging from 1 (far too little time) to 7 (far too much time)), since time pressure is seen as an important determinant for the creativity of the output (see for example Moreau and Dahl, 2005; Burroughs and Mick, 2004). We did not find a significant correlation coefficient between perceived time pressure and the creativity of the solution (r = -0.004, p = 0.985), for novelty r = -0.043 (p = 0.846) and for usability r = -0.047 (p = 0.831). The correlation coefficient between perceived time pressure and the efficiency of developing a solution (i.e. total time – system usage time) is also not significant (r = -0.222, p = 0.309), but the coefficient is in the expected direction. That is, the less efficient a respondent designed a campaign (i.e., needed more time to design a campaign), the more time pressure he perceived.

difficult to assess for the respondents, given the often unrealistic cost indications in their proposals) were first removed based on their low (or even negative) correlations with other items (within judges). The remaining six items were combined to construct an average solution usability score per judge (all Cronbach's αs>0.75).

Next, the averaged novelty and usability scores per judge are used to assess the level of consensual agreement among the judges regarding the creativity of the campaign proposals (see Amabile, 1983). As can be seen in Table 6.3, all correlation coefficients between the judges' ratings are significant.

The (alpha[43]) inter-rater reliability coefficients[44] for novelty ($\alpha = 0.79$) and usability ($\alpha = 0.76$) are sufficient. Given the different backgrounds and perspectives of our judges (e.g., company versus agency perspective), we believe that the inter-rater reliability coefficients are at an acceptable level.

Table 6.3 Correlation Matrix of SP Campaign Ratings Judges*

*Ratings**	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Novelty (Judge 1)	-								
2. Novelty (Judge 2)	***.54***	-							
3. Novelty (Judge 3)	***.70***	***.47***	-						
4. Usability (Judge 1)	***.66***	*.32*	***.55***	-					
5. Usability (Judge 2)	***.57***	***.58***	***.44***	***.64***	-				
6. Usability (Judge 3)	***.42***	*.38*	***.64***	***.51***	***.52***	-			
7. Creativity (Judge 1)	***.95***	***.49***	***.70***	***.87***	***.65***	***.50***	-		
8. Creativity (Judge 2)	***.62***	***.94***	***.52***	***.49***	***.82***	***.48***	***.62***	-	
9. Creativity (Judge 3)	***.61***	***.47***	***.89***	***.58***	***.53***	***.92***	***.65***	**.55**	-

* correlations in bold significant at the 0.05 level; $n = 23$

Hence, the ratings of the three judges were combined into one average novelty rating and one average usability rating for each campaign proposal. To calculate the overall creativity rating of the campaign proposals, we first combined the novelty rating and usability rating into an average creativity score per judge. Finally, we take the average of the three judges as the overall creativity rating for the sales promotion campaign proposal (inter-rater reliability composite creativity scores: $\alpha = 0.82$).

[43] The intra-class correlation coefficient is algebraically equivalent to the alpha coefficient when there is only one rating variable and the judges' ratings are to be averaged to produce a composite rating (i.e., if we are interested in the question how reliable, or internally consistent, the judges' ratings are as a whole).

[44] Intra-class correlation coefficient (ICC): two-way random effects model, consistency definition.

6.4 Results

This section is organized as follows. In subsection 6.4.1, we deal with the main effects of CBR system availability, i.e., CBR system versus no system and near analogies versus far analogies. Next, we analyze and discuss the moderating role of the decision maker's innate creative ability (see subsection 6.4.2.). Finally, we investigate the relation between the decision maker's subjective evaluations of the CBR system and its objective contribution to the solution (see subsection 6.4.3).

In the regression analyses in the next subsection, the *Expert System* condition is used as a benchmark for testing our hypotheses regarding the effects of CBR system availability. The number of observations per condition is small, i.e., we have 8 observation for the CBR near analogies condition (n = 8), 8 observations for the CBR far analogies condition (n = 8) and 7 observations for the expert system condition (n = 7), which results in low statistical power to detect significant effects. We note that if we have a directed hypothesis, we will use a one-sided test (α = 0.05) (p_+ = one-sided positive and p_- = one-sided negative). The other reported p-values in the next subsections are two-sided.

6.4.1 Main Effects of CBR System Availability

Solution Quality: CBR System Availability versus No CBR System. As mentioned, solution quality is measured by creativity, which is composed of the novelty and usability ratings of our expert judges. The average creativity rating for the sales promotion campaign proposals is 4.04 (on a scale from 1 (very low) to 7 (very high); SD = 0.74), which is not significantly different from the mid-point of the rating scale (one-sample t-test (test value = 4): t = 0.282, p = 0.781).

In order to test our first hypothesis (*H1a*) regarding the main effect of *CBR system availability* versus *no CBR system* on the quality of the solution, we performed a multiple regression analysis. The regression model includes: (1) a dummy variable for the availability of a CBR system (1 = CBR system, 0 = benchmark), (2) the decision maker's creative ability (self-assessed) and (3) two covariates (gender (1 = female, 0 = male) and the length of the proposal (i.e., number of words).

We find that decision makers who have a CBR system at their disposal score significantly higher (b = 0.451, p_+ = 0.036) than the users of the benchmark system on the creativity of the solution (as judged by the experts). Thus, the CBR system availability of a CBR system helps to design sales promotion campaigns of higher quality, which is in line with hypothesis *H1a*. The effect size, however, is not very large given the small adjusted R^2. The self-assessed creative ability of the decision maker and the covariates gender and length of the campaign proposal do not have a significant impact on the creativity of the campaign proposal (see Table 6.4). We note that the sign of the regression coefficient for creative ability is negative (b = -

0.059), while we expected a positive relationship ($p_+ = 1 - p_- = 0.607$) between innate creative ability and the creativity of the campaign proposal.

Table 6.4 Regression of Solution Quality: CBR System Availability vs. No CBR System

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	3.664	-	1.991	0.062
CBR System Characteristics				
- CBR System Availability (dummy)	0.709	0.451	1.918	0.036+
Decision Maker Characteristics				
- Creative Ability Level (self-assessed)	-0.004	-0.059	-0.276	0.393+
Covariates				
- Gender (0=male, 1=female)	-0.320	-0.211	-0.977	0.342
- Length of Campaign Proposal	0.001	0.247	1.055	0.305
	R^2_{adj}=0.06 (R^2=0.23)	F=1.355	(p=0.288)	

* Intercept represents the Expert System benchmark condition; + one-sided test; n = 23

Solution Efficiency: CBR System Availability versus No CBR System. The second part of our first hypothesis *H1* concerns the effect of CBR system availability on the efficiency of designing a sales promotion campaign. Solution efficiency is defined as the "time needed to work out a solution" and is measured by the residual *solution time*, i.e., by subtracting the "time that the respondent has worked with the available support tool" from the "total time worked on the task" (both self-reported measures) (see also subsection 4.3.3). After correcting total time for support tool usage time, the participants on average needed 83 minutes (SD = 33) to work out a campaign design. That is, in total the participants spent on average 132 minutes (SD = 23) working on the task, of which on average 48 minutes (SD = 27) were used for working with the available support tools (i.e., the CBR systems or the expert system). The decision makers in the CBR system conditions on average needed 80 minutes (SD = 33) to work out a campaign proposal, whereas the decision makers in the "no CBR system" condition on average needed 91 minutes (SD = 34).

To test the second part of our first hypothesis (*H1b*) regarding the positive effect of CBR system availability on solution efficiency (which is measured by solution time), we included the same independent variables as for solution quality in the regression analysis (see Table 6.5). Although the sign of the regression coefficient is as hypothesized, i.e., CBR system availability reduces the time needed for working out the sales promotion campaign proposal (compared to the benchmark expert system), the effect is not significant (b = -0.005, p = 0.492). The length of the campaign proposal does have a marginally significant effect (b = 0.406, p = 0.093) on solution efficiency (see Table 6.5). That is, the more words the campaign proposal contains, the more time that is needed to work out the proposal (including writing it down).

Table 6.5 Regression of Solution Efficiency: CBR System Availability vs. No CBR System

Dependent Variable	*Solution Time*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	-51.874	-	-0.651	0.523
CBR System Characteristics				
- CBR System Availability (dummy)	-0.325	-0.005	-0.020	0.492+
Decision Maker Characteristics				
- Creative Ability Level (self-assessed)	0.816	0.295	1.419	0.173
Covariates				
- Gender (0=male, 1=female)	-4.539	-0.067	-0.319	0.753
- Length of Campaign Proposal	0.072	0.406	1.772	0.093
	R^2_{adj}**=0.10** *(R^2=0.27)*	F**=1.620**	**(p=0.213)**	

* Intercept represents the Expert System benchmark condition; + one-sided test; n = 23

We will now further explore what drives the positive effect of CBR system availability on solution quality by comparing the different treatments within the CBR system availability condition.

Solution Quality: Near Analogies versus Far Analogies. To test the hypothesis regarding the effect of providing near analogies versus far analogies on solution quality, we compared both CBR system user groups in a regression analysis. For this regression analysis, we thus included the CBR system *near analogies* and the CBR system *far analogies* conditions only (n = 16). The regression equation includes a dummy variable for the availability of a CBR system with far analogies only, the decision maker's innate creative ability and the covariates (see Table 6.6).

Table 6.6 Regression of Solution Quality (Creativity): Near Analogies vs. Far Analogies

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	6.094	-	2.679	0.021
CBR System Characteristics				
- CBR System Far Analogies (dummy)	0.538	0.344	1.321	0.107⁺
Decision Maker Characteristics				
- Creative Ability Level (self-assessed)	-0.017	-0.272	-1.011	0.334
Covariates				
- Gender (0=male, 1=female)	-0.796	-0.471	-1.623	0.133
- Length of Campaign Proposal	0.001	0.108	0.393	0.702
	R^2_{adj}=0.06 (R^2=0.31)	**F=1.256**	**(p=0.344)**	

* Intercept represents the CBR System Near Analogies condition; ⁺ one-sided test; n = 16

We do not find support for our first hypothesis (*H2a)* that decision makers who have only far analogies at their disposal will develop more creative campaigns, i.e., we find a positive, but insignificant effect (b = 0.344, p = 0.107) on the creativity of the sales promotion campaign proposal for the CBR system with far analogies (i.e., relative to the CBR system near analogies condition) (see Table 6.6).

If we perform this analysis for the two dimensions of solution creativity separately (see Table 6.7 and Table 6.8), then we find a significant positive effect of the availability of a CBR system with far analogies on solution novelty (b = 0.477, p_+ = 0.039), which supports hypothesis *H2c*. With respect to solution usability, we expected a negative effect of the availability of a CBR system with far analogies compared to a CBR system with near analogies (*H2d*). That is, we hypothesized that decision makers who have a CBR system with far analogies at their disposal would design less usable campaigns (i.e., relative to decision makers who have a

CBR system with near analogies at their disposal). However, the results show a positive, but insignificant coefficient for the CBR system far analogies dummy variable (*b* = 0.102, *p* = 0.641). Hence, we do not find support for hypothesis *H2d*.

Table 6.7 Regression of Solution Quality (Novelty): Near Analogies vs. Far Analogies

Dependent Variable	*Novelty of the Campaign*			
Independent variables	unstandardized coefficients (B)	standardized coefficients (b)	t-value	p-value
- Intercept*	7.101	-	2.621	0.024
CBR System Characteristics				
- CBR System Far Analogies (dummy)	0.942	0.477	1.941	0.039+
Decision Maker Characteristics				
- Creative Ability Level (self-assessed)	-0.027	-0.341	-1.343	0.206
Covariates				
- Gender (0=male, 1=female)	-0.894	-0.419	-1.532	0.154
- Length of Campaign Proposal	0.001	0.122	0.473	0.645
	R^2_{adj}=0.17 (R^2=0.39)	*F*=1.752	(*p*=0.209)	

* Intercept represents the CBR System Near Analogies condition; + one-sided test; *n* = 16

To conclude, relative to a CBR system with only near analogies, the effect of a CBR system with far analogies on solution creativity is in the hypothesized direction (i.e., positive), but the effect is not significant. Thus, we do not find support for hypothesis *H2a* regarding the positive effect of far analogies on the creativity of the solution. For the novelty of the solution, however, the effect of a CBR system with far analogies is positive and significant, which is in line with hypothesis *H2c*. Decision makers that have the CBR system with far analogies available design more novel sales promotion campaigns than decision makers who have the CBR system with near analogies at their disposal. With respect to solution usability, we do not find a significant difference between both CBR system conditions. Nonetheless, the decision makers in both CBR system conditions significantly outperform the decision makers in the expert system conditions on the usability of their campaign proposal.

Table 6.8 Regression of Solution Quality (Usability): Near Analogies vs. Far Analogies

Dependent Variable	*Usability of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	5.087	-	2.509	0.029
CBR System Characteristics				
- CBR System Far Analogies (dummy)	0.135	0.102	0.371	0.359[+]
Decision Maker Characteristics				
- Creative Ability Level (self-assessed)	-0.007	-0.135	-0.474	0.645
Covariates				
- Gender (0=male, 1=female)	-0.697	-0.489	-1.597	0.139
- Length of Campaign Proposal	0.000	0.072	0.250	0.807
	R^2_{adj}**=-0.04** *(R^2=0.24)*	***F*=0.852**	**(*p*=0.522)**	

* Intercept represents the CBR System Near Analogies condition; [+] one-sided test; n = 16

Finally, there is no significant difference in the number of cases that the decision makers have read and used between the two CBR system conditions. On average, the decision makers in both condition read 4.9 cases, of which they eventually use about one for their campaign proposal (see Table 6.9).

Table 6.9 Cases Read and Used: Average Number of Cases per Type of CBR System

Process Data	*Cases Read*	*Cases Used*
CBR near analogies (50 FMCG cases)	4.88	1.00
CBR far analogies (50 non-FMCG cases)	4.88	1.13
Total	4.88	1.06
T-value	**0.000**	**-0.205**
(independent sample t-test for equality of means)	**(p=1.000)**	**(p=0.841)**

n=16

Solution Efficiency: Near Analogies versus Far Analogies. We hypothesized that recognizing a near analogy and transferring knowledge from the base to the target is easier and faster, because similarities between the base domain (i.e., the retrieved sales promotion campaign) and the target domain (i.e., the new campaign) already exist on a superficial level. That is, we expected that compared to a CBR system with far analogies, decision makers having a CBR system with near analogies available would need less time to work through abstract, structural similarities between both campaigns and translate them into actionable attributes and concepts, which eventually would result in lower solution times. However, we find that decision makers having a CBR system with far analogies at their disposal need less time to work out a solution (b = -0.180, p_- = 0.199, see Table 6.10) than users of a CBR system with near analogies, but the effect is not significant. Hence, we do not find support for the hypothesized (negative) effect (*H2b)* of far analogies on solution efficiency *(*p_+ = 0.801*)*.

Table 6.10 Regression of Solution Efficiency: Near Analogies vs. Far Analogies

Dependent Variable	*Solution Time*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	-67.541	-	-0.929	0.373
CBR System Characteristics				
- CBR System Far Analogies (dummy)	-11.470	-0.180	-0.881	0.199+
Decision Maker Characteristics				
- Creative Ability Level (self-assessed)	0.907	0.358	1.691	0.119
Covariates				
- Gender (0=male, 1=female)	-16.832	-0.245	-1.075	0.305
- Length of Campaign Proposal	0.105	0.436	2.028	0.067
	R^2_{adj}=0.42 ***(R^2=0.58)***	**F=3.741**	**(p=0.037)**	

* Intercept represents the CBR System Near Analogies condition; + one-sided test; n = 16

6.4.2 The Moderating Role of the Decision Maker's Innate Creative Ability

As can be concluded from the regression analyses in the previous subsection, we do not find a significant main effect of the decision maker's innate creative ability on the creativity of the campaign proposal. However, the effect may be attenuated by the different experimental conditions in which the respondents designed their campaign proposal, i.e., the use of the support system may interact with the creative ability of the decision maker.

If we look at the correlation coefficients between the decision maker's innate creative ability and the creativity of the solution (comprising both the novelty and the usability of the campaign) for the CBR system and expert system condition separately (see Table 6.11), then we see that for the respondents in the expert system condition the sign of the correlation coefficient is positive (as hypothesized), but not significant at the 0.05 level (see right column Table 6.11). For the respondents in the CBR system conditions, the sign of the correlation coefficient between innate creative ability and the creativity of the solution is even negative, but highly insignificant (r = -0.06, p_+ = 0.586; see left column Table 6.11). Because we do not have a no system condition in this study, we are not able to test the creative ability hypothesis (*H3)* under uncontaminated conditions (i.e.., having no support system at all available). If we assume that higher levels of creative ability (as measured by the multiple-choice questionnaire) are associated with higher levels of solution creativity, then it seems that the availability of a CBR system (and perhaps, to a lesser extent, also the expert system (r = 0.36, p_+ = 0.213, see Table 6.11)) moderates this positive effect of creative ability on the creativity of the solution.

Table 6.11 Creativity of the Campaign Proposal: Correlations with Innate Creative Ability

	CBR System (n = 16)				*Expert System (n = 7)*			
Variables*	*1*	2	3	4	*1*	2	3	4
1. Creative Ability Level (self-assessed)	-				-			
2. Creativity Rating Campaign	-.06	-			.36	-		
3. Novelty Rating Campaign	-.13	**.97**	-		.29	.65	-	
4. Usability Rating Campaign	.05	**.92**	**.79**	-	.22	.74	-.03	-

* correlations in bold are significant at the 0.05 level

Next, we test for the hypothesized interaction effect for CBR system availability and the decision maker's innate creative ability on solution creativity (*H4*) in a moderated regression analysis. Due to the inclusion of an interaction term in the regression analysis, we mean-centered all independent variables in line with the "good practice" procedure proposed by Irwin and McClelland (2001). Mean-centering helps to avoid inflated estimates of standard errors (and thus difficulties with detecting statistically significant effects) as a result of the multicollinearity introduced by including a multiplicative interaction term (Cronbach, 1987). Moreover, mean-centering facilitates the interpretation of the coefficients for the separate components of the interaction term[45]. The final regression model for

[45] In a moderated regression analysis, the coefficients for the components of the interaction term represent their "simple" effects, i.e., the simple relationship between the dependent variable and

explaining solution creativity includes a dummy variable for the availability of a CBR system, the decision maker's innate creative ability, a multiplicative term of CBR system availability and innate creative ability, and the covariates (all independent variables are mean-centered). The results for the regression analysis are depicted in Table 6.12. To correctly interpret and calculate the simple slopes for visualizing the interaction effect (see Figure 6.3), we use the unstandardized (*B*) regression coefficients here (see Aiken and West, 1991).

Consistent with our hypothesis (*H4*), we find a negative regression coefficient (B=-0.034, p_-=0.173) for the interaction effect of creative ability on the relationship between CBR system availability and the creativity of the solution. This suggests that decision makers with a low creative ability benefit more from the availability of the CBR system with respect to the creativity of the solution than highly creative decision makers. Perhaps partly due to the small sample size, the interaction effect turns out to be insignificant in the regression analysis and therefore we do not find support for this hypothesis (*H4*). The simple effect of CBR system availability on solution quality is positive and significant (B = 0.720, p_+ = 0.035). The simple effect of innate creative ability is not significant (B = -0.000, p_+= 1 - p_+ = 0.504).

Although the regression coefficient for the overall interaction effect is not significant, we decided to take a closer look at the simple effects of CBR system availability for different groups of creative ability. Hence, we followed the procedure developed by Jaccard, Turrisi and Wan (1990) for calculating the presence, strength and nature of the interaction effect (see Appendix 17). In this procedure, the presence of the interaction effect between CBR system availability and innate creative ability is determined by the significance of the estimated coefficient for the interaction term (in this case, as mentioned, not significant: B = -0.034, t = -0.970, p_-= 0.173, see Appendix 18a). Next, the strength of the relation is determined by percentage of variance that is explained by the interaction effect, i.e., the difference in R^2 between the interaction regression model and the main effects regression model (in this case: 27.2% - 23.1% = 4.1%, see Appendix 18a)[46].

independent variable at a particular level of the other independent variable(s) (Irwin and McClelland, 2001). Because the value zero is outside the range for one of the variables included in the interaction term (viz., innate creative ability, scale ranges from 1 to 7), the coefficients and its tests have little or no meaning. Mean-centering the variables (i.e., rescaling the mean to zero) facilitates the interpretation of the simple effects, because they then represent the effect of the independent variable at the average value of the other independent variable(s) (see Aiken and West, 1991; Irwin and McClelland, 2001). Mean-centering changes the correlations between either component of the interaction term and the interaction term itself (e.g., X and XZ), reducing multicollinearity problems, and between the dependent variable and the interaction term (e.g., Y and XZ) (see Irwin and McClelland, 2001).

[46] The strength of the moderating effect can be assessed by comparing the R-squares of the two regression models, i.e. one with the interaction term and one without the interaction term. The effect size is given by $f^2 = (R^2_{INTERACTION\_MODEL} - R^2_{MAIN\text{-}MODEL}) / (1 - R^2_{INTERACTION\_MODEL})$, where f^2 scores of 0.03,

Table 6.12 Regression of Solution Quality: Interaction Effect between CBR System Availability and Innate Creative Ability (compared to "no CBR system" benchmark condition)

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	4.056	-	27.009	0.000
CBR System Characteristics				
- CBR System Availability (dummy)	0.720	0.458	1.944	0.035+
Decision Maker Characteristics				
- Creative Ability Level (self-assessed)	-0.000	-0.002	-0.011	0.496+
Interaction				
- Creative Ability X CBR System	-0.034	-0.219	-0.970	0.173+
Covariates				
- Gender (0=male, 1=female)	-0.363	-0.239	-1.069	0.289
- Length of Campaign Proposal	0.001	0.304	1.257	0.226
	R^2_{adj}=0.06 ***(R^2=0.27)***	***F*=1.269**	**(*p*=0.322)**	

* intercept represents the Expert System benchmark condition; + one-sided test; n = 23
all independent variables are mean-centered
the dependent variable is uncentered, in order to provide predicted scores in the original scale

Finally, the nature of the interaction effect can be determined by calculating the simple effect of CBR system availability on solution quality for different levels of innate creative ability (see Appendix 18a). More specifically, the effect of CBR system availability on solution quality is calculated for "high" creative ability (plus 1 standard deviation) and "low" creative ability (minus 1 standard deviation). The effect for "average" creative ability (i.e., mean-centered creative ability score is zero) is equal to the regression coefficient for CBR system availability depicted in Table 6.12 (B = 0.720, p_+ = 0.035). The results are graphically represented in Figure 6.3.

0.15 and 0.35 suggest small, moderate and large interaction effects, respectively (Cohen, 1988). Here, the effect size is f^2 = 0.056, which suggests a relatively small effect size.

As can be seen in Figure 6.3, the net positive effect of CBR system availability on solution quality is largest for decision makers with a low (self-assessed) innate creative ability and this effect is significant (B = 1.123, *t-value* = 1.993, p_{+} = 0.031; see Appendix 18a). However, for decision makers with a high creative ability there is no significant net simple effect of CBR system availability on the creativity of their solution (B = 0.317, *t-value* = 0.580, p_{+} = 0.285; see Appendix 18a).

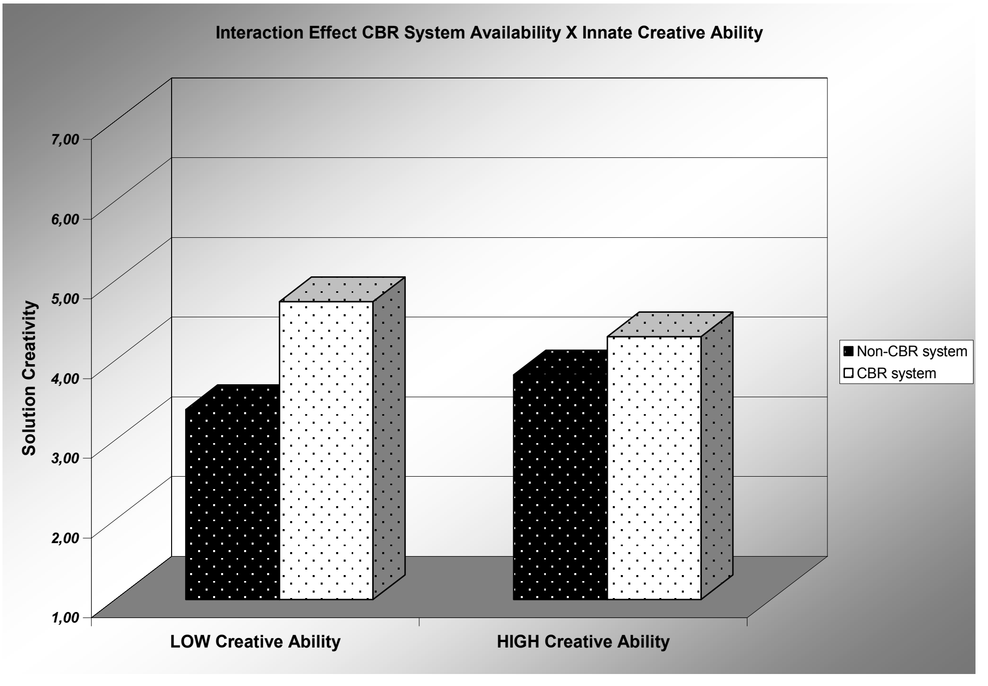

Figure 6.3 **Interaction Effect of CBR System Availability and Creative Ability on the Creativity of the Campaign Proposal (*n*=23)**

To conclude, although the overall interaction effect is not significant, the results suggest that the availability of a CBR system mainly facilitates low creative decision makers to become more creative, presumably by providing them with (creative) ideas that they are not able to generate themselves. However, CBR system availability does not seem to affect highly creative decision makers in their creative process, i.e., the creativity of their campaign proposals does not significantly improve with the availability of a CBR system (i.e., compared to the benchmark expert system). The effect of CBR system availability could have caused the difference in solution quality between high and low creative decision makers to disappear, resulting in a close to zero, insignificant correlation coefficient between solution creativity and (self-assessed) innate creative ability (see Table 6.11).

6.4.3 The Relation between the Decision Maker's Subjective Evaluations of the CBR System and its Objective Contribution to the Solution

Having examined the effects of providing analogies by means of a CBR system on the quality of the solution and the efficiency of the design process in the previous subsections, we now take a look at the subjective evaluations of the CBR system. That is, how do decision makers perceive the usefulness and impact of CBR system availability on their sales promotion campaign proposal? More specifically, we are interested in the relationship between the subjective evaluations of the CBR system and the objective contribution of the CBR system to the solution. For a more elaborate discussion, we refer the reader to section 3.8 and to subsection 4.3.4 for information on the measurement instruments.

In section 6.4.1, we found that the participants who had a CBR system at their disposal significantly outperformed the participants in the expert system benchmark condition, in terms of the quality of their solutions. The question now is: do the teams recognize this "objective contribution" of the CBR system to their solution? Therefore, we will first have a look at the descriptive statistics for the subjective evaluations of the CBR system and the expert system (see Table 6.13).

The average perceived usefulness ratings for the CBR systems (M = 4.1 on a 7-point scale) and, in particular, their average perceived impact on the final solution (M = 34.1 on a scale from 0% to 100%) are (significantly) lower than for the expert system user group (M = 4.7 and M = 59.3, respectively; see Table 6.13). Furthermore, there is no significant overall difference (One-way ANOVA, F = 0.191, p = 0.828; see Table 6.13) between the system user groups in the average attitude towards using an MMSS in general after the experiment. In all conditions, the attitude towards using an MMSS in general for enhancing decision-making performance dropped (but not significantly[47]) with about 0.3 points on a 7-point scale (see Table 6.13), which indicates that the CBR systems and the expert system did not fully meet the participants' expectations.

In this study, we included an extra item with respect to perceived usefulness of the support system, viz. "using the system enhanced my creativity"[48]. The scores on this "creativity" item do not significantly differ among the experimental conditions (F = 0.106, p = 0.900; see Table 6.13). However, as opposed to the other perceived usefulness items, the average rating regarding the perceived usefulness of the CBR systems for enhancing creativity (M = 4.4) is higher than for the expert system (M = 4.1), but overall there are no significant differences between user groups One-way ANOVA, F = 0.106, p = 0.900; see Table 6.13).

[47] One-sample t-tests (test value = 0, no change): CBR near analogies t = -0.865 (p = 0.416), CBR far analogies t = -0.766 (p = 0.469), and for the expert system t = -1.128 (p = 0.302).

[48] Item-to-total correlation for this creativity item with the other perceived usefulness items is 0.61. All the other items have item-to-total correlations over 0.8.

Table 6.13 Analyses of Subjective Evaluations per Type of Support System

Dependent Variable	*Condition*	*n*	*Mean*	*Std. dev.*
Perceived Usefulness of the Support System (scale 1-7)	*1. CBR near analogies (50)*	8	4.0	1.56
	2. CBR far analogies (50)	8	4.3	0.98
	(CBR overall)	*(16)*	*(4.1)*	*(1.27)*
	3. Expert system	7	4.7	1.39
	Total	23	4.3	1.30
	F-test (ANOVA)	**0.608**		
	Between Group Difference	**(p=0.554)**		
Perceived Usefulness of the Support System for enhancing Creativity (scale 1-7)	*1. CBR near analogies (50)*	8	4.5	2.00
	2. CBR far analogies (50)	8	4.3	1.39
	(CBR overall)	*(16)*	*(4.4)*	*(1.67)*
	3. Expert system	7	4.1	1.07
	Total	23	4.3	1.49
	F-test (ANOVA)	**0.106**		
	Between Group Difference	**(p=0.900)**		
Perceived Impact of Support System on the Solution (scale 0% - 100%)	*1. CBR near analogies (50)*	8	31.3	25.2
	2. CBR far analogies (50)	8	36.9	17.4
	(CBR overall)	*(16)*	*(34.1)*	*(24.5)*
	3. Expert system	7	**59.3**[1]	21.7
	Total	23	41.7	26.1
	F-test (ANOVA)	**2.755**		
	Between Group Difference	**(p=0.088)**		
Attitude towards MMSS Usage (after) (scale 1-7)	*1. CBR near analogies (50)*	8	4.6	0.85
	2. CBR far analogies (50)	8	4.8	0.76
	(CBR overall)	*(16)*	*(4.7)*	*(0.78)*
	3. Expert system	7	4.9	0.80
	Total	23	4.8	0.77
	F-test (ANOVA)	**0.191**		
	Between Group Difference	**(p=0.828)**		
Attitudinal Change (after - before)	*1. CBR near analogies (50)*	8	-0.3	1.07
	2. CBR far analogies (50)	8	-0.2	0.75
	(CBR overall)	*(16)*	*(-0.3)*	*(0.90)*
	3. Expert system	7	-0.3	0.59
	Total	23	-0.3	0.80
	F-test (ANOVA)	**0.045**		
	Between Group Difference	**(p=0.956)**		

[1] Significant difference at 0.05 level with CBR near analogies; Post-Hoc LSD test (two-sided), significant difference at 0.10 level with CBR far analogies; Post-Hoc LSD test (two-sided)

From the previous analyses we know that, relative to the expert system, CBR system availability contributed positively and significantly to the objective quality (i.e., the creativity) of the solution. This finding suggests that the users of the CBR

system have more difficulties in assessing the "true" impact of the system on their solution than the expert system users who are given a clear-cut answer by the system. However, using the expert system only solves part of the problem, viz. choosing an appropriate SP technique, which does not necessarily lead to the design of better, more creative sales promotion campaigns.
Over all conditions, the average ratings regarding the perceived usefulness of the support systems (M = 4.3 (SD = 1.30), one-sample t-test (test value = 4): t = 1.175, p = 0.253) and the perceived usefulness for enhancing creativity (M = 4.3 (SD = 1.49), one-sample t-test (test value = 4): t = 0.979, p = 0.338) are not significantly above the scale's midpoint, indicating a neutral evaluation of usefulness of the support systems for enhancing the design of a sales promotion campaign. Nevertheless, the average attitude towards using an MMSS (after the experiment) is, over all conditions, significantly (one-sample t-test: t = 4.799, p = 0.000) above the scale's midpoint (i.e., M = 4.8 on a 7-point scale; SD = 0.77). Thus, although the CBR systems did not fully meet the participants' expectation with respect to the degree of support, they still see value in using a marketing management support system for enhancing decision-making performance (see also the average percentages for the perceived impact of the support systems on the solution in Table 6.13, which are all significantly above zero (all p's < 0.010).
Next, we inspect the relations between the subjective evaluations of the CBR system and the objective outcomes. We therefore calculated the correlation coefficients between the evaluative measures, i.e., "*perceived usefulness of the CBR system*"[49], "*perceived usefulness for of the CBR system for enhancing creativity*", "*perceived impact of the CBR system*" (in percentages) and the change in the "*attitude towards using MMSSs*" (i.e., attitude after the experiment minus before the experiment) and the objective outcomes of CBR system availability, i.e., *solution quality* and *solution efficiency*. Furthermore, we look at the correlation between the subjective evaluations and the process variables, i.e., the *number of cases read*, *number of cases used* and *CBR system usage time* (see Table 6.14).

Relationship between Subjective Evaluations and Objective Outcomes. As in Study 1 (Chapter 5), in general we do not find significant relationships between subjective evaluations of the CBR system and the objective outcomes, i.e., solution quality and solution efficiency (see Table 6.14), which is in line with hypothesis *H5*. If we look at the correlation coefficients between the quality of the campaign proposal and the perceived usefulness of the CBR system (r = -0.21, p = 0.437) and between perceived usefulness and solution efficiency (i.e., solution time; r = -0.10, p = 0.716),

[49] This measure comprises items like "using the CBR system increased the quality of the SP campaign" *(solution quality)* and "using the system enabled me to design the SP campaign more quickly" *(solution efficiency)*, see Appendix 8a: items 6 and 7)

then we see negative, but non-significant coefficients (see Table 6.14). Furthermore, the relationship with solution quality (i.e., creativity) is also not significant for the perceived usefulness of the CBR system for enhancing creativity (r = -0.05, p = 0.850), the perceived impact of the CBR system (r = -0.21, p = 0.432), and the difference in attitude towards using MMSSs before and after the experiment (r = -0.39, p = 0.141). However, the relationship between perceived impact and solution time turns out to be significant and negative (r = -0.53, p = 0.037; see Table 6.14). That is, the participants are more likely to attribute a larger impact to the CBR system when they were able to quickly construct a satisfactory solution. Thus, decision makers associate the perceived impact of the system with gains in solution efficiency rather than with gains in solution quality.

Table 6.14 Correlations between Subjective Evaluations of the CBR Systems and Objective Outcomes & Process Variables*

Objective Outcomes / *Subjective Evaluations*	*Solution Quality (creativity)*	*Solution Efficiency (time)*	*Number of Cases Read*	*Number of Cases Used*	*CBR System Usage Time*
1. *Perceived Usefulness CBR System*	-0.21	-0.10	0.30	-0.25	0.28
2. *Perceived Usefulness CBR System for enhancing Creativity*	-0.05	0.16	-0.02	*-0.49*	0.02
3. *Perceived Impact CBR System*	-0.21	**-0.53**	*0.47*	0.42	*0.49*
4. *Attitude towards using MMSSs (after - before)*	-0.39	-0.12	0.20	-0.02	0.09

* correlations in bold are significant at the 0.05 level; correlations in italic are significant at the 0.10 level; n = 16

In general, the signs for the coefficients regarding the objective outcomes indicate that the better the campaign (according to the expert judges) and the more time that is needed to design the campaign (after the use of the CBR system), the lower the subjective evaluations of the CBR system. The fact that, compared to the expert system condition, CBR system availability leads to better, more creative solutions, combined with the lower evaluations of the CBR system, suggests that decision makers do not have a clue about the positive contribution of the CBR system to the quality of the solution. Moreover, from the previous analyses we know that, in terms of the creativity of the solution, the CBR system seems to be particularly helpful for decision makers with a low creative ability. Therefore, we also checked the correlation coefficients between the creative ability of the decision maker and the perceived usefulness of the CBR system for enhancing creativity (r = -0.13, p = 0.634) and between creative ability and the perceived impact of the CBR system (r = -0.11, p = 0.699), which are both not significant. Thus, participants with a low creative ability (self-assessed) do not evaluate the contribution of the CBR system more positively than participants with a high creative ability[50]. Apparently, decision makers with a low creative ability do not have a clue about the positive contribution of the CBR system to the creativity of their solution either (i.e., relative to highly creative decision makers).

Relationship between Subjective Evaluations and Process Variables. If we look at the correlation coefficients in Table 6.14, then we find that the relation with the subjective evaluations, and perceived impact in particular, is marginally significant for CBR system usage time (r = 0.49, p = 0.056 with perceived impact) and the number of cases read (r = 0.47, p = 0.070 with perceived impact), and nearly significant at the 10% level for the number of cases used (r = 0.42, p = 0.108 with perceived impact) (see Table 6.14). Interestingly, when the participants used more cases from the CBR system for designing their campaign, they gave lower rating for the perceived usefulness of the CBR system for enhancing the creativity of their solution (r = -0.49, p = 0.056). They might have feared that using too many elements or ideas from previous campaigns would be detrimental to the novelty and creativity of their solution (as judged by the experts).

To conclude, the results indicate that the characteristics of the usage process, i.e., system usage time and the sheer number of cases read and used, are more strongly related to the decision maker's evaluation of the contribution of the CBR system to the solution than the objective quality of the outcome. Consistent with the result reported in Study 1, it appears to be difficult for decision makers to relate the "objective" quality of their solution to the contribution of the CBR system. An explanation for this finding could be that, although the final solution may be rather different from the base analogies (resulting also in a low perceived impact rating), the analogies provided by the CBR system may have stimulated divergent thinking or imposed meaningful structure on the solution and, therefore, they are likely to have had an impact on the final solution, i.e., consciously (e.g., by the cases that were used) or unconsciously (e.g., by the cases that were read). As a consequence of the difficulty to pinpoint exactly the contribution of the retrieved analogies to the quality of the final solution, the participants are likely to use the characteristics of the CBR system usage process and the time needed to design a campaign (after the use of the CBR system) as cues to evaluate the contribution of the CBR system to their solution.

[50] Highly creative participants, however, tend to use the CBR system for a shorter period of time than low creative participants (r = -0.48, p = 0.061). A possible explanation could be that they are better able to retrieve relevant cases from the system and/or that they see the similarities between the target problem and the cases proposed by the CBR system faster and can apply them more easily for designing a solution. Another possibility is that they are more reluctant to use the system and tend to rely more on their own creativity.

6.5 Conclusions and Discussion

To recapitulate, in this study we examined the effect of the type of analogies contained in the CBR system. Hence, we manipulated the *content* of the CBR system's case-base. In one condition we provided the participants with a CBR system containing near analogies only (50 cases) (n = 8) and in the other condition we provided the participants with a CBR system containing far analogies only (50 cases) (n = 8). Furthermore, we added a benchmark condition in which the participants had an expert system at their disposal (n = 7). The task in this study was to design a sales promotion campaign for enhancing brand image and increasing loyalty among heavy users of Grolsch (a Dutch beer brand). In this section, we briefly summarize the results with respect to the research questions and hypotheses tested in this study and relate them to the hypotheses formulated in Chapter 3. The research questions that we addressed in this study are: (1) does the use of a CBR system improve solution quality and efficiency compared to using a benchmark system?, (2) what is the influence of the type of analogies in the CBR system?, (3) who benefits most from CBR system usage?, and 4) are decision makers able to recognize the objective contribution of the CBR system to their solution? Finally, we discuss the limitations of this study and outline the improvements that can and will be made in subsequent studies.

6.5.1 Main Findings

Solution Quality. The results show that CBR system availability has a positive effect on the quality of the solution (i.e., the creativity of the campaign) relative to the benchmark, expert system. With respect to the distinction between near analogies and far analogies within the CBR system conditions, we find that decision makers who have a CBR system with far analogies at their disposal design more novel sales promotion campaigns than decision makers who have a CBR system with near analogies at their disposal. We do not find a positive effect of a CBR system with far analogies on the overall creativity of the solution. Finally, although there is no significant difference in solution usability between the two CBR system conditions, i.e., near analogies versus far analogies, decision makers in both CBR system conditions design better usable campaigns than decision makers in the expert system condition.

Solution Efficiency. Although the effect of CBR system availability on solution efficiency is in the expected direction, i.e., reducing the time needed for designing a campaign (compared to the expert system condition), based on the results of this study the hypothesis can not be supported. Furthermore, we expected that having only near analogies available would lead to a more efficient design process than having only far analogies available. That is, we argued that the recognition of a near analogy is faster and the knowledge transfer from the base to the target easier, because similarities between the base domain (i.e., the retrieved sales promotion campaign) and the target domain (i.e., the new campaign) already exist on a superficial level. Hence, there should be no (or less) need to work through abstract, structural similarities between both campaigns and translate them into actionable attributes and concepts. When using near analogies only, it should therefore take less time to design a campaign. However, based on the results of this study we can not support this hypothesis.

The Match between the Decision Maker and the System: To Compensate or To Reinforce? With respect to the interaction effect between CBR system availability and the innate creativity of the decision maker, the use of the CBR system seems to moderate the (hypothesized) relationship between creative ability (and the creativity of the campaign proposal. That is, the positive effect of CBR system availability (compared to the expert system condition) on the creativity of the sales promotion campaign is enhanced for decision makers with a low (and average) creative ability. However, for highly creative decision makers there is no significant net effect of CBR system availability. An explanation for this finding could be that the CBR system provides decision makers with a low creative, low divergent thinking ability with ideas that they are not able to generate themselves, as opposed to decision makers with a high creative ability who are able to generate (creative) ideas themselves.

Subjective Evaluations of the CBR System. This study showed that, relative to the expert system benchmark, CBR system availability has a positive "objective" impact on solution quality. However, the average perceived usefulness and perceived impact ratings for both CBR systems (i.e., near analogies and far analogies) are lower than for the expert system user group. Furthermore, although the differences are not significant, in all conditions the attitude towards using MMSSs in general for enhancing decision-making performance was lower after the experiment than before the experiment, but still this general attitude is on average significantly positive after the experiment. Overall, this suggest that the CBR systems and, to a lesser extent, the expert system did not fully meet the participants' expectations.

Furthermore, decision makers do not seem to fully recognize the objective contribution of the CBR system to the quality of their solution (i.e., relative to the expert system user group). That is, the subjective evaluations of the contribution of the CBR system to the solution are more strongly correlated with the characteristics of the system usage process, i.e., system usage time and number of cases read and used, than with the objective quality of the solution. However, lower solution times (i.e., the time needed to design a campaign after the use of the CBR system) are associated with higher subjective evaluations of the contribution of the CBR system to the final solution.

An explanation for these findings could be that it is more difficult for users of the CBR system to assess the objective impact of the system on their solution than for the expert system users who are given a clear-cut answer (which only solves one part of the problem, namely choosing an appropriate SP technique). For CBR system users the final solution may be quite different from the base analogies provided by the CBR system. However, given the positive effect of CBR system availability on solution quality (i.e., relative to the expert system), the retrieved analogies must have affected the final solution (consciously or unconsciously). Based on the theory discussed in Chapter 3, it is likely that the analogies have activated idea generation processes or imposed meaningful structure on the solution.

6.5.2 Final Conclusions

To conclude, in line with *Hypothesis 1* (see Chapter 3) and the findings in Study 1 (Chapter 5), we find that CBR system availability significantly improves the quality of sales promotion campaigns (compared to using an expert system). In addition, we have a first indication that CBR system availability leads to a more efficient design process (i.e., lower solution times), but this effect turns out to be insignificant in this study. With respect to *Hypothesis 2* (see Chapter 3), decision makers having a CBR system with far analogies at their disposal design, on average, more *novel* sales promotion campaigns than those who have a CBR system with near analogies at their disposal. The availability of a CBR system with more distant, far analogies (compared to near analogies), however, does not lead to higher solution times (i.e., a less efficient design process), as we expected. In fact, the effect seems to be in the opposite direction, but is not significant. For the direct effect of creative ability on solution quality, we find an indication that, without the support of a CBR system, a positive relation exists. However, with only 7 observations for the no CBR system condition it was not possible to estimate this effect in a multivariate fashion (i.e., a regression analysis). Regarding *Hypothesis 4* (see Chapter 3), we have an indication that, in terms of solution quality, CBR system availability might be particularly beneficial for decision makers with a low (and average) creative ability. For highly creative decision makers, there seems to be no substantial improvement in the quality of their solution when having a CBR system at their disposal (i.e., relative to highly creative decision makers who use an expert system). Finally, consistent with Hypothesis 6 (see Chapter 3) and the result of Study 1 (Chapter 5), there is no significant relation between the decision maker's subjective evaluations of the

CBR system and the objective contribution of the CBR system to the solution, except for the relationship between the perceived impact of the CBR system and solution efficiency. Decision makers seem to evaluate the contribution of the CBR system by the characteristics of the CBR system usage process, i.e., system usage time and the number of cases read and used, and by the time needed to design a solution (after the use of the CBR system), rather than by the quality of their solution. In the next chapter, we will test all hypotheses formulated in Chapter 3 in a comprehensive, large-scale study.

6.5.3 Limitations and Suggestions for Further Research

The number of observations per condition in this study is small. Still, we are able to find interesting effects with respect to CBR system availability and the use of far analogies on solution quality (i.e., creativity) and on solution novelty, respectively. Moreover, we have an indication of the presence of a negative interaction effect between the decision maker's creative ability and CBR system availability (i.e., a compensation effect). But again, probably due to the small sample size the interaction effect turns to be non-significant. Hence, we will test for this in a large-scale study using exactly the same task.

Next to the decision support conditions used in this study, we will add two more CBR system conditions, i.e., a standard size CBR system and a large size CBR system conditions and an additional, no system benchmark condition. Finally, in this study we have measured the decision maker's innate creative ability by means of a self-assessed, multiple-choice questionnaire, including the elaboration (convergent), fluency, originality, flexibility (divergent) facets of creative thinking (consistent with Torrance, 1974). In the next study, we will actually test the innate creative ability of the decision maker (including the fluency, flexibility, originality and elaboration dimensions) with an abbreviated version of the widely accepted, validated Torrance Tests for Creative Thinking.

Chapter 7

Designing Sales Promotion Campaigns with Analogical Reasoning: A Comprehensive Laboratory Experiment

7.1 Methodological Improvements and Additional Conditions

In the empirical part of this dissertation, we test the effectiveness and efficiency of the CBR system under different conditions. We use the design of (creative) sales promotion campaigns as our weakly-structured application domain. In the situation of designing sales promotion campaigns, supporting analogical reasoning could help to improve both the effectiveness and efficiency of decision making. That is, using a CBR system might help to come up with solutions with a higher degree of creativity (*solution quality*), but also to find solutions quicker and with less effort *(solution efficiency*) (Leake, 1996).

In the previous chapters (Chapters 5 and 6), we have described two studies in which we have dealt with issues about CBR systems. In these studies, we manipulated one CBR system characteristic at most. In Study 1, the focus was predominantly on exploring the potential of Case-Based Reasoning (CBR)-system for improving the quality of sales promotion campaigns. There were no manipulations regarding CBR system usage, i.e., all respondents used exactly the same system. In Study 2, we manipulated the type of cases in the CBR system (near analogies versus far analogies). In both studies, we explored the effect of CBR system availability in combination with the innate creative ability of the decision maker (see Figure 8.1).

Study 2, described in the previous chapter, served as a pilot study for this comprehensive study (Study 3). Based on an evaluation of the results of Study 2, we made a number of methodological changes. The main differences with Study 2 are the following.

- Large scale study (n = 120).
- Use of a creative ability test (ATTA-test).
- Improving the scale for measuring the quality of the sales promotion campaign proposal.

Moreover, in this comprehensive study we consider all variables that are included in the conceptual framework discussed in Chapter 3. We will combine the previous studies into one large-scale laboratory experiment (n = 120) using six different experimental conditions. As in Study 2, we manipulate the content of the CBR system content, i.e., near analogies versus far analogies. In addition, we manipulate the size of the CBR system, i.e., containing 50 cases versus 100 cases. Finally, we include two benchmark conditions: (1) the use of an alternative MMSS (expert system), and (2) no system at all. Thus, in comparison with Study 2, the main differences are the following.

- Inclusion of a "CBR system standard size" (50 cases) and "CBR system large size" (100 cases) condition.
- Inclusion of a no system condition.

As in the previous studies, the main dependent variables are *solution quality* (i.e., creativity) and *solution efficiency* (see Figure 8.1). Furthermore, we will look at how decision makers evaluate the contribution of the CBR system to their solution (i.e., the design of a sales promotion campaign) and how this relates to the objective contribution of the CBR system to the solution. That is, we want to know whether decision makers are able to recognize the "objective" impact of the CBR system on the quality of their solution and the efficiency of the design process. This comprehensive study (Study 3) investigates all five main research questions raised in Chapter 3 of this dissertation.

1. Does providing decision makers with analogies, by means of a CBR system, result in sales promotion campaigns of higher quality and does it make the design process more efficient?
2. What is the influence of the type of analogies offered to the decision maker? Should they come from the same problem domain (i.e., near analogies) or should they come from more distant domains (i.e., far analogies)?
3. What is the influence of the number of analogies offered to the decision maker? Are more analogies better?
4. In examining the effect of analogies, what is the role of decision maker characteristics? In particular, is the effect different for decision makers with different innate creative abilities?
5. What is the relationship between the decision maker's subjective evaluations of CBR system usage for designing a sales promotion campaign and the objective outcomes, i.e., solution quality and solution efficiency?

In addition, we will investigate whether information about the underlying process, such as CBR system usage time and the number and type of analogies that the decision maker has read and used, can give us more insight into the effects of the CBR system availability on the objective outcomes, i.e., the quality of the sales promotion campaigns and the efficiency of the design process, and the subjective evaluations.

This chapter is organized as follows. In section 7.2, we recapitulate the - for this study - relevant theory and hypotheses as discussed in Chapter 3. Next, we explain the methodology and measures applied in this study (see section 7.3). In section 7.4, we discuss the results of the analyses and this chapter ends with a conclusions and discussion section (see section 7.5).

7.2 Theory and Hypotheses

As depicted in Figure 7.1, in this comprehensive study we investigate the complete framework for explaining "how the use of a CBR system affects the quality of sales promotion campaigns, the efficiency of the design process, and its subjective evaluations" (as discussed in Chapter 3). For an elaborate discussion of the conceptual framework and its hypotheses, we refer the reader to Chapter 3.

In this framework, the dependent variables for assessing the success of CBR system are its *objective outcomes*, i.e., *solution quality* and *solution efficiency*, and its *subjective evaluations* (as perceived by the decision maker). As discussed in Chapter 3, with respect to solution quality, we look at the creativity of the sales promotion campaign, comprising both the novelty and the usability of the campaign (see Figure 7.1). We also examine the novelty and usability dimension of solution creativity separately, since these dimensions may be affected differently by the availability of the CBR system, the decision maker and the CBR system usage process. Moreover, we are interested in the effect of CBR system availability on the efficiency of the design process, which is measured by the solution time. Regarding the subjective evaluations of CBR system success, we distinguish the following aspects: the *perceived usefulness* of the CBR system for designing a sales promotion campaign, the *perceived impact* of the CBR system on the final solution, and the *attitude towards using MMSSs in general (after usage)* for enhancing marketing decision-making performance.

In brief, this framework to investigate the success of the CBR system for supporting the design of sales promotion campaigns basically consists of three elements: (1) characteristics of the CBR system (i.e., case-base *size* and *content*), (2) characteristics of the decision maker (i.e., *innate creative ability, attitude towards using MMSSs (before usage), gender, age,* and *education level*), and (3) characteristics of the decision-making process (i.e., system *usage time*, and *cases read* and *used*) (see Figure 7.1). These features or traits may directly or indirectly influence the solution.

We will now briefly discuss the main hypotheses that will be tested in this study. For an elaborate discussion on the variables and their relationships, we refer the reader the corresponding sections in Chapter 3. Part of this theory is also discussed in the previous empirical chapters (Chapter 5 and 6), but for reasons of readability we will briefly summarize the basic argumentation together with the main findings of the previous studies. Finally, it should be noted that the numbers of the hypotheses in this study correspond with the numbers of the hypotheses formulated in Chapter 3.

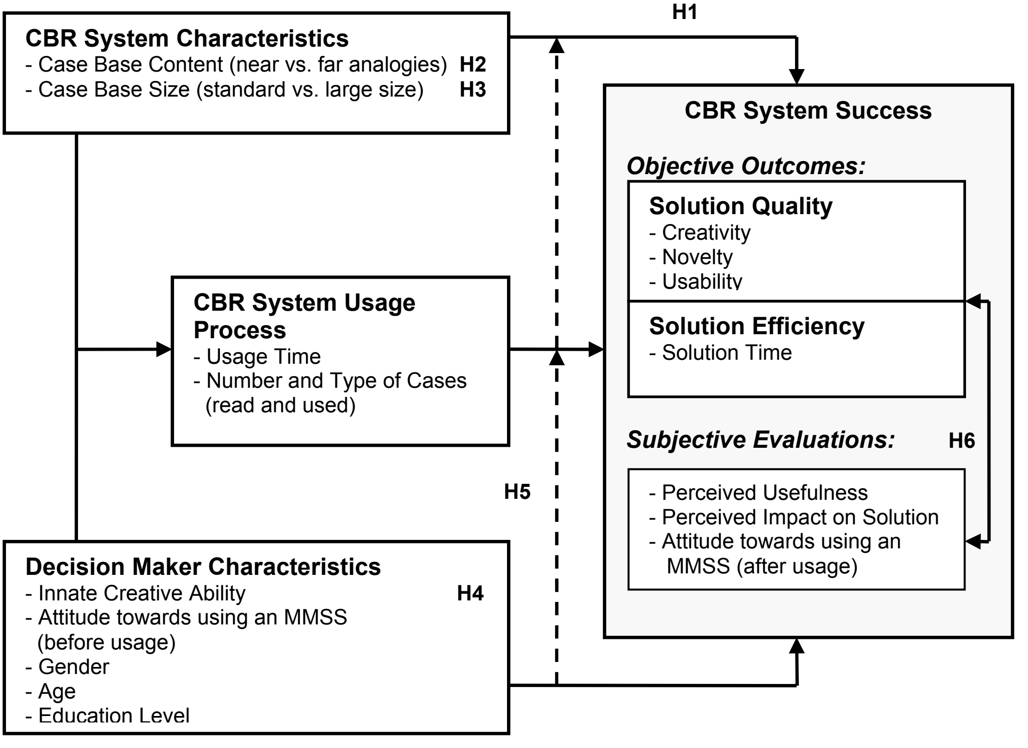

Figure 7.1 Framework of How the Use of a Case-Based Reasoning (CBR) System Affects the Quality of Sales Promotion Campaigns, the Efficiency of the Design Process, and its Subjective Evaluations (Study 3)

CBR System Availability versus No CBR System. The previous studies reported in this dissertation have yielded preliminary evidence that with the use of a CBR system (with analogies) decision maker design solutions of higher quality than without the use of such a decision aid. In Study 1 and 2, we found a positive main effect of CBR system availability on solution quality (i.e., compared to a no system condition (Study 1, Chapter 5) and an expert system condition (Study 2, Chapter 6)).

These findings are consistent with the theory and hypotheses outlined in Chapter 3 and previous empirical research (e.g., MacCrimmon and Wagner, 1994; Massetti, 1996), which has demonstrated that providing people with examples or analogies enhances the fluency aspect of creative thinking, resulting in the generation of significantly more ideas, including creative ones (i.e., the principle of "quantity breeds quality" (Rossiter and Lilien, 1994)).

The downside of providing people with examples could be the so-called "conformity effect" or "unconscious plagiarism", which may constrain creativity (e.g., Smith, Ward and Schumacher, 1993; Dahl and Moreau, 2002). However, results of studies by Marsh, Landau, and Hicks (1996) and Marsh, Bink, and Hicks (1999) suggest that when people are given examples they may indeed transfer or copy salient properties to the new design, but not necessarily at the expense of including novel elements.

A CBR system provides multiple ideas or examples to the decision maker, which may stimulate the generation of more ideas and/or can be used to form novel combinations. Hence, with respect to solution quality, our first hypothesis is that using previous campaigns as the basis for idea generation results in more creative solutions. Second, with respect to efficiency of the design process, we hypothesize that using or copying elements of previous sales promotion campaigns may result in efficient and usable solutions, since the designer can build on previous successes (and/or failures) and does not have to reinvent the wheel. Thus, in line with *Hypothesis 1* formulated in Chapter 3, we posit the following.

H1: Decision makers having a CBR system available a) will design sales promotion campaigns of higher quality (i.e., more creative campaigns) and b) will design them more efficiently (i.e., less time needed to design a campaign) than decision makers who do not have a CBR system at their disposal.

CBR System Content: Near Analogies versus Far Analogies. In Study 2, we found that decision makers who have a CBR system with far analogies at their disposal design more novel sales promotion campaigns than decision makers who have a CBR system with near analogies at their disposal. However, the distinction between near analogies and far analogies has no significant influence on the usability and overall creativity of the solution and also not on the efficiency of the design process.

Nonetheless, we argue that when the target problem and the base problem are more distant from each other, the analogy may not provide clear-cut solutions or specific courses of action but merely provide a framework for thinking about the target problem (Markman and Moreau, 2001). For near analogies, the differences between the base domain and the target problem are small. Near analogies share many surface attributes and many higher-order relations (i.e., literal similarities) (see subsection 2.3.4). Hence, useful features (or knowledge) can be easily identified and transferred from the base to the target in order to develop a solution effectively and efficiently.

In contrast, novel ideas will be triggered in particular by far analogies, which mainly share "deep, structural similarities". Far analogies are usually perceived as less obvious and more novel because of the amount of cognitive effort that is required to draw the analogy ("mental leaps", see Holyoak and Thagard, 1995). However, since transferring elements from more distant domains requires more cognitive effort, developing a solution will take more time.

In sum, we propose that using near analogies will foster efficiency and contribute mainly to the usability of the campaign (i.e., resulting in quick, usable solutions, but not necessarily very novel and creative ones), while the use of far analogies only will result in more novel campaigns (see Study 2) and - provided that the campaign is also useful - in more creative solutions. Thus, in line with *Hypothesis 2* formulated in Chapter 3, we expect the following.

H2: In comparison with a CBR system containing only *near analogies*, decision makers with a CBR system containing only *far analogies* a) will design sales promotion campaigns of higher quality (i.e., more creative campaigns), but b) will design them less efficiently (i.e., more time needed to design a campaign). More specifically, having a CBR system with *far analogies* available will result in c) more novel sales promotion campaigns, but d) less usable, compared to a CBR system with *near analogies*.

CBR System Size: Number of Cases in the CBR System. The relationship we propose between the number of analogies (or cases) in the CBR system and the quality of the solutions and the efficiency of their design is rather straightforward. First, the fact that there are more (and more diverse) cases in the CBR system increases the likelihood of finding a closely matching case (see Leake and Wilson, 2000). Second, a closely matching case needs less adaptation than a more discrepant case (see Rosenman, Gero, and Oxman, 1991; Leake and Wilson, 2000). This has consequences for both the quality of the solution and the efficiency of the design process.

Regarding the quality of the solution, we expect that the less adaptation is needed, the less uncertainty there will be with regard to the outcome (i.e., assuming all other things are equal). Hence, using or copying a previous, successful campaign will result in a usable sales promotion campaign. Furthermore, when there are more cases in the CBR system, the decision maker has the opportunity to take a broader range of possible solutions (or ideas) into consideration. We expect that the larger the variety of ideas that are considered and/or combined, the more novel and creative the final solution will probably be.

Using a CBR system with a larger number of cases will also improve the efficiency of designing a sales promotion campaign. The fact that a more closely matching case needs less adaptation will reduce the time needed to design a solution. That is, resolving the differences between the base and the target problem will require less time.

In sum, we hypothesize that the availability of a CBR system with a larger number of analogies will improve the quality of the sales promotion campaign (i.e., resulting in more creative campaigns) and will also enhance the efficiency of the design process (i.e., less adaptation is required and therefore less time will be needed to design a campaign). Thus, in line with *Hypothesis 3* formulated in Chapter 3, we conjecture the following.

H3: Decision makers having a CBR system with a larger number of analogies available a) will design sales promotion campaigns of higher quality (i.e., more creative campaigns) and b) will design them more efficiently (i.e., less time needed to design a campaign) than decision makers having a CBR system with a smaller number of analogies at their disposal.

Innate Creative Ability of the Decision Maker. The decision maker's innate creative ability comprises the ability to generate many, diverse ideas in response to a problem (i.e., divergent thinking) and the ability to work out this idea into a usable solution (i.e., convergent thinking) (Guilford, 1968, Torrance, 1974). From the widely used "Torrance Tests" perspective (see subsection 4.3.1), creative individuals are therefore supposed to be *fluent*, *flexible* and *original* in their ideation, as well as *elaborate* in working out their ideas (Guilford, 1968; Torrance, 1974).

We expect that decision makers with a high innate creative ability (i.e., profound in fluency, flexibility and originality (divergence) and elaboration (convergence) will design sales promotion campaigns of higher quality, i.e., more creative campaigns (which are both novel and usable). In Study 2, we were not able to find support for this hypothesis about the positive effect of innate creative ability on solution quality.

Notice that in Study 2 we do find a positive relation between creative ability and solution time (i.e., decreasing solution efficiency), but it is not significant. This finding suggests that highly creative decision makers need (or take) more time to work out a solution than decision makers with a low creative ability. However, since this effect is not significant, we will not formulate a directed hypothesis about the influence of innate creative ability on solution efficiency. Thus, in line with *Hypothesis 4* formulated in Chapter 3, we posit the following.

H4: Decision makers with a high innate creative ability will design sales promotion campaigns of higher quality (i.e., more creative campaign) than decision makers with a low innate creative ability.

Interaction between the CBR System and the Creative Ability of the Decision Maker. Hypothesis 4 refers to the main-effect of innate creative ability, and is not yet related to the effect of using a CBR system. Based on the outcomes of the previous study (Study 2), we expect that the contribution of a CBR system is largest when it compensates the decision maker for his weaknesses. The CBR system contains examples of past solutions to similar problems (analogies) and, therefore, may stimulate the decision maker's fluency and trigger ideas about what can be done (or should not be done) in the future. Hence, in line with the compensation theory, we expect that providing analogies (or examples) by means of a CBR system is particularly helpful for people that have difficulty generating many and novel ideas themselves, i.e., low creative decision makers. Thus, following the compensation theory (see section 3.7) and the empirical support so far (Study 1 and 2), it is probably easier to compensate low creative thinkers, by using a CBR system with analogies (or ideas), for their weakness with respect to idea generation than to reinforce the strength of highly creative thinkers (who are supposedly good at generating ideas). Thus, in line with *Hypothesis 5* formulated in Chapter 3, we expect the following.

H5: The effect of the availability of a CBR system on the quality of sales promotion campaigns (i.e., resulting in more creative campaigns) will be larger for decision makers with a low innate creative ability than for decision makers with a high creative ability.

Subjective Evaluations versus Objective Contribution of the CBR System to the Solution. In Study 1 and 2, we found that decision makers do not recognize the impact of the CBR system on the solution and seem to measure the impact of the CBR system by the time it takes them to design a solution, after the use of the CBR system.

These findings are in line with a recent study by Lilien et al. (2004) that has shown that what decision makers perceive (i.e., subjective impact) is not what they actually achieve (i.e., objective impact) by using a decision support system. In other words, decision makers have difficulties in recognizing (or acknowledging) the improvement in the objective decision outcome as a results of the use of a support system (see also McIntyre, 1982; Davis, 1989; Van Bruggen et al., 1996).

We expect this appropriation problem to be even more prominent when using analogical reasoning as a principle for decision support. People have difficulties in recognizing the influence of analogies on their decision process and outcomes (Markman and Moreau, 2001). The constraints that an analogy places on the decision options that are considered (and on the way they are evaluated) are placed by the nature of the analogy and not by some set of explicit, external evaluation criteria (Markman and Moreau, 2001). Hence, the analogy can have its effects without the decision maker acknowledging the true impact of the analogy,

since it will not be easy to grasp the precise factors that have established the representation of the target domain (Markman and Moreau, 2001).
Therefore, we expect that decision makers who use analogies, by means of a CBR system, in the process of designing a sales promotion campaign are not able to recognize the objective impact of CBR system usage on their final solution. More specifically, we expect that subjective evaluations of the CBR system are not related to the objective impact of the CBR system on the solution. Thus, in line with *Hypothesis 6* formulated in Chapter 3, we expect the following.

H6: There is no relation between the decision maker's subjective evaluations of the CBR system and the objective contribution of the CBR system to the solution.

7.3 Methodology and Measurement

In this section, we will deal with the particular methodological and measurement issues of this study. In subsection 7.3.1, we explain the task that has to be performed by the participants in this study. This subsection is followed by a description of the experimental conditions (see subsection 7.3.2). Next, we describe the participants and the data-collection procedure (see subsection 7.3.3). Finally, we discuss the measurement instruments and perform reliability and validity checks in subsection 7.3.4.

7.3.1 The Task

The participant's task is to write a 1-page proposal (+/- 500 words) for a sales promotion campaign that should boost brand loyalty and brand image, targeted at the "heavy-user" consumer segment of the well-known Dutch beer brand Grolsch. Moreover, the campaign has to be organized around the theme *live music*. This real-life briefing (see the brief description below) had actually been used for a campaign developed and executed in 2002 by the Grolsch marketing department.[51,52] The campaign proposal has to include a brief description and motivation of at least the following elements: (1) the basic idea behind the campaign, (2) sales promotion technique and execution, (3) supporting activities/ communication, and (4) an estimation of the costs (for an example of a solution, see Appendix 12b).

[51] The full version of the briefing can be found in Appendix 3. For a discussion of the generic task that is used in our empirical studies, we refer the reader to Chapter 4: section 4.2.2.
[52] The task is identical to the task used in Study 2 (Chapter 6).

Briefing Sales Promotion Campaign Royal Grolsch N.V.
"Live Music Campaign"

Goal: Design a promotional campaign that is based on 'Live Music' and connects to the Grolsch's brand values (e.g., self-conscious, active in life, supreme quality, tasteful, original and passionate). In addition, outline some ideas for communicating the campaign. A TV commercial and a (swing top) premium are among the possible options).

Keywords:	original, fun, functional, (live) music
Target group:	'heavy users'
Objectives:	enhance brand image and loyalty
Constraints:	- promotion applies to purchase of crates only (i.e., both 30cl and 45cl bottle crates) - no promotional items attached to the sides of the crate - the value of the promotional offer should preferably not exceed € 5 per crate (i.e. total of retail-price crate (€10) and the value of the promotional offer ≤ € 15)
Execution:	by Grolsch

7.3.2 The Experimental Conditions

To investigate the effectiveness of CBR under different conditions, we included the following six experimental conditions (see Figure 7.2).

Thus, in this experiment we again have a *CBR System* condition versus a *No CBR System* condition. In the no CBR system condition, we distinguish between the availability of an *Expert System (*i.e., a rule-based, SP technique recommendation system) or *No System* at all *(*i.e., only a SP technique inventory on paper). In the CBR system condition, we further manipulate *CBR System Content* (near analogies versus far analogies) and *CBR System Size* (i.e., 50 versus 100 cases) (see Figure 8.2). Since this study is about designing a sales promotion campaign for a fast-moving consumer good (FMCG), namely the Dutch beer brand Grolsch, we classify all FMCG cases as *Near Analogies* (i.e., coming from basically the same problem domain) and all non-FMCG cases as *Far Analogies* (i.e., coming from more distant domains).

This finally results in four CBR system content conditions (see Figure 7.2). That is, we have a CBR system with only *near analogies* (i.e., 50 FMCG cases) versus a CBR system with only *far analogies* (50 non-FMCG cases). Furthermore, we have two CBR systems with an equal *mix of near analogies and far analogies*. Regarding these two CBR systems with an equal mix of near and far analogies, we make a distinction between the *"standard size"* CBR system (containing 50 cases) and the *"large size"* CBR system (containing 100 cases).

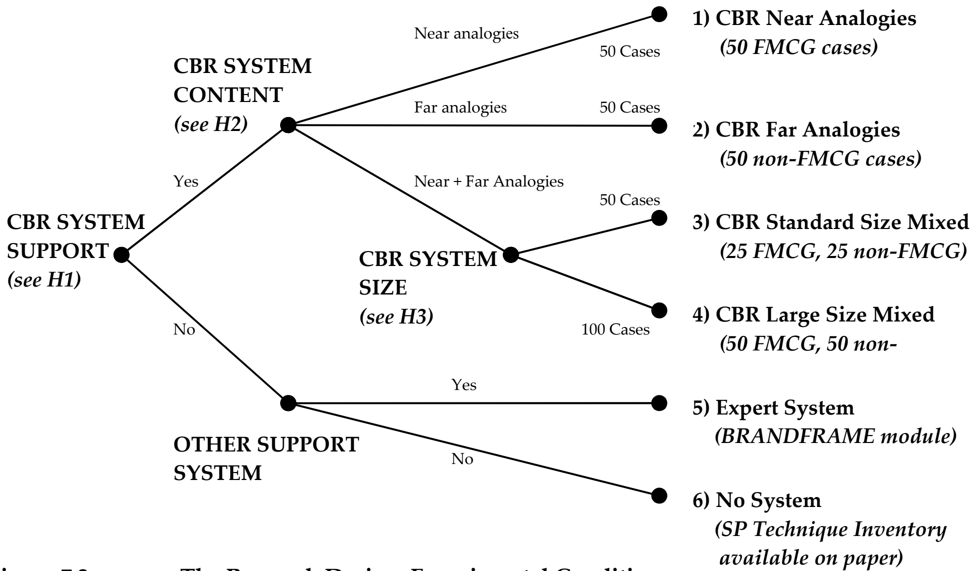

Figure 7.2 **The Research Design: Experimental Conditions**

The CBR Systems LEAPS. Within the *LEAPS* (*LE*arning *P*romotion *S*ystem) the participants can search for previous, similar campaigns using a large number of attributes related to the problem situation (e.g., campaign objectives and product category), the solution (e.g., campaign theme and sales promotion technique used) and even the desired outcome (e.g., response rate). For instance, the decision maker could search previous campaigns that had the same objective of increasing loyalty or had the same main theme of (live-) music, or a combination of both. The CBR system's output consists of a ranking of the ten most similar campaigns in its case-base, based on their similarity score with the input (i.e., the search query) provided by the system user. Participants are asked to make a screendump of their most helpful search query. The retrieved analogies may serve as a source of inspiration for generating novel ideas and/or elements (or parts) of these previous campaigns may be directly reused for designing a campaign for the new Grolsch campaign. Participants are asked to list the campaigns from the CBR system that they have read and also the ones that they have actually used (if any). For a detailed description of *LEAPS*, we refer the reader to subsection 4.2.3.

The Benchmarks. As a first benchmark we use an expert system, i.e., a rule-based Sales Promotion technique recommendation system (see subsection 4.2.4). Based on the campaign's goals (e.g., increase loyalty) and constraint (e.g., low implementation complexity) and their relative importance, the system's output consists of recommended sales promotion techniques in decreasing order of appropriateness (including a brief the description of the proposed SP technique). The second benchmark concerns a *no system* condition in which only an inventory with a brief description of possible SP techniques and is available (see Appendix 6). In all other conditions (i.e., conditions 1 to 5), the respondents have the same SP technique inventory at their disposal also.

7.3.3 Participants and Procedure

One hundred-and-twenty students participated in the experiment which took place in the Erasmus Behavioral Lab (EBL). The laboratory consists of 10 isolated cubicles equipped with fast, state-of-the-art, flat-screen computers. The respondents were randomly distributed over the six experimental conditions mentioned above. Because for most of the sessions not all ten cubicles were occupied (i.e., 120 participant distributed over 29 sessions), we could easily arrange that the experimental treatments were equally distributed over the sessions. The respondents were recruited among graduate and undergraduate students in marketing and marketing communication. The experiment was announced as a sales promotion design contest (to motivate the participant), in which the participants were asked to imagine that they were the creative director of a sales promotion agency and had to design an original campaign for Grolsch beer, and not to copy a previous Grolsch campaign. Furthermore, for participation in this three-hour experiment, each student received a compensation of 10 Euros per hour. Sixteen students participated for course credit[53], since for them this experiment was part of the course assignments of an elective on "Marketing Strategies and Marketing Intelligence in the Era of IT". For an overview of the data-collection procedure, see Table 7.1.

Of the 120 participants, 68% are men and 32% are women and the age of the respondents ranges from 19 to 30 years with a mean of 23. Age and gender are proportionally distributed over the experimental conditions (One-way ANOVA; $F_{age} = 0.323$, $p = 0.898$ and $F_{gender} = 0.327$, $p = 0.896$). 75% of the respondents are graduate students in marketing at either the university's faculty of Business Administration or at the faculty of Economics. The remaining 25% is undergraduate student either at one of those two faculties or studied marketing communication at an institution for higher education (HBO) (12 %).

[53] Since motivation (or situational involvement) is seen as key factor for creativity, in particular the influence of intrinsic versus extrinsic motivation (see Collins and Amabile, 1999), we checked for significant differences on the main dependent variables (creativity, novelty, usefulness and efficiency) between the voluntary (paid) participants ($n = 84$) and the obligatory (course credit) participants ($n = 16$). Since all "course credit" participants had to use a system because of educational reasons, we excluded the no system users ($n = 20$) from the "paid" group to make the two groups comparable. We do not find significant differences in solution quality or efficiency between the "paid" group and the "course credit" group (One-Way ANOVA: $F_{creativity} = 0.095$ ($p = 0.758$), $F_{novelty} = 0.463$ ($p = 0.498$), $F_{usability} = 0.003$ ($p = 0.955$), $F_{efficiency} = 0.028$ ($p = 0.867$)).

Table 7.1 Summary of the Data-Collection Procedure (Study 3)

Data-Collection Procedure
1. *Pre-questionnaires.* Before coming to the laboratory, the participants completed one questionnaire regarding their creative ability (i.e., the multiple-choice questionnaire, see subsection 4.3.1) and one questionnaire about their attitude towards using Marketing Management Support Systems ("before" measure, see Appendix 7).
2. *Creative Ability Test.* At the start of each three-hour laboratory session, the respondents collectively took a creative ability test (i.e., the ATTA-test, see subsection 4.3.1) and were randomly assigned to one of the 6 experimental conditions. The creative ability test consisted of 1 verbal task and 2 figural tasks. Administering this test took about 15 minutes in total.
3. *The Task.* After taking the ATTA creativity test, the participants were instructed to carefully read the assignment (see Appendix 2b), the campaign briefing (see Appendix 3) and a 2-page manual on how to use the Marketing Management Support System (except for the no system condition) (see Appendix 11a (CBR) and 11b (non-CBR System: Expert System). The remaining time could be used to finish the task. Computer log-files were kept of system usage time and total time worked on the task.
4. *Post-Questionnaires.* When ready, the participants were asked to save their campaign proposal on the computer and to fill in a questionnaire about their attitude towards using a Marketing Management Support System ("after" measure, see Appendix 7). Furthermore, the participants were asked to complete a questionnaire on their operating procedure (e.g., support tool usage time, number of cases read and number of cases used) and their evaluation of support tool usage (i.e., perceived impact and perceived usefulness of the support tool) (see Appendix 8a (CBR) and 8d (no CBR)). Finally, the participant was paid and could leave the laboratory.
5. *Judges and Ratings.* The 120 campaign proposals were coded (for an example of a solution, see Appendix 12b) and sent to three sales promotion expert judges who rated all campaign proposals (in random order) on three novelty-related items and four usability-related items (see Appendix 10c).

When signing up for the experiment, participants also had to complete a questionnaire regarding their attitude towards support system usage (before measure). After collectively taking the creative ability test, the participants were instructed to read the assignment carefully (see Appendix 2b), the campaign briefing (Appendix 3) and a 2-page manual on how to use the Marketing Management Support System (except for the no system condition) (see Appendix 11a (CBR) and 11b (non-CBR System: Expert System)). We note that the campaign briefing was exactly the same as the one used in Study 2. The remaining time could be used to work on the assignment using the available support. When the participant had finished the task, he was asked to save the SP campaign proposal on the computer and to complete two more questionnaires. One questionnaire concerned the attitude towards support system usage (after) and the other questionnaire concerned the perceived usefulness of the system and the self-reported process measures. After handing in the questionnaires, the participant was paid and could leave the laboratory.

After each three-hour session, all cubicles and materials were checked and the saved campaign proposals were collected on a central computer (and removed from the computers in the cubicles). Before sending them to the judges, all 120 proposals were coded and provided with the same lay-out (for an example of a solution, see Appendix 12b). Furthermore, all identifying information with respect to the person and the experimental condition was removed and a simple word count was performed to be able to correct for the influence of the length of the proposal (see subsection 4.3.5). The average length of the proposals is 530 words (which is approximately 1 A4, Times New Roman, size 12), with a minimum of 209 words and a maximum of 1149 words (SD = 181). There is no significant overall difference between the different experimental conditions in the average length of the proposals (One-Way ANOVA; F = 1.370, p = 0.241)[54]. The proposals were sent to three sales promotion experts in six randomized batches of 20 proposals (resulting in a unique order of proposals for each judge).[55]

7.3.4 Measures

Innate Creative Ability (ATTA-Test). Each three-hour session started with the participants collectively taking the Abbreviated Torrance Test for Adults© (ATTA) (Goff and Torrance, 2002). This test measures the fluency, flexibility, originality and elaboration facets of creative thinking by means of the respondent's *ability* to complete a verbal response task and two figural response tasks. To obtain valid, norm-referenced results, the experimenter has to read aloud the instructions from the manual (and the participant can read along in his test booklet) and allow exactly three minutes for completing each task. In total, the test takes about 15 minutes. For an elaborate discussion of the ATTA-test, we refer the reader to subsection 4.3.1.

[54] However, a post-hoc LSD test reveals a significant difference (p = 0.028) in length of proposals between the CBR system near analogies group (M = 464, SD = 148) and the no system group (M = 590, SD = 210).

[55] We did not find a batch (or order) effect for the ratings of the campaign proposals of the judges (One-Way ANOVA F-tests; for Judge 1: $F_{creativity}$ = 1.112 (p = 0.358), $F_{novelty}$ = 0.931 (p = 0.464), $F_{usability}$ = 1.400 (p = 0.229); for Judge 2: $F_{creativity}$ = 0.520 (p = 0.761), $F_{novelty}$ = 1.014 (p = 0.413), $F_{usability}$ = 0.745 (p = 0.592); and for Judge 3: $F_{creativity}$ = 0.600 (p = 0.700), $F_{novelty}$ = 0.315 (p = 0.299), $F_{usability}$ = 1.171 (p = 0.328)).

Following closely the scoring instructions in the manual (Goff and Torrance, 2002), the experimenter and a graduate student in psychology independently scored all 120 ATTA-tests on the fluency, flexibility, originality and elaboration dimension of creative thinking and the presence (or absence) of fifteen creativity indicators, such as "richness of imagery" and "conceptual incongruity". The inter-rater reliability coefficients (ICC's)[56] all proved to be sufficient and well above 0.8: creative ability level (0.97), creative ability index score (0.98), creativity indicator scores (0.85), total scaled score (0.96), elaboration (0.90), fluency (0.97), originality (0.88), and flexibility (0.95). These inter-rater reliabilities are consistent with the findings of Goff and Torrance (2000), who reported rater reliabilities in the range of 0.95 to 0.99. Hence, we combined the scores of the two raters into average ratings.

Table 7.2 Creativity Scores on ATTA-test: Sample (*n* = 120) and Population Means

Creativity Scores ATTA-test	*Population Mean (U.S.) (see subsection 4.3.1)*	*Sample Mean*	*Mean Difference (t-test)*	*Sign.*
Creativity Ability Level	M=4	M=4.7(SD=1.4)	t=5.724	p=0.000
Fluency	M=15 (SD≈2)	M=16.1 (SD=1.9)	t=6.105	p=0.000
Flexibility	M=15 (SD≈2)	M=15.8 (SD=1.8)	t=4.911	p=0.000
Originality	M=15 (SD≈2)	M=16.2 (SD=1.8)	t=5.724	p=0.000
Elaboration	M=15 (SD≈2)	M=15.7 (SD=2.2)	t=3.640	p=0.000

The resulting average creative ability level score (M = 4.7) in our sample is significantly higher than the US-based population mean on which the norm-references are based (see Table 7.2). These US-based population means are the following.

- *For the creative ability level:* 4 on a normalized scale from 1 to 7 (which corresponds with 26% of the population).
- *For the fluency, flexibility, originality and elaboration subscales:* 15 on a normalized scale from 11 to 19 (with standard deviations around 2) (which corresponds with 20% of the adult population) (see Goff and Torrance, 2002).

An explanation for the above average creativity scores could be the "upscale" character of our sample, which consists of graduate and undergraduate students

[56] Since this is a norm-referenced test, we used a conservative definition of the intra-class correlation coefficient (ICC), i.e. the two-way random effects model with *absolute agreement* (as opposed to requiring consistency only). A two-way mixed model assumes that both people effects (here: the ATTA-tests) and item effects (here: the raters) are random, meaning that every test is rated by each rater and that the raters are randomly selected from a larger population of possible raters. The absolute agreement definition includes the between measures variance in the denominator variance (while the consistency definition does not include this between measures variance).

only, and the positive relationship between intelligence and creativity. Previous research (see Amabile, 1983; Runco, 1990; Eysenck, 1994) has suggested that intelligence is a necessary condition for creativity (but not sufficient). For instance, a study by Minton and Schneider (1980) found a correlation of 0.5 between IQ (measured by a convergent thinking test) and creativity (measured by a divergent thinking test) for people with an IQ below 120 and a correlation of 0.2 for people with an IQ above 120. Runco and Albert (1985) even found a correlation of 0.85 between an achievement test score (high achievement was also associated with high IQ's) and divergent thinking indices for gifted children, i.e., a "high achievement-high originality" group. Hence, given our student sample with supposedly above average IQ's, a mean for creative ability that is above the normative population average seems reasonable. Besides, we are not so much interested in the absolute creativity levels as we are in the distribution of the creative ability scores over the experimental conditions and participants. There are no significant differences (F = 0.443, p = 0.818) in the *tested* creative ability level between the different system user groups (nor in their average scores on the fluency, flexibility, originality and elaboration subscales).

Innate Creative Ability (Self-Assessment). To check the convergent validity of the innate creative ability measure that was used in Study 2, we also let the participants in this study fill out the 56-item, multiple-choice, creative ability questionnaire (Abedi, 2000). Hence, before coming to the laboratory, the participants completed the creative ability questionnaire. This self-administered, multiple-choice questionnaire[57] is intended to measure the same four aspects of creative thinking as included in the abbreviated Torrance test (see Abedi, 2002).

1) Fluency, i.e., the ability to produce a large number of relevant ideas (17 items).
2) Flexibility, i.e., the ability to process information in different ways (13 items).
3) Originality, i.e., the ability to produce uncommon or totally new ideas (16 items).
4) Elaboration, i.e., the ability to embellish an idea with details (10 items).

For a more elaborate discussion on this self-assessed creative ability questionnaire, we refer the reader to subsection 4.3.1). For two respondents the questionnaires were incomplete and therefore treated as missing values (n = 118).

Adding the individual item scores (ranging from 1 = low to 3 = high) per construct results in total scores for fluency (17 items; M = 39.9, SD = 4.6), flexibility (13 items;

[57] The Abedi Test of Creativity (ATC©) is available upon request from the author Jamal Abedi (e-mail: jabedi@cse.ucla.edu).

M = 31.6, SD = 3.6), originality (16 items; M = 38.7, SD = 3.4), and for elaboration (10 items; M = 23.2, SD = 2.3). To calculate an overall creative ability score (56-items, theoretical scores ranging from 56 tot 168), we added the scores of the four subscales (Cronbach's α = 0.80). There are no significant differences (F = 1.908, p = 0.099) in the average *self-assessed* creative ability level between the different experimental conditions (and also not for the fluency, not for the flexibility, originality and elaboration subscales).

To check the convergent validity of this self-assessed creative ability measure (Abedi, 2002), which we used in our previous studies because the ATTA-test was not available at that time, we calculated the correlation coefficients between the two tests on the creative ability level and on the four subscales, viz. fluency, flexibility, originality and elaboration (see Table 7.3). As one can read from Table 7.3, the correlation coefficients among the corresponding constructs are all positive but small, ranging from a low 0.01 for flexibility to a significant 0.25 (α = 0.05) for originality. The sizes of these coefficient are comparable to the small, but significant correlation coefficients between the Torrance Tests (TTCT) and the self-assessed multiple-choice questionnaire (Abedi, 2002) found by Auzmendi et al. (1999) for a sample of 2264 Spanish high-school students (see subsection 4.3.1).

Table 7.3 Correlation Matrix: Creative Ability Test with Self-Assessment Method

Self-Assessed / ***ATTA-Test***	*1. Creative Ability Level*	*2. Fluency*	*3. Flexibility*	*4. Originality*	*5. Elaboration*
1. Creativity Ability Level	***.14***	.14	.08	.17	.00
2. Fluency	.14	***.14***	.13	.16	-.01
3. Flexibility	.04	.08	***.01***	.06	-.08
4. Originality	.21*	.15	.16	***.25****	.10
5. Elaboration	.10	.14	.03	*.10*	***.04***

* correlation is significant at the 0.05 level; n = 118

In the previous studies, we used the self-assessed creative ability questionnaire, since the ATTA-test was not available at that time. Although both tests for assessing the decision maker's creative ability are internally consistent and are positively correlated, they demonstrate limited convergent validity (Althuizen and Wierenga, 2006). In the remainder of this chapter, we will confine ourselves to discussing only the results for innate creative ability as measured by the ATTA-test. When we use the self-assessed questionnaire as a measure for innate creative ability in the (moderated) regression analyses (instead of the ATTA-test), we find comparable results. That is, the regression coefficients are, by and large, in the same direction, but less often significant. This suggests that the interaction effect for creative ability reported in the previous study (Study 2) is probably underestimated as a result of applying a less precise measure (with less predictive validity) for innate creative ability than the ATTA-test.

Attitude towards using MMSS (before and after). This questionnaire concerns the respondent's attitude towards using marketing management support systems for enhancing decision-making performance (Van Bruggen, 1993), measured by eight items on a 7-point Likert scale ranging from 1 (completely disagree) to 7 (completely agree)). For instance, "I think marketing decisions made using an MMSS will be better" (see Appendix 7 for the other items, and subsection 4.3.4 for a discussion). Two "before" questionnaires were returned incompletely and therefore treated as missing values (n = 118). The internal consistency of the scale is sufficient (Cronbach's $\alpha = 0.73$) to combine the individual item scores into an average scale score. There is no significant overall difference in the average attitude towards using MMSSs between the different system user groups before the experiment (One-way ANOVA, $F = 0.610$, $p = 0.692$). Overall, the participant's attitude towards using MMSSs before the experiment ($M = 4.8$, on a 7-point scale; $SD = 0.67$) is significantly above the scale's mid-point (one-sample test (test-value = 4), $t = 12.671$, $p = 0.000$), indicating an overall positive attitude towards MMSS usage for decision making. The internal consistency of the "after" measure is high (Cronbach's $\alpha = 0.88$). For further analysis of the "after" measure, we refer the reader to subsection 7.4.3.

Perceived Usefulness of the CBR System and Process Measures. The other questionnaire that the participants had to complete after the experiment concerned the perceived usefulness of the system (Cronbach's $\alpha = 0.94$ (six items, 7-point scale)) and a number of self-reported process measures (see Appendix 8a (CBR) and 8d (no CBR)). These process measure are: system usage time in minutes (also asked for in the no system SP technique inventory, i.e., how long the respondent had used the SP technique inventory) (single item), total time worked on the assignment in minutes (single item)[58], perceived impact of system usage on the final solution in

[58] Since time pressure is seen as an important determinant for the creativity of the output (see for example Moreau and Dahl, 2005; Burroughs and Mick, 2004), we also asked the respondent about the time pressure they perceived (on a 7-point Likert scale, ranging from 1 (far too little time) to 7 (far too much time)). All means are above the scale's midpoint, indicating that the participants felt that they, on average, had sufficient time to finish the assignment. Not surprisingly, the group who perceived the least perceived time pressure is the no system group. The mean score on perceived time pressure of this group does significantly differ from all other groups ($F = 3.514$, $p = 0.005$). The average score for the CBR system near analogies is 4.9 ($SD = 1.04$), for the CBR system far analogies 4.5 ($SD = 1.24$), for the CBR system standard size mixed 5.1 ($SD = 1.10$), for the CBR system large size mixed 4.7 ($SD = 1.08$), for the expert system 5.1 ($SD = 1.12$) and for the no system group 5.8 ($SD = 0.83$) which significantly differs from all other groups (post-hoc LSD tests). We did not find a significant correlation coefficient between perceived time pressure and the creativity of the solution ($r = -0.027$, $p = 0.771$), for novelty $r = -0.034$ ($p = 0.715$) and for usability $r = -0.016$ ($p = 0.860$). The correlation coefficient

percentages (single item), the sales promotion cases that were read and used (see Appendix 13 for an overview). In the benchmark conditions, we also asked for (1) usage time, (2) total time and (3) perceived impact of the expert system or SP technique inventory. In addition, we asked which technique the expert system or inventory suggested and which technique they eventually have chosen (see Appendix 14 for an overview). Finally, the CBR system users were asked to give a brief explanation if they had not used any of the cases provided by the CBR system (see Appendix 15 for an overview). For further analysis of these measures, we refer the reader to section 7.4.

Solution Quality. As in the previous studies, we measure the creativity of the solution on two dimensions, i.e., novelty and usability. Based on the feedback received from the judges on the measurement instrument that was used in the "pilot" study (Study 2), we fine-tuned and reduced the number of items for usability and measured all items on an 11-point scale (in line with the Dutch grading system from 0 (= lowest score) to 10 (= highest score)). In this study (Study 3), we also use three items for measuring the novelty dimension of the campaign, which are inspired by Besemer and O'Quin's (1986) Creative Product Semantic Scale (CPSS) (see literature overview Appendix 1b). Instead of asking for novelty (and originality in Study 2) directly, we use the following three items to measure the underlying novelty construct.

- The uniqueness of the campaign.
- The originality of the campaign.
- The degree of surprise in the campaign.

To measure the usability of the solution, we use five items that are based on Besemer and O'Quin's (1986) CPSS and Moreau and Dahl's (2005) scale for measuring the appropriateness of a design, and are meaningful in the context of the targets formulated in the Grolsch briefing (see Appendix 3).

- The effectiveness to increase the loyalty of heavy users.
- The fit of the campaign with the brand values of Grolsch.
- The attractiveness of the campaign for heavy users.
- The usefulness of the campaign for Grolsch.
- The willingness to accept the promotion by trade partners.

All items are rated on an 11-point, unipolar scale ranging from 0 (not at all) to 10 (excellent) (see Appendix 10c), which is consistent with the Dutch grading system at schools and universities. Following Amabile's (1983) consensual technique for creativity assessment (see Chapter 4), three sales promotion experts are asked to

between perceived time pressure and solution time is significant (r = -0.251, p = 0.006), meaning that the more time a respondent needed to work out a solution, the more he perceived that there was too little time to finish the assignment.

judge independently all 120 proposals on all eight items. Two expert judges come from different, renowned Dutch sales promotion agencies (see subsection 4.3.3). The other expert judge is the marketing manager in charge of the promotional activities for the Grolsch beer brand. He is also a recognized expert on sales promotions and acted several times as the chairman of the jury for the annual Dutch sales promotion awards.

Table 7.4 Item Analyses within Judges (Factor Analyses and Reliability)

Scale Items *Rater*	*Judge 1*	*Judge 2*	*Judge 3*
	Factor Loadings	***Factor Loadings***	***Factor Loadings***
Novelty of the Campaign (Factor 1 [a,b]***)***			
1. Originality	*.92*	*.92*	*.92*
2. Surprise	*.85*	*.92*	*.88*
3. Uniqueness	*.87*	*.88*	*.80*
Variance Explained	***40,4%***	***45.6%***	***42.4%***
Cronbach's Alpha	***.90***	***.97***	***.91***
Usability of the Campaign (Factor 2 [a,b]***)***			
4. Effectiveness to Increase Loyalty	*.89*	*.94*	*.91*
5. Usability for Grolsch	*.79*	*.83*	*.58*
6. Fit with Brand Values	*.68*	*.64*	*.58*
7. Attractiveness for Heavy Users	*.89*	*.92*	*.91*
Variance Explained	***36,2%***	***45.1%***	***36.6%***
Cronbach's Alpha	***.86***	***.94***	***.86***
Total Variance Explained	***76.6%***	***90.7%***	***79.0%***
Creativity of the Campaign:			
Overall Cronbach's Alpha	***.86***	***.95***	***.91***
(including all novelty and usability items, 1 dimension)			

[a] All items have no loadings on the other factor > 0.50, except for the "fit" item of Judge 2 which has a loading of 0.61 on the novelty factor as well as the "usability" and "fit" items for Judge 3 (0.58 and 0.53, respectively); [b] Rotated Solution (Varimax); n = 120

Based on the factor analyses and reliability analyses within judges (see Table 7.4), one item was removed from further analysis, namely "willingness to accept the sales promotion by trade partners". This item seems to belong neither to the usability construct nor to the novelty construct. Trade partner acceptance is clearly something that is the result of negotiations with third parties and thus beyond the control of the sales promotion agency and the company. Hence, it does not influence judgments of the intrinsic novelty or usability of the campaign proposal. The remaining four usability-related items and the three novelty-related items exhibit sufficient unidimensionality and reliability (within judges, see Table 7.4) to combine the individual item scores into one novelty rating and one usability rating per judge.

Next, the averaged novelty and usability scores are used to assess the level of consensual agreement among judges regarding the creativity of the campaign proposals (see Amabile, 1983). As can be seen in Table 7.5, all correlations coefficients between the judges' ratings are significant (mean inter-rater correlations: $r_{\text{creativity}} = 0.38$; $r_{\text{novelty}} = 0.33$; $r_{\text{usability}} = 0.40$). The correlation coefficients between the ratings of Judge 2 and the ratings of the other two judges are significant, but smaller than among the other judges (mean inter-rater correlations: $r_{\text{novelty}} = 0.33$, $r_{\text{usability}} = 0.40$).

The (alpha[59]) inter-rater reliability coefficients[60] for novelty ($\alpha = 0.57$) and usability ($\alpha = 0.66$) are sufficient and comparable to the coefficients reported in some similar studies (see Table 4.11). This difference is probably due to the heavier workload for the rating task in this study. The level of inter-rater reliability is found to be inversely related to the effort required of judges (Amabile, 1983). As a result of judge fatigue and the difficulty to maintain consistent criteria (Amabile, 1983), the inter-rater reliabilities will be considerably lower for tasks that require more effort. For instance, Amabile (1983) reported a mean inter-rater correlation of only 0.21 for fifteen artist judges who had to rate 95 collages on 16 dimensions, a task which approximately took them 4 hours. Given the highly demanding task for the judges in this study, i.e., judging 120 proposals on 7 items (which took them approximately 12 hours) and the different backgrounds and perspectives of our judges (e.g., company versus agency perspective), we believe that the mean inter-rater correlation (for the 7 items) of 0.31 is acceptable. This is also supported by the higher level of inter-rater reliability found in the pilot study (Study 2: $\alpha = 0.79$ for novelty and $\alpha = 0.76$ for usability, see Chapter 6). In that study, we used exactly the same task and the same judges, but the workload was much smaller (i.e., judging 23 proposals instead of 120). We note that we did not find a batch or order effect for the rating of the campaign proposal, see footnote 55.

[59] The intra-class correlation coefficient is algebraically equivalent to the alpha coefficient when there is only one rating variable and the judges' ratings are to be averaged to produce a composite rating (i.e., if we are interested in the question how reliable, or internally consistent, the judges' ratings are as a whole).

[60] Intra-class correlation coefficient (ICC): two-way random effects model, consistency definition.

Table 7.5 Correlation Matrix of SP Campaign Ratings Judges*

*Ratings**	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Novelty (Judge 1)	-								
2. Novelty (Judge 2)	***.27***	**-**							
3. Novelty (Judge 3)	***.43***	***.29***	-						
4. Usability (Judge 1)	*.48*	.22	.23	-					
5. Usability (Judge 2)	.27	*.71*	.24	***.49***	**-**				
6. Usability (Judge 3)	.29	.21	*.66*	***.43***	***.27***	-			
7. Creativity (Judge 1)	*.82*	.28	.37	*.90*	.46	.43	-		
8. Creativity (Judge 2)	.29	*.92*	.28	.39	*.93*	.26	***.40***	-	
9. Creativity (Judge 3)	.40	.27	*.92*	.36	.27	*.91*	***.43***	***.30***	-

* all correlations are significant at the 0.05 level; n = 120

Hence, the ratings of the three judges were combined into one average novelty rating and one average usability rating for the campaign proposals. For the overall creativity rating of the campaign proposals, we first combined the novelty rating and usability rating into an average creativity score per judge. Finally, we took the average of the three judges as the overall creativity rating for the sales promotion campaign proposal (with an inter-rater reliability of 0.63 for the composite creativity ratings of the three judges).

7.4 Results

This section is organized as follows. In subsection 7.4.1, we deal with the main effects of CBR system availability, i.e., CBR system versus no system, near analogies versus far analogies, and a large size case-base versus a standard size case-base. Next, we analyze and discuss the moderating role of the decision maker's innate creative ability (see subsection 7.4.2.). Finally, we investigate the relation between the decision maker's subjective evaluations of the CBR system and its objective contribution to the solution (see subsection 7.4.3).

Before testing our main hypotheses regarding CBR system availability, we investigated whether we could aggregate the two benchmark groups, i.e., the expert system group (n = 20) and the no system group (n = 20), into one group (n = 40) in order to gain more statistical power in testing the effect of CBR system availability versus no CBR system. Therefore, we performed a t-test to check for the equality of means on the main dependent variables, i.e., solution quality and solution efficiency. We do not find significant differences between the two groups on solution creativity (t = -0.124; p=0.902), solution novelty (t = -0.523; p = 0.604), solution usability (t = -0.362; p = 0.719) and solution efficiency (t = 1.146; p = 0.259). Hence, in our regression analyses we combined the two groups into one *no CBR system* benchmark group (n = 40), unless explicitly mentioned otherwise. We note that if we have a directed hypothesis, we will use a one-sided test (α = 0.05)

(p_+=one-sided positive and p_-=one-sided negative). The other reported p-values in the following subsections are two-sided.

7.4.1 Main Effects of CBR System Availability

Solution Quality: CBR System Availability versus No CBR System. Regarding solution quality, which is measured by the creativity of the campaigns (i.e., the composite of their novelty and usability ratings), the sales promotion campaign proposals score on average significantly (t = 16.254, p = 0.000) above the mid-point of the rating scale (M = 5.96, SD = 0.65, on a scale from 0-10). The average solution quality score in this study is comparable to the average score of 4.04 on a 7-point scale in the pilot study (Study 2, see 6.4.1), which amounts to an average score of 5.77 converted to scale from 0 to 10.

In order to test our first hypothesis (*H1a*) regarding the main effect of *CBR system availability* versus *no CBR system* on the quality of the solution, we performed a multiple regression analysis. The regression model includes: (1) a dummy variable for the availability of a CBR system (1 = CBR system, 0 = benchmark), (2) the decision maker's creative ability (i.e., ATTA-score creative ability level, scale 1-7) and (3) a number of covariates (i.e., age, gender (1 = female, 0 = male), education level (0 = undergraduate level, 1 = graduate level) and length of the proposal (i.e., number of words).

We find a significant positive effect of CBR system availability (b = 0.152, p_+ = 0.041) on the creativity of the campaign proposal (see Table 7.6), which supports the first part of our hypothesis *H1*. Interestingly, the creative ability of the decision maker does not have a significant direct effect on the creativity of the outcome (b = 0.044, p_+ = 0.313). We will further investigate the hypothesized positive effect of creative ability (*H4*) on solution quality in subsection 7.4.2.

Regarding our covariates, we find significant effects for gender (b = -0.160, p = 0.037), education level (b = 0.247, p = 0.010) and length of the campaign proposal (b = 0.267, p = 0.003). The fact that women develop less creative campaigns than men may be due to the nature of the task, i.e., developing a sales promotion campaign for (heavy users of) beer. In the literature, there is evidence that girls are, in general, more creative than boys (see, for example, Stephens, Karnes, and Whorton, 2001), which is also true in our sample for the average scores on creative ability as measured by the ATTA-test (M_{women} = 5.18 versus M_{men} = 4.50; $F_{\text{difference}}$ = 6.775, p = 0.010). However, for this specific task the men clearly outperformed the women regarding the creativity of the solution (M_{women} = 5.76 versus M_{men} = 6.05; $F_{\text{difference}}$ = 5.348, p = 0.022). Education level (i.e., undergraduate versus graduate in marketing and communication) can be regarded as a proxy for the degree of marketing knowledge and experience and general intelligence of the decision maker, which may have an impact on the creativity of the outcome (see, for example, Amabile 1983; Sternberg and Lubart 1992). Finally, the significant effect of the length of the proposal on the creativity ratings of the judges is in line with the findings of Lilien et al. (2004). From a Torrance Test perspective, we can argue that the amount of detail (i.e., elaboration) is a vital component of the creativity of a response (see Guilford, 1968; Torrance, 1974). Hence, assuming that each word is used to elaborate on the campaign idea, the more words the proposal contains, the more detailed it is and thus the higher the (perceived) creativity of the solution.

Table 7.6 Regression of Solution Quality: CBR System Availability vs. No CBR System

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	5.574	-	6.002	0.000
CBR System Characteristics				
- CBR System Availability (dummy)	0.207	0.152	1.762	0.041⁺
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	0.021	0.044	0.489	0.313⁺
Covariates				
- Gender (0=male, 1=female)	-0.221	-0.160	-1.805	0.037
- Age	0.007	0.021	0.222	0.824
- Education Level	0.368	0.247	2.619	0.010
- Length of Campaign Proposal	0.001	0.267	3.083	0.003
	R^2_{adj}=0.16	**F=4.799**	**(p=0.000)**	

* Intercept represents both benchmark conditions; ⁺ one-sided test; n = 120

Solution Efficiency: CBR System Availability versus No CBR System. The second part of our first hypothesis concerns the effect of CBR system availability on the efficiency of designing a sales promotion campaign. Solution efficiency is defined as the "time needed to work out a solution" and is measured by the residual *solution time*, i.e., by subtracting the "time that the respondent has worked with the available support tool" from the "total time worked on the task" (see subsection 4.3.3). After correcting total time for support tool usage time, the participants on average needed 90 minutes (*SD* = 36) to work out a campaign design. That is, in total the participants spent on average 122 minutes (*SD* = 33) working on the task, of which on average 32 minutes (*SD* = 29) were used for working with the available support tools (i.e., the CBR systems, the expert system or the SP technique inventory on paper)[61]. The decision makers in the CBR system conditions on average needed 85 minutes (*SD* = 37) to work out a campaign proposal, whereas the decision makers in the "no CBR system" conditions on average needed 101 minutes (*SD* = 33).

Table 7.7 Regression of Solution Efficiency: CBR System Availability vs. No CBR System

Dependent Variable	*Solution Time*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	80.41	-	1.464	0.146
CBR System Characteristics				
- CBR System Availability (dummy)	-12.50	-0.163	-1.801	0.037+
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	-0.074	-0.003	-0.030	0.976
Covariates				
- Gender (0=male, 1=female)	-0.58	-0.008	-0.081	0.936
- Age	-0.46	-0.023	-0.233	0.816
- Education Level	-0.52	-0.006	-0.063	0.950
- Length of Campaign Proposal	0.06	0.273	2.995	0.003
	R^2_{adj}=**0.07**	*F*=**2.438**	**(*p*=0.030)**	

* Intercept represents both benchmark conditions; + one-sided test; *n* = 120

To test the second part of our first hypothesis (*H1b*) regarding the efficiency of designing a solution, we included the same independent variables as for solution quality in the regression analysis (see Table 7.7). The results of the multiple regression analysis show that CBR system availability significantly reduces (*b* = -0.163, *p*+ = 0.037) the time needed for working out the sales promotion campaign proposal (see Table 7.7), which supports the second part of our hypothesis *H1*. Next to CBR system availability, the length of the campaign proposal has also a

61 All self-reported measures. Due to technical problems, we could only retrieve 42 valid observations from the log-files for system usage time and 109 valid observations for total time worked on the assignment. The correlations between the self-reported time and the registered time are high and significant both for total time and system usage time, *r* = 0.86 (*p* = 0.000, *n* = 109) and *r* = 0.82 (*p* = 0.000, *n* = 42), respectively. In the analyses for solution efficiency, we will therefore use the self-reported measures.

significant effect (b = 0.273, p = 0.003) on solution efficiency. That is, the more words the campaign proposal contains, the more time that is needed to work out the proposal (including writing it down).
Given these positive findings for *CBR system availability* versus *no CBR system*, we will now compare the results for the different treatments within the CBR system availability condition. First, we will compare and test the difference between the availability of only near analogies versus only far analogies and, second, the availability of a larger number of cases versus the standard number of cases.

Solution Quality: CBR System Content: Near Analogies versus Far Analogies. To test the hypothesis regarding the effect of providing near analogies versus far analogies on solution quality, we compared both CBR system user groups in a regression analysis. For this analysis, we thus included the *CBR system near analogies* and the *CBR system far analogies* groups only (n=40). The regression equation includes a dummy variable for the availability of a CBR system with far analogies only, the decision maker's innate creative ability and the covariates (see Table 7.8).

Table 7.8 Regression of Solution Quality (Creativity): Near Analogies vs. Far Analogies

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	6.338	-	4.950	0.000
CBR System Characteristics				
- CBR System Far Analogies (dummy)	-0.295	-0.264	-1.602	0.060+
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	-0.031	-0.076	-0.452	0.654
Covariates				
- Gender (0=male, 1=female)	-0.166	-0.132	-0.722	0.476
- Age	-0.040	-0.116	-0.689	0.496
- Education Level	0.386	0.316	1.638	0.111
- Length of Campaign Proposal	0.001	0.316	2.084	0.045
	R^2_{adj}=0.17	**F=2.296**	**(p=0.058)**	

* Intercept represents the CBR System Near Analogies condition; + one-sided test; n=40

Contrary to our expectation (*H2a*) that decision makers who have only far analogies at their disposal will develop more creative campaigns, we find a negative effect on the creativity of the sales promotion campaign proposal for the CBR system with far analogies only (*b* = -0.264, p_{-}= 0.060) (i.e., relative to the CBR system near analogies condition) (see Table 7.8). Hence, we do not find support for the first part of hypothesis *H2* concerning the positive effect of far analogies on solution creativity (p_{+} = 1 - p_{-}= 0.940).

Next, we investigate the effect of far analogies versus near analogies on the two dimensions of solution creativity separately, i.e., solution novelty and solution usability (*see H2c and H2d*). For both dimensions, we find a negative coefficient for the availability of a CBR system with far analogies only, i.e., the standardized regression coefficient *b* for novelty is -0.263 (p_{-} = 0.058) and for usability -0.202 (p_{-} = 0.121) (see Table 7.9 and 7.10, respectively). As opposed to the marginally significant negative effect of far analogies on the novelty of the solution (*H2c: positive effect; b* = -0.263, p_{+} = 0.942), the negative coefficient regarding the usability of the solution (*b* = -0.202, p_{-} = 0.121) is in line with hypothesis *H2d*. That is, we expected that decision makers who have a CBR system with far analogies available would design less usable campaigns (i.e., relative to decision makers who have a CBR system with near analogies at their disposal). However, as can be seen in Table 7.10, the effect on usability is not significant (p_{-} = 0.121).

Table 7.9 Regression of Solution Quality (Novelty): Near Analogies vs. Far Analogies

Dependent Variable	*Novelty of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	6.437	-	3.824	0.001
CBR System Characteristics				
- CBR System Far Analogies (dummy)	-0.331	-0.263	-1.617	0.058+
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	-0.093	-0.204	-1.228	0.228
Covariates				
- Gender (0=male, 1=female)	-0.013	-0.009	-0.051	0.960
- Age	-0.005	-0.012	-0.072	0.943
- Education Level	0.300	0.219	1.150	0.259
- Length of Campaign Proposal	0.002	0.414	2.757	0.009
	R^2_{adj}=**0.19**	*F*=**2.479**	**(*p*=0.043)**	

* Intercept represents the CBR System Near Analogies condition; + one-sided test; *n* = 40

To conclude, we do not find support for our hypothesis regarding the positive effect of far analogies on the creativity and novelty of the solution. That is, relative to a CBR system with only near analogies, the effect on solution creativity and novelty is marginally significant, but in the opposite direction (i.e., negative). An explanation for this finding could be that for most marketing students it may be difficult to see the analogy when the base and target are very distant from each other. As a result, the availability of a CBR system with only far analogies could fail to lead to the design of more novel and usable (i.e., more creative) sales promotion campaigns.

Table 7.10 Regression of Solution Quality (Usability): Near Analogies vs. Far Analogies

Dependent Variable	*Usability of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	7.781	-	4.340	0.000
CBR System Characteristics				
- CBR System Far Analogies (dummy)	-0.260	-0.202	-1.193	0.121+
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	0.031	0.067	0.389	0.700
Covariates				
- Gender (0=male, 1=female)	-0.345	-0.240	-1.269	0.213
- Age	-0.075	-0.190	-1.098	0.280
- Education Level	0.471	0.336	1.693	0.100
- Length of Campaign Proposal	0.001	0.146	0.937	0.355
	R^2_{adj}=0.12	**F=1.855**	**(p=0.119)**	

* Intercept represents the CBR System Near Analogies condition; + one-sided test; n = 40

Solution Efficiency: CBR System Content: Near Analogies versus Far Analogies. Regarding solution efficiency, we find that the availability of a CBR system with only far analogies results in higher solution times (b = 0.321, p_+ = 0.033, see Table 7.11). That is, decision makers having a CBR system with only far analogies at their disposal need more time to work out a solution, which supports hypothesis *H2b*. Recognition of a near analogy and knowledge transfer from the base to the target is easier and faster, because similarities between the base domain (i.e., the retrieved sales promotion campaign) and the target domain (i.e., the new campaign) already exist on a superficial level. Thus, there is no (or less) need to work through abstract, structural similarities between both campaigns and translate them into actionable attributes and concepts. Again, for relative novices in the domain of sales promotions, such as marketing students, it may be difficult to see the analogy when the base and target are more distant (in the case of far analogies).

Table 7.11 Regression of Solution Efficiency: Near Analogies vs. Far Analogies

Dependent Variable	*Solution Time*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	157.056	-	1.742	0.091
CBR System Characteristics				
- CBR System Far Analogies (dummy)	20.942	0.321	1.912	0.033+
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	-0.053	-0.002	-0.013	0.990
Covariates				
- Gender (0=male, 1=female)	14.889	0.204	1.089	0.284
- Age	-4.996	-0.249	-1.450	0.157
- Education Level	13.138	0.185	0.939	0.355
- Length of Campaign Proposal	0.079	0.356	2.297	0.028
	R^2_{adj}=**0.13**	*F*=**1.977**	**(*p*=0.097)**	

* Intercept represents the CBR System Near Analogies condition; + one-sided test; $n = 40$

To gain more insight into the unexpected effects for the CBR system with far analogies, which clearly contradict the findings of Study 2, we can take a look at the process variables "number of cases read" and "number of cases used" (see also Table 7.14). We find no significant difference between the average number of cases *read* ($t = 0.405$, $p = 0.688$) between the two types of CBR systems, i.e., 4.6 ($SD = 2.1$) cases and 4.3 ($SD = 2.6$) cases read for the CBR system near analogies and the CBR system far analogies, respectively. However, if we look at the average number of cases *used*[62], then the difference is significant ($t = 2.096$, $p = 0.043$), i.e., 1.3 ($SD = 0.9$) cases and 0.6 ($SD = 1.0$) cases used for the CBR system near analogies and the CBR

[62] "Case used" means that the respondent directly transferred an idea or element from that case and provided a reference to the used case(s) in their campaign proposal. All references to previous cases were removed from the campaign proposals before sending them to the judges.

system far analogies, respectively. This finding suggests that decision makers who have the CBR system with only far analogies at their disposal do indeed not (immediately) see the applicability or usability of the retrieved analogies, as opposed the users of the CBR system with near analogies only.

Because of these results, which are different from Study 2, we collected new data for the CBR system far analogies condition only and compared this additional CBR system far analogies user group (n = 22) with the CBR system near analogies user group from the comprehensive study (n = 20). The results are consistent with the findings reported in this study. In fact, the detrimental effects of the CBR system with far analogies on solution quality (b = -0.376, p_+ = 0.980) and solution time (b = 0.307, p_+ = 0.028) are even stronger (see Appendix 16C). Hence, the findings reported here clearly contradict the beneficial effects reported in the previous chapter (Study 2). As a result of the small number of observation per condition in Study 2 (n = 8 for far analogies and near analogies), the impact of one exceptional observation in a condition could have a big impact on the average solution quality for that condition. The best, outstanding campaign in Study 2 was designed in the CBR system far analogies condition, which is likely to have positively biased our results in favor of the CBR system with far analogies.

This leads us the provisional conclusion that the availability of a CBR system with only far analogies does not lead to more novel and creative sales promotion campaigns. The effects of the CBR system with far analogies on solution usability (i.e., less usable campaigns relative to a CBR system with near analogies) and on solution efficiency (i.e., far analogies take more time) are in line with our hypotheses H2b and H2d (see also Appendix 16c). Again, a logical explanation for these finding is that for most marketing students it may be difficult to see the analogy when the base and target are quite distant from each other. As a result, the availability of a CBR system with only far analogies could fail to lead to the design of more novel and creative sales promotion campaigns and result in higher solution times and less usable solution compared to the decision makers who have a CBR system with near analogies at their disposal.

Solution Quality:CBR System Size: Standard Size versus Large Size. Below, we test the hypothesis regarding the effects of providing a CBR system with a larger number of cases versus a CBR system with the standard number of cases on solution creativity and solution efficiency. Thus, for the analysis we included only the *CBR system standard size* and the *CBR system large size* groups (n = 40). The regression model includes a dummy variable for the availability of the large size CBR system, the decision maker's innate creative ability and the covariates (see Table 7.12).

From the results of the regression analysis, we may conclude that the availability of a large size CBR system increases (b = 0.316, p_+ = 0.017, see Table 7.12) the creativity of the campaign proposal relative to the standard size CBR system, which supports the first part of our hypothesis *H3*. If we run the regression analysis for the two dimensions of creativity separately (results not shown here, see Appendix 16a), then we find a large standardized regression coefficient for the effect of the availability of a large size CBR system on the usability of the solution (b = 0.329, p_+ = 0.016). This suggests that decision makers are able to retrieve more closely matching cases than for the standard size CBR system. For the novelty of the solution, the standardized regression coefficient is also positive and marginally significant (b = 0.235, p_+ = 0.067). Hence, decision makers also might benefit from the larger variety of cases in the large size CBR system in terms of the novelty of their solution.

Table 7.12 Regression of Solution Quality: Large Size vs. Standard Size

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	4.875	-	2.873	0.007
CBR System Characteristics				
- CBR System Large Size Mixed (dummy)	0.423	0.316	2.209	0.017+
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	0.020	0.038	0.268	0.790
Covariates				
- Gender (0=male, 1=female)	-0.320	-0.228	-1.585	0.123
- Age	0.078	0.178	1.222	0.230
- Education Level	0.736	0.440	2.919	0.006
- Length of Campaign Proposal	0.000	0.062	0.422	0.676
	R^2_{adj}=0.30	**F=4.799**	**(p=0.006)**	

* Intercept represents the CBR System Standard Size condition; + one-sided test; n = 40

Solution Efficiency: CBR System Size: Standard Size versus Large Size. With respect to the efficiency of designing the campaign proposal, we do not find a significant effect for CBR system large size availability (b = -0.117, p_-= 0.253, see Table 7.13). We expected that having a CBR system with a large number of cases would increase the probability of finding a closely matching case and, therefore, less adaptation and time is needed for designing a campaign (see *H3b*). The sign of the coefficient is in the hypothesized direction (i.e., less time needed to work out a solution), but the effect is not significant.

Table 7.13 Regression of Solution Efficiency: Large Size vs. Standard Size

Dependent Variable	*Solution Time*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	20.643	-	0.174	0.863
CBR System Characteristics				
- CBR System Large Size Mixed (dummy)	-9.009	-0.117	-0.674	0.253⁺
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	0.186	0.006	0.037	0.971
Covariates				
- Gender (0=male, 1=female)	-13.381	-0.166	-0.984	0.350
- Age	1.211	0.048	0.273	0.786
- Education Level	-25.136	-0.261	-1.428	0.163
- Length of Campaign Proposal	0.043	0.228	1.274	0.211
	R^2_{adj}=-0.04 (R^2=0.121)	**F=0.759**	**(p=0.607)**	

* Intercept represents the CBR System Standard Size condition; ⁺ one-sided test; n = 40

Table 7.14 Cases Read and Used: Average Number of Cases per Type of CBR System

Process Data	*Cases Read*	*Cases Used*	*Near Read*	*Far Read*	*Near Used*	*Far Used*
CBR near analogies (50)	4.60	1.25	4.60	-	1.25	-
CBR far analogies (50)	4.30	0.60	-	4.30	-	0.60
CBR standard size mixed (50)	4.40	1.00	2.75	1.65	0.80	0.20
CBR large size mixed (100)	3.30	0.95	2.35	0.95	0.85	0.10
Total	4.15	0.95	3.23	2.30	0.97	0.30
F-test (ANOVA) Between Group Differences	**1.028 (p=0.385)**	**1.337 (p=0.269)**	-	-	-	-

n = 80

If we look at the average number of cases read and used (see Table 7.14), then we see that the respondents who had the large size CBR system at their disposal (have to) read fewer cases (M = 3.30, SD = 2.4) than respondents who had the standard size CBR system at their disposal (M = 4.40, SD = 3.1), although the difference is not statistically significant (t = -0.216, p = 0.108; one-sided t-test). The users of the standard size CBR system read about as many cases as for the other two CBR systems containing 50 cases, i.e., the CBR system with only near analogies (M = 4.6, SD = 2.1) and the CBR system with only far analogies 4.3 (SD = 2.6).

It is also noteworthy that decision makers who have a CBR system available that contains both type of cases, read and use significantly fewer far analogies (M_{far_read} = 1.30 (SD = 1.57) and M_{far_used} = 0.15 (SD = 0.43)) than near analogies (M_{near_read} = 2.55 (SD = 1.77) and M_{near_used} = 0.83 (SD = 0.98))[63] (paired sample t-tests (n = 40): t = 4.241, p = 0.000 for cases read; t = 3.984, p = 0.000 for cases used). Hence, when it comes to actually using a case, it is far more likely that people will use a near analogy, unless they have no alternative (i.e., when the CBR system contains only far analogies). Again, for our student population (i.e., novice marketing managers) it may too far-fetched to grasp the analogy when the base and target are quite distant from each other. However, in the conditions in which the respondent has both type of cases available (i.e., for the CBR system standard size and CBR system large size), we observe that the correlation coefficient between the number of far analogies used and solution novelty is significantly positive (r = 0.31, p = 0.049). Thus, if the respondent has decided to actually use a far analogy, then the resulting campaign is more novel. This finding provides partial support for hypothesis *H2c*, which states that the use of far analogies will lead to more novel campaigns.

In an earlier study (see Althuizen and Wierenga, 2004), we found a similar positive effect of the availability of the large CBR system (100 cases) on solution quality relative to the standard size CBR system (50 cases), but the effect was not significant (b = 0.059, p_+ = 0.377; see Appendix 16b). In this small-scale study (n = 28), we only manipulated the *size* of the CBR system's case-base (i.e., containing 50 cases (n = 14) or 100 cases (n = 14)). The task in this study was to design a SP campaign for introducing and creating awareness for a new Research Master program at the university (non-FMCG campaign). Irrespective of the size of the CBR system, we furthermore found that the number of cases (or analogies) read and used by the participants positively influenced the quality of the solution (i.e., the creativity, novelty *and* usability of the solution). In this study we did not find support for the hypothesized positive effect of the availability of the large size CBR system on solution efficiency (i.e., for solution time: b = 0.226, p_- = 1 - p_+ = 0.916; see Appendix 16b). An explanation could be that solution efficiency may not so much depend on the number of matching cases in the system, but more on the type of cases that the respondent has read and used, i.e., near versus far analogies.

[63] Averages for the CBR system standard size mixed and CBR system large size mixed conditions in Table 7.14.

To conclude, having more cases stored in the CBR system results in campaign proposals of higher quality, but does not significantly lead to a more efficient design process in terms of the time needed to design a campaign. Although it seems that respondents do (have to) read fewer previous campaigns (analogies) in order to come up with an idea than in the other, standard size CBR system conditions, which suggests that they are able to retrieve more closely matching analogies.

7.4.2 The Moderating Role of the Decision Maker's Innate Creative Ability

Does Creative Ability Moderate the Effect of the CBR System Availability? As may be concluded from the regression analyses in the previous subsection, we do not find a significant main effect of the decision maker's innate creative ability on the creativity of the campaign proposal. That is, we do not find a significant main effect of creative ability if we include both the CBR system user groups and the "no CBR system" user groups in our sample. However, this effect may be attenuated by the different experimental conditions in which the respondents designed their campaign proposal.

Table 7.15 Regression of Solution Quality: Innate Creative Ability

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept	3.846	-	1.829	0.089
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	0.324	0.550	2.380	0.016+
Covariates				
- Gender (0=male, 1=female)	-0.166	-0.109	-0.478	0.640
- Age	0.015	0.043	0.164	0.872
- Education Level	-0.058	-0.036	-0.142	0.889
- Length of Campaign Proposal	0.001	0.148	0.655	0.523
	R^2_{adj}=0.15	**F=1.649**	**(p=0.212)**	

+ one-sided test; n = 20

To test our hypothesis regarding the direct effect of innate creative ability on solution quality (i.e., solution creativity) (*H*4), we therefore estimate a regression model, including innate creative ability and the covariates, for the uncontaminated no system condition only (n = 20) (see Table 7.15). For the decision makers in this condition, we indeed find a substantial and significant positive direct effect of innate creative ability (b = 0.550, p_+ = 0.016) on the creativity of their campaign proposal (see Table 7.15), which supports hypothesis *H4*. This finding suggests that there might be an interaction effect between the creative ability of the decision maker and the (type of) support system, which attenuates the effect of creative ability on the creativity of the solution. That is, the availability of a CBR system (and to some extent also the expert system) seems to remove the direct positive of innate creative ability on solution quality (i.e., the creativity of the campaign). This could either mean that, when using a CBR system for designing a sales promotion campaign, the low creative decision makers become more creative or that the highly creative decision makers become less creative, or both.

Before we turn to testing the hypothesized interaction between CBR system availability and the decision maker's innate creative ability (*H5*), we first investigate the correlation coefficients between creative ability and the different type of support systems (see Table 7.16). For the CBR system conditions, there exist no positive correlation between the creative ability of the decision maker and the quality of his campaign proposal (r = -0.08, p_+ = 0.745). However, if we consider the no system group (n = 20), we do find positive and substantial correlation coefficients (r = 0.58, p_+ = 0.004) between the quality of the outcome and the participant's innate creative ability (see Table 7.16). We note that this pattern of correlations is consistent with the pattern found in the "pilot" study (see Table 6.11), with the difference that in this study we used an actual test (ATTA) to measure innate creative ability instead of a self-reported questionnaire.

In conclusion, the availability of a CBR system (and, to a lesser extent, also the expert system (r = 0.12, p_+ = 0.314)) seems to weaken the positive effect - as present in the no system condition (see Table 7.15 and 7.16) - of innate creative ability (as measured by the ATTA-test) on the quality of the solution.

Table 7.16 Creativity of the Campaign Proposal: Correlations with Innate Creative Ability

	CBR System (n=80)				*Expert System (n=20)*				*No System (n=20)*			
Variables*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*
1. Creative Ability Level (ATTA)	-				-							
2. Creativity Rating Campaign	*-.08*	-			*.12*	-			***.58***	-		
3. Novelty Rating Campaign	*-.08*	***.88***	-		*-.01*	***.90***	-		***.60***	***.92***	-	
4. Usability Rating Campaign	*-.06*	***.91***	***.61***	-	*.20*	***.94***	***.69***	-	***.46***	***.92***	***.69***	-

* correlations in bold are significant at the 0.05 level

Next, we test for the presence of an interaction effect between CBR system availability and the decision maker's innate creative ability on solution creativity (*H5*). Due to the inclusion of an interaction term in the regression analysis, we mean-centered all independent variables in line with the "good practice" procedure proposed by Irwin and McClelland (2001). Mean-centering helps to avoid inflated estimates of standard errors (and thus difficulties with detecting statistically significant effects) as a result of the multicollinearity introduced by including a multiplicative interaction term (Cronbach, 1987). Moreover, mean-centering facilitates the interpretation of the coefficients for the separate components of the interaction term[64].

The final regression model for explaining solution creativity includes a dummy variable for the availability of a CBR system, the decision maker's innate creative ability, a multiplicative term of CBR system availability and innate creative ability, and the covariates (all independent variables are mean-centered). The results for the regression analysis are depicted in Table 7.17. To correctly interpret and calculate the simple slopes for visualizing the interaction effect (see Figure 7.3 and 7.4), we use the unstandardized (*B*) regression coefficients here (see Aiken and West, 1991).

The regression coefficient for the interaction term is significant and negative (B = -0.157, p = 0.031). Thus, the positive effect of CBR system availability on solution creativity that we found in the previous regression analyses is dependent on the decision maker's innate creative ability level. The negative interaction coefficient means that the positive effect of CBR system availability is weaker for highly creative decision makers and stronger for low creative decision makers.

[64] In a moderated regression analysis, the coefficients for the components of the interaction term represent their "simple" effects, i.e., the simple relationship between the dependent variable and independent variable at a particular level of the other independent variable(s) (Irwin and McClelland, 2001). Because the value zero is outside the range for one of the variables included in the interaction term (viz., innate creative ability, scale ranges from 1 to 7), the coefficients and its tests have little or no meaning. Mean-centering the variables (i.e., rescaling the mean to zero) facilitates the interpretation of the simple effects, because they then represent the effect of the independent variable at the average value of the other independent variable(s) (see Aiken and West, 1991; Irwin and McClelland, 2001). Mean-centering changes the correlations between either component of the interaction term and the interaction term itself (e.g., X and XZ), reducing multicollinearity problems, and between the dependent variable and the interaction term (e.g., Y and XZ) (see Irwin and McClelland, 2001).

Table 7.17 Regression of Solution Quality: Interaction Effect between CBR System Availability and Innate Creative Ability (compared to both "no CBR System" benchmarks)

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	5.970	-	110.974	0.000
CBR System Characteristics				
- CBR System Available (dummy)	0.189	0.138	1.620	0.054+
Decision Maker Characteristic				
- Creative Ability Level (ATTA)	0.018	0.039	0.440	0.331+
Interaction				
- Creative Ability X CBR System	-0.157	-0.158	-1.885	0.031+
Covariates				
- Gender (0=male, 1=female)	-0.212	-0.153	-1.753	0.082
- Age	0.008	0.021	0.226	0.822
- Education Level	0.345	0.232	2.477	0.015
- Length of Campaign Proposal	0.001	0.262	3.058	0.003
	R^2_{adj}=0.18	**F=4.714**	**(p=0.000)**	

* intercept represents the benchmark condition (no system); + one-sided test; n = 120
all independent variables are mean-centered
the dependent variable is uncentered, in order to provide predicted scores in the original scale

To check this, we followed the procedure developed by Jaccard et al. (1990) for calculating the presence, strength and nature of the interaction effect (see Appendix 17). In this procedure, the presence of the interaction effect between CBR system availability and innate creative ability is determined by the significance of the estimated coefficient for the interaction term (in this case, as mentioned, not significant: B = -0.157, t = -1.885, p = 0.031, see Appendix 18b). Next, the strength of the relation is determined by percentage of variance that is explained by the interaction effect, i.e., the difference in R^2 between the interaction regression model and the main effects regression model (in this case: 22.8% - 20.3% = 2.5%, see Appendix 18b)[65]. Finally, the nature of the interaction effect can

[65] The strength of the moderating effect can be assessed by comparing the R-squares of the two regression models, i.e. one with the interaction term and one without the interaction term. The effect size is given by $f^2 = (R^2_{INTERACTION\_MODEL} - R^2_{MAIN\text{-}MODEL}) / (1 - R^2_{INTERACTION\_MODEL})$, where f^2 scores of 0.03,

be determined by calculating the simple effect of CBR system availability on solution quality for different levels of innate creative ability (see Appendix 18b). More specifically, the effect of CBR system availability on solution quality is calculated for "high" creative ability (plus 1 standard deviation) and "low" creative ability (minus 1 standard deviation). The effect for "average" creative ability (i.e., mean-centered creative ability score is zero) is equal to the regression coefficient for CBR system availability depicted in Table 7.17 (B = 0.189, p_+ = 0.054). The results are graphically represented in Figure 7.3.

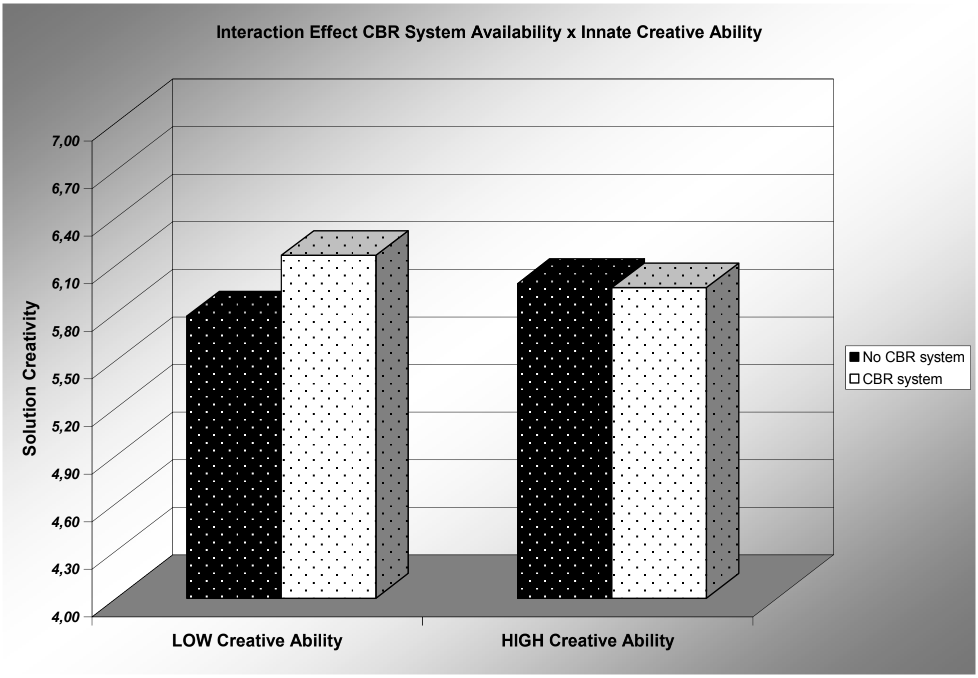

Figure 7.3 **Interaction Effect of CBR System Availability and Creative Ability on the Creativity of the Campaign Proposal (n = 120)**

As one can see in Figure 7.3, the net positive effect of CBR system availability is largest and significant for decision makers with a low innate creative ability (B = 0.404, *t-value* = 2.590, p_+ = 0.005; see Appendix 18b). For decision makers with a high creative ability there is no significant net effect of CBR system usage on the creativity of their solution (B = -0.026, *t-value* = -0.150, *n.s.*; see Appendix 18b). Since the interaction effect also seems to be present with respect to availability of

0.15 and 0.35 suggest small, moderate and large interaction effects, respectively (Cohen, 1988). Here, the effect size is f^2 = 0.032, which suggests a small effect size.

the expert system (see correlation coefficients in Table 7.16), we finally compare the CBR system user groups (n = 80) to the uncontaminated no system group (n = 20) only. The results of the regression analysis and the calculation of the presence, strength and nature of the interaction are depicted in Table 7.18 and Figure 7.4 (see also Appendix 18c), respectively.

Table 7.18 Regression of Solution Quality: Interaction Effect between CBR System Availability and Innate Creative Ability (compared to the no system only)

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	6.003	-	102.806	0.000
CBR System Characteristics				
- CBR System Available (dummy)	0.083	0.051	0.554	0.291+
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	0.041	0.084	0.882	0.190+
Interaction				
- Creative Ability X CBR System	-0.365	-0.268	-3.131	0.001+
Covariates				
- Gender (0=male, 1=female)	-0.119	-0.143	-1.495	0.138
- Age	0.009	0.025	0.249	0.804
- Education Level	0.400	-0.271	2.690	0.008
- Length of Campaign Proposal	0.001	0.198	2.112	0.037
	R^2_{adj}=0.20	**F=4.534**	**(p=0.000)**	

* intercept represents the benchmark condition (no system); + one-sided test; n = 100
all independent variables are mean-centered
dependent variable is uncentered, in order to provide predicted scores in the original scale

Again, we followed the procedure developed by Jaccard, Turrisi and Wan (1990) for calculating the presence, strength and nature of the interaction effect (see Appendix 17). The negative regression coefficient for the interaction term is substantial and highly significant (B = -0.365, p = 0.001, see Table 7.18). The strength of the relation is 25.6% - 17.7% = 7.9%, see Appendix 18c).[66] As one can

[66] The strength of the moderating effect can be assessed by comparing the R-squares of the two regression models, i.e. one with the interaction term and one without the interaction term. The effect

see in Figure 7.4, the net positive effect of CBR system availability is largest and significant for decision makers with a low innate creative ability (B = 0.569, *t-value* = 2.845, p_+ = 0.003; see Appendix 18c). However, for decision makers with a high creative ability, CBR system availability has a negative net impact (B = -0.403, *t-value* = -1.708, p_-= 0.046; see Appendix 18c). The effect for "average" creative ability (i.e., mean-centered creative ability score is zero) is equal to the regression coefficient for CBR system availability depicted in Table 7.18 (B = 0.083, p_+ = 0.291).

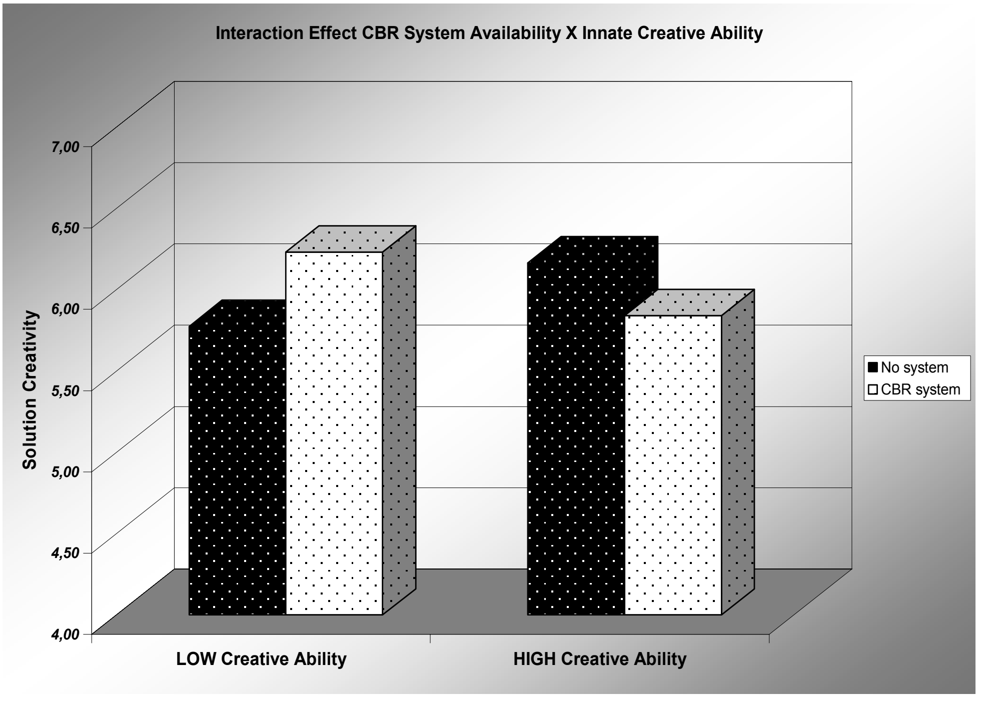

Figure 7.4 **Interaction Effect of CBR System Availability and Creative Ability on the Creativity of the Campaign Proposal (*n* = 100)**

To conclude, these results suggest that CBR system availability acts as a two-edged sword, i.e., the availability of a CBR system (1) has a positive effect on the creativity of the solution for decision makers with a low creative ability, presumably by providing them with (creative) ideas that they are not able to generate themselves (i.e., a compensation effect), and (2) it has a negative effect on the creativity of the solution for decision makers with a high creative ability,

size is given by $f^2 = (R^2_{INTERACTION\_MODEL} - R^2_{MAIN\text{-}MODEL}) / (1 - R^2_{INTERACTION\_MODEL})$, where f^2 scores of 0.03, 0.15 and 0.35 suggest small, moderate and large interaction effects, respectively (Cohen, 1988). Here, the effect size is f^2 = 0.106, which suggests a small to moderate effect size.

presumably by fixating their attention too much on the examples provided by the CBR system (i.e., unconscious plagiarism or conformity effect).

Which Aspect of Creative Ability Drives the Interaction Effect: Convergent Thinking versus Divergent Thinking? Here, we will take a closer look at what drives the moderating (negative) effect of the decision maker's creative ability on the (positive) relationship between CBR system availability and solution quality. More specifically, we will make a distinction between the divergent thinking facets of creative thinking (i.e., fluency, flexibility, and originality) and the more convergent facet of creative thinking (i.e., elaboration). Does CBR system usage interfere with the decision maker's ability to think divergently and/ or his ability to think convergently? In addition, we will perform a group level analysis, in which we will determine the interaction effect within four groups of creative ability.

The two basic modes of thinking mentioned above, i.e., divergent thinking and convergent thinking, have been recognized as being essential in weakly-structured, creative problem solving (Guilford, 1968; Torrance, 1974; Tardif and Sternberg, 1988; Runco and Mraz, 1992; Sternberg and O'Hara, 1999). Divergent thinking and convergent thinking may affect different aspects of the creativity of the outcome. Divergent thinking allows one to explore the solution space in different directions from the initial problem state, in order to discover many possible ideas and idea combinations that may serve as solutions (Finke et al., 1992). Thus, decision makers who predominantly think divergently will generate many alternative solutions in response to a problem, including unusual and creative ones (Runco, 1986; Sternberg and Lubart, 1992; Baer, 1993).

In contrast, with convergent thinking one goes from an initial problem state through a series of prescribed operations in order to converge upon a single correct solution. Thus, decision makers who predominantly think convergently have a tendency to directly work towards a single, best solution in response to a problem (Finke et al., 1992; Sternberg and Lubart, 1992). They are likely to modify an initial, workable idea or previous solution just until it fits all requirements of the problem at hand (Sternberg and Lubart, 1992). Since convergent thinkers tend to work directly towards a solution, they will design a solution more efficiently (i.e., it will take less time) than divergent thinkers who first generate many alternative solutions and then work out the best solution.

Sternberg and Lubart (1992), for instance, observed in an experiment that students who applied a convergent problem-solving strategy (i.e., they implemented the first idea that came to mind and fitted the problem) were perceived as less creative than students who applied an alternative method. Decision makers with a high convergent thinking ability are likely to suffer most from a possible conformity effect than decision makers with a high divergent thinking ability. That is, convergent thinkers are probably inclined to apply a copy-strategy by taking the first matching, usable previous campaign (most likely a near analogy) and modify it (if necessary) until a satisfactory solution has been developed, while divergent thinkers are more likely to search the CBR system for additional and alternative examples. This may result in a usable campaign (and an efficient design process) for highly convergent thinkers, but not necessarily in a very novel, and creative campaign.

First, we checked the internal consistency of the divergent thinking subscales, i.e., fluency, flexibility an originality, which proved to be sufficient to combine them into one average score (Cronbach's $\alpha = 0.69$). For the decision maker's convergent thinking ability, we use the elaboration subscale as a proxy. The correlation coefficient between the resulting divergent thinking ability score and the convergent thinking ability score is positive and significant ($r = 0.48$, $p = 0.000$), but including them both in the regression analysis will cause no severe multicollinearity problems.

The results of the regression analysis in Table 7.19 (see also Table 7.20) show that the negative effect of CBR system availability on solution creativity is largest for the interaction with the decision maker's convergent thinking ability ($B = -0.277$, $p = 0.000$). Decision makers who think highly convergently are probably more inclined to conform to the examples or analogies provided by the CBR system than low convergent thinkers. The interaction between CBR system usage and the ability to think divergently is not significant. Apparently, the availability of a CBR system reduces the differences in the creativity of the outcome between decision makers who easily generate (creative) ideas themselves (i.e., a high divergent thinking ability) and decision makers that have difficulties with generating ideas (i.e., a low divergent thinking ability). We will explore this issue in more detail by means of a group level analysis.

Table 7.19 Regression of Solution Quality: Interaction Effect between CBR System Availability and Divergent versus Convergent Thinking (compared to no system only)

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	5.991	-	108.141	0.000
CBR System Characteristics				
- CBR System Available (dummy)	0.133	0.082	0.943	0.348
Decision Maker Characteristic				
- Divergent Thinking Ability (ATTA)	0.019	0.043	0.427	0.671
- Convergent Thinking Ability (ATTA)	0.027	0.093	0.929	0.355
Interaction				
- Divergent Thinking X CBR System	-0.094	-0.080	-0.856	0.394
- Convergent Thinking X CBR System	-0.277	-0.374	-4.028	0.000
Covariates				
- Gender (0=male, 1=female)	-0.143	-0.103	-1.110	0.270
- Age	0.022	0.058	0.581	0.562
- Education Level	0.425	0.288	2.976	0.004
- Length of Campaign Proposal	0.001	0.191	2.150	0.034
	R^2_{adj}=0.28	**F=5.174**	**(p=0.000)**	

* intercept represents the benchmark condition (no system); *n* = 100
all independent variables are mean-centered
the dependent variable is uncentered, in order to provide predicted scores in the original scale

Group Level Analysis. Based on the median scores with respect to the respondents' innate ability on both the divergent (i.e., high or low) and the convergent (high or low) aspects of creative thinking, we divided the total sample into four groups.

1. High Divergent/ High Convergent (HDHC) (*n* = 47).
2. High Divergent/ Low Convergent (HDLC) (*n* = 16).
3. Low Divergent/ High Convergent (LDHC) (n = 18).
4. Low Divergent/ Low Convergent (LDLC) (*n* = 39).

It should be noted that the LDLC group wil be the benchmark group in the regression analysis. Because divergent thinking and convergent thinking are not mutually exclusive, i.e., both abilities are significantly correlated (r = 0.483, p = 0.000)), the large majority (72%) of the respondents falls either in the high divergent/high convergent group or in the low divergent/ low convergent group. Since the interaction effects between creative ability and CBR system usage are most prominent when excluding the expert system group, we also conduct this group level analysis comparing the CBR system conditions and no system condition only (n = 100) (see Table 7.20).

The results basically confirm the findings of the previous regression analysis, in which we find that the negative net effect of CBR system availability on solution quality for decision maker's with a high creative ability is mainly caused by the convergent facet (i.e., elaboration) of creative thinking. For the group level analysis we find that in comparison with the low divergent, low convergent group (which is included in the intercept), both high convergent groups (HC) have a negative interaction coefficient, meaning that the positive effect of CBR system availability on the creativity of the solution is reduced for decision makers with a high convergent thinking ability. We note that consistent what we would expect based on our previous line of reasoning, the high divergent, low convergent group (HDLC) scores best on solution creativity (see positive regression coefficient in Table 7.20), however the effect is not significant (b = 0.047, p = 0.929; based on only 16 observations).

As mentioned earlier, an explanation for this finding could be that decision makers with a high convergent ability are more susceptible to the conformity (or form fixation) effect. That is, the availability of a CBR system may focus their attention too much to the analogies provided by the system, instead of using their own imagination to may be more inclined to apply (consciously or unconsciously) a copy-paste strategy in designing the campaign. This, however, does not lead to a significant reduction in solution time, as might be expected based on the effort-accuracy trade-off theorem (Payne et al., 1993; see section 3.1)[67]. We note that if we look at the total sample (n = 120) and only make a distinction between a high convergent ability and a low convergent ability (ignoring the decision maker's divergent thinking ability), then we find a marginally significant (*t-value* = 1.793, p = 0.078) difference in the average solution time for the high convergent ability group ($M_{no\ CBR\ system}$ = 101.5 (n = 24) and $M_{CBR\ system}$ = 86.6 (n = 41)) and not for the low convergent ability group. This result provides some support for the assertion that

[67] Analysis of subpopulations (n = 100) for creative ability with respect to average solution times for the "no CBR system" versus the "CBR system" condition. For the high divergent, high convergent (HDHC) group: $M_{no\ CBR\ system}$ = 94.6 (n = 11) versus $M_{CBR\ system}$ = 88.3 (n = 31) (independent samples t-test: *t-value* = 0.554, p = 0.583). For the high divergent, low convergent (HDLC) group: $M_{no\ CBR\ system}$ = 69.0 (n = 2) versus $M_{CBR\ system}$ = 70.5 (n = 11) (*t-value* = -0.078, p = 0.939). For the low divergent, high convergent (LDHC) group: $M_{no\ CBR\ system}$ = 125.5 (n = 2) versus $M_{CBR\ system}$ = 81.5 (n = 10) (*t-value*=1.448, p = 0.178). For the low divergent, low convergent (LDLC) group: $M_{no\ CBR\ system}$ = 92.6 (n = 5) versus $M_{CBR\ system}$ = 89.0 (n = 28) (*t-value* = 0.161, p = 0.873). Due to the small number of observations in some of the groups, the results have to be interpreted cautiously.

high convergent thinkers might trade-off solution quality for solution efficiency when having a CBR system at their disposal.

Table 7.20 Regression of Solution Quality: Interaction Effect between CBR System Availability and Creative Ability Groups (compared to no system only)

Dependent Variable	*Creativity Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	5.961		102.400	0.000
CBR System Characteristics				
- CBR System Available (dummy)	0.251	0.155	1.673	0.098
Decision Maker Groups				
- High Divergent, High Convergent (*n*=42)	-0.019	-0.015	-0.131	0.896
- High Divergent, Low Convergent (*n*=13)	0.296	0.154	1.459	0.148
- Low Divergent, High Convergent (*n*=12)	0.108	0.054	0.542	0.589
Interaction				
- HDHC X CBR System	-1.116	-0.348	-3.208	0.002
- HDLC X CBR System	0.047	0.009	0.089	0.929
- LDHC X CBR System	-0.622	-0.118	-1.161	0.249
Covariates				
- Gender (0=male, 1=female)	-0.160	-0.115	-1.158	0.250
- Age	-0.008	-0.020	-0.197	0.844
- Education Level	0.361	0.245	2.413	0.018
- Length of Campaign Proposal	0.001	0.245	2.621	0.010
	R^2_{adj}=0.21	**F=3.441**	**(p=0.001)**	

* intercept represents the benchmark condition (i.e., the low divergent, low convergent group with no system); *n* = 100
all independent variables are mean-centered
the dependent variable is uncentered, in order to provide predicted scores in the original scale

7.4.3 The Relation between the Decision Maker's Subjective Evaluations of the CBR System and its Objective Contribution to the Solution

Having examined the effects of providing analogies by means of a CBR system on the quality of the solution and the efficiency of the design process in the previous subsections, we now take a look at the subjective evaluations of the CBR system. That is, how do decision makers perceive the contribution of the CBR system to their sales promotion campaign proposal? More specifically, we are interested the relationship between the subjective evaluations of the CBR system and its objective contribution to the solution, i.e., solution quality and the efficiency of the design process. For a more elaborate discussion, we refer the reader to section 3.8 and to subsection 4.3.4 for information on the measurement instruments.

In section 7.4.1, we found that the participants who had a CBR system at their disposal significantly outperformed the participants in the expert system and no system benchmark conditions, in terms of both the quality of their solutions and the efficiency of the design process. The question now is: do the teams recognize this "objective contribution" of the CBR system to their solution? Therefore, we will first have a look at the descriptive statistics for the subjective evaluations of the CBR system and the expert system (see Table 7.21).

Table 7.21 Analyses of Subjective Evaluations per Type of System

Dependent Variable	*Condition*	*n*	*Mean*	*Std. dev.*
Perceived Usefulness of the Support System (scale 1-7)	*1. CBR near analogies (50)*	20	4.1	1.50
	2. CBR far analogies (50)	20	3.6	1.23
	3. CBR standard size mixed (50)	20	3.5	1.41
	4. CBR large size mixed (100)	20	3.5	1.12
	(CBR overall)	*(80)*	*(3.7)*	*(1.32)*
	5. Expert system	20	4.1	1.31
	6. No system	20	**4.6**[2]	0.96
	(No CBR overall)	*(40)*	*(4.4)*	*(1.17)*
	Total	120	3.9	1.31
	F-test (ANOVA)	**2.621**		
	Between Group Difference	**(p=0.028)**		
Perceived Usefulness of the Support System for enhancing Creativity (scale 1-7)	*1. CBR near analogies (50)*	20	3.5	1.40
	2. CBR far analogies (50)	20	3.3	1.92
	3. CBR standard size mixed (50)	20	3.2	1.51
	4. CBR large size mixed (100)	20	3.5	1.50
	(CBR overall)	*(80)*	*(3.4)*	*(1.57)*
	5. Expert system	20	3.2	1.47
	6. No system	20	3.9	1.23
	(No CBR overall)	*(40)*	*(3.5)*	*(1.38)*
	Total	120	3.4	1.50
	F-test (ANOVA)	**0.526**		
	Between Group Difference	**(p=0.756)**		
Perceived Impact of Support System on the Solution (scale 0% - 100%)	*1. CBR near analogies (50)*	20	29.3	24.0
	2. CBR far analogies (50)	20	20.4	17.4
	3. CBR standard size mixed (50)	20	23.2	19.2
	4. CBR large size mixed (100)	20	23.0	24.1
	(CBR overall)	*(80)*	*(24.0)*	*(21.2)*
	5. Expert system	20	**44.3**[3]	30.1
	6. No system	19[5]	**41.7**[4]	24.8
	(No CBR overall)	*(39)*	*(43.0)*	*(27.3)*
	Total	119	30.2	24.9
	F-test (ANOVA)	**3.743**		
	Between Group Difference	**(p=0.004)**		

Table 7.21 Analyses of Subjective Evaluations per Type of System (continued)

Attitude towards MMSS Usage (after) (scale 1-7)	*1. CBR near analogies (50)*	20	4.3	1.15
	2. CBR far analogies (50)	20	4.1	0.86
	3. CBR standard size mixed (50)	20	4.1	0.98
	4. CBR large size mixed (100)	20	4.1	0.94
	(CBR overall)	*(80)*	*(4.2)*	*(0.98)*
	5. Expert system	20	4.0	1.07
	6. No system	20	**5.0**[1]	0.60
	(No CBR overall)	*(40)*	*(4.6)*	*(1.00)*
	Total	120	4.3	1.00
	F-test (ANOVA)	**3.562**		
	Between Group Difference	**(p=0.005)**		
Attitudinal Change (after - before)	*1. CBR near analogies (50)*	19	-0.3	0.95
	2. CBR far analogies (50)	19	-0.8	0.80
	3. CBR standard size mixed (50)	20	-0.8	1.10
	4. CBR large size mixed (100)	20	-0.6	0.79
	(CBR overall)	*(78)*	*(-0.6)*	*(0.92)*
	5. Expert system	20	-0.7	0.84
	6. No system	20	**0.2**[1]	0.69
	(No CBR overall)	*(40)*	*(-0.2)*	*(0.88)*
	Total	118	-0.5	0.93
	F-test (ANOVA)	**3.928**		
	Between Group Difference	**(p=0.003)**		

[1] Significant difference (α = 0.05) with CBR near analogies, CBR far analogies, CBR standard size, CBR large size, and expert system; Post-Hoc LSD test (two-sided); [2] Significant difference (α = 0.05) with CBR far analogies, CBR standard size, and CBR large size; Post-Hoc LSD test (two-sided); [3] Significant difference (α = 0.05) with CBR near analogies, CBR far analogies, CBR standard size, and CBR large size; Post-Hoc LSD test (two-sided); [4] Significant difference (α = 0.05) with CBR far analogies, CBR standard size, and CBR large size; Post-Hoc LSD test (two-sided); [5] Missing value.

The average perceived usefulness ratings for the CBR systems (M = 3.7 on a 7-point scale) and the average perceived impact of the CBR systems (M = 24.0 on a scale from 0% to 100%) are quite low compared to the average ratings for the two "no CBR system" user groups (M = 4.4 and M = 43.0 for perceived usefulness and perceived impact, respectively). The average perceived impact for the CBR systems is even significantly lower than the average impact reported by the no system users (M = 41.7; see Table 7.21), who only had a list with SP techniques (on paper) available as support tool. That is, apart from the near analogy CBR system (M = 29.3), for which the difference in perceived impact relative to the no system condition is not significant. This suggests that the users of the CBR system with near analogies only are better able to see the applicability of the retrieved analogies to the current case than the users of the other CBR systems, i.e., the far analogies CBR system and the mixed analogies CBR systems. Furthermore, we find a significant overall difference between the different system user groups

(One-way ANOVA, $F = 3.562$, $p = 0.005$; see Table 7.21) in the average attitude towards using an MMSS in general for enhancing decision-making performance, after the experiment. As one can read from Table 7.21, the average attitude towards using MMSSs in general did not significantly change after the experiment for the participants in the no system condition ($M_{after} = 5.0$ versus $M_{before} = 4.8$). In all other support conditions, the attitude towards using an MMSS significantly[68] dropped on average with more than a half point on a 7-point scale (see Table 7.21), except for the CBR near analogy system user group ($M_{after} = 4.3$ versus $M_{before} = 4.6$), which suggests that the other CBR systems and the expert system did not fully meet the participants' expectations with respect to the degree of support provided by the systems.

As in Study 2, we included an extra item with respect to the perceived usefulness of the support system, viz. "using the system enhanced my creativity" [69]. The scores on this "creativity" item do not significantly differ among the different system user groups ($F = 0.526$, $p = 0.756$; see Table 7.21). From the previous analyses we know that, relative to the benchmark systems, CBR system availability contributed positively and significantly to the objective quality (i.e., the creativity) of the solution. The average perceived usefulness ratings for all support system conditions are, however, (significantly[70]) below the scale's midpoint, indicating that the respondents did not perceive the support systems to be very useful for designing a creative sales promotion campaign.

Nevertheless, over all support system conditions ($n = 100$), the attitude towards using MMSSs in general is, after the experiment, on average still slightly above the scale's midpoint (i.e., $M = 4.1$; $SD = 0.99$), but not significantly (one-sample t-test (test-value = 4): $t = 1.274$, $p = 0.206$). Thus, although the CBR systems and the expert system did not fully meet the participants' expectation with respect to the degree of support (except maybe for the near analogies CBR system, see the perceived usefulness ratings in Table 7.21), their opinion about using MMSSs in general for enhancing decision-making performance does not become negative. In addition, on average they do attribute a significant part of their solution in all conditions (> 20%) to the availability of the support system (see the average

[68] One-sample t-tests (test value = 0, no change): CBR near analogies $t = -1.570$ ($p = 0.134$), CBR far analogies $t = -4.242$ ($p = 0.000$), CBR standard size mixed $t = -3.187$ ($p = 0.005$), CBR large size mixed $t = -3.391$ ($p = 0.003$), expert system $t = -3.494$ ($p = 0.002$), no system $t = 1.489$ ($p = 0.153$).

[69] Item-to-total correlation for this creativity item with the other perceived usefulness items is 0.43. All the other items have item-to-total correlations over 0.7.

[70] For perceived usefulness: $M_{CBR\ systems} = 3.7$, $SD = 1.32$ ($n = 80$; one-sample t-test (test value = 4): $t = -2.184$, $p = 0.032$) and $M_{Expert\_System} = 4.1$ $SD = 1.31$ ($n = 20$; one-sample t-test (test value = 4): $t = 0.370$, $p = 0.715$). For perceived usefulness for enhancing creativity: $M_{CBR\ systems} = 3.4$ $SD = 1.60$ ($n = 80$; one-sample t-test (test value = 4): $t = -3.634$, $p = 0.000$) and $M_{Expert\_System} = 3.2$ $SD = 1.47$ ($n = 20$; one-sample t-test (test value = 4): $t =-2.430$, $p = 0.025$).

percentages for the perceived impact of the support systems on the solution in Table 7.21, which are all significantly above zero (all *p*'s < 0.000).

Finally, notice that the support system evaluation scores are consistently lower than in the pilot study (Study 2), i.e., for the perceived usefulness of the CBR system: M = 4.3 (Study 2) versus M = 3.8 (this study), perceived usefulness of the CBR system for enhancing creativity: M = 4.3 (Study 2) versus M = 3.3 (this study), and for the perceived impact: M = 41.7 (Study 2) versus M = 2.0 (this study), and for the general attitude towards using MMSSs (after usage): M = 4.8 (Study 2) versus M = 4.1 (this study). This could be due to a respondent effect. That is, the respondents in the pilot study were all participants of an undergraduate course on knowledge-driven marketing management support systems and thus supposedly had genuine interest and more favorable attitude towards support system usage for decision making than the participants in the large study.

Next, we inspect the relations between the subjective evaluations of the CBR system and the objective outcomes. We therefore calculated the correlation coefficients between the evaluative measures, i.e., "*perceived usefulness of the CBR system*"[71], "*perceived usefulness for of the CBR system for enhancing creativity*", "*perceived impact of the CBR system*" (in percentages) and the change in the "*attitude towards using MMSSs*" (i.e., attitude after the experiment minus before the experiment) and the objective outcomes of CBR system availability, i.e., *solution quality* and *solution efficiency*. Furthermore, we look at the correlation between the subjective evaluations and the process variables, i.e., the *number of cases read*, *number of cases used* and *CBR system usage time* (see Table 7.22).

Relationship between Subjective Evaluations and Objective Outcomes. As in the previous studies (see Chapter 5 and 6), in general we do not find significant relationships between the subjective evaluations of the CBR system and the objective outcome variables, i.e., solution quality and solution efficiency (see Table 7.22), which is consistent with hypothesis *H6*. The correlation coefficients between the perceived usefulness of the CBR system and solution quality (r = 0.03, p = 0.763) and between perceived usefulness and solution efficiency (r = -0.17, p = 0.137) are not significant at the 5% level (see Table 7.22). This is also true for the perceived usefulness of the CBR system for enhancing creativity (r = 0.04, p = 0.714 and r = -0.13, p = 0.257, for solution quality and solution efficiency, respectively) and for the difference in the decision maker's attitude towards using MMSSs in general before and after the experiment (r = -0.20, p = 0.084 and r = -0.08, p = 0.512, for solution quality and solution efficiency, respectively; see Table 7.22). However,

[71] This measure comprises items like "using the CBR system increased the quality of the SP campaign" *(solution quality)* and "using the system enabled me to design the SP campaign more quickly" *(solution efficiency)*, see Appendix 8a: items 6 and 7.

consistent with Study 2, the relationship with the perceived impact of the CBR system is not significant for solution quality (*r*=-0.02, *p*=0.894), but is significant and negative for solution time (*r* = -0.28, *p* = 0.013; see Table 7.22). That is, the participants are more likely to attribute a larger impact to the CBR system when they were able to quickly construct a satisfactory solution. Thus, decision makers associate the perceived impact of the system with gains in solution efficiency rather than with gains in solution quality.

Table 7.22 Correlations between Subjective Evaluations of the CBR Systems and Objective Outcomes & Process Variables*

Objective Outcomes / *Subjective Evaluations*	*Solution Quality (creativity)*	*Solution Efficiency (time)*	*Number of Cases Read*	*Number of Cases Used*	*CBR System Usage Time*
1. *Perceived Usefulness CBR System*	0.03	-0.17	**0.24**	**0.47**	0.15
2. *Perceived Usefulness CBR System for enhancing Creativity*	0.04	-0.13	-0.05	0.15	-0.01
3. *Perceived Impact CBR System*	-0.02	**-0.28**	**0.39**	**0.50**	**0.40**
4. *Attitude towards using MMSSs (after - before)*+	*-0.20*	-0.08	0.09	*0.20*	0.19

* correlations in bold are significant at the 0.05 level; correlations in italic are significant at the 0.10 level; *n* = 80; + *n* = 78 (2 missing values)

The fact that, compared to the expert system and SP technique inventory conditions, CBR system availability leads to better, more creative solutions and a more efficient design process, combined with the lower evaluations for the perceived usefulness of the CBR system, suggests that decision makers do not fully recognize the true impact of the CBR system on their solution. Moreover, from the previous analyses we know that, in terms of the creativity of the solution, the CBR system seems to be particularly helpful for decision makers with a low creative ability. Therefore, we also checked the correlation coefficients between the creative ability of the decision maker and the perceived usefulness of the CBR system for enhancing creativity (*r* = -0.16, *p* = 0.159) and between creative ability and the perceived impact of the CBR system(*r* = -0.07, *p* = 0.545), which are both not significant. Thus, decision makers with a low creative ability do not evaluate the contribution of the CBR system to the creativity of their solution more positively than decision makers with a high creative ability[72]. Apparently,

[72] To check whether highly creative decision makers are more reluctant to use the CBR system, we calculated the correlation coefficient between the decision maker's creative ability level and CBR system usage time, like in Study 2. The correlation coefficient turns out to be negative, but not significant in this comprehensive study (*r* = -0.09, *p* = 0.451). In this comprehensive study, we used the ATTA-test to measure the decision maker's creative ability level and not the self-assessment instrument (as in Study 2). People who *perceive* themselves as highly creative might be more reluctant

decision makers with a low creative ability do not have a clue about the positive contribution of the CBR system to the creativity of their solution either (i.e., relative to highly creative decision makers).

Relationship between Subjective Evaluations and Process Variables. If we look at the correlation coefficients in Table 7.22, then we find that the relation with the subjective evaluations, and perceived impact in particular, is significant and for the number of cases used (r = 0.50, p = 0.000 and r = 0.47, p = 0.000, for perceived impact and perceived usefulness, respectively), the number of cases read (r = 0.39, p = 0.000 and r = 0.24, p = 0.031, for perceived impact and perceived usefulness, respectively) and, to a lesser extent, for CBR system usage time (r = 0.40, p = 0.000 and r = 0.15, p = 0.174, for perceived impact and perceived usefulness, respectively) (see Table 7.22).

To conclude, the results indicate that the characteristics of the usage process, i.e., system usage time and the number of cases read and used, are more strongly related to the decision maker's evaluation of the contribution of the CBR system to the solution than the objective quality of the outcome. Consistent with the results reported in Study 1 and 2, we find that decision makers have difficulties in relating the "objective" quality of their solution to the contribution of the CBR system. As mentioned in the Chapter 6, an explanation for this finding could be that, although the final solution may be rather different from the base analogies (resulting also in a low perceived impact rating), the analogies provided by the CBR system may have stimulated divergent thinking or imposed meaningful structure on the solution and, therefore, they are likely to have had an impact on the final solution, i.e., consciously (e.g., by the cases that were used) or unconsciously (e.g., by the cases that were read). As a consequence of the difficulty to exactly pinpoint the contribution of the retrieved analogies to the quality of the final solution, the participants are likely to use the characteristics of the CBR system usage process and the time needed to design a campaign (after the use of the CBR system) as cues to evaluate the contribution of the CBR system to their solution.

7.5 Conclusions and Discussion

This dissertation addresses the question whether providing decision makers with analogies, by means of a CBR system, is an effective and efficient support tool for designing sales promotion campaigns. In this comprehensive study, Study 3, we manipulated the type of analogies in the CBR system content (i.e., near analogies

to use a CBR system, resulting in lower system usage times, than people who *are* creative. If we look at the correlation coefficient between the *self-assessed* measure of creative ability and CBR system usage time in this comprehensive study, it also turns out to be non-significant (r = 0.01, p = 0.937).

versus far analogies) and the number of analogies in the CBR system (i.e., 50 cases versus 100 cases) simultaneously. In addition, we included two benchmark conditions: (1) the use of an alternative MMSS (expert system), and (2) no system at all. The task in this study was exactly the same as in Study 2, i.e., to design a sales promotion campaign for enhancing brand image and increasing loyalty among heavy users of Grolsch (a Dutch beer brand). In this section, we briefly summarize the results with respect to the research questions and hypotheses tested in this study. The research questions that we addressed in this study are: (1) does the use of a CBR system improve solution quality and efficiency compared to using a benchmark system?, (2) what is the influence of the type of cases in the CBR system, i.e., near analogies versus far analogies?, (3) what is the influence number of cases in the CBR system, i.e., a large size versus a standard size case-base?, (4) who benefits most from CBR system usage?, and (5) are decision makers able to recognize the contribution of the CBR system to their solution?

In subsection 7.5.1, we summarize the main findings of this study. In the next chapter, we will relate the main findings of this comprehensive study (and the other studies) to the hypotheses formulated in Chapter 3 and discuss the limitations and provide suggestions for further research.

7.5.1 Main Findings

We start with stating the key findings of this comprehensive study and then discuss the main findings per dependent variable, i.e., solution quality, solution efficiency and perceived impact, in more detail. Moreover, we pay specific attention to the results regarding the interaction effect between CBR system availability and the innate creativity of the decision maker. The key findings are:

1) The availability of a CBR system does help to design better sales promotion campaigns and to design them more efficiently;
2) The effect of the CBR system on solution quality and solution efficiency is dependent on the type of system. With respect to solution quality, a large size CBR system outperforms a standard size CBR system. And, regarding solution efficiency, a CBR system with near analogies outperforms a CBR system with far analogies;
3) The effect of the CBR system on solution quality is also dependent on the type of decision maker. That is, the availability of a CBR system is most beneficial for decision makers with a low creative ability (probably due to a compensation effect, i.e., it helps them to generate ideas). For highly creative decision makers, the net effect of CBR system availability on solution quality can even become negative (probably due to an unconscious plagiarism or conformity effect);

4) Decision makers have difficulties in recognizing the positive contribution of the CBR system to the quality of the solution and, therefore, they use the characteristics of the CBR system usage process, i.e., system usage time and the number of cases read and used, and the time needed for designing a campaign (after the use of the CBR system) to evaluate the contribution of the CBR system to their solution.

Solution Quality. The results demonstrate that, compared to not having a CBR system available (i.e., an expert system or no system at all), CBR system availability has a positive effect on the quality of the solution (i.e., the creativity of the campaign). This effect is most prominent for the large size mixed CBR system (containing 100 cases: 50 near and 50 far analogies) in comparison with the standard size mixed CBR system (containing 50 cases: 25 near and 25 far analogies). That is, decision makers having a CBR system with a larger number of cases at their disposal design more creative and more novel sales promotion campaign than decision makers who have a CBR system with a smaller number of cases at their disposal. This result suggests that decision makers might benefit from the larger variety of cases in the large size mixed CBR system and are able to retrieve more closely matching cases than from the standard size mixed CBR system.

As opposed to the "pilot" study (Study 2), we do not find a positive effect of far analogies on the novelty (and creativity) of the solution. In fact, the relationship we find is in the opposite direction. That is, the effect of providing a CBR system with far analogies on the creativity of the solution is negative (i.e., relative to a CBR system with only near analogies). An explanation for this finding could be that for most users it may be difficult to see the analogy when the base and target are rather distant from each other, which is evidenced by the relatively low average number of far analogies that is used for designing a campaign. As a result, the availability of a CBR system with only far analogies could fail to lead to the design of more novel and usable (i.e., more creative) sales promotion campaigns. However, we also observed a positive relation between the number of far analogies used and *solution novelty* for the conditions in which the respondent has both type of cases available (i.e., the CBR system standard size mixed and CBR system large size mixed). Thus, if the respondent sees the similarity and applicability of the far analogy and has decided to actually use it, then the resulting campaign is likely to be more novel.

Solution Efficiency. CBR system availability reduces the time needed for designing a campaign (i.e., improves solution efficiency). We also expected that having only near analogies available would lead to a more efficient design process than having only far analogies available. That is, the recognition of a near analogy is expected to be faster and the knowledge transfer from the base to the target easier, because similarities between the base domain (i.e., the retrieved sales promotion campaign) and the target domain (i.e., the new campaign) already exist on a superficial level. Hence, there is no (or less) need to work through abstract, structural similarities between both campaigns and translate them into actionable attributes and concepts. Indeed, we find that decision makers who have a CBR system with near analogies available need less time to design a campaign than decision makers who have a CBR system with far analogies at their disposal.

Interestingly, for solution efficiency we did not find a significant effect for case-base size. We argued that having more cases stored in the CBR system increases the likelihood of finding a more closely matching case, which needs less adaptation. Therefore, we hypothesized that solution times would be shorter for the large size CBR system than for the standard size CBR system. It turns out that respondents having the large size CBR system at their disposal do (have to) read fewer previous campaigns (analogies) in order to come up with an idea than in the other, standard size CBR system conditions, which suggests that they are able to retrieve more closely matching analogies if the CBR system contains more cases. However, this does not lead to a more efficient design process in terms of the (residual) time needed to design a campaign.

The Match between the Decision Maker and the System: To Compensate or To Reinforce? With respect to the interaction effect between CBR system availability and the innate creativity of the decision maker, the use of the CBR system seems to remove the influence of individual differences in creative ability (as measured by the ATTA test) on the creativity of the campaign proposal, as present in the no system benchmark condition. The positive effect of CBR system availability on the creativity of the campaign proposal is reduced for decision makers with higher creative thinking abilities (and compared to the no system condition only, the net effect becomes even negative). For low-creative decision makers, the positive effect of CBR system availability on the creativity of the campaign is enhanced. The negative interaction effect seems to be mainly driven by the more convergent component (i.e., elaboration) of the decision maker's creative thinking ability, and thus not by his ability to think divergently (i.e., fluency, flexibility and originality). Decision makers who have a high convergent thinking ability are probably more inclined to conform to the examples or analogies provided by the CBR system than low convergent thinkers.

Subjective Evaluations of the CBR System. The result in this study indicate that, relative to the expert and no system benchmarks, CBR system availability has a positive effect on the quality of the solution and the efficiency of the design process. However, the average perceived usefulness ratings for the CBR systems (except for the near analogies system) and the average perceived impact of the CBR systems on the final solution are significantly lower than for the no system group and the expert system group. Moreover, in most support system conditions, i.e., except for the near analogy CBR system, the attitude towards using an MMSS for decision making after the experiment was significantly lower than before the experiment. For the no system group there is no significant difference in the attitude towards using MMSSs for decision making before and after the experiment. These findings regarding the subjective evaluations of the CBR system reveal that CBR systems (and, to a lesser extent, the expert system) did not fully meet the participants' expectations.

Furthermore, decision makers do not seem to fully recognize the objective contribution of the CBR system to the quality of their solution (i.e., relative to the "no CBR system" user groups). That is, the subjective evaluations of the contribution of the CBR system to the solution are more strongly correlated with the characteristics of the system usage process, i.e., system usage time and number of cases read and used, than with the objective quality of the solution. However, lower solution times (i.e., the time needed to design a campaign after the use of the CBR system) are associated with higher subjective evaluations of the contribution of the CBR system to the final solution.

An explanation for these findings could that the CBR system does not provide clear-cut answers (such as the expert system does), but only provides base analogies that might be relevant for the problem at hand. For CBR system users, the final solution may be quite different from the base analogies provided by the CBR system, which could result in lower subjective evaluations. However, given the positive effect of CBR system availability on solution quality and solution efficiency, the analogies are likely to have had their effect on the solution by stimulating divergent thinking and/or by imposing meaningful structure on the solution. To sum up, decision makers are not able to recognize the objective contribution of the CBR system to the quality of their solution and, therefore, they use the characteristics of the CBR system usage process, i.e., system usage time and the number of cases read and used, and the time needed to design a solution (after the use of the system) as cues to evaluate the contribution of the CBR system to the final solution.

Part III

Conclusions & Discussion

Chapter 8

Main Findings, Conclusions, and Discussion

"Operations research has demonstrated its effectiveness in dealing with the kinds of management problems that we might call 'well structured', but it has left pretty much untouched the remaining, 'ill structured' problems." (Simon and Newell, 1958)

8.1 Goal of this Dissertation

Many day-to-day and high-level marketing problems are weakly-structured or ill-structured. From the psychological literature, we know that analogical reasoning is an effective and efficient problem-solving method in ill-structured and weakly-structured decision situations. That is, when confronted with a problem, one of the first things managers will naturally do is to search their memory for previous, similar experiences (cases) that could help to interpret or solve the problem at hand. Case-Based Reasoning (CBR) is a state-of-the-art artificial intelligence technique that builds on the principles of analogical reasoning and can be used to put the vast amount of experience-based marketing knowledge into action for decision making in situations for which model-based decision support is not available. CBR-applications can be found in different domains, such as medical diagnosis and law (see Riesbeck and Schank, 1989; Kolodner, 1993; Muñoz-Avila and Ricci, 2005), but are not yet common in marketing. The goal of this dissertation was formulated as follows:

> ***"…To investigate the effectiveness and efficiency of analogical reasoning as a principle for marketing management support systems in weakly-structured marketing decision domains."***

In this dissertation, we have focused on the marketing domain of sales promotion decisions. Hitherto, decision support in sales promotions has focused mainly on supporting the well-structured parts of sales promotion problems (e.g., the SCAN*PRO-model for supporting price-promotion decisions). Of course, when a manager has decided to use a price discount, it is important to fine-tune the discount level to optimize sales volume and revenues. But maybe the manager should not have chosen a price-promotion in the first place. In our studies, we focused on higher-level sales promotion campaign decisions, such as choosing the theme, content and type of a sales promotion campaign. Thus, we focused on the higher-level, weakly-structured decision within the design of sales promotion campaigns.

We theoretically (in Part I) and empirically examined (in Part II) the appropriateness of analogical reasoning, by means of a CBR system, for supporting weakly-structured problems in marketing, and more specifically, the design of sales promotion campaigns. In Part I, we provided an overview of the theoretical background, developed a conceptual framework and formulated six main hypotheses regarding the effects of CBR system availability on the quality of the solution and the efficiency of the design process. In Part II, we empirically investigated the effectiveness and efficiency of providing decision makers with analogies (by means of a CBR system), relative to a rule-based support system (expert system) and no system at all. In addition, we explored the conditions under which CBR system availability is most effective and efficient, such as the effect of the content and the size of the case-base. We also examined the moderating role of the decision maker's innate creative ability.

In this chapter, we will first summarize the key findings of the empirical studies (section 8.2). Then, this chapter continues with a discussion of the limitations of this dissertation project (section 8.3) and we will provide suggestions for further research (8.4). Finally, we conclude this dissertation with a discussion of the main scientific and managerial implications (8.5).

8.2 Summary of Key Findings

In this section, we summarize the key findings of the three empirical studies reported in this dissertation. In Table 8.1, we provide an overview of the results and conclusions with respect to our main research questions. The main research questions, and their corresponding hypotheses, that we addressed in this dissertation project are the following (see also Table 8.1).

1. Does providing decision makers with analogies, by means of a CBR system, result in a) sales promotion campaigns of higher quality and b) does it make the design process more efficient? **(*Hypothesis 1*)**
2. What is the influence of the type of analogies offered to the decision maker? Should they come from the same problem domain (i.e., near analogies) or should they come from more distant domains (i.e., far analogies)? **(*Hypothesis 2*)**
3. What is the influence of the number of analogies offered to the decision maker? Are more analogies better? ***(Hypothesis 3)***
4. In examining the effect of using a CBR system with analogies, what is the role of decision maker characteristics? In particular, is the effect different for decision makers with different innate creative abilities? ***(Hypothesis 4 & 5)***

5. What is the relationship between the decision maker's subjective evaluation of using a CBR system for designing a sales promotion campaign and the objective outcomes, i.e., solution quality and solution efficiency?
(Hypothesis 6)

The main conclusions from the empirical part of this dissertation are as follows.

1. The availability of a CBR system helps a) to design *better, more creative* sales promotion campaigns and b) to design sales promotion campaigns *more efficiently*, i.e., relative to not having a CBR system available. This is a consistent and significant finding across the empirical studies (see subsection 8.2.1).
2. The effect of CBR system availability is dependent on the content of the case-base, i.e., containing near analogies or far analogies. The effect on the *efficiency* of the design process is more prominent for a CBR system with near analogies than for a CBR system with far analogies (see subsection 8.2.2).
3. The effect of CBR system availability is dependent on the size of the case-base, i.e., a large size (100 cases) versus a standard size (50 cases) CBR system. The effect on the *quality* of the solution is more prominent for a large size CBR system than for a standard size CBR system (see subsection 8.2.3).
4. The effect of CBR system availability is dependent on the characteristics of the decision maker, i.e., a decision maker with a high innate creative ability versus a low (or average) innate creative ability. The net effect of CBR system availability on the *quality* of the solution is largest for decision makers with a low innate creative ability. For highly creative decision makers, the net effect of CBR system availability on solution quality can even become negative (which seems to be mainly driven by the convergent aspect of creative thinking, presumably resulting in unconscious plagiarism) (see subsection 8.2.4).
5. Decision makers have difficulties in recognizing the contribution of the CBR system to the objective quality of their solution. That is, they evaluate the contribution of the CBR system by the characteristics of the CBR system usage process, i.e., system usage time and the number of cases read and used, and by the efficiency of the design process, i.e., the time that is needed to design a campaign (after the use of the CBR system), rather than by the CBR system's contribution to designing a better, more creative sales promotion campaign (see subsection 8.2.5).

In the next subsections, we will discuss the findings of the empirical studies in more detail and in light of the hypotheses formulated in Chapter 3.

Table 8.1 Summary of the Key Findings

Independent Variable(s)	*Dependent Variable*	*Hyp.*	*Expected Sign*	*Study 1 (n=17)*	*Study 2 (n=23)*	*Study 3 (n=120)*	*Conclusion*[+]
CBR System: ***Availability*** **(yes versus no)**	Solution Quality *(Creativity)*	H1a	+	**+**	**+**	**+**	**Supported (Study 1-3)**
	Solution Efficiency *(Solution Time)*	H1b	-	**NA**	**- (n.s.)**	**-**	**Supported (Study 3)**
CBR system: C*ase Base Content* **(far versus near analogies)**	Solution Quality *(Creativity)*	H2a	+	**NA**	**+ (n.s.)**	**- (n.s.)**	**Not Supported (Study 3)**
	Solution Efficiency *(Solution Time)*	H2b	+	**NA**	**- (n.s.)**	**+**	**Supported (Study 3)**
	Solution Quality *(Novelty)*	H2c	+	**NA**	**+**	**- (n.s.)**	**Not Supported (Study 3)**
	Solution Quality (Usability)	H2d	-	**NA**	**+ (n.s.)**	**- (n.s.)**	**Not Supported (Study 3)**
CBR System: ***Case Base Size*** **(large versus standard size)**	Solution Quality *(Creativity)*	H3a	+	**NA**	**NA**	**+**	**Supported (Study 3)**
	Solution Efficiency *(Solution Time)*	H3b	-	**NA**	**NA**	**- (n.s.)**	**Not Supported (Study 3)**
Decision Maker: ***Creative Ability*** **(high versus low ability)**	Solution Quality *(Creativity)*	H4	+	**(-)* (n.s)**	**- (n.s.)**	**+**	**Supported (Study 3)**
CBR System and Decision Maker: ***Availability x Creative Ability***	Solution Quality *(Creativity)*	H5	Negative Moderation	**(-)* (n.s.)**	**- (n.s.)**	**-**	**Supported (Study 3)**
Objective Contribution of CBR System to the Solution	Subjective Evaluations CBR System	H6	No Relation	**n.s.**	**n.s.**	**n.s.**	**Partially Supported (Study 1-3)**[0]

n.s. not significant at the 0.05 level; [*] creative ability in conjunction with CBR system availability

[+] *supported* = significant and in hypothesized direction; *not supported* = not significant

[0] no significant relationships between subjective evaluations and objective outcomes, except for perceived impact and solution efficiency (Study 2 and 3)

8.2.1 The Effect of CBR System Availability on Solution Quality and Efficiency

In line with *Hypothesis 1* and based on the findings reported in the empirical studies (Chapter 5 to 7), we may conclude that, compared to alternative means of decision support, CBR system availability significantly improves the quality of sales promotion campaigns (Studies 1 to 3) and the efficiency of the design process (Study 3) (see Table 8.1).

Solution Quality. In Study 1 (Chapter 5), we find evidence that CBR system availability enhances solution quality compared to not having a support system available. In Study 2 (Chapter 6), the results show that CBR system availability has a positive effect on the quality of the solution (i.e., the creativity of the campaign) relative to a benchmark system (i.e., an expert system). In the comprehensive third study (Chapter 7), we are able to replicate these findings. That is, compared to not having a CBR system available (i.e., an expert system or no system at all), CBR system availability has a positive effect on the quality of the solution (i.e., the creativity of the campaign). This effect is most prominent for decision makers who have a large size mixed CBR system available (i.e., containing 50 near analogies and 50 far analogies), relative to decision makers who have a standard size CBR system at their disposal (i.e., containing 25 near analogies and 25 far analogies). These results support the first part of *Hypothesis 1* with respect to the positive effect of CBR system availability on solution quality.

Solution Efficiency. For the second part of *Hypothesis 1*, regarding the efficiency of the design process, in Study 2 we find preliminary support that CBR system availability leads to a more efficient design process (i.e., resulting in lower solution times). In Study 3, we are able to statistically confirm this effect. That is, CBR system availability significantly reduces the time needed for designing a campaign (thus improving solution efficiency). This effect is most prominent for decision makers who have a CBR system with near analogies available, relative to decision makers who have a CBR system with far analogies at their disposal. These results support the second part of *Hypothesis 1* with respect to the positive effect of CBR system availability on solution efficiency, i.e., reducing the time needed to design a sales promotion campaign.

Remember that solution time is measured by subtracting system usage time from the total time that the participants worked on the task. The total time, i.e., system usage time plus solution time, is not lower for CBR system users than for no CBR system users. However, we should keep in mind that this was the decision maker's first experience with the CBR system. CBR system usage time thus also includes "learning" time, i.e., the time that was necessary for users to get acquainted with the system. Hence, on future CBR system usage occasions, efficiency might be further improved as a result of learning effects on the part of the decision maker.

Process Characteristics. If we reflect on the characteristics of the process behind the solutions, we might find clues about why CBR system availability can lead to better, more creative solution and to a more efficient design process.

Dahl and Moreau (2002), for instance, found a positive relationship between the number of analogies used and the originality of the design for a new "automotive dining" product (see "study 1" in their paper). Previous research has shown that people typically retrieve and use only a small number of base analogies (May 1973; Burstein, 1988; Wharton, Holyoak, Downing, Lange, Wickens and Melz, 1994; Markman and Moreau, 2001). The first analogy that is retrieved to serve as a base domain for a new problem has the strongest influence on the solution. Analogies that are looked at later are usually less influential (see Markman and Moreau, 2001; Moreau, Markman and Lehmann, 2001). Nonetheless, any dissimilarities or gaps in the solution that cannot be resolved by the primary analogy may be resolved by using supplementary base domains (Moreau, Lehmann and Markman, 2001). To put it differently, the primary analogy serves as the basis for the solution by enabling the decision maker to develop an initial structure for the target solution. Supplementary base domains can be used to fill the gaps that result from mapping the primary base structure onto the target domain.

Therefore, Dahl and Moreau (2002) suggest that it is important to learn and understand if (and how) firms can actively encourage managers to access multiple base domains when making their decisions (Dahl and Moreau, 2002). The more cases the decision maker has accessed (read and/or used), the larger the number and the variety of ideas that will be generated and the more discrepancies between base and target domain that can presumably be resolved. Eventually, this will lead to a more creative solution, i.e., both novel (as a result of a larger variety of ideas) and useful (as a result of the gaps that can be filled between base and target). A case-based reasoning system can actually help decision makers to access multiple base domains and, therefore, improve decision making resulting in solutions of higher quality.

In the comprehensive study (Study 3), we find that decision makers on average consult about four different cases, of which one is actually used in their campaign proposal. Furthermore, consistent with Dahl and Moreau (2002), in general we find positive correlation coefficients between the quality of the solution, i.e., creativity, novelty and usability, and the number of cases read and used. In the conditions in which the decision maker can choose between near analogies and far analogies (i.e., the standard and large size CBR system mixed analogies conditions), the relationship between the novelty (and creativity) of the solution and the number of far analogies *used* is significant and positive. Across all CBR system conditions, the relationship between the creativity and usability of the solution and the number of near analogies *read* is also positive and almost significant.

In contrast, in an unconstrained creative process, people might take a path-of-least-resistance (see Ward, 1994; Moreau and Dahl, 2005). That is, they might try to implement the first solution that comes to mind (e.g., a similar, previous sales promotion campaign). In line with the effort-accuracy trade-off theorem (Payne et al., 1993), when designing a sales promotion campaign with the availability of a CBR system, decision makers may choose to trade-off solution quality for solution efficiency, resulting in lower CBR system usage (both in time and the number of cases read and used). Decision makers who trade off quality for efficiency are likely to take the first suitable solution provided by the CBR system (which is most likely to be a near analogy) as a ballpark solution and modify it (if necessary) until a satisfactory solution has been developed. That is, they are more likely to apply a copy-strategy, which could result in a highly efficient, quick and usable solution, but not necessarily a novel and creative one.

The above-mentioned line of reasoning suggests that decision makers will not consult many cases and use the CBR system mainly as a tool for effort reduction, i.e., quickly construct a satisfactory solution. As mentioned earlier, in our studies we find that (on average) decision makers consult multiple cases, of which one is typically used for designing the campaign proposal. Our results demonstrate that this not (necessarily) comes at the expense of the quality (i.e., creativity) of the solution. That is, CBR system availability reduces the time needed to design a campaign, but also helps to improve the quality of the campaign (i.e., relative to decision makers who do not have a CBR system at their disposal). This implies that the CBR system provides the decision makers with high-quality examples on the basis of which he is able to quickly construct a good, creative solution.

As mentioned earlier, it may be difficult for decision makers to use more than one analogy, since the first suitable retrieved analogy places strong constraints on the solution by shaping the target domain. That is, analogies are often so helpful because they provide a set of relations that structure the representation of the target domain. However, once that structure has been established, other base domains (that are structured differently) will be less influential or useful for the newly structured concept (Markman and Moreau, 2001; Moreau, Markman and Lehmann, 2001). Nevertheless, supplementary analogies still might be used to resolve any dissimilarities or gaps in the solution that result from mapping the primary base structure onto the target domain.

In the comprehensive study, we find that when there are more cases stored in the CBR system (i.e., the large size mixed CBR system with 100 cases), decision makers on average (have to) read fewer cases than decision makers who have the standard size CBR systems (all containing 50 cases) at their disposal. This suggests that the larger the number of cases in the CBR system, the easier it is to find a closely matching case that largely structures the target domain and, therefore, the fewer the number of additional cases the decision maker has to consult. That is, the more closely the retrieved case matches with the problem at hand, the less adaptation is needed and, thus, the smaller the number of cases that the decision maker has to consult for resolving the differences with the current problem situation. The likelihood of finding a closely matching case is presumably larger for a CBR system that contains a larger number of cases as well as for a CBR system that contain near analogies.

8.2.2 The Effect of the Type of Analogies in the CBR System

With respect to *Hypothesis 2*, regarding the effect of near versus far analogies on solution quality and solution efficiency, we reported conflicting findings for Study 3 and Study 2 (see Table 8.1). In conclusion, we may say that far analogies require more time than near analogies and do not necessarily lead to more novel and creative sales promotion campaigns.

Solution Quality. In Study 3, we do not find a significant positive effect of the CBR system with far analogies on the novelty (*Hypothesis 2c*) and creativity (*Hypothesis 2a*) of the solution. In fact, the effect appears to be in the opposite direction. That is, providing decision makers with a CBR system with far analogies results, on average, in less creative and novel sales promotion campaigns than providing decision makers with a CBR system with only near analogies. With respect to the usability of the solution, we do not find a significant effect for the CBR system with far analogies either. Nonetheless, this effect is in the expected direction. That is, in comparison with a CBR system with near analogies, the availability of a CBR system with far analogies tends to result in the design of less usable sales promotion campaigns. Thus, the negative sign for the effect of a CBR system with far analogies on solution quality (relative to a CBR system with near analogies) provides preliminary support for *Hypothesis 2d*, but we are not able to confirm this effect statistically (see Table 8.1).

In Study 2, however, we did find that decision makers who had a CBR system with far only analogies at their disposal, on average, produced more novel sales promotion campaigns than those who had a CBR system with only near analogies at their disposal, which is consistent with *Hypothesis 2c*. This was also true for the creativity of the campaign (*Hypothesis 2a)*, but the latter effect was not significant. A replication study to resolve the conflicting findings of Study 2 and 3 for the far analogy condition, showed even stronger negative effects on solution novelty and creativity for the CBR system with far analogies. Hence, we have to conclude that *Hypothesis 2a* (creativity) and *2c* (novelty) cannot be supported (see Table 8.1). The findings reported in Study 2 could be due to a respondent effect, i.e., all participants in that study followed a bachelor course on knowledge-driven support systems in marketing. As a consequence, they might be more open and willing to let the CBR system interfere in their decision process and influence their outcome.

An explanation for the unexpected findings for the CBR system with far analogies could be that for most first-time, inexperienced sales promotion campaign designers it may be difficult to see the analogy when the base and target are rather distant from each other. As a result, the availability of a CBR system with only far analogies could fail to lead to the design of more creative sales promotion campaigns. As discussed in the theoretical part of this dissertation, when drawing far analogies the decision maker can map and transfer few surface-level attributes from the base domain to the target domain (Dahl and Moreau, 2002). The mapping and transferring has to occur mainly between higher-order, relational structures, which requires more cognitive effort and resources (Roehm and Sternthal, 2001). In other words, the problem solver has to make a mental "leap" instead of a mental "hop" (Holyoak and Thagard, 1995; Ward, 1998). Near analogies are drawn from base domains that have many surface and relational properties in common with the target domain. As a result, the analogy is visible at a superficial level and can thus be easily accessed and applied (by experts as well as novices).

This is also evidenced by the lower (average) number of far analogies used for designing a campaign in comparison with the (average) number of near analogies used in those condition where the decision makers has both types of analogies available. That is, decision makers consistently read and use fewer far analogies than near analogies when the CBR system contains both types of analogies. It should be mentioned that in Study 3, we observed a positive relation between the number of far analogies used and solution novelty in these conditions (i.e., for the CBR system standard size mixed and CBR system large size mixed). Apparently, if the respondent sees the similarity and applicability of a far analogy and decides to use it, then the resulting campaign is likely to be more novel (and creative), which is in line with *Hypothesis 2c* and *2a*, respectively. However, it is difficult to get the respondents to read and use a far analogy.

Solution Efficiency. In Study 3 and in the replication study we find that decision makers who have a CBR system with more distant, far analogies available need more time to design a campaign than decision makers who have a CBR system with near analogies at their disposal. This is consistent with our line of reasoning (see *Hypothesis 2b*) that the recognition of a near analogy is faster and the knowledge transfer from the base to the target is easier, because similarities between the base domain (i.e., the retrieved sales promotion campaign) and the target domain (i.e., the new campaign to be designed) already exist on a superficial level. For far analogies, one needs to work through abstract, structural similarities between both campaigns and translate them into actionable attributes and concepts, resulting in more time needed to design a campaigns. In Study 2, however, we find that the availability of a CBR system with far analogies does not lead to a less efficient design process, relative to the availability of a CBR system with near analogies. In fact, we find an opposite, but non-significant effect. Again, this could be due to a respondent effect. Based on the results of the comprehensive study and the replication study, we therefore may conclude that *Hypothesis 2b* is supported (see Table 8.1).

8.2.3 The Effect of the Number of Analogies in the CBR System

Hypothesis 3 deals with the effect of the number of cases in the CBR system on the quality of the solution and the efficiency of the design process. This effect was investigated in Study 3. In conclusion, having more cases available in the CBR system leads to the design of better, more creative sales promotion campaigns, but does not necessarily result in a more efficient design process.

Solution Quality. We find that the positive effect of CBR system availability (compared to having no CBR system available) is most prominent for the large size mixed CBR system (100 cases: 50 near analogies and 50 far analogies). Relative to the availability of the standard size mixed CBR system (containing 50 cases: 25 near and 25 far analogies), the effect of the large size mixed CBR system on solution quality is also significant and positive. That is, decision makers having a CBR system with 100 cases at their disposal design more creative (and more novel) sales promotion campaign than decision makers who have a CBR system with only 50 cases at their disposal. This result suggests that decision makers might benefit from the larger variety of cases in the large size mixed CBR system and are able to retrieve more closely matching cases than from the standard size mixed CBR system, which is also evidenced by the lower (average) number of cases they (have to) consult (i.e., 3.3. cases versus 4.4 cases for the standard size CBR system user group). Hence, we may conclude that *Hypothesis 3a* is supported (see Table 8.1).

The positive sign for the effect of the availability of a large CBR system (100 cases) on solution quality, relative to the standard size CBR system (50 cases), was also found in a preliminary study (see section 7.4.1 and Althuizen and Wierenga, 2004). In that preliminary study, however, the effect was not significant at the 5% level. Furthermore, in that study we also found that, irrespective of the size of the CBR system, the number of cases read and used by the participants positively influenced the quality of the solution (i.e., the creativity, novelty and the usability of the solution).

Solution Efficiency. We do not find a significant effect of case-base size on solution time, but the effect for the large size CBR system (i.e., relative to the standard size CBR system) is in the direction we expected (i.e., reducing solution time and thus improving the efficiency of the design process). In the theoretical part of this dissertation, we have argued that having more cases stored in the CBR system should increase the likelihood of finding a more closely matching case that requires little (or less) adaptation. Hence, we hypothesized that solution times should be lower for the large size CBR system than for the standard size CBR system. The effect that we find is not significant, but is in the hypothesized direction. Therefore, we may conclude that we have preliminary support for *Hypothesis 3b*, but we are not able to confirm this effect statistically (see Table 8.1).
Although their solution times are not significantly lower, it turns out that participants who have the large size CBR system at their disposal do (have to) read fewer cases in order to come up with an idea for a sales promotion campaign than participants who have the standard size CBR system at their disposal. This finding suggests that the users of the large size CBR system are able to retrieve more closely matching analogies than the users of the standard size CBR system and, therefore, provides additional preliminary support for *Hypothesis 3b.*

8.2.4 The Moderating Influence of the Decision Maker's Innate Creative Ability

Hypothesis 4 and *5* are about the effects of the decision maker's innate creative ability, in conjunction with CBR system availability, on the quality of the solution. *Hypothesis 5* deals with the moderating effect of innate creative ability on the relationship between CBR system availability and solution quality (i.e., creativity), and is examined in Study 2 and Study 3. In conclusion, the results of our studies suggest that CBR system availability acts as a two-edged sword, i.e., the availability of a CBR system (1) has a positive effect on the creativity of the solution for decision makers with a low creative ability, presumably by providing them with (creative) ideas that they are not able to generate themselves (i.e., a compensation effect), and (2) has a negative effect on the creativity of the solution for decision makers with a high creative ability, presumably by fixating their attention too much on the examples provided by the CBR system (i.e., unconscious plagiarism or conformity effect).

Solution Quality. In our empirical studies, we find convincing evidence that the innate creative ability of the decision makers moderates the effect of CBR system availability on the quality of the solution. In Study 3 (and Study 2), we find that CBR system availability is particularly beneficial for decision makers with a low (and average) creative ability, which is in line with *Hypothesis 5*. This suggests that the CBR system can compensate for a lack of creativity on the part of the decision maker. In other words, the CBR system seems to enhance the fluency, flexibility, and originality of decision makers who have difficulties with generating novel and original ideas themselves, by providing them with analogies. This finding is in line with a hypothesis formulated by Kletke et al. (2001; p.228), who expected that computerized creativity support systems "should facilitate more improvement in creative outcomes for low creative individuals than for high creative individuals". They argued that such a system is not likely to change the person's level of *innate* creative ability, but it may help to generate more novel ideas by stimulating divergent thinking.

For highly creative decision makers, there seems to be no improvement in the quality of their solution, relative to highly creative decision makers who do not have a CBR system at their disposal. In Study 3, we even find a significantly negative net effect of CBR system availability on solution quality for highly creative decision makers. The negative effect of CBR system availability seems to be mainly driven by the more convergent component (i.e., elaboration) of the decision maker's creative thinking ability, and not by his ability to think divergently (i.e., fluency, flexibility, and originality). Decision makers who have a high convergent thinking ability are probably more inclined to conform to the examples or analogies provided by the CBR system than low convergent thinkers. It should be noted that (unconscious) plagiarism as such is not a problem, after all that is the whole idea behind learning from previous experiences, but it might have a negative effect on creativity when "flaws" are copied or when it goes at the expense of including novel element (Marsh et al., 1996).

The availability of a CBR system entirely removes the initial advantage of decision makers with a high creative ability relative to decision makers with a low creative ability regarding the creativity of the solution. In the no system condition (in Study 3), the highly creative decision makers clearly outperform the low creative decision makers in terms of the creativity of their solution, but this difference disappears when they have a CBR system available. Thus, consistent with *Hypothesis 4*, we find convincing evidence for a positive direct effect of innate creativity ability on the creativity of the solution, but only when decision makers do not have a support system available. Hence, we may conclude that *Hypothesis 4* and *5* are supported (see Table 8.1).

8.2.5 The Relation between the Decision Maker's Subjective Evaluations of the CBR System and its Objective Contribution to the Solution

Consistent with *Hypothesis 6*, in all studies we do not find a significant relationship between the subjective evaluations of the contribution of the CBR system to the solution and its objective contribution to the quality of the solution. In conclusion, decision makers have difficulties in recognizing the contribution of the CBR system to the objective quality of the outcome. As a consequence, they evaluate the contribution of the CBR system by the characteristics of the CBR system usage process, i.e., system usage time and the number and type of cases read and used, and by the efficiency of the design process rather than by the quality of the solution.

Subjective Evaluations of the CBR System. First of all, in the empirical studies we find convincing evidence that the CBR system helps to improve both the quality of the sales promotion campaign and the efficiency of the design process, relative to the "no CBR system" benchmarks. However, in all studies, this is not reflected in the decision makers' subjective evaluation of the contribution of the CBR system. In comparison with the expert system and the no system conditions, the CBR systems received, on average, consistently lower ratings for the perceived usefulness of the system for enhancing the design of the sales promotion campaign, the perceived impact of the system on the final solution, and for the general attitude towards using marketing management support system for enhancing decision-making performance (i.e., after having worked with the system).

An explanation could be that the CBR system does not provide clear-cut answers, like the expert system does for instance. The CBR system leaves much room for interpretation and input from the decision maker, which may result in lower subjective evaluations regarding the contribution of the CBR system to the solution. These findings are in line with a study by Lilien et al. (2004), who found that decision support system users make objectively better decisions. However, the subjective evaluations of the decision process and the outcomes, such as decision satisfaction, did not necessarily improve as a result of (non-directive) support system usage (see also McIntyre, 1982; Davis, 1989; Van Bruggen et al., 1996).

Furthermore, in our studies we find that the relationship between the subjective evaluations of the contribution of the CBR system to the solution and the objective quality of the solution turns out to be non-significant. In addition, in the comprehensive study (Study 3) we demonstrated that the CBR system is particularly helpful for enhancing solution quality for decision makers with a low level of innate creativity ability. However, this difference in the contribution of the CBR system to the quality of the solution for high and low creative decision makers is also not reflected in their subjective evaluations of the CBR system. It may be difficult for decision makers to assess the true impact of the retrieved analogies on the quality of their solution, since the effects of the analogies on the solution may not be visible to the decision maker. It is well known that prototypes, metaphors and narratives exert their influence mainly via unconscious, automatic, intuitive "System 1" thinking processes, which are not accessible to the decision maker (Hogarth, 2001, p. 30; see also footnote 4).

Moreover, we find that the subjective evaluations of the CBR system, and particularly the perceived impact on the solution, are more strongly correlated with the characteristics of the system usage process, i.e., CBR system usage time and the number and type of cases read and used. That is, the longer the decision maker has used the CBR system usage and the more cases he has read and used, the higher the subjective evaluations of the contribution of the CBR system to the solution. The perceived impact of the CBR system on the solution is also correlated with the time that is needed to design a campaign (after the use of the CBR system), i.e., the lower the solution time the higher the perceived impact of the CBR system.

To conclude, the decision makers evaluate the contribution of the CBR system by the characteristics of the CBR system usage process and by solution efficiency, i.e., the time that is needed to design a campaign (after the use of the CBR system), rather than by its contribution to the objective quality of their solution. Hence, we can partially support *Hypothesis 6*, i.e., there is no relation between the subjective evaluation of the contribution of the CBR system to the solution and its objective contribution to the quality of the solution.

8.3 Limitations of the Empirical Studies

In this section, we will discuss three main limitations of the empirical studies reported in this dissertation. A first main limitation concerns the respondent population, i.e., in our studies we used novice marketing managers (see subsection 8.3.1). A second main limitation deals with the domain and the tasks (i.e., sales promotion campaign briefings) that are used, i.e., in our studies we confined ourselves to the design of sales promotion campaigns within the domain of fast-moving consumer goods (FMCG) (see subsection 8.3.2). A third main limitation concerns the research design and measurement instruments used in our studies, and the measures for innate creative ability in particular (see subsection

8.3.3). In this discussion section, we will also pay attention to the generalizability of our findings to other decision makers and settings.

8.3.1 Expert versus Novice Marketing Managers

In our empirical studies, we used marketing students as substitutes for the novice marketing or sales promotion manager. A study by Remus (1987) showed that students are reasonable surrogates for real managers in managerial decision-making experiments. In addition, the managers in charge of sales promotion campaigns in companies usually are relative novices, i.e., junior or assistant brand managers. The results reported in this dissertation first and foremost pertain to the novice sales promotion manager.

Novice managers have much to gain from using a support system - and for weakly-structured problems in particular, such as designing a sales promotion campaign - since they lack the profound domain knowledge, practical experience and the rich collection in memory of previous, similar problem situations and solutions (i.e., potential base analogies) that the senior or expert manager typically possesses (see also Kletke et al., 2001). In this dissertation, we have shown that the graduate and undergraduate marketing students in our experiments indeed design better, more creative sales promotion campaigns when they have a CBR system at their disposal, and they do that more efficiently.

Are these results also relevant for expert sales promotion campaign managers and designers? One might expect that expert decision makers will benefit less from a CBR system, since the knowledge (captured in the form of cases) that the system provides is presumably already part of the large body of domain knowledge stored in their own memory. However, CBR systems, and knowledge-driven marketing management support systems in general, cannot only compensate for the lack of domain knowledge on the part of the novice marketing manager, but can also remove cognitive biases on the part of the expert. Moreover, the CBR system may remind the expert managers of cases that he has forgotten or has not been aware of. Hence, experts may still benefit from CBR system usage as some kind of artificial memory tool (see also Kletke et al., 2001), which can help to overcome biases like selective memory or selective perception (cf. the availability heuristic) by facilitating the retrieval of relevant cases from memory (i.e., from their own memory or from a collective memory).

Furthermore, novices are more likely to recognize analogies only at a superficial level (near analogies), which restricts the range of alternatives that they take into consideration as appropriate candidate solutions. Experts are known for their more effective and efficient search process for retrieving relevant information from (an artificial) memory (Glaser and Chi, 1998). Experts are also profound in recognizing analogies on a deeper, more structural level (Glaser and Chi, 1988) and may therefore be better able to benefit from the CBR system (and far analogies in particular), in terms of the quality of the solution and the efficiency of the design process. Kletke et al. (2001; p. 228) propose that decision makers with high domain-specific expertise will benefit more from using a "computerized creative support system (CCSS)", i.e., in terms of a larger number and a higher degree of novel solutions, and that they will use the support tool more intensively (i.e., in terms of a greater number of executions) than relative novices. They deduce this proposition from a review of the relevant literature and the empirical findings regarding the relationship between expertise and the effectiveness and efficiency of decision support systems (e.g., Mackay and Elam, 1992, Mackay, Barr and Kletke, 1992). In addition, they put forward that highly creative, expert decision makers who have a creativity support system available will generate a greater number of novel solutions (and use the system more intensively) than highly creative, novice decision makers (Kletke et al., 2001).

To conclude, we expect that experts may benefit from a CBR system as a tool to overcome biases by facilitating the retrieval of relevant cases from memory (i.e., from their own memory or from a collective memory). Moreover, they might particularly benefit from a CBR system with far analogies as tool to generate truly creative ideas (i.e., mental leaps). For novice decision makers, we saw that noticing the applicability of far analogies might be too far-fetched. Nonetheless, novices may benefit from a CBR system as a knowledge transfer tool to efficiently generate good ideas, which are largely based on near analogies. This can result in campaigns that are both more novel and usable, and thus more creative than without the support of a CBR system (as demonstrated in our studies), but not necessarily as creative as for expert designers. Thus, it would be interesting to conduct a follow-up study with experienced sales promotion campaign designers. Hence, in subsection 8.4.1, we will further elaborate on the role of expertise in the context of the suggestions for further research.

8.3.2 The Task Domain

In the studies reported in this dissertation, we confined ourselves to using briefings for sales promotion campaigns within the fast-moving consumer goods (FMCG) domain, viz. noodles and beer. One of the reasons for choosing this particular domain is that people can easily relate to it, since they are confronted with sales promotion campaigns for fast-moving consumer goods on a day-to-day basis when they enter a supermarket or a retail-store. Now, one could raise the question whether the CBR system also helps to design better, more creative campaign outside the domain of fast-moving consumer goods.

In a preliminary study (also mentioned in section 7.4.1), we gave the participants a briefing for a non-FMCG campaign. Their task was to design a campaign for the introduction of a new Research Master program at the Rotterdam School of Management with the objective to create awareness and let people sign up for the program (see Althuizen and Wierenga, 2004). Thus, in this study, the sales promotion campaign concerned a service, i.e., a new educational program, and not a fast-moving consumer good. Hence, we considered FMCG cases as *far analogies* and non-FMCG cases (mostly for services, non-profit organizations, and consumer durables) as *near analogies*. Consistent with the studies reported in this dissertation, in this preliminary study the participants also read and used, on average, more near analogies (here: non-FMCG case) than far analogies (here: FMCG cases).

In this study, we did find a positive effect of the number of cases that were *read* and *used* by the participants on the quality of the solution (i.e., on the creativity, novelty *and* usability of the solution) (see section 7.4.1). However, although the above-mentioned findings indicate that the participants "correctly" used the CBR system and did see the applicability of the analogies provided, we did not find a significant effect of CBR system availability as such on the quality of the solution and the efficiency of the design process. An explanation could be the degree of problem structure for the "Research Master" task. The degree of problem structure is one of the factors that determine the success of a marketing management support system (see, for instance, Wierenga and Van Bruggen, 2000). For novice decision makers in particular, it is probably more difficult to design a campaign for a service than for a fast-moving consumer good, since such campaigns are less common and less visible. As a consequence of the more ill-structured nature of the task, it might be difficult to retrieve and apply relevant cases from the CBR system (which is also less likely to contain "literal similarities", such as previous campaigns for educational programs). Hence, the degree of problem structure might moderate the relationship between CBR system and solution quality (cf. Spence and Brucks, 1997; see also subsection 8.4.2).

It would be worthwhile to explore the possibilities of using Case-Based Reasoning systems for decision support in other weakly-structured, experience-rich areas of managerial (marketing) decision making. An example of a potentially fruitful application area for CBR systems within the marketing domain would be new product development.

8.3.3 Research Design and Measurement Instruments

Research Design: Within-Subject versus Between-Subjects Experimental Design. With conducting experiments, one can always raise the issue of the external validity of the findings. We believe that the tasks in our studies closely resembled the "natural" process of designing a sales promotion campaign, including real-life company briefings and the use of previous campaigns in the idea generation process. One could argue that the process is extremely condensed, since in the second and third study the participants only had three hours to complete the task including support system usage. In real-life, sales promotion practitioners normally have and need more time (e.g., incubation time, see Wallis, 1926) to design a campaign proposal for a briefing. In our studies, three hours were found to be sufficient for the vast majority of the participants to come up with a one- or two-page proposal for a sales promotion campaign in which the basic idea and most important campaign features were conveyed. In the comprehensive study, we also measured perceived time pressure and found that the participants (on average) indeed felt that they had sufficient time to complete the task (see Chapter 7, footnote 58).

In line with previous studies on creativity and decision support systems (e.g., Elam and Mead, 1990; Massetti, 1996; Marakas and Elam, 1997), we performed a between-subject analysis. By conducting a within-subject study (see, for instance, MacCrimmon and Wagner, 1994) one could control for individual differences, such as the possession of prior marketing knowledge, experience, expertise, and the cognitive style of the decision maker. Assigning a respondent first to a "CBR system availability" condition and then to a "no CBR system" condition and vice versa (see, for example, Lilien et al., 2004) and could effectively rule out the alternative explanation that the results are due to individual differences (that are unaccounted for in our studies, e.g., intrinsic motivation to solve the problem) rather than CBR system availability. In contrast, a within-subject design introduces other problems, such as the occurrence of learning effects.

CBR System Characteristics: The Cases. The cases that are stored in the CBR system are cases that were publicly available at the time we built our *LEAPS* sales promotion application. They comprise the most successful, prize-winning campaigns from The Netherlands (Meetlatcomité Nederland, 1994) and Europe (Toop, 1992) from the late seventies to the early nineties of the last century. As a consequence, the cases do not incorporate knowledge regarding the latest information and communication technologies, such as promotion campaign via internet, e-mail, and mobile commerce. As our results show, there is still value in these cases. In fact, since these cases are distant (at least in time) from the sales promotion campaigns that are executed nowadays (cf. far analogies), they might be beneficial for enhancing creativity (i.e., by reviving successful ideas and techniques from the past that deviate from current sales promotion practices). In addition, it might be worthwhile to explore the possibilities for further enhancing creativity by including very distant base domains, such as poetry. To illustrate this, the "metaphoric connections" module in MacCrimmon and Wagner's GENI creativity support system contains fragments of poems in order to, as they say, "move the user away from an overly intense focus on the problem and to induce ideas that are less obvious" (MacCrimmon and Wagner, 1994, p. 1521). As our findings suggest, providing distant base domains is likely to be suitable for experts only, since they are probably better able to grasp the analogy with the target domain than relative novices (see also Novick, 1988).

The Measurement of Innate Creative Ability. Creativity is an elusive concept, hard to grasp with scientific methods. In the context of design tasks, we can distinguish the creative person, the process, and the outcome. Most creativity studies in marketing focus on the outcome and do not pay much attention to the creativity of the individual (i.e., innate creative ability), which can influence the outcome and the process. The few studies in (marketing) management that do measure innate creative ability use an easy-to-administer, self-report method (e.g., Massetti, 1996; Marakas and Elam, 1997). A notable exception is, for instance, a study by Burroughs and Mick (2004), who use a psychometric test (i.e., the Metaphoric Thinking Ability Sentence Completion Test) that is closely related, but not identical to creative ability. The apparent lack of innate creative ability measurement is probably due to the cumbersome (scoring) procedures for existing tests and the questionable validity of self-report methods (see, for a review and critique of methods, Hocevar, 1981).

A large variety of methods has been developed to assess innate creative ability, such as creative (or divergent) thinking tests (e.g., Guilford, 1968, Torrance, 1974), creative personality inventories (e.g., Gough and Heilbrun's (1980) Adjective Check List), attitude and interest inventories, biographical inventories, peer and expert nominations, and self-reported creative achievements (see Hocevar, 1981, Runco, 2004). However, it is probably safe to say that the Torrance Tests of Creative Thinking (TTCT) have become the most prominent and widely used test for the assessment of innate creative ability, since they were first published in the 1960s. They have been applied in over 2000 studies (Goff and Torrance, 2002) and in many different domains, such as psychology, child development and education. Repeated longitudinal studies have established strong evidence of relationships between the TTCT-test scores and real-life creative achievement (see, for a review, Torrance, 2000). However, administering the Torrance tests requires considerable testing time (1¼ hour per respondent) and scoring time (approximately 20 minutes per respondent). This is a huge impediment for its application in experimental research.

Apart from the "creative barriers" checklist that was used in the first study, in this dissertation we measured innate creative ability by means of two relatively easy-to-administer and validated methods that are both based on the renowned Torrance Tests (see subsection 4.3.1) and have become recently available, viz. a psychometric test (i.e., the Abbreviated Torrance test for Adults (ATTA) and a self-reported questionnaire (i.e., the Abedi Creativity Test (ACT)). The methods revealed sufficient internal consistency, but low to moderate convergent validity. In terms of predictive validity, the psychometric test that we used in the comprehensive study clearly outperforms the self-reported questionnaire (see Althuizen and Wierenga, 2006). With the limited evidence so far, it is too early to draw definite conclusions about the two methods for the assessment of individual creativity. However, it appears that with the ATTA-test we have a relatively easy-to-administer method for assessing the creative ability of individuals with relatively high predictive validity. The Abedi Creativity Test, which was used in Study 2, is even easier to administer, internally consistent and seems to possess predictive validity too, but to a lesser extent than the ATTA-test. This might be a reason for the difficulties we had in finding a significant direct and interaction effect for creative ability in Study 2.

In conclusion, the ATTA-test seems to be the appropriate test when taking into account "baseline" creativity for determining the effectiveness of creativity-enhancing support system and for selecting potentially creative individuals for sales promotion agencies or companies. More research is, however, needed to further investigate the reliability and validity of the two methods, such as larger sample sizes and different domains for assessing the predictive validity of the two methods.

8.4 Suggestions for Further Research

In this section, we will mention interesting avenues for further research based on the findings reported in this dissertation. A first, important avenue for further research concerns the role of expertise (subsection 8.4.1), as mentioned in subsection 8.3.1. A second interesting avenue for further research is the role of the structuredness of the problem, e.g., the difference in problem structure for non-FMCG versus FMCG sales campaigns (see subsection 8.4.2). A third promising avenue for further research concerns the role of the divergent versus convergent facets of creative thinking (see subsection 8.4.3). Finally, it might be interesting to include decision satisfaction and decision confidence as subjective evaluation measures for CBR system usage (see subsection 8.4.4) in order to investigate the decision maker's trust in the quality of the CBR system and its outcomes.

8.4.1 The Role of Expertise

Research on the role of expertise in analogical reasoning in the domain of psychology and also in consumer behavior (e.g., Alba and Hutchinson, 1987; Gregan-Paxton and John, 1997; Moreau, Lehmann, and Markman, 2001; Roehm and Sternthal, 2001), has shown that novices tend to focus on surface attributes and lower-order relations when processing analogies and transferring knowledge from base to target, while experts are also able to process higher-order, structural relations. Comprehending structural relations between base and target takes more cognitive resources and effort than comprehending surface attributes (see Roehm and Sternthal, 2001). Hence, in the absence of attribute cues, as with remote, far analogies, mapping the relations becomes effortful, and for novices in particular. For novices decision makers, comprehending and applying far analogies simply requires too much effort and cognitive resources, which explains the non-significant effect on solution quality for the CBR system with far analogies and its negative effect on the efficiency of the design process relative to the CBR system with near analogies. Moreover, research has shown that "given a fixed level of cognitive resources, the *elaboration* (cf., convergent thinking) of *surface attributes* prompted by a literal similarity (cf. near analogies) would come at the expense of the elaboration of *structural relations*" (cf. far analogies) (Roehm and Sternthal, 2001, p. 258). This might explain why we find a negative effect of high creative ability, and for the convergent facet of creative thinking (i.e., elaboration) in particular, on the positive relation between CBR system availability and solution quality. That is, novice decision makers in general, but probably the ones who think highly convergent in particular, tend to focus too much elaborating surface attributes, which goes at the expense of elaborating on the more abstract, higher-order relations between base and target that are important for the quality (i.e., creativity) of their solution.

How would the results differ if we let experts participate in our experiments? As mentioned, a consistent finding in the literature (see, for instance, Glaser and Chi, 1988) is that, due to their extensive base domain knowledge, experts are better able to recognize, map and transfer structural relations between base and target, even in the absence of attribute cues (see Roehm and Sternthal, 2001). According to Gregan-Paxton and John (1997), when it comes to knowledge transfer experts are more likely to engage in schema-based transfer processes (i.e., focusing on similar structural relations) as a means to transfer knowledge from base to target, while novices engage in a similarity-to-exemplar transfer process (i.e. focusing on similar attributes). Hence, we expect experts to be better able to benefit from a CBR system that contains far analogies (i.e., analogies that share few attributes, but many relations) in terms of the creativity and novelty of their solution.

Furthermore, Spence and Brucks (1997) found that the expert-novice differential in decision performance is largest at moderate levels of problem structure, i.e., for weakly-structured problems or "ill-structured, but structurable tasks" in their terminology (such as the real estate appraisal problem in their study). At both ends of the "structuredness" continuum (i.e., for well-structured, trivial problems and inherently ill-structured problems), they argue, performance differences between experts and novices are small, with absolute performance levels, of course, being lowest for ill-structured problems (see also discussion next subsection). Thus, experts and novices have most to gain from using a support system in ill-structured or weakly-structured decision situations. However, as Spence and Brucks (1997) argue, when novices have a decision support system at their disposal that requires “expert measurement” (i.e., requiring user judgment and qualitative input), they will not be able to close to gap in decision performance with experts in weakly-structured decision situations completely (Spence and Brucks, 1997). Since our CBR system is a qualitative, knowledge-driven support system that proposes relevant cases but leaves the final decisions to the user, we expect that, with respect to the design of sales promotion campaigns, experts clearly outperform novice decision makers when having a CBR system at their disposal.

To conclude, the effectiveness and efficiency of the CBR system may be contingent on the decision maker’s level of expertise. More specifically, the effect of the type of cases in the CBR system, i.e., near versus far analogies, will be dependent on level of prior domain knowledge of the user and his ability to grasp the (structural) similarities between the proposed base domains and the target. Hence, further research should include experts, e.g., senior sales promotion campaign managers from companies and professional designers from sales promotion agencies, in order to further explore the effectiveness and efficiency of CBR system availability for designing sales promotion campaigns.

8.4.2 The Role of Problem Structuredness

Besides the differences between experts and novices in decision performance for weakly-structured problems as such, as discussed in the previous subsection, it might be worthwhile to investigate the role of the degree of (weak) problem structure. That is, within the domain of sales promotion, for instance, we can distinguish between briefings that contain detailed information regarding the problem situation, objectives and constraints, and briefings that only contain a vague idea, some broad directives or just a theme. Clearly, these briefings differ in their degree of problem structure, which might have an effect on the (potential) contribution of the CBR system to the solution.

There has not been much research on the role of problem structure in marketing decision making (e.g., Spence and Brucks, 1997) and certainly not on how to measure problem structure. To measure the degree of problem structure, one option would be to use the “structuredness” instrument recently developed by Houdeshell (2005). This instrument is based extensively on the work done by Jonassen (1997, 2000), but the instrument has not been extensively validated. Preliminary results indicate sufficient internal consistency, i.e., Houdeshell (2005) reported a reliability coefficient of 0.82 when using the instrument for rating the degree of structure for content materials from mathematics, science, business, and engineering technology by three subject matter experts. Another option would be to let domain experts rate the campaign briefings, for instance, on a semantic-differential scale containing items such as repetitive-rare, unique-routine, unstructured-structured, programmable-not programmable, data rich-data scarce (or experience rich). Once the degree of problem structure is adequately measured, we can set-up an experiment in which we vary the degree of problem structure in the briefings and, therefore, investigate the possible moderating effect of problem structure on the contribution of CBR system availability to the quality of the solution.

As discussed earlier, for weakly-structured problems there is much room for improvement, for novices in particular. However, as Spence and Brucks (1997) argue, when the problem becomes "noisier" the performance differential between experts and novices becomes smaller and absolute performance levels become lower. This implies that there is also less room for improvement by providing novices with a decision aid, such as the CBR system, when the problem becomes less structured. In a preliminary study (Althuizen and Wierenga, 2004), in which the problem was less common and presumably less structured, we found that there was no significant difference in performance between the aided and non-aided novice decision makers. In contrast, experts might still be able to benefit from the CBR system in less structured decision situations.

8.4.3 The Role of Convergent versus Divergent Thinking Ability

To illustrate that the difference between convergent and divergent thinking can play a role regarding the effect of providing examples on the quality of the solution, we refer to an experiment by Smith et al., 1993. They found that when subjects were instructed to *diverge* from the examples that were provided, it had no effect on the degree of conformity relative to other groups. However, when subjects were explicitly instructed to *converge* to the examples provided to them, it significantly increased the conformity effect (see Smith et al., 1993). In our comprehensive study, we found evidence that the negative moderating effect of creative ability on the quality (i.e., creativity) of the solution is mainly driven by the more convergent facet of creative thinking.

The classification of fluency, flexibility, and originality as divergent thinking abilities is commonly accepted in the literature, but to rely solely on elaboration as a measure for the ability to think convergent would be open for serious debate. Therefore, we will need more distinctive and commonly accepted measures for measuring convergent thinking ability, such as IQ-tests, in order to draw firm conclusions about the moderating influence of convergent thinking ability on the relationship between CBR system availability and the creativity of the solution.

Nonetheless, the moderate correlation coefficients that we find in our studies between the measures of convergent thinking (i.e., elaboration) and divergent thinking (i.e., fluency, flexibility and originality) have face validity in our findings. That is, these moderate correlation coefficients are consistent with the empirical evidence regarding the relationship between convergent thinking ability and divergent thinking ability. That is, creativity (which is typically measured by divergent thinking ability tests) and intelligence (which is typically measured by convergent thinking ability tests (IQ-tests)) are found to be moderately correlated, and the correlation is stronger in the lower and midrange levels of intelligence than in the higher levels (e.g., above IQ = 120) (see Amabile 1983; Runco 1990; Eysenck 1994). Given our student samples, a moderate correlation between our divergent thinking and convergent thinking measure seems plausible in this perspective. In conclusion, further research should include a more distinctive and valid measure of convergent thinking in order to investigate the differential effects of convergent and divergent thinking ability on the effectiveness and efficiency of the CBR system.

To take this discussion a bit further, an interesting question would be whether the negative moderating effect of convergent thinking ability on the relation between CBR system availability and solution quality is dependent on the type of analogies that the decision maker reads and uses. That is, a promising avenue for further research in this direction could be to investigate the presence of a second-order interaction effect between CBR system availability, the type of cases (i.e., near versus far analogies) and the thinking ability of the decision makers (i.e., highly convergent and/or highly divergent).

In our studies, we find that for decision makers who have a low innate creative ability the quality of their solution improves when they have a CBR system available. Innate creative ability (as measured by the Torrance Tests) is composed of divergent thinking facets (i.e., fluency, flexibility, and originality) and a more convergent facet (i.e., elaboration) of creative thinking. Fluency is just the sheer number of ideas, which may be enhanced by a CBR system containing examples of previous, similar cases (analogies). Flexibility is defined as the number of different categories to which the responses belong, whereas originality refers to the unusualness (i.e., statistical rarity) of the responses (Sternberg and Lubart, 1992). The extent to which the CBR system can also enhance flexibility, originality, and elaboration will probably depend on the nature of the cases provided by the system, viz. near versus far analogies.

We would expect that far analogies will particularly stimulate flexibility and originality resulting in more novel and creative solutions, whereas near analogies will mainly stimulate convergent thinking, i.e., to help to find a quick, practical and usable solution. Hence, in line with the compensation effect we find in our studies, we would expect that the contribution of the CBR system - and that of near analogies in particular - to the usability of the solution is largest for decision makers with a low convergent thinking ability. Regarding the novelty of the solution, we would expect that the contribution of the CBR system – and that of far analogies in particular - is largest for decision makers with a low divergent ability. Thus, it would be most beneficial to provide low convergent thinkers with a CBR system with near analogies and low divergent thinkers with a CBR system with far analogies. Moreover, we also found in our studies that it might be too far-fetched for low creative, low divergent decision makers too understand and apply far analogies.

As already mentioned, to be able to estimate an interaction effect between CBR system availability, the type of analogies in the CBR system (i.e., near versus far analogies) and thinking abilities (i.e., convergent versus divergent thinking), we first need a more distinctive and valid measure for the ability to think convergent. Second, for performing a regression analysis that includes first-order and second-order interaction effects, we need a larger number of observations for each possible combination of the three interacting factors in order to be able to estimate the parameters and to have sufficient statistical power to detect a second-order interaction effect.

8.4.4 The Role of Decision Confidence and Satisfaction

In this dissertation, we used perceived usefulness and perceived impact as evaluative measures for the contribution of the CBR system to the solution. Perceived usefulness is commonly used evaluative construct in the decision support literature (see, for instance, Venkatesh and Davis, 2000). In their study, Lilien et al. (2004) classify the perceived usefulness of a decision support system as a subjective evaluation measure of the *process*, although it includes items related to the quality and efficiency of the outcome, such as "using the system increased the quality of the SP campaign" and "using the system increased my productivity" (see Appendix 8a, question no. 7 and no. 8, respectively). However, it measures the perceived usefulness of the CBR system to *enhance* decision performance, and not the perceived quality of the outcome solution and the perceived efficiency of the decision process as such. For measuring the subjective evaluation of the decision *outcome*, Lilien et al. (2004) therefore use the construct of decision satisfaction, i.e., the degree to which the decision maker is satisfied with the decision that has been reached or, in our case, the solution that has been generated. The measurement instrument that they developed consists of five-items, such as “it is of high quality”, “I am satisfied with it”, and “I am confident that it will work out well” (see Lilien et al., 2004).

Given that weakly-structured problems are characterized by the fact that they have no right or wrong answers, i.e., we can only speak of in terms of better or worse solutions, it is difficult to assess the objective quality of a solution. Nevertheless, it would be interesting to see whether decision makers who are satisfied with their solution also produced better, more creative solutions (i.e., according to the expert judges).

8.5 Scientific and Managerial Contributions

As will have become clear by now, we are first of all concerned with research into, and the development of, support tools for weakly-structured problems in marketing. Hence, the main contribution of this dissertation concerns the provision of effective and efficient support for weakly-structured decision making in marketing by means of analogical or case-based reasoning (see subsection 8.5.1). We believe that case-based reasoning is an appealing and intuitive approach to weakly-structured decision support that closely resembles the way managers usually tackle this kind of problems in practice. The second contribution of this dissertation relates the body of research on the effectiveness of analogical reasoning as a support principle in marketing (see subsection 8.5.2). In this dissertation, we experimented with the number and type of cases contained in the CBR systems and gathered information about the number and type of cases that the decision makers accessed and actually used for designing a sales promotion campaign. The results with respect to quality of the solution and the efficiency of the design process add to the literature on analogical reasoning. Third, there has not been much empirical research on the use of case-based reasoning for supporting creative (design) tasks. Hence, with this dissertation, we also contribute to the field of artificial intelligence and case-base reasoning research in particular (see subsection 8.5.3). Finally, we conclude this dissertation with recommendations for marketing and sales promotion practice (see subsection 8.5.4).

8.5.1 Contribution to Supporting Weakly-Structured Decision Making in Marketing

Data-driven models and support systems are excellent tools for supporting managerial decision making for structured marketing problems. However, many marketing problems, such as the sales promotion campaign design problems reported in this dissertation, and especially at higher decision levels, have the weakly-structured characteristics that make them more suitable for a qualitative, knowledge-driven approach towards decision support, such as analogical or case-based reasoning. Analogical reasoning is an appealing and intuitive problem-solving strategy when managers are confronted with weakly-structured problems (Polya, 1957; Gentner, 1989; Finke, Ward and Smith, 1992). That is, one of the first things that managers will do in practice is to search their memory for previous, similar experiences (or cases) that could help to interpret or solve the problem at hand.

The emergence of sophisticated, knowledge-driven AI techniques has greatly enlarged the possibilities for supporting managerial decision making. Whereas traditional techniques rely heavily on the availability of data (e.g., information systems), deep knowledge (e.g., expert systems) and the structuredness of the problem (e.g., analytical models), nowadays knowledge-driven techniques are available that are able to put also qualitative knowledge (accumulated from past problem-solving experiences) into action (see Fowler, 2000). To the extent that the knowledge residing in the heads of these marketing managers can be made explicit in the form of cases, the case-based reasoning (CBR) approach is especially fruitful in experience-rich domains, such as medical diagnosis and marketing communications. Furthermore, capturing problem-solving experiences in the form of cases and making them available for decision making is also the way in which we educated our future managers in business. Hence, by matching the type of support, i.e., a qualitative, knowledge-driven, case-based reasoning system, with the type problem, i.e., weakly-structured marketing problems, we also tried to bridge the gap between marketing theory and practice.

This approach to decision support is in accordance with the "task-technology fit" philosophy, which states that the type of support system should match with the type of problem (e.g., Goodhue and Thompson, 1995; Wierenga and van Bruggen, 2000). We have argued that structured problems can be best supported by means of data-driven, quantitative systems such as marketing models, whereas weakly-structured or ill-structured problems can be best supported by means of knowledge-driven, qualitative systems such as case-based reasoning systems. An additional advantage is that by using practitioners' knowledge as the source of decision support, the adoption and use of decision support tools may be facilitated.

Moreover, for weakly-structured (design) problems in which creativity plays an important role, analogical or case-based reasoning is probably one of the most powerful and efficient means of support. Creativity is often argued to stem from making "novel combinations of old ideas" (Boden, 1994), "using old solutions in a novel ways" (Kolodner and Wills, 1993) or "the forming of associative elements into new combinations which either satisfy requirements or are in some way useful" (Mednick, 1962) (see section 3.2), which is closely related to the process of analogical or case-based reasoning (Boden, 1994).

This dissertation demonstrated that analogical or case-based reasoning can be successfully used to put the vast amount of experience-based marketing knowledge (in the form of cases) into action for supporting weakly-structured problem solving in situations for which data-driven, model-based decision support is not available. We showed that CBR system availability improves the quality (i.e., creativity) of sales promotion campaigns and the efficiency of their design process. However, in line with the framework of factors that determine the success of MMSSs developed by Wierenga et al. (1999), the success is dependent on the characteristics of the CBR system (i.e., the supply side of decision support), such as number and type of cases in the CBR system, and the characteristics of the decision maker (i.e., the demand side of decision support), such as innate creative ability. Furthermore, we confirm the dominant finding reported in the decision support system literature with respect to the subjective evaluations of MMSSs (e.g., perceived usefulness). That is, decision makers who have a decision support system at their disposal are often unable to fully recognize, are not satisfied with, or have low confidence in the contribution of the support system to the quality of their solution (see McIntyre, 1982; Davis, 1989; Van Bruggen et al., 1996, Lilien et al., 2004).

To conclude, in the empirical part of this dissertation project, we focused on aiding decision makers in the process of designing creative sales promotion campaigns, which is a weakly-structured problem domain. We showed that the availability of our CBR system, called LEAPS, resulted in a significant improvement of both the quality of the campaign design and the efficiency of the decision process. Hence, to the wide range of marketing management support tools that are available to the decision makers for solving relatively structured marketing problems, we add an effective and efficient means of support that matches with how managers naturally approach weakly-structured or ill-structured problems, viz. analogical or case-based reasoning.

Ideally, in the near future management support systems should be flexible, multipurpose systems consisting of a quantitative, data-driven, rule-based component as well as a qualitative, knowledge-driven, case-based component (so-called case-based reasoning integrations, see Marling et al. 2002). In this way, the system can accommodate all kinds of decision makers and problem situations, while both reinforcing the strengths of the manager and compensating for his weaknesses.

8.5.2 Contribution to the Use of Analogical Reasoning in Marketing

There have been a number of studies on the use of analogies to enhance consumer understanding and learning in marketing domains, such as (comparative) advertising, brand extensions and really new products (e.g., Gregan-Paxton and

John, 1997; Moreau, Lehmann and Markman, 2001; Moreau, Markman and Lehmann, 2001; Roehm and Sternthal, 2001; Gregan-Paxton et al., 2002; Ait El Houssi, Morel and Hultink, 2005). Research on the use of analogies for (creatively) solving marketing problems, and design problems in particular, is not ubiquitous. There are, however, a few exceptions in domains such as new product development (Goldenberg and Mazursky, 2002; Dahl and Moreau, 2002; Moreau and Dahl, 2005), consumption and product usage (Burroughs and Micks, 2004), and marketing communications (this dissertation). This emerging stream of research focuses on (1) the effects of using analogies (Dahl and Moreau, 2002) or templates (Goldenberg and Mazursky, 2002) on the creativity or innovativeness of the outcome, and (2) on the characteristics of the problem-solving process itself, i.e., the conditions under which analogical reasoning is most effective (Moreau and Dahl, 2005, Burroughs and Micks, 2004).

In our studies, we did not pre-select or limited the number of the analogies that were provided to the decision maker such as in most of the studies mentioned above. That is, we provided the decision maker with a large repository of 50 or 100 potential analogies. The analogies that were retrieved from the CBR system depended on the type and number of search criteria that the decision maker deemed relevant for solving the task at hand. Furthermore, when the decision maker did not find the retrieved cases relevant for solving the problem, he could easily adjust the search criteria to retrieve other cases by using more, less or other criteria and values. This could either result in retrieving cases closer to the current case or cases that are more distant. However, the final decision whether to use a case for designing the sales promotion campaign was completely left to the decision maker. In that sense, the participants in our studies had more freedom to choose and to combine relevant ideas from previous, similar sales promotion campaigns.

As opposed to Dahl and Moreau (2002), who used a fixed number and set of examples (or “primes” in their terminology), we do not find a negative main effect, i.e., a conformity effect or form fixation, of providing decision makers with examples on the creativity of their solution. On the contrary, we find that examples or analogies can help to design better, more creative sales promotion campaigns. If decision makers conform to or fixate too much on the examples provided to them, i.e., so much that it goes at the expense of including novel elements, then only under certain circumstances. Our results indicate that this might be dependent on the characteristics of the decision maker. That is, for decision makers with a high creative (and high convergent thinking ability) the positive effect of providing cases diminishes and even becomes negative. This suggests that these type of decision makers should not be distracted too much in their creative process by giving them previous examples, which may cause them to inadvertently plagiarize or conform to the ideas and solutions presented in the cases. Furthermore, it might be that the conformity effect is stronger when using visual examples, such as in the study by Dahl and Moreau (2002), than when using narratives, such as the case descriptions in our CBR system.

However, we confirm the positive effect of using analogies *as such* for creatively solving design problems, in line with the studies by Dahl and Moreau (2002) and Goldenberg, Mazursky and Solomon (1999) in the area of new product development. We add to these previous findings that (1) the quality of the solution is dependent on the number of cases (or potential analogies) available to the decision maker and (2) the efficiency of the design process is dependent on the type of analogies that are available.

We conclude this subsection with three remarks. First, the more cases that the decision makers have at their disposal, the more creative the final solutions are. Of course, the advantage of the CBR system here is that it helps the decision maker in retrieving and selecting relevant analogies from a large repository. We note that Dahl and Moreau (2002) also found a positive effect of the number of analogies on the originality of the solution, but only for the number of analogies that were generated by the decision maker himself and thus not for the number of examples (or “primes”) that were provided to the decision maker.

Second, as suggested by other studies (e.g., Bonnardel, 2002; Dahl and Moreau; 2002), providing decision makers with far analogies should enhance the creativity and novelty of the solution more than providing them with near analogies. In this dissertation, we did not find this positive effect of far analogies on the creativity of the solution, probably because the far analogies are too far-fetched for the novice decision makers in our studies. We do, however, find that providing far analogies result in a less efficient design process.

Finally, in line with the findings reported by Burroughs and Micks (2004) for metaphoric thinking ability, we find that individual differences play a role in the creativity of the outcome. That is, we find a positive main effect of the creative ability (including the fluency, flexibility, originality, and elaboration) of the decision maker, as measured by the Abbreviated Torrance Test for Adults (ATTA), on the creativity of the solution. Moreover, as mentioned before, we find that the individual differences in creative ability moderate the positive effect of providing analogies on the quality of the solution. That is, providing analogies is most beneficial for decision makers with a low creative ability, whereas for highly creative decision makers this positive effect diminishes or even becomes negative. More research is needed to identify the main drivers of this effect, e.g., further investigate the role that convergent thinking ability plays in unconscious plagiarism.

8.5.3 Contribution to Case-Based Reasoning and Creativity

There is an ongoing debate in the literature about whether computers can be creative. This question has not been answered unequivocally yet (see, for example, Boden, 1991; Cohen, 1999; Schank and Cleary, 1995). In the field of Artificial Intelligence there have been a number of attempts to let computers act creatively (see Buchanan, 2001). A well-known example is the AARON program (written in the LISP computer language), which was developed by Cohen (1999) and is capable of autonomously drawing original, colored paintings at a speed of about one every two minutes. However, as the author concludes himself (see Cohen 1999, p.35):

"I don't regard AARON as being creative; and I won't, until I see the program doing things it couldn't have done as a direct result of what I had put into it"…"On the other hand, I don't think I've said anything to indicate definitively that it isn't possible. Many of the things we see computer programs doing today would have been regarded as impossible a couple of decades ago".

Case-based reasoning has always been regarded as a promising tool for supporting creative problem solving (Schank and Leake, 1989; Aamodt and Plaza, 1994; Kolodner, 1994; Leake, 1996). Based on the principle of analogical reasoning, CBR systems may serve as a basis for creativity by retrieving previous cases and applying solutions to new situations or in new ways. We will briefly outline two examples of CBR-applications that focus on creativity and then discuss what this dissertation adds these studies[73].

Previous CBR-research on creativity has focused on full automation. An early example is the SWALE research project (which is also mentioned in Table 2.5), conducted by Roger Schank, David Leake and colleagues. The SWALE system (see Schank and Leake, 1989) has a library of cases for explaining why animals and people die. For instance, people and animals can die naturally because of their age or can die because they are run over by a car. Swale is named after a young, successful, and thus apparently healthy, race horse that died mysteriously. Now, based on the cases and explanations stored in the library and some adaptation rule, the system generates creative explanation for this sudden death. Creative explanations involve, for instance, "owner kills horse for property insurance", which is based on an analogy with "spouse kills spouse for life insurance".

In the tradition of Cohen's work on painting, a more recent example is a system, called MONICA, that is able to autonomously draw original paintings in the style

[73] Other examples in this area are Kolodner and Wills (1993), and Wills and Kolodner (1994).

of the famous Dutch painter Mondriaan (Gomez de Silva Garza and Zamora Lores, 2005). The MONICA system combines the CBR-approach, i.e., storing existing Mondriaan paintings in a case-base, with formal adaptation rules (or neural networks) and evolutionary (combinatory) algorithms in order to generate novel paintings in the same abstract style as Mondriaan's paintings. The resulting paintings indeed closely resemble Mondriaan's style and are yet quite different from his existing paintings.

In both examples, the researchers tried and, arguably, succeeded in building a CBR system that is capable of autonomously being creative. However, in our opinion, designing sales promotion campaigns - and thereby having to anticipate on consumer behavior - is a less structured task than suggesting death causes and mimicking the mathematical approach of Mondriaan towards painting (i.e., use of the straight lines, boxes and colors). For instance, the researchers were able to capture the essence of a "Mondriaan" painting in just eight evaluation rules, such as "each colored region that is contained in a cases must have one of the five valid colors (blue, red, yellow black, white)" (Gomez de Silva Garza and Zamora Lores, 2005, p. 244).

Due to the weakly-structured nature of sales promotion campaign design problems, we opt for a different strategy towards supporting creativity, i.e., a combination of system and manager. This approach is in line with a study by Blattberg and Hoch (1990), who demonstrated that a combination of system support and managerial judgment produced the best results with respect to a sales forecasting task. More specifically, they found that a combination of 50% manager and 50% model outperformed other combinations. Thus, in this dissertation, we left the case adaptation part completely to the decision maker. To put it differently, our CBR system allows the decision maker to benefit from previous, successful experiences, while leaving the combination of ideas and/or the addition of novel elements, i.e., the creative part, to the domain of the decision maker. We found that the participants in our studies, who were asked to design a creative sales promotion campaign, produced (on average) more creative campaigns when having a CBR system available. Maybe in the near future, as our knowledge of the design of sales promotion campaigns advances, it might be also possible to combine our CBR-application with adaptation, combination (e.g., evolutionary algorithms) and evaluation rules or neural networks.

Finally, it should be noted that creativity is not always required in practice. For instance, when a given problem situation requires a company to boost sales quickly, it is likely to be sufficient and highly efficient to just retrieve and copy a similar, previous campaign. It goes without saying that the CBR system can support this practice as well. The decision maker does not have to reinvent the wheel in situations in which creativity is not directly required.

Summary of Contributions. In this dissertation, we have investigated the effectiveness and efficiency of CBR system availability for supporting weakly-structured marketing problems and the conditions under which CBR system availability is most successful. Our contribution to the literature is threefold.

1. We provided an effective and efficient means for decision support in weakly-structured, creative problem domains, viz. analogical or case-based reasoning.
2. We produced insight into the conditions under which this approach is most successful, i.e., the success depends on the number of cases in the system (i.e., more cases improve the quality of the solution), the type of case in the system (i.e., near analogies improve the efficiency of the design process), and the characteristics of the decision maker (i.e., the improvement in solution quality is largest for decision makers with a low creative ability).
3. We demonstrated that case-based reasoning can be used to stimulate creativity in design. Furthermore, we produced additional insight into the process behind it, such as the number and type of cases read and used.

In addition, we established that the Abbreviated Torrance Test for Adults (ATTA) is a relatively easy-to-administer, valid and predictive measure for the creative ability of the decision maker, which can be used in marketing research and in practice to select creative employees. After all, creativity is the lifeblood of marketing.

8.5.4 Managerial Recommendations

The fact that (marketing) professionals get very well paid for designing things (e.g., strategies, products, campaigns) stresses the importance of the type of weakly-structured problem solving that is studied in this dissertation (see also Jonassen, 2000). We will now outline five managerial recommendations for supporting weakly-structured decision making, which are based on this dissertation.

Recommendation 1: Try Case-Based Reasoning for Supporting Weakly-Structured Problems

Despite the focus in management education on solving relatively structured problems, many problems at higher management levels are ill-structured (Simon and Newell 1958; Jonassen 2000). Given the high-stakes often involved at higher management levels, improving managerial decision making for weakly-structured (marketing) problems by means of knowledge-driven support systems provides an excellent opportunity to improve a company's performance. In brief, there is a high potential pay-off.

Irrespective of the results reported in this dissertation, it would be therefore wise for organizations to start building a knowledge base by capturing, organizing and storing cases in a CBR system, and subsequently putting them into action for weakly-structured decision making. It is evident that there is value in case material. To give an example, for supporting their recruiting and selecting procedures, professional organizations, but also universities, might want to build a case base with past applications (both accepted and rejected ones) and recorded performances in order to facilitate the assessment of the potential of future candidates.

Recommendation 2: Capture, Store and Make Knowledge Available in the Form of Cases

Knowledge management is nowadays considered to be of utmost importance for companies to gain and sustain a competitive advantage (see, for a review, Alavi and Leidner, 2001). Knowledge management (i.e., by capturing, storing and making knowledge available for decision making) is not yet common practice, at least not in The Netherlands, although the attention for this topic is growing. An advantage is that by capturing and storing all relevant (marketing) knowledge that is present in- or outside the organization in a repository, knowledge is made more independent of persons or existing knowledge networks (e.g., communities of practice). Making existing knowledge independent of persons or networks, knowledge management has additional practical advantages besides securing the knowledge for the company, viz. facilitating the training of novices (cf. case-based education), less danger of "reinventing-the-wheel", detecting knowledge gaps, and time can be saved when searching for knowledge within the company (Ülpenich, 1999).

Systematically storing qualitative sales promotion knowledge in the form of cases, including problem situation, solution and outcomes, and putting these cases into action for decision making is certainly not common practice in The Netherlands. That is, neither for the companies engaging in campaigns to promote their sales, nor for the bureaus and agencies that are specialized in designing campaigns. Moreover, the people in charge of sales promotions in companies are usually junior or assistant managers, who are typically promoted after a few years to higher management positions within or outside the company. As a consequence, they take their accumulated sales promotion knowledge with them, which is then lost to the company. Our CBR system LEAPS can function as corporate memory for executed sales promotion campaigns, but can also include cases that have been executed by other companies. Case libraries, such as the ones accumulated by help-desk type of CBR systems, are an interesting example of the use of cases for building corporate memories and knowledge sharing (Leake, 1996, Sengupta, Wilson and Leake, 1999). Some of these case libraries have even become commercially available (Leake, 1996).

Recommendation 3: Different Types of Decision Makers need Different Types of CBR Systems

This dissertation demonstrated that CBR system availability is most beneficial for decision makers with a low creative ability. From a company perspective, the people who are usually in charge of sales promotion campaigns, i.e., assistant or junior brand managers, are comparable to the (under-) graduate marketing students in our studies. So, providing them with the CBR system could significantly enhance the creativity of their output, and consequently improve their company's performance. Nonetheless, as our results suggest, CBR system availability has a negative effect on the creativity of the solution for highly creative decision makers and - based on preliminary results - for decision makers with a high convergent thinking ability in particular. These results, however, apply to the novice decision maker.

For expert sales promotion campaign designers (from sales promotion agencies or companies) the effects of CBR system availability are likely to be different from the novices that participated in our experiments. As discussed earlier, experts are better able to recognize similarities and relationships at a deeper and more structural level, which makes it easier for them to comprehend and use far analogies. As discussed in Chapter 2 (see subsection 2.3.4), far analogies often underlie creative acts, such as the discovery of the benzene molecule. In addition, designers at sales promotion agencies are usually employed because of their creative abilities. Hence, we expect that, unlike the novices in our studies (except for Study 2), highly creative, expert decision makers might particularly benefit from the availability of a CBR system that contains far analogies, which may be even derived from other domains than sales promotions.

In general, consistent with Dahl and Moreau (2002), we argue that is important to learn and understand if (and how) firms can actively encourage managers to access multiple base domains when making their decisions, since the number of base domains (or cases) has a positive impact on the quality of the solution. In this dissertation, we demonstrated that providing decision makers with a CBR system helps to achieve this.

Recommendation 4: Follow and Stimulate a Compensation Strategy

A CBR system provides the decision maker with examples or ideas of previous sales promotion campaigns, which can serve as the basis for developing new and creative ideas. Hence, one could argue that a CBR system *reinforces* the strength of decision makers with a high creative ability, i.e., people who are able to generate many and diverse ideas. In this dissertation, we found that, in terms of the quality of the solution, a *compensation strategy* is most successful, i.e., decision makers with a low creative ability benefit most from the availability of a CBR system.
However, with respect to the *adoption* and *use* of support systems by managers, previous studies have suggested that a *reinforcement* strategy is most successful (Zinkhan, Joachimstaler and Kinnear, 1987; O'Keefe and Pitt, 1988; Van Bruggen et al., 1998). That is, decision makers are more inclined to adopt and actually use a system that reinforces their dominant thinking style. If a support system forces the use of an alternative cognitive style upon the decision maker, then this is likely to result in non-use or, if use is mandatory, in lower performance (De Waele, 1978; Huber, 1983). Hence, decision makers with a high creative ability should be more inclined to use the CBR system (and perceive the system as more useful) than decision makers with a low creative ability. In contrast, highly creative people, who are known for their independent minds, are likely to rely on their own creative ability. That is, the potential positive effect of a match with their dominant thinking style might be offset by a reluctance of such people to let a system interfere in their creative process.
In our studies, we gathered anecdotal evidence[74] that highly creative people in particular feared that using the CBR system would constrain their creativity by fixing their attention too much to the solutions given in the examples (which is consistent with what we find). Hence, some of them decided to solely rely on their own creative thoughts instead of using the CBR system. However, in general, we did not find significant differences with respect to the subjective evaluations and the characteristics of CBR system usage process for decision makers with different creative ability levels. Adoption and usage of our CBR system *LEAPS* might be further enhanced (for low creative decision makers) by developing a more user-friendly interface, training and by providing performance feedback (see next recommendation).

Recommendation 5: Provide Performance Feedback

The importance of perceived usefulness as a determinant of support system usage is well-documented in the support system literature (e.g., Robey 1979; Davis 1989;

[74] A number of respondents mentioned this explicitly in their SP campaign proposal, though they were not aware of the purpose of this study (see comments participants in Appendix 15).

Davis et al. 1989; Venkatesh and Davis 2000). The participants in our studies were not able to recognize the objective contribution of the CBR system to the quality of their solution and, therefore, they tended to evaluate the contribution of the characteristics of the CBR system usage, i.e., system usage time and the number of cases read and used, and by the efficiency of the design process. Performance feedback with respect to solution quality and efficiency would probably cause the more "objective" performance indicators to have a significant impact on the perceived usefulness of the CBR systems and on the general attitude towards using MMSSs for enhancing decision-making performance (see, for instance, Kayande et al., 2006). Hence, improving the perceived usefulness of the system, e.g., by feedback, training and education, could help improve CBR system usage and the ability of the decision maker to recognize the objective impact of the system on their solution. Furthermore, the presence of an MMSS advocate or "champion" within the company and support from top management (see Wierenga and Van Bruggen, 2000) are also important determinants for the adoption and use of a support system such as LEAPS.

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Appendices

Appendix 1a Methodology & Measurement Characteristics of the Studies Reported in Chapter 4

	Methodology					Measurement				
Study	n	Respondents	Design	Task	Conditions	Ability	Process	Outcome	Judges	Remarks
Connoly, Jessup and Valacich (1990)	23	Teams of business students (3 or 4 persons each)	2x2 Exp.	*Public Policy* plan to solve university parking problem	Software: - Electronic Brainstorming (EBS) (for idea generation and evaluation) Control: - paper and pencil	-	Manipulations: - Evaluative tone (critical/ supportive) - Anonymity (anonymous/ identified) Questionnaire on group decision making	Number of ideas Solution rarity "Workable and creative" ratings Overall ranking based on mean across judges (CAT)	3 Experts from Parking & Transport Department (CAT)	Instructions For Participants - Solution will be judged by experts on workability and creativity
Elam and Mead (1990)	12	Individual professionals of one company	1x3 Exp.	2 Tasks: to solve - *Business* plan for IS integration with client (+/- 15min) - *Public Policy* plan to increase patent activity in US (+/-15min) 2 tasks x 12 = 24 obs.	Software - ods/ CONSULTANT Version 1 (focus on causes) - ods/ CONSULTANT Version 2 (focus on solutions) Control: - paper and pencil	Adjective Check List (Gough , 1979)	Think aloud protocols Online protocols Time worked on assignment	Single-item creativity ratings Overall ranking based on mean across judges (CAT)	4 Business Experts 3 Public Policy Experts	Instructions *For Participants* - Creativity not mentioned in briefing *For Judges* - Relative judgments (not against domain standard)
MacCrimmon and Wagner (1994)	48	Individual undergraduate business students	Lab exp.	3 Main Tasks to solve: - Airline no- show - Ailing donut franchise - Public image large company (30min each) 3 x 48 = 136 between–subject obs (8 miss. obs) 41 within-subject obs (7 missing obs)	Software: - GENI (idea generation) Control: - Modified word processor (subjects in random order assigned to one condition per task, for contest free choice of program to use)	-	-	Number of ideas Dec. Quality: - Novelty - Non-obviousness - Relevance - Workability - Thoroughness	3 Expert Judges from Business Adm. Faculty	Instructions For Participants - 3 pages software manuals are available

	Methodology					Measurement				
Study	n	Respondents	Design	Task	Conditions	Ability	Process	Outcome	Judges	Remarks
MacCrimmon and Wagner (1994) (continued)				1 task (contest): - Rescuing hostages, airline safety, or acid rain (20min) 3-hour sessions				Overall ranking based on mean across judges (CAT)		
Massetti (1996)	44	Individual MBA students	1x4 Exp.	*Public Policy:* Solve Homeless Problem (30min)	Software: - IdeaFisher (generative) - IdeeTree (explorative) - Harvard Graphics (conventional, benchmark) Control: - paper and pencil	Hellriegel and Slocum Check List (1991)	-	Number of Ideas Novelty (averaged across judges) (CAT) Value (averaged across judges) (CAT) Creative Performance (mean of novelty and value rating)	2 Public Policy Experts	Instructions For Judges: - Relative judgments (not against domain standard)
Marakas and Elam (1997)	40	Individual professionals, graduates and undergraduate information system students	Lab exp.	Business related task adapted from Elam and Mead (1990)	Software: - ods/ CONSULTANT Vers. 1 Control: - paper and pencil	Adjective Check List (Gough 1979)	Manipulations: - Instruction vs. no instruction creativity enhancement process Post question. on process Computer logs Word count on solution	Single-item creativity ratings Overall ranking based on average across judges (CAT)	3 Expert Judges from Business School Faculty	Instructions For Participants: - Creativity not mentioned in briefing For Judges: - Relative judgments (not against domain standard

	Methodology					Measurement				
Study	n	Respondents	Design	Task	Conditions	Ability	Process	Outcome	Judges	Remarks
Dahl and Moreau (2002)	4	Teams of product designers	Verbal protocols	3 Studies, same task: New product development Design "automotive dining" device (1 hour)	single analogy multiple analogies no analogies (control)	-	Manipulations: - no prime - one prime - multiple primes - access strategy	All studies: - Originality - Innovativeness - Creativity	19 target customers (commuters who drove to work or school)	Use of judge dummies, instead of average rating across judges
	104	Undergraduate engineering students	Exp.				Insight into Creative Process: - number of analogies used		3 senior product designers,	Use of independent coders to judge use of near vs. far analogies
	119	Senior engineering students	Exp.				- resemblance of used analogy with base domain (3 items) - use of near versus far analogies	Third study only: - Willingness to pay	4 target customers 16 target customers	
Moreau and Dahl (2005)	96	Undergrads	Exp.	Design a toy, anything a child (5-11) can use to play with.	different sets of exemplar shapes	-	Manipulations: 1) input restrictions and 2) input requirements 3) time restrictions	All studies: Novelty: - Innovativeness - Originality	3 senior consumer product design professionals	-
	72	Undergrads	Exp.	Design a toy, anything a child (5-11) can use to play with. (replication study, the only difference concerns the timing of one of the manipulations, in this study prior to informing participants about the task)			Written protocols by participants used to asses creative cognitive process (rated by 2 coders on a six-item scale)	- Creativity (7-point scales) (averaged across judges) (CAT) Appropriateness - Practical - Effective - Useful		
	131		Exp.	Design a toy, anything a child (5-11) can use to play with. (replication study, with additional time constraints 5 min. versus 50 min.)			Amount of time the participant spent on doing the creative activity was also noted (covariate)	(7-point scales (averaged across judges) (CAT) (all α's > .80)		

Appendix 1b Methodology & Measurement Characteristics of the Studies Reported in Chapter 4 (cont'd)

	Methodology				Measurement			
Study	n	Respondents	Design	Task	Outcome	Items	Judges	Remarks
Haberland and Dacin (1992)	102	Students	Survey	Watch TV commercials and rate them on creativity scale items (Likert and Semantic differential scale items)	Originality/ Novelty (4 items)	- unique, out of the ordinary, intriguing, commonplace/surprising	102 students	Creativity scale development study
					Meaningfulness/ Appropriateness (4 items)	- Know what is advertised, satisfying/unsatisfying, useful/useless, good/bad		
					Reformulation (4 items)	- does not change view, want to buy, see in a new light, change view/does not change view		
					Condensation (4 items)	- easy t o remember, simple but powerful to get message, brings lot of thoughts, interesting/uninteresting		
Andrews and Smith (1996)	193	Product managers	Survey	Designing marketing programs (in retrospect)	Novelty	- Dull/exciting, fresh/routine, conventional/ unconventional, novel/predictable, usual/unusual, unique/ordinary, commonplace/original	193 product managers judge most recent program in which there were involved	Novelty scale adapted from semantic differential Creative Product Semantic Scale (CPSS) (Besemer and O'Quin (1986)
	60	Consumers			Meaningfulness	- trendsetting/warmed over, average/revolutionary, nothing special/an industry model	60 consumers judge 4 products each = 240 obs	
					Creativity	mean of novelty and meaningfulness		
					Creativity	single-item Likert 7-point scale		
Moorman and Miner (1997)	92	Vice president of Marketing	Survey	New product development project (in retrospect)	Performance (4 items, 7-point Likert scale)	- sales relative to objective, profit margin relative to objective, return on assets relative to objective, return on investment relative to objective	92 vice presidents of marketing judge most recent new product, in the market for a minimum of 12 months	Creativity scale short version of Moorman (1995)
					Creativity (4 items, 7-point Likert scale)	- challenged existing ideas for category, offered new ideas to category , creative, spawned new ideas to other products		

	Methodology				Measurement			
Study	n	Respondents	Design	Task	Outcome	Items	Judges	Remarks
Menon, Bharadwaj, Adidam, and Edison (1999)	212	Senior executives	survey	Devising Marketing Mix Strategy (in retrospect)	Market Performance (3 items) Strategy Creativity (5 items)	- growth in sales relative to expectations, net profits relative to expectations, overall strategy performance relative to expectations - different from past, included new aspects, broke some rules of the game, innovative, parts are daring/risky/bold	212 executives judge the formulation and implementation of a recent marketing strategy for which performance data are available	-
Ford and Gioia (2000)	51	Upper-level managers	Interview protocol Survey	Managerial decision making (3 decisions in retrospect) (3x51 = 153 obs)	Novelty (2 items) Value (3 items) Creativity (1 item)	- novel/common, routine/unusual (7-point semantic differential scale) - worthless/valuable, effective/ineffective, successful/unsuccessful (7-point semantic differential scale) - creative/ non-creative	4 second-year MBA students judge the 3 decisions (past year, for which results are known) that the 51 managers themselves described and also classified as being creative or not	Classification of Creativity in: - Creative Solution (high novelty/high value) - Novel but Ineffective (high novelty/ low value) - Common but Valuable (low novelty/ high value) - Common but Ineffective (low novelty/ low value)
Burroughs and Mick (2004)	172 72	Adults (21-65) Undergrads	Exp. Exp.	Consumption problem: Find ways to solve problem of scuffed shoes before dinner and you're almost out of shoe polish. (based on Torrance (1966) "Just suppose…" problem)	Novelty Functionality Creativity	44 five-point items from Creative Product Semantic Scale (O'Quin and Besemer 1989) Purified into 10 item scale (not reported which items)	2 graduate students in psychology (inter-rater reliability, CAT)	The person's creative ability is also measured by means of 9-item sentence completion test, intended to measure metaphorical thinking ability (MAT-SC)

Appendix 2a Task Study 1

Sales Promotion Assignment

Minor Marketing Strategies and Marketing Intelligence
in the Era of Information Technology BMN62

15 November 2001

(Time and Location: 12:30 – 13:00 (A2), 13:00 – 15:30 (GB-19))

1. Introduction

For the following exercise you are have to use a knowledge-driven Marketing Management Support System. More specifically, you are going to use a Case-Based Reasoning system that is developed to support managers in designing promotional campaigns. **For this assignment you will work in teams of 2 persons each**. Preferably, non-Dutch speaking students team up with a Dutch speaking person, since the full case descriptions are written in Dutch. The system contains short case descriptions in English (to read them, go to *General Information*: 004 Short Case Description).

2. How does it work?

In short, CBR-Works4 is a case-based reasoning (CBR) program that allows you to retrieve cases from a repository of previous cases based on the user's inputs of the current problem situation. Based on your input regarding the current case and the importance you assign to each variable, the system will retrieve the most similar cases from its repository (as indicated by a similarity score). You may combine and adapt ideas provided by the retrieved cases in order to develop a solution for the current case, but of course you may also use your own imagination. Thus, don't expect the system to come up with clear-cut answers, it basically supports you in generating ideas for solving the current case.

The CBR-Works4 software is in principle self-explanatory. Some directives:

Searching for Relevant Cases:

- Go to ***Retrieval*** in the menu and select ***New Query***.
- By clicking on the **>** sign, which is shown in front of higher-order variables (for example "Market Situation"), a list of sub-variables will appear. But only after you have specified the value for this higher-order variable (in this case "Market Situation Description").
- By double-clicking with the left mouse button on the question mark **(?)** you can select and fill in a value for a certain variable (the combination "CTRL + left mouse click" allows you to select more than one value, if allowed (as for the "main objective variable", for example).

- You do not have to fill in the *"General Information"* part. This part serves informational purposes.
- Keep in mind that you only have to fill in values for the variables that you think are relevant for solving the current case.
- You can increase (or decrease) the importance of a particular variable, by selecting an importance level (ranging from *very high* to *very low*) in the right part of the pop-up screen.
- Some variables (i.e., *Product Category Name (fixed)* and *Country/ Region*) have subcategories which can be revealed by clicking on the + sign in front of the main category.

Retrieving Relevant Cases:

- After you have filled in the values for the variables you think are important, go to ***Retrieval*** in the menu and select ***Start Retrieval***.
- The case with the highest similarity score (see the bottom part of your screen) is listed first.
- You are able to view the ten most similar cases by selecting a case number (1-10) at the upper part of your screen.
- To start a new query, go to ***Retrieval*** in the menu and select ***New Query***. Or you can modify your input in the old query and again **"Start Retrieval"**

If you have any questions, I will be around to answer them.

3. Assignment

Unilever - a Dutch/ British producer of fast-moving consumer goods - wants to introduce four new flavors of Uno Noodles (i.e., ready-made food) on the Dutch market. The new flavors are *Beef*, *Ketjap*, *Oriental Vegetables* and *Red Chili*. The objective of the sales promotion campaign is to generate as much awareness among Dutch consumers (especially adolescents and young adults) as possible for each flavor, In addition, the campaign has to enhance the image of the brand and flavor. Therefore, for each flavor a separate campaign will be designed. ***Your task is to design a SP campaign for the Ketjap flavor***. The desired image of Uno Noodles Ketjap is:

Ready-made food that is "very well edible". The Indonesian ketjap (i.e., soy sauce) flavor is honest and exotic. People that have a liking for Ketjap are mysterious types, which can be expressed in an exotic and exciting campaign.

Your promotion budget is 9,000 Euro. To somewhat compensate for this low budget, you also have 4,000 sample packages of Uno Noodles Ketjap at your disposal. The execution period for the campaign is August/September 2002. The actual running time of the campaign is limited to one month or less (e.g., one day or one week). Note that your campaign will be judged on *measurable* awareness only. ***It is not allowed to contact Unilever for further information.***

The assignment: Hand in a written paper ***(max. 2 pages)*** in which you describe and motivate the design of your campaign, including:

- theme/ content
- technique
- supporting activities
- running time
- other remarkable, unique characteristics of the campaign

Also briefly describe ***(max. ½ page)*** which (parts of the) retrieved cases from the repository were useful for designing your campaign and describe how you retrieved these cases:

- the variables used *(e.g., main objective)*
- their corresponding values *(e.g., increase awareness)*
- their importance *(e.g., very high)*

And finally, please fill in the questionnaire attached to this assignment.

4. Judgment

Your contribution will be judged based on the following criteria:

- The potential reach of the SP campaign (e.g., the number of readers of a magazine, etc.). Including the potential to generate "free publicity" and with special attention to the reach within the target group, i.e., young people.
- The association with the Uno Noodles brand and the Ketjap flavor.
- The degree of novelty, creativity and usefulness/ feasibility of the SP campaign.

The SP campaigns will be judged and graded by a committee of sales promotion experts.
Good Luck!

The assignments and questionnaires have to be handed in on Monday, November 19th,, before 12:00 (room F1-61). Please write your name and student number on the assignment and questionnaire.

Appendix 2b Task Study 2 and 3

Sales Promotion Design Contest

Marketing Students

1. Introduction

For this exercise you are going to use a Marketing Management Support System (MMSS). More specifically, you are going to use an MMSS that is developed to support managers in designing Sales Promotion (SP) campaigns. *(For the no system condition: You are going to design a sales promotion campaign.)*

In order for this research project to succeed, it is absolutely necessary that you do not exchange information with your fellow students about the assignment! Most important is to make your own, original contribution!

2. The Assignment

Imagine that you are the creative director of a sales promotion agency and that you are asked to design a campaign for Grolsch beer. Again they ask you to be original, and not copy a previous Grolsch campaign!
For further details on the assignment, please read the Grolsch briefing carefully.

3. The Proposal + Questionnaire

Write a proposal for a sales promotion campaign in which you describe and motivate the design of your campaign, including:

- *Basic Idea* (within the music domain and consistent with desired brand image)
- *Sales Promotion Technique and Execution* (which promotional offer does the consumer get and how can he or she obtain it?).
- *Supporting Activities/ Communication* (how to attract the consumers' attention?)
- *Estimated Costs of the Promotional Offer*

Note: using advertising only does not qualify as a promotional campaign!

Save the proposal (max. 1 page in Dutch or English) in the word-file on your computer! And finally, fill in the questionnaire attached to this assignment!

Don't forget to write your name and student number in the proposal and on the questionnaire!!!

You will have 3 hours to complete the assignment, but if you are finished earlier you are allowed to leave.

4. Judgment

Sales promotion experts and Grolsch marketers will judge the SP campaigns**.** Your contribution will be judged based on the following criteria:

- The degree of creativity/ novelty of the campaign.
- The degree of usefulness/ feasibility of the campaign.
- The potential to reach the campaign's objectives.
- The consistency of the campaign with the desired brand image.

Success!

Appendix 3 Real-Life Briefing Study 2 and 3

GROLSCH BEERBREWERY THE NETHERLANDS

MEMO

To: ….

From: Eric Welles

CC: Mark Luft

Date: 1 October 2002

Subject: Promotion June 2003 Grolsch

Objective: Campaign Proposal

To	**:**	**Sales Promotions Agency**
Date	**:**	**1 October 2002**
Product(s)	**:**	**Grolsch Premium Pilsner**
Promotion manager	**:**	**Eric Welles**
Promotion number	**:**	**-**
Promotion Type	**:**	**National**
Customer(s)	**:**	**Food/Liquor**

Background:

Hereby we instruct you for a promotional campaign in the at-home consumption channel in June 2003.

Grolsch is a premium beer brand. At the market for at-home consumption Grolsch takes 3rd place, just behind Heineken and Amstel. In the "Achterhoek" en "Twente" (Dutch provinces) Grolsch is the most consumed premium brand of lager ("pilsner"), in the rest of the Netherlands it is considered to be a top quality brand. Competition on the lager-market is increasingly taking place on price (many price-reduction campaigns).

Grolsch values:

Current values:

- Outspoken life (self-confident, active in life)
- Top quality, tasteful beer, original, natural
- Sympathetic, passionate, self-confident, sense of style and quality

Brand Symbols:

- Logo
- Swingtop ("beugel") bottle
- "Plop" (sound of an opening swingtop bottle)

Promotion Period:

week 23 - …(length of period depends on promotion concept)

Objective Promotion:

Brand enhancing promotion that contributes to loyalty target for 2003:

- Loyalty Heavy Users 31% (vs. 28% 2001) (GFK-measure)
- Spontaneous campaign awareness: 10%
- Attractiveness: 40%
- Judgment – average: 6,8

On the basis of awareness/attractiveness measurement (Trendbox)

Target Group:

Heavy user beer consumers

The Task:

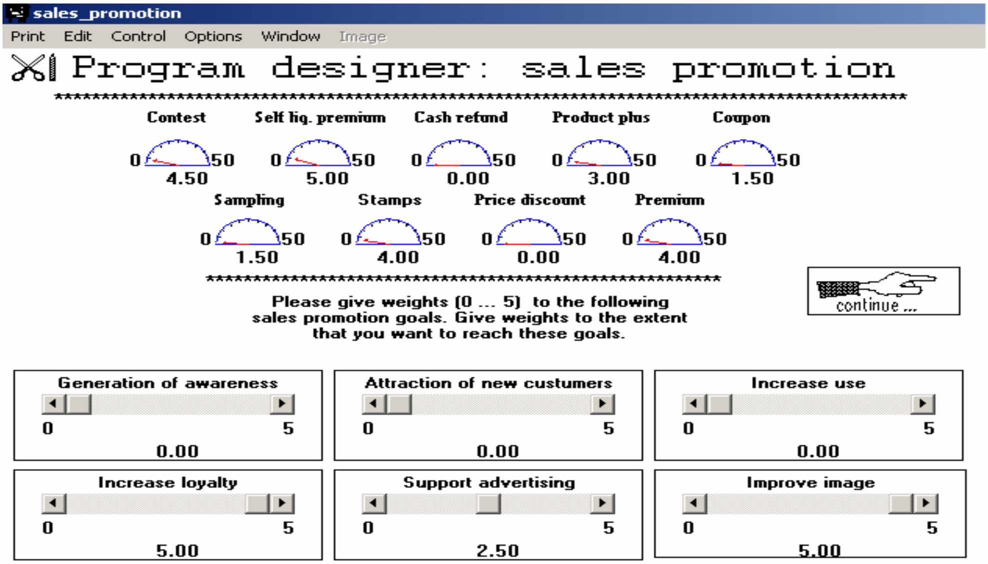
Develop a sales promotion campaign that connects with the Grolsch brand values and the domain "Live Music", moreover provide ideas for communicating the promotion. Support by means of a TV-commercial and/or a swingtop-item is possible.

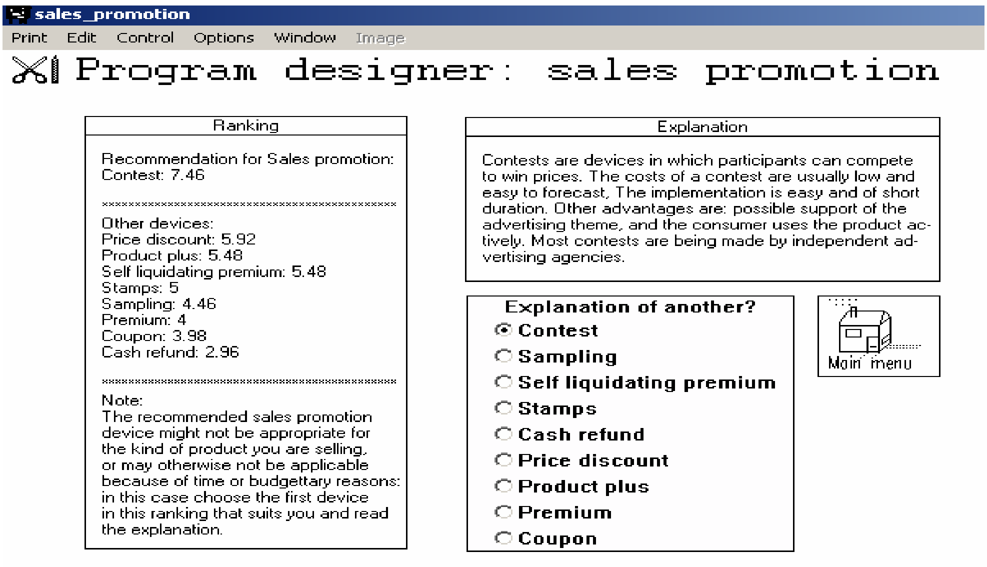
	Reference points: • original • fun • functional • (live) music
Constraints:	• No side-pack construction (i.e. nothing that has to be attached to the crate), no complex distribution/handling for supermarkets, not sensitive to shop-lifting and easily executable and visible at the point-of-purchase (preferably "self-displaying") • Promotion for crate(s) of Grolsch Premium Lager (30cl en 45cl bottles) • Total price (crate at €10.79 + value promotional offer) in principle lower than €15.
Planning:	Debriefing — week 40 Proposals — week 42 Definitive Concept — week 45
Costs:	• Please do include an offer for this assignment. • Please a clear distinction between concept & execution costs, because a third a third party or our own Marketing Services could do the execution.

Appendix 4 Excerpt of Technical Details CBR Sales Promotion Application: Concepts, Attributes, Types and Values

Concept	Attribute	Type	Values
General			
	Case Title	String	-
	Start Date Campaign	Date	Day/ Month/ Year
	End Date Campaign	Date	Day/ Month/ Year
	Short Case Description	String	-
	Full Case Description	Reference	Http://…
Problem Situation - Market Situation			
Product Category Situation	Product Category Name (broad)	Product Category	1st layer: Business-to-Business, Consumer Durables, Consumer Goods, Consumer Services, Non-profit, charity & fundraising, Communication 2nd and 3rd layer: Automotive, Household Appliances, Consumer Electronics, Furniture, Food, Non-food, Beverages, Non-alcoholic beverages, Alcoholic beverages, Tobacco, Health & beauty, Pet care, Fashion & clothing, Financial services, Telecom services, Energy supply, Travel & leisure, Retail, Hyper- & supermarkets, Hotels, Restaurants & bars, Other retail chains (e.g., department-, fashion- & drugstores)
	Product Category Name (narrow)	String	-
	Category Life Cycle Phase	Life Cycle	Introduction Growth Maturity Decline
	Price Level (Euro)	Price Range	Below 5 euro 5 – 49 euro 50 – 999 euro 1000 – 4999 euro 5000 – 24999 euro 25000 – 100000 euro Above 100000 euro
	Involvement	Generic2	High Medium Low
	Loyalty	Generic2	High Medium Low
	Purchase Motivation	Motivation	Informational Transformational
	Promotion Intensity	Generic2	High Average Low

Appendix 5 The Expert System: Sales Promotion Designer





BRANDFRAME's Sales Promotion Designer and Recommendation Module

Appendix 6 Sales Promotion Technique Inventory

Brief Explanation Sales Promotion Techniques

Contest

Contests are devices in which participants can compete to win prices. The costs of a contest are usually low and easy to forecast. The implementation is easy and short of duration. Other advantages are: possible support of the advertisement theme, and the consumer uses the product actively. Most contests are being made by independent advertising agencies.

Sampling

Sampling means offering the product free or almost free (in a small quantity). The costs of sampling are very high because the product is for "free", it commonly has an expensive package, and has high distribution costs. Sample actions usually have a long implementation time. Advantages: a fast introduction of the product and brand loyalty is stimulated.

Self-Liquidating Premium

Self-liquidating premiums are other products coming with the product for free or against price discounts. SLP's are cheap, although risk is involved because of stocks. Implementation can last long because of development and production time. Advantages: SLP's can support the product and the advertising theme, and costs can be adjusted to budgets easily.

Stamps

When stamps come with a product, the consumers can collect points to receive a present or cash money. Costs can hardly be forecasted, and the implementation time is long. Advantages: long term build up of brand loyalty, retailers support stamp actions (can be organized by them) and the flexibility to adapt stamp actions to the product or advertising theme.

Cash Refund

Cash refund means giving back a (percentage) of the purchase price. When the refund is relatively or absolutely high costs can be hard to forecast and very high. Advantages: the refund can differ per geographic region, weak products are also stimulated and some insight is given in the type of user buying the product. Note: cash refund may have a negative impact on brand loyalty.

Price Discount

A price discount is a temporary discount of the in-store price. Costs are easy to forecast and the implementation time can be very short. Price discounts are therefore a good defensive device. Other advantages: price discounts can be segmented easily and are easy to communicate. Disadvantages: a relatively expensive device and the impulse given to the consumer is not emotional but strictly rational.

Product Plus

Product plus means giving an extra quantity of the product for the same price. Costs are usually high due to the requirement of a special package, but can be forecasted accurately. Advantages: product plus actions are easy to communicate, a form of direct promotion and the extra volume that is given is cheap. Note: sales can fall when the quantity is back to normal.

Premium (in-, on-, near-pack)

In-, on-, or near-pack premiums are free gifts that come with the product. Costs are easy to forecast and fully adaptable to budgets. Duration of the implementation depends on the production and packaging of the premium. Advantages: little support of communication required and premiums result in a lot of impulse purchases. Note: packages without premium must be withdrawn from the shelf.

Coupon

A coupon action means giving a paper of a certain value that gives right to a discount when one buys the product. Costs are determined by the attractiveness of the offer, but the “out of pocket” costs are usually low. The implementation time can be very short. Other advantages: the execution can be regional or tailor made and joint promotion is easy made. Note: response is hard to forecast.

Appendix 7 MMSS Questionnaire: Form A (Before- and After-Measure)

Name: ____

Student number: ____

Please indicate, on a 7-points scale, the extent to which you agree with the following statements (MMSS = Marketing Management Support System (in Dutch: een beslissingsondersteunend systeem voor marketing managers).

1. I expect marketing decision making to be more satisfactory when using an MMSS.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

2. I think that marketing decision making will be easier when using an MMSS.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

3. I think marketing decisions made using an MMSS will be better.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

4. I think that the use of an MMSS is absolutely necessary for the support of marketing decisions.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

5. I expect that by using an MMSS, I will spend less time looking for information.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

6. I think the value of an MMSS is greatly overrated.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

7. I expect the use of an MMSS to increase my insight into marketing phenomena.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

8. I think that by using an MMSS, I will be able to make marketing decisions quicker.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

Appendix 8a MMSS Questionnaire: Form B ("After" Measure) (CBR)

Name: ____

Student number: ____

Please answer the following questions.

1. Assess the impact of the use of the Marketing Management Support System on your solution. Fill in a percentage that best expresses this impact: **... %**

   (0% = no impact at all; 100% = the solution is completely due to the system)

2. How long have you worked with the system? **.... minutes**

3. How long have you worked on the assignment in total? **.... minutes**

Please indicate the extent to which you agree with the following statements.

4. Did you feel that you had enough time to come up with an adequate solution?

   far too little **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***far too much***

5. Did you feel that there were enough cases in the system to come up with an adequate solution?

   far too little **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***far too much***

6. Using the system enabled me to design the Sales Promotion (SP) campaign more quickly.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

7. Using the system increased the quality of the SP campaign.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

8. Using the system increased my productivity.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

9. Using the system enhanced my effectiveness.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

10. Using the system made it easier to design the SP campaign.

    completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

11. I found the system useful for designing a SP campaign.

    completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

12. Using the system enhanced my creativity.

    completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

13. Are you aware of any Grolsch sales promotion campaign last year? **Yes/ No**
    If so, could you very briefly describe that campaign(s):
    -

Cases Read (please mention all cases that you have read, also the ones that you didn't use eventually):

1.
2.
3.
4.
5.
…

Cases Used (please mention the cases that you actually have used):

1.
2.
3.
4.
5.
…

If you didn't use the cases provided by the system at all, please briefly explain why not:

Appendix 8b MMSS Questionnaire: Form B ("After" Measure) (No CBR)

Name: ____

Student number: ____

Please answer the following questions.

1. Assess the impact of the use of the Marketing Management Support System/ *Sales Promotion Technique Inventory* on your solution. Fill in a percentage that best expresses this impact: **...** %

   (0% = no impact at all; 100% = the solution is completely due to the system)

2. How long have you worked with the system/ *inventory*? **.... minutes**

3. How long have you worked on the assignment in total? **.... minutes**

Please indicate the extent to which you agree with the following statements.

4. Did you feel that you had enough time to come up with an adequate solution?

   far too little **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***far too much***

5. Using the system/ *inventory* enabled me to design the Sales Promotion (SP) campaign more quickly.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

6. Using the system/ *inventory* increased the quality of the SP campaign.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

7. Using the system/ *inventory* increased my productivity.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

8. Using the system/ *inventory* enhanced my effectiveness.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

9. Using the system/ *inventory* made it easier to design the SP campaign.

   completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

10. I found the system/ *inventory* useful for designing a SP campaign.

    completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

11. Using the system/ *inventory* enhanced my creativity *(only asked in Study 4)*

    completely disagree **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***completely agree***

12. Are you aware of any Grolsch sales promotion campaign last year? **Yes/ No**
    If so, could you very briefly describe that campaign(s): -

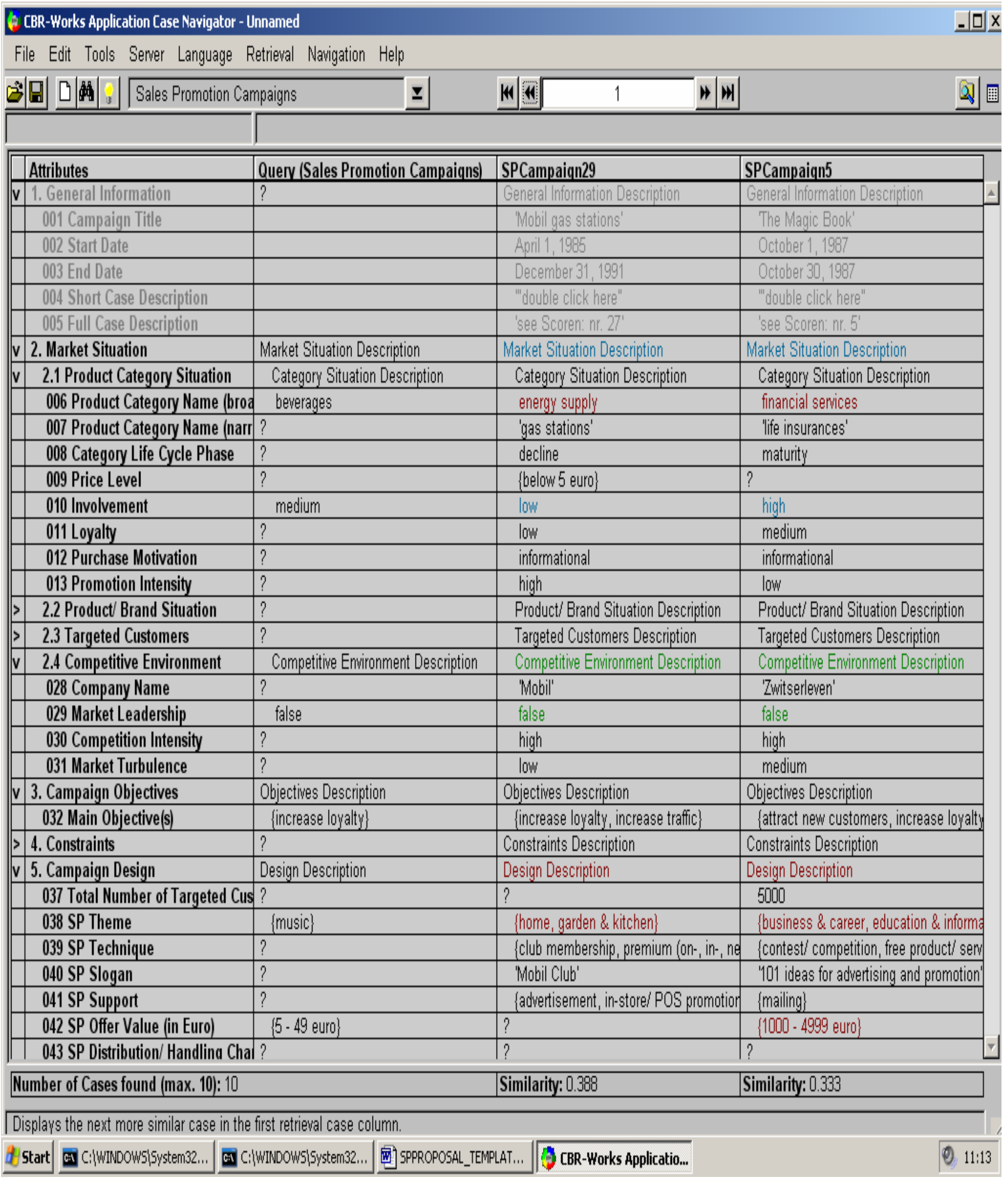
13. Which SP technique did the system advice you to use/ seems most appropriate to you, given the objectives of the campaign?

    ❍ cash refund
    ❍ price discount
    ❍ product plus
    ❍ premium (in-, on-, near-pack)
    ❍ sampling
    ❍ contest
    ❍ self-liquidating premium
    ❍ stamps
    ❍ coupon

14. Which SP technique did you eventually use in your SP campaign?

    ❍ cash refund
    ❍ price discount
    ❍ product plus
    ❍ premium (in-, on-, near-pack)
    ❍ sampling
    ❍ contest
    ❍ self-liquidating premium
    ❍ stamps
    ❍ coupon

Appendix 9 Example of a Screendump of the CBR System: Search Results Participant WM4



	Attributes	Query (Sales Promotion Campaigns)	SPCampaign29	SPCampaign5
v	1. General Information	?	General Information Description	General Information Description
	001 Campaign Title		'Mobil gas stations'	'The Magic Book'
	002 Start Date		April 1, 1985	October 1, 1987
	003 End Date		December 31, 1991	October 30, 1987
	004 Short Case Description		'"double click here"	'"double click here"
	005 Full Case Description		'see Scoren: nr. 27'	'see Scoren: nr. 5'
v	2. Market Situation	Market Situation Description	Market Situation Description	Market Situation Description
v	2.1 Product Category Situation	Category Situation Description	Category Situation Description	Category Situation Description
	006 Product Category Name (broa	beverages	energy supply	financial services
	007 Product Category Name (narr	?	'gas stations'	'life insurances'
	008 Category Life Cycle Phase	?	decline	maturity
	009 Price Level	?	{below 5 euro}	?
	010 Involvement	medium	low	high
	011 Loyalty	?	low	medium
	012 Purchase Motivation	?	informational	informational
	013 Promotion Intensity	?	high	low
>	2.2 Product/ Brand Situation	?	Product/ Brand Situation Description	Product/ Brand Situation Description
>	2.3 Targeted Customers	?	Targeted Customers Description	Targeted Customers Description
v	2.4 Competitive Environment	Competitive Environment Description	Competitive Environment Description	Competitive Environment Description
	028 Company Name	?	'Mobil'	'Zwitserleven'
	029 Market Leadership	false	false	false
	030 Competition Intensity	?	high	high
	031 Market Turbulence	?	low	medium
v	3. Campaign Objectives	Objectives Description	Objectives Description	Objectives Description
	032 Main Objective(s)	{increase loyalty}	{increase loyalty, increase traffic}	{attract new customers, increase loyalty
>	4. Constraints	?	Constraints Description	Constraints Description
v	5. Campaign Design	Design Description	Design Description	Design Description
	037 Total Number of Targeted Cus	?	?	5000
	038 SP Theme	{music}	{home, garden & kitchen}	{business & career, education & informa
	039 SP Technique	?	{club membership, premium (on-, in-, ne	{contest/ competition, free product/ serv
	040 SP Slogan	?	'Mobil Club'	'101 ideas for advertising and promotion'
	041 SP Support	?	{advertisement, in-store/ POS promotion	{mailing}
	042 SP Offer Value (in Euro)	{5 - 49 euro}	?	{1000 - 4999 euro}
	043 SP Distribution/ Handling Cha	?	?	?
	Number of Cases found (max. 10): 10		Similarity: 0.388	Similarity: 0.333

Appendix 10a Campaign Evaluation Form (Study 1: Uno Noodles)

Please rate, on a seven-point scale, the sales promotion campaign with respect to the following criteria.

1. The potential reach of the campaign.

   very low **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***very high***

2. The campaign's association with the Uno Noodles brand and Ketjap flavor.

   very low **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***very high***

3. The degree of novelty in the campaign design.

   very low **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***very high***

4. The degree of creativity in the campaign design.

   very low **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***very high***

5. The usefulness of the campaign.

   very low **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***very high***

6. The feasibility of the campaign.

   very low **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***very high***

7. How does this campaign compare to the campaign that was actually executed for the Uno Noodles Ketjap flavor.

   much worse **1 ----- 2 ----- 3 ----- 4 ----- 5 ----- 6 ----- 7** ***much better***

Comments (if any):

Appendix 10b Campaign Evaluation Form (Study 2: Grolsch Music)

Please rate the Sales Promotion proposals on a seven-point scale, ranging from:

very low 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 *very high*

Campaign no. Code no. / *Criteria*	*1 AB5*	*2 BG7*	*3 BO6*	*4 BV3*	*5 DM8*	*6 DS2*	*7 FB6*	*8 LP6*	*9 MB1*	*10 MH9*	*11 MR5*	*12 MV2*
1. *Potential to reach the target group "heavy users"*												
2. *Cost effectiveness*												
3. *Novelty*												
4. *Consistency with the desired Grolsch brand image*												
5. *Originality*												
6. *Consistency with the theme choice "live music"*												
7. *Complexity of handling of the promotional offer*												
8. *Potential to reach the objective "loyalty heavy users" (31%)*												
9. *Potential to reach the objective "awareness campaign" (10%)*												
10. *Potential to reach the objective "attractiveness campaign" (40%)*												

NAME JUDGE:
BATCH NR:

Appendix 10c Campaign Evaluation Form (Study 3: Grolsch Music)

Please rate the Sales Promotion proposals on the eight criteria listed below.
Assign a score from 0 to 10 to the corresponding boxes:

not at all 0 --- 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 --- 8 --- 9 --- 10 excellent

Campaign no.	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Criteria / *Code no.*	**AB7**	**AD5**	**AH5**	**AM2**	**AS6**	**AvH5**	**BH2**	**BK10**	**BO8**	**CE1**	**CT2**	**DR4**
1. The originality of the campaign.												
2. The effectiveness of the campaign to increase the loyalty of heavy users.												
3. The degree of surprise of the campaign.												
4. The usefulness of the campaign for Grolsch.												
5. The uniqueness of the campaign.												
6. The fit of the campaign with the brand values of the Beer Brand.												
7. The willingness to accept the promotion by trade partners.												
8. The attractiveness of the campaign for heavy users.												

NAME JUDGE:
BATCH NR:

Appendix 11a How to use the CBR-Works4 program?

What is CBR-Works4?

In brief, CBR-WORKS4 is a case-based reasoning program that allows you to retrieve cases from a repository of previous cases that are more or less similar to the current problem. Based on your input regarding the current case and the importance you assign to each variable, the system will retrieve for you the most similar cases (as indicated by a similarity score) from its repository.

You may adapt and combine ideas provided by the retrieved cases in order to develop a solution for the current case, but of course you may also use your own imagination. The system doesn't come up with clear-cut answers; it basically supports you in generating ideas for how to solve the case at hand.

Don't Forget To:

1. Make a screen-dump (SHIFT + Print Screen) of your last Query (zoekopdracht) and paste it into the word-file (at the end of the document)

2. Provide a reference (like in scientific articles), if an idea in your proposal is taken from one of the cases. ***For example: …. (Case 1: Lucky Strike)***

3. Keep a record of the cases that you have read, also the ones you didn't use in your proposal eventually, and report these in the questionnaire section "*Read Cases*".

4. If you are not using the system anymore, please close the program!

Start up Instructions

- Double-click on the **"start_althuizen"**-icon on your screen.
- Go to "**Tools**" in the menu-bar and select "**Case Navigator**"
- Go to "**Retrieval**" in the menu-bar and select "**New Query**"
- Now you can start to fill in the values for the variables that you think are relevant for the assignment.

The CBR-WORKS4 software is in principle self-explanatory. Some guidelines:

Searching for Cases

- To specify a value for a variable, double-click with the left mouse-button on the question mark (**?**)
- By clicking on the **>** sign, which is shown in front of some higher-order variables (for example "*Market Situation*"), a list of sub-variables will appear. But only after you have specified the value for this higher-order variable (in this case "*Market Situation Description*").
- The combination **CTRL + left mouse click** allows you to select more than one value, if possible (as, for example, for the "*Main Objectives*" variable).
- Some variables (for example, *Product Category Name (fixed)* and *Country/ Region*) have subcategories which can be revealed by clicking on the **+** sign in front of the main category.

- You can increase (or decrease) the importance of a particular variable, by selecting an importance level (ranging from *very high* to *very low*) in the right part of the pop-up screen.
- **You only have to fill in values for the variables that you think are relevant for solving the current case.**
- You do not have to fill in the "**General Information**" part. This part mainly serves informational purposes.

Retrieving Cases

- After you have filled in the values for the variables that you think are important, go to "**Retrieval"** in the menu and select "**Start Retrieval**".
- The case with the highest similarity score (see the bottom part of your screen) is listed first.
- You are able to view the ten most similar cases by selecting a case number (1-10) at the upper part of your screen.
- To start a new query, go to "**Retrieval**" in the menu and select "**New Query**". Or you can modify your input in the old query and again select "**Start Retrieval**".

Tips:

- Carefully read the briefing to identify appropriate values for the variables in order to retrieve relevant cases. You do not have to fill in values for all variables, only for those you think are important for solving the current case. **Keep in mind that there are no wrong answers!!**

- For more information about the retrieved cases, go to "**General Information**". Go to "**004 Short Case Description**" to read a short description of the case. To do so, double-click with the left mouse button on the words "double click here".

- For a more detailed case description, go to "Full Case Description" in order to find the location of the case in the Casebook.

If you have any questions, don't hesitate to ask!

Appendix 11b How to use the BRANDFRAME program?

What is BRANDFRAME?
In brief, BRANDFRAME is a program that helps you in selecting an appropriate sales promotion technique based on the objectives of the campaign. Depending on your input regarding the current case and the importance you assign to each objective, the system will come up with a recommendation for the most appropriate sales promotion technique to use.
You do not necessarily have to follow this recommendation; you may also use your own imagination. The system doesn't come up with clear-cut answers; it basically supports you in generating ideas for how to solve the case at hand.

Don't Forget To:
- If you are not using the system anymore, please close the program!

Start up Instructions

- Double-click on the "**start_althuizen**"-icon on your screen.
- Enlarge the BRANDFRAME-window (by clicking on the small window in the upper right corner)
- Click-on "**Design a marketing program**", and then on "**Sales Promotion**"

The BRANDFRAME software is in principle self-explanatory. Some guidelines:

- You can attach weights (from 0-5) to the objectives by left-clicking on the grey square and dragging it to the right or left. Or by left-clicking on the left or right arrow **(< … >)**
- You only have to attach weights to the objectives that you think are relevant for this campaign.
- Click on continue if you think you are ready.
- The last screen is the recommendation screen.
- You can read a brief explanation of the other techniques by left clicking on the circle in front of the technique.
- Click on "**Main menu**" to restart the program.

Tips:

- Carefully read the briefing to assign appropriate values to the objectives. You do not have to assign values to all objectives, only for those you think are important for solving the problem. **Keep in mind that there are no wrong answers!!**
- You can re-run the program with different input for the objectives to see what happens to the recommendation if you change the values.

If you have any questions, don't hesitate to ask!

Appendix 12a Example of a Campaign Proposal for UNO Noodles

SALES PROMOTION TEAM 15

Basic Idea: Uno Noodles is easy to prepare and “very well edible”. Ketjap is a new flavor in the noodles assortment, it has an exotic image. The people who will be interested in this flavor are mysterious types, who will get interested by a campaign that is exotic and exciting. To get such a campaign we thought of the following. It is always important to let people taste the Ketjap Noodles, otherwise you will never get convinced of the qualities of this well edible product. It is our job to avoid the barrier of not buying it because it is uncertain what you get. Because of the limit budget, we should come up with a campaign that does not take long, is not too expensive but does reach the target group.
The main goal of our campaign is to let people taste the Ketjap Noodles. There will be promotion team who hand out ready-to-eat Uno Noodles for free. Because of the limited budget we think it is realistic to do one big promotion action instead of a few small ones. Our first question is: where do you find your target group, and related to this, where should our promotion action be held? We want to reach as many people as possible. Where do you find these people at the end of the summertime? At a festival like Pinkpop! Each year this pop festival is held in Landgraaf. The festival takes from Friday till Monday evening and there are about 100.000 visitors during the weekend. Most of the people fit in our target group, they are about 20 to 30 years old. They stay at the festival ground for three full days, so they often eat their dinner at the stands available on this ground. These circumstances are perfect for us. In this way we can reach a big increase in awareness, because it is such a huge festival with a lot of hungry people, willing to eat something new and which is free.

Sales Promotion Technique and Execution: Thinking concrete, the plan is as follows. We will stay at Pinkpop for three days, from Saturday till Monday. We will hire a stand and get some free promotion in the publications about Pinkpop. During these days, we will hire a two person promotion team who will prepare the Uno Noodles. These people will need a stand with access to hot water in order to prepare the noodles. The way of preparing the noodles is easy, you take the noodles out of the package, put them in a specially made for this purpose (already existing) cup. This cup is green and has a yellow grate, which officiates as a little strainer. After the hot water is gone, you put the bag with herbs over the noodles and mix it together: ready to eat. The cup is a by-product of the Uno Noodles. The cooks and the stand will get an exotic look. Because this alone is not enough, we

should also get our own website with information about the product. We also want to offer a stamps action, where people can collect stamps to get their own cup (there will be an amount of own contribution). The stamps are on all the new noodles-flavors. Information about this action will also be available on the website. When people come to the stand to get some free taste they will get a flyer. The flyer will mention the URL of the website and will have a stamp (for the stamp action) for free, meant as encouragement for saving.
The techniques that are used for this campaign are the following: free samples, an event, and a stamps/savings system. Especially the stamps/saving system makes the campaign measurable. And, the website also generates information about the customer.

Supporting Activities/ Communication: We will launch a website where information about the product and the stamps collecting will be available and a stamps campaign for a Uno Noodles cup where you can prepare your noodles very easy. The running time will be short; it will take three days. We launch the campaign in August, as a result of the date of Pinkpop.

Estimated Costs of the Promotional Offer: Financially it divides as follows:

10.000 flyers (internally done)	EUR 1300
2 exotic cooks (EUR 100 per day)	EUR 600
hiring of stand + promotion	EUR 5000
transportation of goods	EUR 75
exotic clothes + accessories	EUR 300
6000 extra sample packages	EUR 800
internetsite (internally done)	EUR 1000
	EUR 9075

(749 words)

Appendix 12b Example of a Campaign Proposal for Grolsch

SALES PROMOTION PROPOSAL JP1

Basic Idea: On tour with Grolsch. Grolsch works together with public transport and event organisers to enable consumers to visit concerts and festivals during the summer. Consumers collect codes from Grolsch crates and choose where they want to go from brochures that are available at the retailers or on a special website. When they have enough codes, they enter these in the Grolsch web-site which sends them an automatic SMS which is their pass for the transport to the festivals, and gives them discount or entrance to the festival. This campaign fits with Grolsch' value of an outspoken, active life. It enables people to make the most of their summer, and drink a lot of Grolsch without the side-effects of paying for public transport or worrying about driving home. Also coupon systems increase consumer loyalty during the promotion with hopefully lasting effects. Having the mentioned program during summer can be very profitable for Grolsch as this is a time where most beer is consumed. Also, the brochures supplied by Grolsch give valuable information for anyone's interest and will help increase brand awareness.

Sales Promotion Technique and Execution: As already mentioned, the material needed to take part is in the crates. It works as a coupon and joint promotion. For example, if a consumer buys ten crates of Grolsch, he has ten codes; one in each crate. He can then find out in the brochure included with the crate or on internet, where he can go with them. When he has decided, he fills in the codes along with his name and starting address and immediately receives an sms which is the 'ticket' he needs to take part in the action. The further the event is from the consumer's home, the more codes are needed. To be most effective one 'ticket' should be valid for two people; no one wants to go somewhere alone.

Supporting Activities/ Communication: The most important supporting activities are making the correct arrangements with the public transport companies so that it works. Also, Grolsch must have a comprehensive list of events going on that are part of this deal so that it is truly attractive to people throughout the Netherlands. It should have the website in place to enable the infrastructure needed. It should also advertise this promotion on television, radio and posters to create awareness for the offer. Grolsch should do this in a joint effort with the event organizers as this promotion will also benefit them largely, as more people are likely to visit their events. Grolsch should also make sure they are the main supplier of beer for these events and take part in their sponsoring.

Estimated Costs of the Promotional Offer: The costs that will be incurred in this promotion depend on the deals that are made with the public transport company and on how long before summer Grolsch run this campaign. If it is started too early, consumers will be able to save lots of codes and will be able to take part in a lot of festivals, increasing the cost for Grolsch. Starting too late means that fewer customers will probably be attracted. The website – sms system is very useful as the information as to how many people used the service as well as where they went are available to Grolsch and the Public Transport companies.

(555 words)

Appendix 13 Cases Read and Used (Study 3)

Case Info			Frequency									
Case No.	*Case Title*	*Case Type*	*Total*		*C = 100*		*C = 50*		*C = NEAR*		*C = FAR*	
			Read	*Used*	*Read*	*Used*	*Read*	*Used*	*Read*	*Used*	*Read*	*Used*
1.	American Original Sunday	FMCG	5	3	1	1	-	-	4	2	-	-
2.	Megapool Cash Refund 2000	Non-FMCG	2	0	1	0	-	-	-	-	1	0
3.	Panda Loaf (WNF)	FMCG	2	0	0	0	0	0	2	0	-	-
4.	Great Anti Traffic Jam Book	Non-FMCG	5	0	0	0	3	0	-	-	2	0
5.	The Magic Book	Non-FMCG	4	2	1	1	-	-	-	-	3	1
6.	Chesterfield “Letter from Cairo”	FMCG	5	0	1	0	-	-	4	0	-	-
7.	Preservation of the Lickebaert	Non-FMCG	2	0	0	0	1	0	-	-	1	0
8.	Dommelsch Beer	FMCG	14	2	3	1	8	0	3	1	-	-
9.	Chiquita Bananas	FMCG	0	0	0	0	-	-	0	0	-	-
10.	PTT Post Writing Campaign	Non-FMCG	0	0	0	0	-	-	-	-	0	0
11/12.	Etos/ Margriet Sinterklaas (joint promo)	Non-FMCG	9	0	2	0	2	0	-	-	5	0
13.	AH Babyweek (joint promo)	Non-FMCG	7	1	2	0	4	0	-	-	1	1
14.	AH Babyweek (joint promo)	FMCG	4	0	0	0	1	0	3	0	-	-
15.	Blue Band Cookbooks	FMCG	1	1	0	0	-	-	1	1	-	-
16.	Shell Stamps	Non-FMCG	2	0	1	0	-	-	-	-	1	0
17.	Winner Shag and Art	FMCG	3	2	0	0	1	0	2	2	-	-
18.	Verkade Picture Books	FMCG	4	1	2	0	-	-	2	1	-	-
19.	Bijenkorf Crazy Days	Non-FMCG	7	0	0	0	3	0	-	-	4	0
20.	AH Chinese Chef	FMCG	3	0	0	0	3	0	0	0	-	-
21.	Pickwick Porcelain	FMCG	1	0	0	0	-	-	1	0	-	-
22.	Smiths Crispy Chips	FMCG	11	4	2	1	4	0	5	3	-	-
23.	Kodak Vakfotograaf	Non-FMCG	2	0	2	0	-	-	-	-	0	0
24.	ABN Corneille Pencil	Non-FMCG	6	1	1	0	2	0	-	-	3	1
25.	NS Tienertoer	Non-FMCG	1	0	0	0	-	-	-	-	1	0
26.	AH Premium of the Month Club	Non-FMCG	6	1	1	1	2	0	-	-	3	0
27.	Colgate/Palmolive Mien Dobbelsteen	FMCG	1	1	0	0	-	-	1	1	-	-
28.	Douwe Egberts Value Coupons	FMCG	18	9	3	3	10	4	5	2	-	-
29.	Mobil Gas Stations	Non-FMCG	2	0	0	0	-	-	-	-	2	0
30.	Mr. Edet	FMCG	1	0	0	0	-	-	1	0	-	-
31.	KLM America Now or Never	Non-FMCG	3	1	0	0	1	0	-	-	2	1
32.	NS/ Kanis & Gunnik (joint promo)	FMCG	4	2	2	0	1	1	1	1	-	-
33.	NS/ Kanis & Gunnik (joint promo)	Non-FMCG	1	0	0	0	0	0	-	-	1	0
34.	Lucky Strike Loewe Exposition	FMCG	8	1	4	1	-	-	4	0	-	-
35.	Sony Professor Decibel	Non-FMCG	3	0	0	0	0	0	-	-	3	0
36.	Sony Speakers	Non-FMCG	0	0	0	0	-	-	-	-	0	0
37.	Hubo Do-it-Yourself Stores	Non-FMCG	4	0	0	0	1	0	-	-	3	0
38.	Fur for Animals	Non-FMCG	3	0	0	0	-	-	-	-	3	0
39.	O de Lancome	FMCG	4	0	1	0	1	0	2	0	-	-

40/41.	Simon de Wit/ VNU Publishers	Non-FMCG	5	1	0	0	2	0	-	-	3	1
42.	Joseph Guy	FMCG	0	0	0	0	-	-	0	0	-	-
43	Uniekaas	FMCG	2	0	0	0	1	0	1	0	-	-
44.	Dummy Candy	FMCG	1	0	0	0	-	-	1	0	-	-
45.	Camel Trophy	FMCG	7	2	3	1	1	1	3	0	-	-
46.	Unox Tin Can Recycling	FMCG	4	0	1	0	-	-	3	0	-	-
47.	ABN Coin Collection	Non-FMCG	3	2	0	0	2	1	-	-	1	1
48.	Buitoni Egg Pasta	FMCG	1	0	0	0	1	0	0	0	-	-
49.	Amstel Bingo	FMCG	16	12	7	4	-	-	9	8	-	-
50.	Sony's Mad Avenue	Non-FMCG	5	0	2	0	-	-	-	-	3	0
		Subtotal Cases 1-50	202	49	43	14	55	7	58	22	46	6
Case Info			**Frequency**									
Case Nr	*Case Title*	*Case Type*	*Total*		*C = 100*		*C = 50*		*C = NEAR*		*C = FAR*	
			Read	*Used*	*Read*	*Used*	*Read*	*Used*	*Read*	*Used*	*Read*	*Used*
51.	The Great Nike Soccer Boots Transfer	Non-FMCG	1	0	0	0	0	0	-	-	1	0
52.	Heudebert Income Tax Cancellation	FMCG	5	1	0	0	2	0	3	1	-	-
53.	The New Vetril Game Show	FMCG	3	0	0	0	-	-	3	0	-	-
54.	Ernst Mortensen Double-Page Spread	Non-FMCG	0	0	0	0	-	-	-	-	0	0
55.	Johnnie Walker Free Phone Call	FMCG	10	1	2	0	4	1	4	0	-	-
56.	Lowenbrau Bavarian Shorts	FMCG	7	1	3	1	-	-	4	0	-	-
57.	NS Senior Citizens Rail Card	Non-FMCG	5	1	0	0	1	1	-	-	4	0
58.	Nescafe's Art of Loving Coffee	FMCG	1	0	0	0	0	0	1	0	-	-
59.	Range Rover's Wild Weekend	Non-FMCG	2	1	0	0	-	-	-	-	2	1
60.	Crown Piant's in Advance	FMCG	0	0	0	0	-	-	0	0	-	-
61.	Johnson Wax Shoe-Shine Boys	FMCG	0	0	0	0	0	0	0	0	-	-
62.	PTT Post's Write To Me	Non-FMCG	1	0	0	0	0	0	-	-	1	0
63.	Goodyear Looking for Winners	Non-FMCG	0	0	0	0	-	-	-	-	0	0
64.	Aosept National Lens-care Consultation	FMCG	0	0	0	0	-	-	0	0	-	-
65.	Half-Price Sprite	FMCG	1	1	0	0	1	1	0	0	-	-
66.	SIBC's One Left Wellie	Non-FMCG	0	0	0	0	0	0	-	-	0	0
67.	Light Up The World Cup with Matches	FMCG	2	0	0	0	-	-	2	0	-	-
68.	Ruddles' Tuppence Ha'Penny Pint	FMCG	5	0	0	0	0	0	5	0	-	-
69.	Chiquita's Day Out at Wallaby Park	FMCG	0	0	0	0	-	-	0	0	-	-
70.	Heinz 100 Day Driveaway	FMCG	0	0	0	0	0	0	0	0	-	-
71.	British Airways Air Miles	Non-FMCG	2	0	0	0	-	-	-	-	2	0
72.	Citizens! Let's unite our Tickets	Non-FMCG	4	1	1	0	0	0	-	-	3	1
73.	Royal Mail Britain Bearing Gifts	Non-FMCG	0	0	0	0	-	-	-	-	0	0
74.	Ramada Duck in a Box (Hotel)	Non-FMCG	8	1	2	0	4	1	-	-	2	0
75.	DMC Designer Dress Pattern	FMCG	0	0	0	0	-	-	0	0	-	-
76.	Sansoni Dictionary That Goes Click	Non-FMCG	1	0	0	0	-	-	-	-	1	0
77.	French Railways Get into Rock	Non-FMCG	6	2	0	0	0	0	-	-	6	2
78.	IP's La Squadra del Cuore	Non-FMCG	4	1	0	0	-	-	-	-	4	1
79.	Family Day	Non-FMCG	3	1	1	0	1	1	-	-	1	0

80.	Lysoform's Plant a Forest for Italy	FMCG	1	0	0	0	0	0	1	0	-	-
81.	Kourtakis Free Chalet Wine	FMCG	2	0	1	0	-	-	1	0	-	-
82.	Colgate's Give your Child the Best Start	FMCG	2	0	0	0	2	0	0	0	-	-
83.	Win a Fortune with your Number Plate	Non-FMCG	0	0	0	0	-	-	-	-	0	0
84.	Carlsberg Leisure Guides	FMCG	5	2	4	2	-	-	1	0	-	-
85.	Oggi in Tavola's Futuristic Electronics	FMCG	0	0	0	0	0	0	0	0	-	-
86.	Masterpieces by Javel la Croix	FMCG	2	0	1	0	-	-	1	0	-	-
87.	Lego's Escape from Shark Island	Non-FMCG	1	0	1	0	0	0	-	-	0	0
88.	Grand'mere's Grandmothers Day	FMCG	4	1	1	0	3	1	0	0	-	-
89.	Cardhu Cream Truffles	FMCG	4	0	0	0	-	-	4	0	-	-
90.	Stanley Help the Red Cross	Non-FMCG	2	1	0	0	-	-	-	-	2	1
91.	The Swatch Collector's Club	Non-FMCG	6	0	1	0	3	0	-	-	2	0
92.	Levi's 10 Best	Non-FMCG	1	0	0	0	-	-	-	-	1	0
93.	Win A Ghost in a Can	Non-FMCG	2	0	0	0	0	0	-	-	2	0
94.	Scotch Book of the Olympics	Non-FMCG	2	0	0	0	-	-	-	-	2	0
95.	Schlitz Beer Pro Football Guide	FMCG	6	4	0	0	5	4	1	0	-	-
96.	GE Spring Gift Catalog	Non-FMCG	2	0	0	0	1	0	-	-	1	0
97.	Jaguar's Drive a Classic/ Win A Classic	Non-FMCG	1	0	0	0	-	-	-	-	1	0
98.	9-Lives Poster Giveaway	FMCG	0	0	0	0	-	-	0	0	-	-
99.	UA's Take-off Game	Non-FMCG	2	0	0	0	0	0	-	-	2	0
100.	Kool Super Nights	FMCG	14	7	5	2	6	3	3	2	-	-
		Subtotal Cases 51-100	130	27	23	5	33	13	34	3	40	6

Total

Case Info	Frequency									
	Total		*C = 100*		*C = 50*		*C = NEAR*		*C = FAR*	
	Read	*Used*	*Read*	*Used*	*Read*	*Used*	*Read*	*Used*	*Read*	*Used*
Subtotal Cases 1-50	202	49	43	14	55	7	58	22	46	6
Subtotal Cases 51-100	130	27	23	5	33	13	34	3	40	6
Total	332	76	66	19	88	20	92	25	86	12

Legend

Color	Case Content
(green)	Beer/ Alcoholic Beverages
(magenta)	Music
(light blue)	Enhance Loyalty
(yellow)	Support Brand Image

Appendix 14 Sales Promotion Techniques Used per Type of System and the Average Solution Quality Ratings per Type of Sales Promotion Technique Used

Table 14A Used and Recommended Sales Promotion Techniques per Type of System

SP Technique	*CBR near*	*CBR far*	*CBR standard*	*CBR large*	*Expert system**		*No system**		*Total**	
	used	*used*	*used*	*used*	*adv.*	*used*	*adv.*	*used*	*adv.*	*used*
Cash refund	0	0	0	0	0	0	0	1	0	1
Price discount	0	0	0	0	0	0	0	0	0	0
Product plus	0	0	0	0	0	0	2	0	2	0
Premium	6	6	3	4	0	1	6	3	6	23
Self liquidating premium	1	3	1	2	0	2	1	6	1	15
Sampling	0	0	0	0	2	1	1	1	3	2
Contest/ Sweepstake	4	7	2	4	18	15	7	5	25	37
Stamps/Savings campaign	9	4	10	10	0	0	1	4	1	37
Coupon	0	0	0	0	0	0	2	0	2	0
Event	0	0	2	0	0	1	0	0	0	3
Loyalty program/ Club membership	0	0	2	0	0	0	0	0	0	2
Total	20	20	20	20	20	20	20	20	40	120

* adv. stands for advised meaning either the recommended technique in the expert system condition or perceived as most suitable technique on the inventory list in the no system condition

Table 14B Solution Quality: Average Scores per Type of Sales Promotion Technique Used

SP Technique	*N*	*Creativity Rating*	*Novelty Rating*	*Usability Rating*	*Efficiency (in minutes)*	*Length of Proposal*
Cash refund	1	4.97	6,11	3,88	88	663
Price discount	0	-	-	-	-	-
Product plus	0	-	-	-	-	-
Premium	23	5.95	6.23	5.67	84	521
Self liquidating premium	15	5.94	6.21	5.69	90	602
Sampling	2	*4.47*	*4.61*	*4.33*	**78**	367
Contest/ Sweepstake	37	5.89	6.17	5.62	92	523
Stamps/ Savings campaign	37	6.16	6.23	**6.09**	90	493
Coupon	0	-	-	-	-	-
Event	3	5.45	6.41	4.50	*121*	577
Loyalty program/ Club membership	2	**6.33**	**6.83**	5.83	**78**	610
Total	120	5.96	6.20	5.72	90	524
F-test (ANOVA) Between Group Differences		**3.214 (p=0.005)**	**2.110 (p=0.048)**	**5.372 (p=0.000)**	**0.464 (p=0.859)**	**0.923 (p=0.491)**

Appendix 15 Comments Participants

CBR Near Analogies (50 cases):

0. “Because I didn’t want to use the same ideas again.” (MW2) (pilot study, no ATTA score available)

1. “Cases were dated, didn’t look like the current marketing tools.” (SL3; ATTA-CI: 77(level 5))

2. “One case provided me with the initial idea, on which I based my plan.” (RT9; ATTA-CI: 68 (level 4))

3. “The match between the cases is too small. You can get some ideas, but that’s it. It is more useful for distribution etc than for the idea itself.” (ES3; ATTA-CI: 76 (level 5))

4. “To me, every campaign is unique. It is possible that there are similarities between target group etcetera, but in my opinion you can only globally scan through the case, not copy them. (SC3; ATTA-CI: 77 (level 5))

5. “No cases used, because they were not in line with the Grolsch values” (JV3; ATTA-CI: 77 (level 5))

6. “a) In my head, I was already forming my own idea, b) I found it hard to indicate similarities and values of attributes in the system c) couldn’t discover the similarities between the cases and the Grolsch case d) sometimes/often found the cases not original enough.” (PA3; ATTA-CI: 87 (level 7))

CBR Far Analogies (50 cases):

0. “The cases the system provided didn’t gave me ideas for the new campaign. It did stimulate me to come up with ideas myself.” (BG7) (pilot study, no ATTA score available)

1. “It decreases your creativity and makes you create ‘more of the same’. The campaigns were not relevant for the SP I wanted to create. Furthermore the program was not really user friendly which made it quite time consuming to browse through the potentially helpful cases.” (MK4; ATTA-CI: 91 (level 7))

2. “No cases used, wouldn’t be original, no match with image and objectives of Grolsch campaign.” (AP10; ATTA-CI: 87 (level 7))

3. "I did not find one cases in line with the campaign I had in mind." (RF4; ATTA-CI: 61 (level 3))

4. "Did have the feeling that many cases were about specific events, in addition the techniques mentioned are applied many times already and therefore wouldn't arouse people." (WH10; ATTA-CI: 68 (level 4))

5. "Unfortunately, the costs of the campaign are difficult to find and I find it difficult to estimate what my campaign will cost. In practice, it will depend on the available budget." (SE4; ATTA-CI: 80 (level 6))

6. "Cases were not in line with the idea I had in mind." (BH10; ATTA-CI: 84 (level 6))

7. "I find that the cases were not in line with the case of Grolsch." (WD4; ATTA-CI: 79 (level 6))

8. "Actually, I already had some ideas in mind after reading the Grolsch briefing and they are not affected much by the cases I read." (RC4; ATTA-CI: 83 (level 6))

9. "I did get some ideas. But I felt that I could not use specific actions for the Grolsch case. The system helped me to think differently en find solutions in other directions." (LO4; ATTA-CI: 70 (level 4))

10. "Too little choice. Creativity still has to come from the inside. The system is useful though to see different action strategies (stamps/premiums). Nevertheless, they are also in student textbooks and easier to find in such books." (DD4; ATTA-CI: 71 (level 4))

11. "No cases used, because I had a promotional campaign in mind, a combination of online en offline!" (JJ4; ATTA-CI: 70 (level 4))

12. "I haven't read them properly only to get an idea what it is about. I felt there was to big chance that I will copy the solutions and won't come up with my own, therefore I tried to use the cases as less as possible. The MMSS can be quite useful on the second stage of designing of a promotional campaign to prevent mistakes which were made in the past, however the use on the first stage (creative phase), program will be of less help." (ATTA-CI: 79 (level 6))

13. "I did not feel comfortable working with the CBR-Works. This is because I had the feeling it did not give me any helpful output after I specified the variables. Only one of the cases it found had music as campaign theme and this case was listed as number 10. I would rather prefer a more open structure in which I can see all the cases that responded to one variable. I want to do the selection by myself. Therefore I prefer a tree structure." (DR4; ATTA-CI: 71 (level 4))

14. "The basis on which this system selects is too abstract. Also, the explanation of the cases is too short. The base is okay, but I miss the feeling." (SA4; ATTA-CI: 60 (level 3))

15. "The cases I found through query had no similarity with my case. Plus, I think this case is unique." (MJ4; ATTA-CI: 71 (level 4))

16. "Difficult to find a campaign with music, and if it was the case, it was for a consumer durable, thinking about it by myself was more effective." (WM4; ATTA-CI: 69 (level 4))

CBR Standard Size Mixed (50 cases):

1. "They didn't match my idea enough." (ST2; ATTA-CI: 70 (level 4))

2. "PS: system served as support. When I read the word Grolsch, I immediately thought that they should position themselves as an "experience" (RA8; ATTA-CI: 77 (level 5))

3. "I quickly had an idea myself." (PB2; ATTA-CI: 59 (level 2))

4. "If you see other cases your creativity is filled with these existent ideas, it can't harm you if you have read it in advance but when you have to be creative it stops or blocks creativity. And in the long run you can get a lot of similar ideas (when segmenting or positioning)! So the main part of marketing 'diversification' (JS2; ATTA-CI: 66 (level 3))

5. "I can understand why the system prompted the case, but if I used them, I would just be copying another campaign, where's the originality in that?" (CT2; ATTA-CI: 88 (level 7))

6. "I partly used the Douwe Egberts case. Their stamps made me indirectly think of a multi-journey/ stamp-/ season ticket. But basically they are two different things. Every situation is different. For some it is a success, for others a disaster." (SB2; ATTA-CI: 91 (level 7))

7. "I didn't work with the system before and I didn't have much time to figure out how it works. Used my own creativity and did (unfortunately) not investigate the market and competition data first. I did read a few cases from the book." (AM2; ATTA-CI: 82 (level 6))

8. "Every product is unique, the time-setting is unique (in relation to market environment/opportunities and the company history (e.g., opening a new brewery)). In the case of Grolsch beer, none of the cases fitted 100%. Nevertheless, you can get some inspiration." (TD2; ATTA-CI: 84 (level 6))

9. "The case (no. 8) was about repositioning a brand. I had no ideas after reading that case." (JH8; ATTA-CI: 77 (level 5))

10. "I just came up with my own solution." (PV2; ATTA-CI: 69 (level 4))

11. "Far too little time to thoroughly master the program. Not user-friendly at all. I did browse through the case book though. I liked that better." (YT2; ATTA-CI: 72 (level 4))

12. "No cases used, because I didn't find them fit well with this case" (LT2; ATTA-CI: 86 (level 7))

13. "The MMSS system allows to create ordinary solutions. Cases show the options that are existing and probably have been used by competition. My study brought enough examples to rely on." (VA2; ATTA-CI: 82 (level 6))

CBR Large Size Mixed (100 cases):

1. "Beer and collecting items don't go together, beer drinkers don't collect items of bottles, you don't want to save labels for discounts, filling in something in order to win something is more effective for the consumer." (MB1; ATTA-CI: 83 (level 6))

2. "I felt like I only needed to use the system if and when I couldn't come up with creative solutions or ideas myself. This wasn't the case." (JD7; ATTA-CI: 77 (level 5))

3. "I didn't see many useful similarities." (TW1; ATTA-CI: 65 (level 3))

4. "Not similar enough, enough ideas of my own!" (AV7; ATTA-CI: 89 (level 7))

5. "While reading the instructions and thinking about it, this idea began to take form in my mind. (At that time, I didn't know exactly how to use it). I worked with it for a while, but I had my idea already formed and described." (EB7; ATTA-CI: 77 (level 5))

6. "To big differences." (KV1; ATTA-CI: 68 (level 4))

7. "The cases were interesting, but not applicable to the Grolsch case. I don't think that based on certain characteristics you can come to a creative solution. Especially ideas from a very different branch, product life cycle etcetera are interesting to apply." (MG7; ATTA-CI: 81 (level 6))

8. "I didn't find them similar enough to this case." (WE1; ATTA-CI: 87 (level 7))

9. "I didn't need the system, I just browsed through the case book to get an impression of sales promotions." (VW7; ATTA-CI: 72 (level 4))

10. "Eventually, I didn't use that many cases because creativity is triggered by one idea on which you elaborate further." (MM1; ATTA-CI: 63 (level 3))

11. "It is hard to apply them to Grolsch case and you don't have much time to write a proposal." (RS1; ATTA-CI: 61 (level 3))

12. "I had difficulties to work with the system, I did read the cases that were in the book, but after working with the system for ten minutes I quit." (CE1; ATTA-CI: 78 (level 6))

CBR Far Analogies (50 cases; follow-up study):

1. "On the basis of the summary, I did not expect any of them to be useful." (JV4; ATTA-CI: (level))

2. "The cases were in Dutch. I had a look at some cases to get an idea about types of promotional tools they used and basically used my imagination thereafter for coming up with a promotional design." (AK4; ATTA-CI: (level))

3. "First the system did not work. I had already come up with a campaign and after that the system was eventually working but it did not provide me with the information to find something creative." (SY4; ATTA-CI: (level))

4. "I did not use all the cases. I only glanced through the Shell case." (FK4; ATTA-CI: (level))

5. "They just made me think many things. The ones I wrote down made me think more." (AM4; ATTA-CI: (level))

6. "I felt the cases were too specific and individual. I imagined to copy part of or the total case but realized that would not be appropriate or new." (JB4; ATTA-CI: (level))

7. "The cases are not relevant. I think I'm able to create my own campaign without using those examples. I took an elective "communication and advertising" which was very useful." (FD4; ATTA-CI: (level))

8. "I didn't find relevant cases: no FMCG and not recent. The system was disorderly, but maybe it helps to select fewer variables. I obviously chose too many." (KA4; ATTA-CI: (level))

9. "I didn't really use a case. For a previous elective, I developed a marketing campaign that I used as a guideline for this one." (PF4; ATTA-CI: (level))

10. "Because I don't get creative from reading existing ideas. Maybe, it is good to read them in order to get in a creative "mood". But not useful beyond that." (VV4; ATTA-CI: (level))

11. “It was hard to use other cases, because mostly the cases from the CBR system were about products that are of transformational nature, while here I had to deal with an informational type of product. This difference can be very important when developing a campaign. Like this, there were other cases that differed from the Grolsch case on crucial aspects.” (WT4; ATTA-CI: (level))

12. “Did browse through them all, but not really used. Came up with an idea myself very soon. After reading the cases I quickly got and idea in mind and work that one out (by brainstorming).” (AF4; ATTA-CI: (level))

Appendix 16a Regression of Solution Quality: Large Size versus Standard Size CBR System

Table 16A.1 Regression of Solution Novelty: Large Size versus Standard Size

Dependent Variable	*Novelty of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	3.915	-	2.238	0.032
CBR System Characteristics				
- CBR System Large Size Mixed (dummy)	0.303	0.235	1.535	0.067+
Decision Maker Characteristics				
- Creative Ability Level	0.045	0.092	0.603	0.551
Covariates				
- Gender (0=male, 1=female)	-0.285	-0.211	-1.366	0.181
- Age	0.106	0.252	1.620	0.115
- Education Level	0.474	0.294	1.825	0.077
- Length of Campaign Proposal	0.000	0.121	0.763	0.451
	R^2_{adj}**=0.19**	F**=2.533**	**(**p**=0.040)**	

* Intercept represents the CBR System Standard Size condition; + α = 0.05, 1-sided; n = 40

Table 16A.2 Regression of Solution Usability: Large Size versus Standard Size

Dependent Variable	*Usability of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	5.835	-	2.736	0.010
CBR System Characteristics				
- CBR System Large Size Mixed (dummy)	0.542	0.329	2.256	0.016+
Decision Maker Characteristics				
- Creative Ability Level	-0.006	-0.010	-0.067	0.947
Covariates				
- Gender (0=male, 1=female)	-0.356	-0.206	-1.401	0.170
- Age	0.049	0.091	0.616	0.542
- Education Level	0.998	0.485	3.149	0.003
- Length of Campaign Proposal	0.000	0.007	0.046	0.964
	R^2_{adj}=0.26	**F=3.329**	**(p=0.011)**	

* Intercept represents the CBR System Standard Size condition; + α = 0.05, 1-sided; n = 40

Appendix 16b Regression of Solution Quality: Large Size versus Standard Size CBR System (preliminary study, n = 28)

Table 16B.1 Regression of Solution Quality: Large Size versus Standard Size

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	0.225	-	0.146	0.885
CBR System Characteristics				
- CBR System Large Size Mixed (dummy)	0.096	0.059	0.317	0.377+
Decision Maker Characteristics				
- Creative Ability Level (self-assessed)	0.017	0.272	1.434	0.165
Covariates				
- Gender (0=male, 1=female)	0.382	0.231	1.232	0.231
- Length of Campaign Proposal	0.001	0.332	1.434	0.087
	R^2_{adj}=0.12	**F=1.920**	**(p=0.141)**	

* Intercept represents the CBR System Standard Size condition; + one-sided test; n = 28

Table 16.B2 Regression of Solution Efficiency: Large Size versus Standard Size

Dependent Variable	*Solution Time*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	-96.219	-	-0.724	0.476
CBR System Characteristics				
- CBR System Large Size Mixed (dummy)	37.268	0.226	1.423	0.084⁺
Decision Maker Characteristics				
- Creative Ability Level (self-assessed)	0.593	0.092	0.568	0.575
Covariates				
- Gender (0=male, 1=female)	21.240	0.127	0.792	0.436
- Length of Campaign Proposal	0.192	0.575	3.618	0.001
	R^2_{adj}**=0.36**	***F*=4.710**	**(*p*=0.06)**	

* Intercept represents the CBR System Standard Size condition; ⁺ one-sided test; $n = 28$

Appendix 16c Regression of Solution Quality: Near Analogies versus Far Analogies CBR System (extra study)

Table 16C.1 Regression of Solution Quality (Creativity): Near Analogies vs. Far Analogies

Dependent Variable	*Creativity of the Campaign*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	6.582	-	4.597	0.000
CBR System Characteristics				
- CBR System Far Analogies (dummy)	-0.460	-0.376	-2.447	0.010⁺
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	0.043	0.107	0.736	0.466
Covariates				
- Gender (0=male, 1=female)	0.096	0.075	0.481	0.634
- Age	-0.017	-0.057	-0.348	0.730
- Education Level	0.792	0.380	2.132	0.040
- Length of Campaign Proposal	0.001	0.329	2.254	0.031
	R^2_{adj}=0.16	**F=2.343**	**(p=0.052)**	

* Intercept represents the CBR System Near Analogies condition; ⁺ one-sided test; n = 42

Table 16C.2 Regression of Solution Efficiency: Near Analogies vs. Far Analogies

Dependent Variable	*Solution Time*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	108.962	-	1.472	0.150
CBR System Characteristics				
- CBR System Far Analogies (dummy)	18.661	0.307	1.983	0.028+
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	1.842	0.092	0.623	0.538
Covariates				
- Gender (0=male, 1=female)	18.009	0.286	1.785	0.083
- Age	-2.372	-0.155	-0.910	0.369
- Education Level	18.641	0.182	0.996	0.326
- Length of Campaign Proposal	0.044	0.224	1.518	0.138
	R^2_{adj}=0.17	**F=2.406**	**(p=0.048)**	

* Intercept represents the CBR System Near Analogies condition; + one-sided test; n = 42

Table 16C.3 Regression of Solution Quality (Novelty): Near Analogies vs. Far Analogies

Dependent Variable	*Creativity of the Campaign*			
Independent variables	unstandardized coefficients (B)	standardized coefficients (b)	t-value	p-value
- Intercept*	8.326	-	5.429	0.000
CBR System Characteristics				
- CBR System Far Analogies (dummy)	-0.467	-0.361	-2.318	0.013⁺
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	0.036	0.085	0.575	0.569
Covariates				
- Gender (0=male, 1=female)	0.243	0.180	1.137	0.263
- Age	-0.068	-0.213	-1.278	0.210
- Education Level	0.978	0.444	2.457	0.019
- Length of Campaign Proposal	0.001	0.272	1.838	0.075
	R^2_{adj}=0.14	**F=2.138**	**(p=0.073)**	

* Intercept represents the CBR System Near Analogies condition; ⁺ one-sided test; n = 42

Table 16C.4 Regression of Solution Quality (Usability): Near Analogies vs. Far Analogies

Dependent Variable	*Solution Time*			
Independent variables	**unstandardized coefficients (B)**	**standardized coefficients (b)**	**t-value**	**p-value**
- Intercept*	4.837	-	2.695	0.011
CBR System Characteristics				
- CBR System Far Analogies (dummy)	-0.453	-0.308	-1.924	0.032+
Decision Maker Characteristics				
- Creative Ability Level (ATTA)	0.050	0.104	0.683	0.499
Covariates				
- Gender (0=male, 1=female)	-0.051	-0.033	-0.205	0.839
- Age	0.033	0.092	0.537	0.595
- Education Level	0.607	0.242	1.302	0.201
- Length of Campaign Proposal	0.001	0.308	2.026	0.050
	R^2_{adj}=0.09	**F=1.712**	**(p=0.147)**	

* Intercept represents the CBR System Near Analogies condition; + one-sided test; n = 42

Appendix 17 Test for Presence, Strength, and Nature of Interaction Effect (see Jaccard et al. 1990)

MAIN EFFECT MODEL:

$Y = \alpha + \beta_1 X + \beta_2 Z + \varepsilon$

Estimation:
$\hat{Y} = a + b_1 X + b_2 Z$ $R^2_{MAIN\_MODEL}$ = % explained variance main effect model

INTERACTION EFFECT MODEL

$Y = \alpha + \beta_1 X + \beta_2 Z + \beta_3 XZ + \varepsilon$

Estimation:
$\hat{Y} = a + b_1 X + b_2 Z + b_3 XZ$ $R^2_{INTERACTION\_MODEL}$ = % explained variance interaction effect model

1. Presence of Interaction

Coefficient b_3 ($t < -1.645$; $p<0.05$; 1-sided)

2. Strength of Interaction

$R^2_{difference} = R^2_{INTERACTION\_MODEL} - R^2_{MAIN\_MODEL}$ = % explained variance accounted for by the interaction effect

3. Nature of Interaction (with Z as moderator)

Std. Dev. Z

Z_{LOW} = minus one standard deviation
$Z_{AVERAGE}$ = 0
Z_{HIGH} = plus one standard deviation

Slopes for X at Z_{LOW}, $Z_{AVERAGE}$, and Z_{HIGH}

b_1 at Z_{LOW}	$= b_1 + b_3\ Z_{LOW}$
b_1 at $Z_{AVERAGE}$	$= b_1 + b_3\ Z_{AVERAGE}$
b_1 at Z_{HIGH}	$= b_1 + b_3\ Z_{HIGH}$

Std. Errors of Slopes for X at Z_{LOW}, $Z_{AVERAGE}$, and Z_{HIGH}

$s(b_1$ at $Z_{LOW})$	$= \sqrt{[s_{11} + 2\ Z_{LOW}\ s_{13} + Z_{LOW}^2\ s_{33}]}$
$s(b_1$ at $Z_{AVERAGE})$	$= \sqrt{[s_{11} + 2\ Z_{AVERAGE}\ s_{13} + Z_{AVERAGE}^2\ s_{33}]}$
$s(b_1$ at $Z_{HIGH})$	$= \sqrt{[s_{11} + 2\ Z_{HIGH}\ s_{13} + Z_{HIGH}^2\ s_{33}]}$

T – values of Slopes for X at Z_{LOW}, $Z_{AVERAGE}$, and Z_{HIGH}

T-value of slope for X at Z_{LOW}	$= b_1$ at Z_{LOW}/ $s(b_1$ at $Z_{LOW})$
T-value of slope for X at $Z_{AVERAGE}$	$= b_1$ at $Z_{AVERAGE}$/ $s(b_1$ at $Z_{AVERAGE})$
T-value of slope for X at Z_{HIGH}	$= b_1$ at Z_{HIGH}/ $s(b_1$ at $Z_{HIGH})$

Appendix 18a Calculation of Interaction Effect CBR System Availability (Dummy) x Creative Ability

N = 23 (Study2)

MAIN EFFECTS MODEL:

CREA = α + β_1CBRAVAIL + β_2CREAABILITY + β_3GENDER + β_4LENGHTPROPOSAL + ε

Estimation (unstandardized coefficients, t-values between parentheses):

CREA = 3.664 + 0.709CBRAVAIL - 0.004CREAABILITY - 0.320GENDER +
(1.991) (1.918) (-0.276) (-0.977)

0.001LENGHTPROPOSAL
(1.055) **R^2 = 23.1%**

INTERACTION MODEL:

CREA = α + β_1CBRAVAIL + β_2CREAABILITY + β_3 CBRAVAILxCREAABILITY +
β_4GENDER + β_5LENGHTPROPOSAL + ε

Estimation (unstandardized coefficients, t-values between parentheses):

CREA = 4.056 + 0.720CBRAVAIL - 0.000CREAABILITY – 0.034CBRAVAILxCREAABILITY
(27.009) (1.944) (-0.011) (-0.970)

-0.363GENDER + 0.001LENGHTPROPOSAL
(-1.069) (1.257) **R^2 = 27.2%**

Test for Presence, Strength, and Nature of Interaction Effect (see Jaccard et al. 1990)

1. Presence of Interaction Effect

Coefficient CBRAVAILxCREAABILITY ($t = -0.970$, $p > 0.05$; 1-sided)

2. Strength of Interaction Effect

$R^2_{difference} = 27.2 - 23.1 = 4.1\%$ (of the variance in solution creativity is accounted for by the interaction effect)

3. Nature of Interaction Effect (with Creative Ability as moderator)

Std. Dev. CREAABILITY = 11.864

Low CREAABILITY = -11.864
Average CREAABILITY= 0
High CREAABILITY = +11.864

Slopes for CBRAVAIL at low, average and high CREAABILITY

$b_{CBRAVAIL}$ at –11.864	= 0.720 + (-0.034)(-11.864)	= 1.123
$b_{CBRAVAIL}$ at 0	= 0.720 + (-0.034)(0)	= 0.720
$b_{CBRAVAIL}$ at +11.864	= 0.720 + (-0.034)(11.864)	= 0.317

Std. Errors

s($b_{CBRAVAIL}$ at –11.864)	$= [0.137 + (-11.864)^2(-0.0004) + 2(-11.864)(0.001)]^{1/2}$	= 0.563
s($b_{CBRAVAIL}$ at 0		= 0.370
s($b_{CBRAVAIL}$ at +11.864)	$= [0.137 + (11.864)^2(0.0004) + 2(11.864)(0.001)]^{1/2}$	= 0.546

T – values

T-value of slope for CBRAVAIL at Low CREAABILITY = b / se = 1.123 / 0.563 = 1.993
T-value of slope for CBRAVAIL at Average CREAABILITY = b / se = 0.720 / 0.370 = 1.945
T-value of slope for CBRAVAIL at High CREAABILITY = b / se= 0.317 / 0.546 = 0.580

Appendix 18b Calculation of Interaction Effect CBR System Availability (Dummy) x Creative Ability

N = 120 (Study 3)

MAIN EFFECTS MODEL:

$$CREA = \alpha + \beta_1 CBRAVAIL + \beta_2 CREAABILITY + \beta_3 GENDER + \beta_4 AGE + \beta_5 EDULEVEL + \beta_6 LENGHTPROPOSAL + \varepsilon$$

Estimation (unstandardized coefficients, t-values between parentheses):

$$CREA = \underset{(6.002)}{5.574} + \underset{(1.762)}{0.207}CBRAVAIL + \underset{(0.489)}{0.021}CREAABILITY - \underset{(-1.805)}{0.160}GENDER + \underset{(0.222)}{0.007}AGE +$$

$$\underset{(2.619)}{0.368}EDULEVEL + \underset{(3.083)}{0.001}LENGHTPROPOSAL \qquad \mathbf{R^2 = 20.3\%}$$

INTERACTION MODEL:

$$CREA = \alpha + \beta_1 CBRAVAIL + \beta_2 CREAABILITY + \beta_3 CBRAVAIL x CREAABILITY + \beta_4 GENDER + \beta_5 AGE + \beta_6 EDULEVEL + \beta_7 LENGHTPROPOSAL + \varepsilon$$

Estimation (unstandardized coefficients, t-values between parentheses):

$$CREA = \underset{(110.974)}{5.970} + \underset{(1.620)}{0.189}CBRAVAIL + \underset{(0.440)}{0.018}CREAABILITY - \underset{(-1.885)}{0.157}CBRAVAIL x CREAABILITY$$

$$- \underset{(-1.753)}{0.212}GENDER + \underset{(0.226)}{0.008}AGE + \underset{(2.477)}{0.345}EDULEVEL + \underset{(3.058)}{0.001}LENGHTPROPOSAL \qquad \mathbf{R^2 = 22.8\%}$$

Test for Presence, Strength, and Nature of Interaction Effect (see Jaccard et al. 1990)

1. Presence of Interaction Effect

Coefficient CBRAVAILxCREAABILITY ($t = -1.885$, $p < 0.05$; 1-sided)

2. Strength of Interaction Effect

$R^2_{difference} = 22.8 - 20.3 = 2.5\%$ (of the variance in solution creativity is accounted for by the interaction effect)

3. Nature of Interaction Effect (with Creative Ability as moderator)

Std. Dev. CREAABILITY = 1.3716

Low CREAABILITY = -1.3716
Average CREAABILITY= 0
High CREAABILITY = +1.3716

Slopes for CBRAVAIL at low, average and high CREAABILITY

$b_{CBRAVAIL}$ at –1.3716	= 0.189 + (-0.157)(-1.3716)	= 0.404
$b_{CBRAVAIL}$ at 0	= 0.189 + (-0.157)(0)	= 0.189
$b_{CBRAVAIL}$ at +1.3716	= 0.189 + (-0.157)(1.3716)	= -0.026

Std. Errors

s($b_{CBRAVAIL}$ at –1.3716)	$= [0.014 + (-1.3716)^2(0.007) + 2(-1.3716)(0.001)]^{1/2}$	= 0.156
s($b_{CBRAVAIL}$ at 0		= 0.118
s($b_{CBRAVAIL}$ at +1.3716)	$= [0.014 + (1.3716)^2(0.007) + 2(1.3716)(0.001)]^{1/2}$	= 0.173

T – values

T-value of slope for CBRAVAIL at Low CREAABILITY = b / se = 0.404 / 0.156 = 2.590
T-value of slope for CBRAVAIL at Average CREAABILITY = b / se = 0.189 / 0.118 = 1.602
T-value of slope for CBRAVAIL at High CREAABILITY = b / se= -0.026 / 0.173 = -0.150

Appendix 18c Calculation of Interaction Effect CBR System Availability (Dummy) x Creative Ability

N = 100 (Study 3)

MAIN EFFECTS MODEL:

CREA = α + β_1CBRAVAIL + β_2CREAABILITY + β_3GENDER + β_4AGE + β_5EDULEVEL + β_6LENGHTPROPOSAL + ε

Estimation (unstandardized coefficients, t-values between parentheses):

CREA = 5.609 + 0.152CBRAVAIL + 0.030CREAABILITY – 0.204GENDER + 0.010AGE +
(5.225) (0.975) (0.626) (-1.466) (0.248)

0.374EDULEVEL + 0.001LENGHTPROPOSAL
(2.404) (2.356) **R^2 = 17.7%**

INTERACTION MODEL:

CREA = α + β_1CBRAVAIL + β_2CREAABILITY + β_3CBRAVAILxCREAABILITY + β_4GENDER + β_5AGE + β_6EDULEVEL + β_7LENGHTPROPOSAL + ε

Estimation (unstandardized coefficients, t-values between parentheses):

CREA = 6.003 + 0.083CBRAVAIL + 0.041CREAABILITY – 0.365CBRAVAIL x CREAABILITY
(102.806) (0.554) (0.882) (-3.131)

– 0.199GENDER + 0.009AGE + 0.400EDULEVEL+ 0.001LENGHTPROPOSAL
(-1.495) (0.249) (2.690) (2.112) **R^2 = 25.6%**

Test for Presence, Strength, and Nature of Interaction Effect (see Jaccard et al. 1990)

1. Presence of Interaction

Coefficient CBRAVAILxCREAABILITY ($t = -3.131$, $p < 0.05$; 1-sided)

2. Strength of Interaction

$R^2_{difference}$ = 25.6 - 17.7 = 7.9% (of the variance in solution creativity is accounted for by the interaction effect)

3. Nature of Interaction (with Creative Ability as moderator)

Std. Dev. CREAABILITY = 1.3320

Low CREAABILITY = -1.3320
Average CREAABILITY= 0
High CREAABILITY = +1.3320

Slopes for CBRAVAIL (dummy) at low, average and high Creative Ability

$b_{CBRAVAIL}$ at –1.3320	= 0.083 + (-0.365)(-1.3320)	= 0.569
$b_{CBRAVAIL}$ at 0	= 0.083 + (-0.365)(0)	= 0.083
$b_{CBRAVAIL}$ at +1.3320	= 0.083 + (-0.365)(1.3320)	= -0.403

Std. Errors

s($b_{CBRAVAIL}$ at –1.3320)	= $[0.023 + (-1.3320)^2(0.014) + 2(-1.3320)(0.003]^{1/2}$	= 0.200
s($b_{CBRAVAIL}$ at 0		= 0.152
s($b_{CBRAVAIL}$ at +1.3320)	= $[0.023 + (1.3320)^2(0.014) + 2(1.3320)(0.003]^{1/2}$	= 0.236

T – values

Creative Ability
T-value of slope for CBRAVAIL at Low CREAABILITY = b / se = 0.569 / 0.200 = 2.845
T-value of slope for CBRAVAIL at Average CREAABILITY = b / se = 0.083 / 0.152 = 0.546
T-value of slope for CBRAVAIL at High CREAABILITY = b / se= -0.403 / 0.236 =-1.708

Summary

Problems vary along dimensions such as structuredness, complexity and abstractness (Jonassen, 2000). Simon (1973) distinguished three types of problems: well-structured problems, weakly-structured, and ill-structured problems. Well-structured problems have a well-defined initial state and goal state, and known problem-solving procedures for moving from the initial state to the goal state. For this type of problems, all relevant variables and their underlying relationships can be specified, and they come with complete data and information. They are often repetitive and routine problems (Reitman, 1965; Simon, 1973; Voss and Post, 1988). For ill-structured problems, it is difficult to define the exact nature, state and even the goal of the problem. As a consequence, there may be multiple "good" solutions and more than one way to arrive at a solution. Such problems appear to be novel and non-routine, and suffer from incomplete data and information (Reitman, 1965; Simon, 1973; Voss and Post, 1988).

Many marketing problems are weakly-structured. From the psychological literature, we know that analogical reasoning is an effective problem-solving method in ill-structured or weakly-structured decision situations. That is, when confronted with a problem, one of the first things managers will do is to search their memory for previous, similar experiences (or cases) that could help to interpret or solve the problem at hand. Recently an Artificial Intelligence (AI) technique, called Case-Based Reasoning (CBR), has become available, which builds on the principles of analogical reasoning. So far, CBR applications can be found in very different domains, such as medical diagnosis and law (see Riesbeck and Schank, 1989; Kolodner, 1993). We believe that case-based reasoning can also be used to put the vast amount of experience-based marketing knowledge into action for decision making in situations for which model-based decision support is not available. Hence, the goal of this dissertation project is:

To investigate the effectiveness and efficiency of analogical reasoning as a principle for marketing management support systems in weakly-structured marketing decision domains.

In a series of experiments, we empirically test the effectiveness and efficiency of a CBR system under different conditions. We use the design of sales promotion campaigns as our weakly-structured application domain. Hitherto, decision support in sales promotions has focused mainly on supporting the structured part of sales promotion problems, such as the well-known SCAN*PRO-model for supporting price-promotion decisions. Design problems are typically constraint problems for which the problem solver has to produce a concrete artifact that

satisfies the constraints (Kolodner, 1993; Jonassen, 2000). However, because of the usual under-specification of the design problem, or in Reitman's (1965) terminology, the presence of "open constraints" (i.e., parameters for which the values are left unspecified), multiple solutions are possible (Voss and Post, 1988). When designing a new sales promotion campaign, marketers usually have a large problem and solution space available. Hence, designing a sales promotion campaign has the weakly-structured characteristics that make the problem suitable for a case-based reasoning approach towards decision support.

In the introductory chapter, we position the topic of this dissertation in a broader research tradition on heuristic decision making and decision support. Nobel Prize winners Simon and Kahneman both conducted ground-breaking research on non-rational, heuristic decision making. In addition, Simon devoted much of his work to the simulation of heuristic decision making by means of computer programs, laying the foundation for the field of artificial intelligence from which also the technique of case-based reasoning originated. Next, we argue that analogical or case-based reasoning could serve as a heuristic principle for decision support in weakly-structured problem domains in marketing.

The second chapter provides a historical and theoretical overview of decision support systems in marketing, which we refer to as Marketing Management Support Systems (MMSSs). We outline the evolution in decision support from the development of mathematical models for supporting structured marketing problems in the early 1960s to the recent birth of advanced AI techniques that are able to mimic and support weakly-structured decision making, such as case-based reasoning. We discuss the theoretical background and principles of analogical reasoning and case-based reasoning. To illustrate the case-based reasoning approach towards decision support, a few examples of existing CBR-applications (outside the domain of marketing) are given. The chapter ends with an introduction to the weakly-structured application domain in marketing that we choose for our studies, viz. the design of (creative) sales promotion (SP) campaigns.

In Chapter 3, we provide a theoretical underpinning of how analogical reasoning, by means of a CBR system, affects the quality of sales promotion campaigns and the efficiency of their design process. To develop hypotheses, we use theory and concepts from the marketing, cognitive psychology and artificial intelligence literature. We visualize the hypothesized effects of CBR system characteristics in a conceptual framework. That is, we depict the effects of case-base size and content (i.e., the number and type of analogies in the CBR system) and decision maker characteristics (e.g., creative ability) on solution quality (i.e., creativity) and solution efficiency (i.e., the time needed to design a campaign). Furthermore, we look at the interaction between the CBR system and the decision maker's characteritics in their effect on the quality of the solution. Next, we discuss the relation between the decision maker's subjective evaluation of the contribution of the CBR system to the solution and its objective outcomes. We end this chapter with discussing a number of underlying process characteristics (e.g., system usage time and number and type of cases read and used) that can help to explain the effects of CBR system availability.

In Chapter 4, we discuss the basic research design of the empirical studies reported in this dissertation, including the methodology (i.e., experiments), the type of support systems, and the measurement instrument that are used. Furthermore, we look at how previous, related studies have tackled similar methodological and measurement issues. In this chapter, we introduce our CBR system for sales promotion design decisions that we use in our empirical studies and which we call *LEAPS* (*LEA*rning *P*romotion *S*ystem). One of the focal research topics in our studies is the effect of using an analogical reasoning system on the creativity of the sales promotion campaign. We are not only interested in the creativity of the outcome (as a measure of solution quality), but also in the creative ability of the decision maker (in conjunction with the availability of a support system). Creativity is a relatively underexposed research topic in the scientific marketing literature. Therefore, a substantial part of this chapter is devoted to its definition and measurement.

Chapter 5 deals with the first of the three empirical studies reported in Part II of this dissertation. This study (Study 1) is a first attempt to test the basic assumption that a CBR system does help to improve the design of sales promotion campaigns. The creative ability of the decision maker is measured by means of a checklist (self-assessed) containing items related to the divergent and convergent facets of creative thinking. The task in this study concerns the design of a SP campaign for launching a new ready-made food product of a large, multinational FMCG company, viz. UNO Noodles manufactured by Unilever.

We find preliminary evidence that, in comparison with a similar situation in which the participating teams had no CBR system available, the teams in this study design sales promotion campaigns of higher quality. We cannot test for the presence of an interaction effect between the decision maker's creative ability and CBR system availability on the quality of the solution. However, the negative sign for the coefficient of creative ability (in conjunction with CBR system availability) suggests that CBR system availability is most helpful for decision makers with a low innate creative ability (i.e., a compensation effect). Finally, it appears that the teams are not able to fully recognize the objective contribution of the CBR system to the solution. They tend to assess the system's contribution based on the characteristics of the usage process, such as CBR system usage time.

In Chapter 6, we further explore the conditions under which CBR system availability is most effective and efficient (Study 2). Here, we investigate the influence of the type of analogies in the CBR system on the quality of the sales promotion campaigns and the efficiency of their design process. Hence, we make a distinction between *near analogies* (i.e., cases from basically the same problem domain) and *far analogies* (i.e., cases from more distant problem domains). Next to a CBR system with only near analogies and a CBR system with only far analogies, we use an *expert system* (i.e., a rule-based, SP technique recommendation system) as a benchmark condition for assessing the effectiveness and efficiency of CBR system availability. Creative ability is measured by using a multiple-choice questionnaire (self-assessed), including the fluency, originality, flexibility (i.e., divergent thinking) and the elaboration (i.e., convergent thinking) facets of creative thinking. The task is to develop a loyalty- and brand-image enhancing campaign for a well-known Dutch Beer brand, viz. Grolsch. This study is also used as a pilot study to refine the methodology and data-collection procedures for Study 3.

In line with the findings in Study 1, we find that CBR system availability significantly improves the quality of sales promotion campaigns, i.e., compared to using the expert system. Furthermore, we find an indication that CBR system availability can lead to a more efficient design process (i.e., lower solution times). Consistent with the preliminary finding in Study 1, we find an indication that, in terms of solution quality, CBR system availability might be particularly beneficial for decision makers with a low creative ability. For highly creative decision makers, there seems to be no substantial improvement in the quality of their solution when having a CBR system at their disposal. Finally, in line with the results of Study 1, we do not find a significant relation between the decision maker's subjective evaluations of the CBR system and the objective contribution of the CBR system to the solution, except for the relationship between the perceived impact of the CBR system and solution efficiency. Thus, decision makers seems to evaluate the contribution of the CBR system by the characteristics of the CBR system usage process, i.e., system usage time and the number of cases read and used, and by the time needed to design a solution (after the use of the CBR system), rather than by the quality of their solution.

Chapter 7 deals with the main study (Study 3) of this dissertation, in which we combine elements of the previous two studies in a comprehensive, large-scale study. This study includes six experimental conditions: (1) a CBR system *Standard Size Mixed* (50 cases), (2) a CBR system *Large Size Mixed* (100 cases), (3) a CBR system *Near Analogies*, (4) a CBR system *Far Analogies*, (5) an *Expert System*, and (6) *No System*. Furthermore, we use a psychometric test for measuring the decision maker's creative ability, viz. the Abbreviated Torrance Test for Adults (ATTA).

This measurement instrument comprises the fluency, originality, flexibility (i.e., divergent thinking) and elaboration (i.e., convergent thinking) facets of creative thinking. The task in this study is exactly the same as in the Study 2, i.e., to develop a loyalty and brand-image enhancing campaign for Grolsch (a well-known Dutch Beer brand).

This comprehensive large study confirms our previous findings. First, the availability of a CBR system does help to design sales promotion campaigns of higher quality and helps to design them more efficiently (i.e., less time needed). Second, the effect of CBR system availability on solution quality and solution efficiency is dependent on the type of system. With respect to solution quality, a large size CBR system outperforms a standard size CBR system. Regarding solution efficiency, a CBR system with near analogies outperforms a CBR system with far analogies. Third, the effect of the CBR system on solution quality is also dependent on the type of decision maker. That is, the availability of a CBR system is most beneficial for decision makers with a low creative ability. This result suggests a compensation effect, i.e., the CBR system particularly helps decision makers who have difficulties with generating creative ideas and solutions themselves. For highly creative decision makers, the net effect of CBR system availability on solution quality can be negative. This could be due to an unconscious plagiarism or conformity effect, i.e., the CBR system might fixate their attention too much on the examples provided and, therefore, can constrain their creativity. Finally, the results again demonstrate that decision makers have difficulties in recognizing the positive contribution of the CBR system to the quality of the solution. They use the characteristics of the CBR system usage process, i.e., system usage time and the number of cases read and used, and the time needed for designing a campaign (after the use of the CBR system) to evaluate the contribution of the CBR system.

In Chapter 8, we summarize the key findings reported in this dissertation and their scientific contribution. With our findings, we contribute to (1) the literature on supporting weakly-structured decision making in marketing, (2) the literature on the use and effectiveness of analogical reasoning in marketing, and (3) the literature on the application of case-based reasoning to creative tasks. Next, we mention a number of limitations of this research project that are related to the respondent population, the task domain, the research design and the measurement instruments used. In relation to these issues, we propose a number of suggestions for further research, which include exploring the role of expertise, the role of problem structuredness, the role of the divergent thinking and the convergent thinking facets of creative thinking and the role of decision confidence and satisfaction. Finally, we provide a number of managerial implications that are based on this dissertation project, such as "capture, store and make knowledge available in the form of cases" and "different types of decision makers need different types of CBR systems".

To conclude, this dissertation shows that analogical reasoning does help to improve marketing decision making. More specifically, we demonstrate that a CBR system helps to design better, more creative sales promotion campaigns and helps to design them more efficiently. Furthermore, we show that the effects of CBR-system availability are dependent on: 1) the content of the case-base (i.e., near analogies versus far analogies), 2) the size of the case-base (i.e., large size versus standard size), and 3) the characteristics of the decision-maker (i.e., innate creative ability). Interestingly, the effect of CBR-system availability on the solution quality is largest for decision-makers with a low creative ability (i.e., a compensation effect). Finally, we show that decision-makers have difficulties in recognizing the contribution of the CBR-system to the objective quality of their solution.

Samenvatting (Summary in Dutch)

Problemen variëren op dimensies als gestructureerdheid, complexiteit en abstractheid (Jonassen, 2000). Simon (1973) onderscheidde drie typen problemen: gestructureerd, zwak-gestructureerd en ongestructureerde problemen. Gestructureerde problemen hebben een duidelijk gedefinieerde probleemstelling en doelstelling en er bestaan oplossingstechnieken om van de probleemstelling naar het doel te geraken. Voor dit type problemen kunnen alle relevante variabelen en hun onderlinge samenhang worden gespecificeerd en zijn volledige data en informatie beschikbaar. Ze komen regelmatig voor en het zijn vaak routinematige problemen (Reitman, 1965; Simon, 1973; Voss and Post, 1988). Voor ongestructureerde problemen is het lastig om het probleem exact te definiëren en zelfs de doelstelling is vaak niet duidelijk. Als gevolg daarvan zijn er meerdere "goede" oplossingen en meerdere manieren om tot een oplossing te komen. Onder dit type problemen vallen veel nieuwe, niet routinematige problemen, waarvoor niet alle data en informatie volledig beschikbaar zijn (Reitman, 1965; Simon, 1973; Voss and Post, 1988).

Veel marketing problemen zijn zwak-gestructureerd. Vanuit de psychologie weten we dat analoog redeneren een effectieve manier is om dit soort problemen op te lossen. Dat wil zeggen: één van de eerste dingen die een manager zal doen wanneer hij of zij geconfronteerd wordt met een dergelijk probleem is in zijn of haar geheugen zoeken naar eerdere, soortgelijke ervaringen (of cases) die zouden kunnen helpen bij het interpreteren en oplossen van het probleem. Recent is een techniek genaamd "Case-Based" Redeneren (CBR) beschikbaar gekomen. Deze techniek is afkomstig uit het gebied van kunstmatige intelligentie en is gebaseerd op het principe van analoog redeneren. Tot dusverre zijn er applicaties te vinden in verschillende gebieden, waaronder medische diagnose en recht (zie Riesbeck and Schank, 1989; Kolodner, 1993). Wij denken dat "case-based" redeneren ook gebruikt kan worden om de grote hoeveelheid, op ervaring gebaseerde marketing kennis aan te wenden voor het nemen van beslissingen in situaties waarvoor geen beslissingsondersteunende marketing modellen beschikbaar zijn. Vandaar dat het doel van dit proefschrift als volgt luidt.

Het onderzoeken van de effectiviteit en de efficiëntie van analoog redeneren als principe voor beslissingsondersteunende marketing management systemen in zwak-gestructureerde marketing beslissingsdomeinen.

In een aantal experimenten toetsen wij de effectiviteit en efficiëntie van het beschikbaar maken van een CBR-systeem onder verschillende condities. Hiervoor gebruiken we het ontwerpen van "sales promotie" campagnes als zwak-gestructureerd toepassingsdomein Tot nu toe heeft de ondersteuning van "sales promotie" beslissingen voornamelijk betrekking gehad op de gestructureerde delen van "sales promotie" problemen, zoals het bekende SCAN*PRO model voor het ondersteunen van prijspromotie beslissingen. Ontwerpproblemen zijn over het algemeen problemen met richtlijnen of voorwaarden waaraan het eindproduct moet voldoen (Kolodner, 1993; Jonassen, 2000). Echter deze richtlijnen of voorwaarden laten vaak ruimte voor nadere invulling - of in Reitman's (1965) terminologie: het zijn "open richtlijnen" (dat wil zeggen: parameters waarvoor de waarde niet gespecificeerd is) - waardoor meerdere oplossingen mogelijk zijn. Wanneer marketers een nieuwe "sales promotie" campagne ontwerpen kunnen zij vaak nog vele kanten op binnen de gestelde voorwaarden. Het ontwerpen van een "sales promotie" campagne heeft dus de zwak-gestructureerde karakteristieken die het probleem geschikt maken voor case-based redeneren als principe voor het ondersteunen van beslissingen.

In het inleidende hoofdstuk positioneren we het onderwerp van deze dissertatie binnen een bredere onderzoekstraditie met betrekking tot het nemen van beslissingen op basis van heuristieken en het ondersteunen van beslissingen. Nobelprijs winnaars Simon en Kahneman hebben bedien baanbrekend onderzoek verricht naar het nemen van beslissingen op basis van niet-rationele gronden en heuristieken. Simon wijdde bovendien veel van zijn werk aan het simuleren van het nemen van beslissingen op basis van niet-rationele gronden en heuristieken met behulp van computerprogramma's. Hiermee legde hij de basis voor het gebied van kunstmatige intelligentie, waaruit de techniek van "case-based" redeneren voortgekomen is. Vervolgens lichten we in dit hoofdstuk toe hoe analoog of "case-based" redeneren kan dienen als (heuristiek) principe voor het ondersteunen van beslissingen in zwak-gestructureerde probleemdomeinen binnen de marketing.

Het tweede hoofdstuk geeft een historisch en theoretisch overzicht van beslissingsondersteunende systemen binnen de marketing, die wij de verzamelnaam Marketing Management Support Systemen (MMSSs) geven. We schetsen de evolutie in de ontwikkeling van het ondersteunen van beslissingen van wiskundige modellenvoor het ondersteunen van gestructureerd marketing problemen in de vroege jaren 1960 tot de recente opkomst van geavanceerde AI-technieken die in staat zijn het nemen van zwak-gestructureerde beslissingen na te bootsen en te ondersteunen, zoals "case-based" redeneren. We bespreken de theoretische achtergrond en principes van analoog redeneren en "case-based" redeneren. Om de "case-based" aanpak voor het ondersteunen van beslissingen te illustreren geven we een aantal voorbeelden van bestaande CBR-applicaties (buiten het domein van de marketing). Het hoofdstuk eindigt met een introductie van het door ons gekozen zwak-gestructureerd applicatie domein binnen de marketing, namelijk het ontwerpen van (creatieve) "sales promotion" (SP) campagnes.

In Hoofdstuk 3 onderbouwen we theoretisch hoe analoog redeneren, met behulp van een CBR systeem, de kwaliteit van "sales promotie" campagnes and de efficiëntie van het ontwerpproces kan beïnvloeden. Voor het formuleren van hypothesen maken we gebruik van theorie en concepten uit de marketing literatuur, cognitieve psychologie en kunstmatige intelligentie. In een conceptueel raamwerk visualiseren we de veronderstelde effecten van de karakteristieken van het CBR-systeem. Hierin geven we de effecten weer van case-base grootte en type (d.w.z., het aantal en het type analogieën in het CBR-systeem) en de karakteristieken van de beslisser (zoals creativiteit) op de kwaliteit van de oplossing (d.w.z, de creativiteit) en de efficiëntie van het ontwerpproces (d.w.z, de tijd die nodig is om een campagne te ontwerpen). Bovendien kijken we naar de interactie tussen het CBR systeem en de beslisser en het effect daarvan op de kwaliteit van de oplossing. Vervolgens bespreken we de relatie tussen de subjectieve evaluatie van de beslisser met betrekking tot bijdrage van het systeem aan de oplossing en de objectieve uitkomst. We eindigen dit hoofdstuk met het bespreken van een aantal onderliggende karakteristieken van het proces (zoals de tijd dat het systeem gebruikt is en het aantal en type cases dat gelezen en gebruikt is) die kunnen helpen bij het verklaren van de effecten van de beschikbaarheid van het CBR-systeem.

In Hoofdstuk 4 bespreken we de onderzoeksopzet die als basis dient voor de empirische studies in deze dissertatie, inclusief de methodologie (te weten: experimenten), het type beslissingsondersteunde systemen, en de meetinstrumenten die we gebruiken. Daarnaast kijken we hoe eerdere, gerelateerde studies deze methodologische en meetvragen hebben aangepakt. In dit hoofdstuk introduceren we ook het door ons ontwikkelde CBR-systeem voor "sales promotie" ontwerpbeslissingen die we in de empirische studies zullen gebruiken en *LEAPS* (*LEA*rning *P*romotion *S*ystem) noemen. Een van de belangrijkste onderzoeksonderwerpen in onze studies is het effect van een, op analoog redeneren gebaseerd, systeem op de creativiteit van de "sales promotie" campagne. We zijn niet alleen geïnteresseerd in creativiteit als uitkomst (als een maat voor de kwaliteit voor de oplossing), maar ook creativiteit van de beslisser (in samenspel met de beschikbaarheid van een beslissingsondersteunend systeem). Creativiteit is een tamelijk onderbelicht onderwerp in de wetenschappelijke marketing literatuur. Een substantieel deel van dit hoofdstuk zal daarom in het teken staan van de definitie van creativiteit en de methode om het te meten.

Hoofdstuk 5 (Studie 1) betreft de eerste van de drie empirische studies beschreven in Deel II van dit proefschrift. Deze studie is een eerste poging om de basisaanname dat een CBR systeem helpt om de kwaliteit van het ontwerpen van "sales promotie" te verbeteren. De creativiteit van de beslisser wordt gemeten aan de hand van een checklist (zelf gerapporteerd) die items omvat die gerelateerd zijn aan de divergente and convergente facetten van creatief denken. De taak in deze studie betreft het ontwerpen van een SP campagne voor het lanceren van een nieuwe kant-en-klaar maaltijd van een groot, multinationaal "fast-moving-consumer good" bedrijf, namelijk UNO Noodles geproduceerd door Unilever.

We vinden aanwijzingen dat, in vergelijking met een soortgelijke situatie waarin deelnemende teams geen CBR systeem tot hun beschikking hadden, de teams in deze studie "sales promotie" campagnes ontwerpen van hogere kwaliteit. We kunnen in deze studie niet bepalen of er een interactie-effect aanwezig is tussen de creativiteit van de beslisser en de beschikbaarheid van een CBR-systeem op de kwaliteit van de oplossing. Niettemin, het negatieve teken voor de coëfficiënt van de creativiteit van de beslisser (in samenspel met de beschikbaarheid van het CBR-systeem) suggereert dat de beschikbaarheid van het CBR-systeem het meest helpt voor beslissers die niet zo creatief van zichzelf zijn (dat wil dus zeggen: een compensatie effect). Tot slot blijkt dat de teams niet in staat waren om de objectieve bijdrage van het CBR-systeem aan de oplossing op de juiste waarde in te schatten. Daarom bepalen zij de bijdrage van het systeem eerder aan de hand van de karakteristieken van het gebruiksproces, zoals de tijd die men met het systeem heeft gewerkt.

In Hoofdstuk 6 bekijken we onder welke condities de beschikbaarheid van een CBR-systeem het meest effectief en efficiënt is (Studie 2). Hier onderzoeken we de invloed van het type analogieën in het CBR-systeem op de kwaliteit van de oplossing en de efficiëntie van het ontwerpproces. Hiervoor maken we een onderscheid tussen *nabije analogieën* (dat wil zeggen: cases afkomstig uit ongeveer hetzelfde probleemdomein) en *verre analogieën* (dat wil zeggen: cases afkomstig uit meer afgelegen probleemdomeinen). Naast een CBR-systeem met alleen nabije analogieën en een CBR-systeem met alleen verre analogieën, gebruiken we een expert systeem (dat wil zeggen: een op regels gebaseerd systeem dat aanbevelingen doet over de te gebruiken SP techniek) als controleconditie om de effectiviteit en de efficiëntie van de beschikbaarheid van het CBR-systeem te bepalen. De creativiteit van de beslisser wordt gemeten aan de hand van een multiple-choice vragenlijst (zelf gerapporteerd) die de volgende facetten van het creatief denken omvat: vloeiendheid, originaliteit, flexibiliteit (tesamen: divergent denken) en uitwerking (dat wil zeggen: convergent denken). De taak is om een campagne te ontwerpen voor een bekend Nederlands biermerk, namelijk Grolsch, die de trouw van klanten en het merkimago verbetert. Deze studie dient ook als proef teneinde de methodologie en dataverzamelingsprocedures voor Studie 3 te verfijnen.

In overeenstemming met de bevindingen van Studie 1 vinden we dat de beschikbaarheid van een CBR-systeem de kwaliteit van de oplossing significant verbetert, dat wil zeggen ten opzichte van een expert systeem. Verder vinden we een aanwijzing dat de beschikbaarheid van een CBR-systeem kan leiden tot een efficiënter ontwerpproces (dat wil zeggen: lagere oplossingstijden). Consistent met de voorlopige bevinding in Studie 1 vinden we een aanwijzing dat, met betrekking tot de kwaliteit van de oplossing, de beschikbaarheid van een CBR-systeem in het bijzonder kan baten voor beslissers die niet zo creatief van zichzelf zijn. Voor de heel creatieve beslissers lijkt er geen substantiële verbetering in de kwaliteit van hun oplossing te zijn wanneer zij een CBR-systeem tot hun beschikking hebben. Tot slot, in lijn met de resultaten van Studie 1 vinden we geen significant verband tussen de subjectieve evaluatie van het CBR-systeem door de beslisser en de objectieve bijdrage van het CBR-systeem aan de oplossing, uitgezonderd de relatie tussen de waargenomen impact van het CBR-systeem en de efficiëntie van de oplossing. Beslissers lijken dus de bijdrage van het CBR-systeem niet zozeer te bepalen aan de hand van de kwaliteit van de oplossing. Ze bepalen dit eerder aan de hand van de karakteristieken van het CBR-gebruiksproces, dat wil zeggen de gebruikstijd en het aantal cases dat gelezen en gebruikt is, en aan de hand van de tijd die nodig is om tot een oplossing te komen (nadat hij of zij het systeem heeft gebruikt).

Hoofdstuk 7 behandelt de hoofdstudie (Studie 3) van deze dissertatie waarin we elementen van onze eerdere studies combineren in een allesomvattende, grote studie. Deze studie kent zes experimentele condities: (1) een CBR-systeem *Standaard Formaat Gemengd* (50 cases), (2) een CBR-systeem *Groot Formaat Gemengd* (100 cases), (3) een CBR-systeem *Nabije Analogieën*, (4) een CBR-systeem *Verre Analogieën*, (5) een *Expert Systeem*, en (6) *Geen Systeem*. Daarnaast gebruiken we een psychometrische test voor het bepalen van de creativiteit van de beslisser, namelijk de “Abbreviated Torrance Test for Adults” (ATTA). Dit meetinstrument omvat de volgende facetten van creatief denken: vloeiendheid, originaliteit, flexibiliteit (tesamen: divergent denken) en de uitwerking (dat wil zeggen: convergent denken). De taak is hetzelfde als in Studie 3, te weten een campagne ontwerpen voor Grolsch (een bekend Nederlands biermerk) die de trouw van klanten en het merkimago verbetert.

Deze allesomvattende, grote studie bevestigt onze eerdere bevindingen. Ten eerste, de beschikbaarheid van een CBR-systeem helpt om “sales promotie” campagnes te ontwerpen van hogere kwaliteit en helpt om ze efficiënter te ontwerpen (dat wil zeggen: minder tijd nodig). Ten tweede, het effect van de beschikbaarheid van een CBR-systeem op de kwaliteit en efficiëntie van de oplossing hangt af van het type systeem. Met betrekking tot de kwaliteit van de oplossing is een groot formaat CBR-systeem (100 cases) dan een standaard formaat CBR-systeem (50 cases). Met betrekking tot de efficiëntie van de oplossing is en CBR-systeem met nabije analogieën beter dan een CBR-systeem met verre analogieën. The derde, het effect van het CBR-systeem op de kwaliteit van de oplossing hangt eveneens af het type beslisser. Dat wil zeggen: de beschikbaarheid van een CBR-systeem baat het meest voor beslissers die minder creatief zijn van zichzelf. Dit resultaat suggereert het optreden van een compensatie effect, dat wil zeggen dat het CBR-systeem in het bijzonder helpt voor beslissers die problemen hebben om zelf met creatieve ideeën en oplossingen te komen. Voor heel creatieve beslissers kan het netto-effect van de beschikbaarheid van een CBR-systeem negatief zijn. Dit kan veroorzaakt worden door onbewust plagiëren of conformeren, dat wil zeggen dat het CBR-systeem de aandacht van deze beslissers teveel fixeert op de gegeven voorbeelden en het daardoor hun eigen creativiteit beperkt. Ten slotte, de resultaten tonen opnieuw aan dat beslissers problemen hebben met de inschatting van de positieve bijdrage die het CBR-systeem levert aan de kwaliteit van de oplossing. Als gevolg daarvan gebruiken ze voor het bepalen van de bijdrage van het CBR-systeem: (1) de karakteristieken van het CBR-systeem gebruiksproces, dat wil zeggen de gebruikstijd van het systeem en het aantal cases dat gelezen en gebruikt is, en (2) de tijd die nodig is voor het ontwerpen van een campagne (nadat het systeem gebruikt is).

In Hoofdstuk 8 geven we een samenvatting van de belangrijkste bevindingen van de studies beschreven in dit proefschrift en beschrijven we de bijdrage die deze studies leveren aan de wetenschap. Onze bevindingen dragen bij aan de literatuur op: (1) het gebied van het ondersteunen van zwak-gestructureerde beslissingen binnen de marketing, (2) het gebruik en de effectiviteit van analoog redeneren binnen de marketing, en (3) de toepassing van “case-based” rederenen op creatieve taken. Vervolgens noemen we een aantal beperkingen van dit onderzoeksproject die betrekking hebben op de gebruikte populatie van respondenten, het taakdomein, het onderzoeksontwerp en de gebruikte meetinstrumenten. Naar aanleiding hiervan doen we een aantal suggesties voor vervolgonderzoek, zoals het bestuderen van de rol van expertise, de rol van de mate van gestructureerdheid van het probleem, de rol van de divergente en convergente facetten van creatief denken, en de rol van vertrouwen in of tevredenheid met de beslissing. Tot slot geven we op basis van onze bevindingen een aantal implicaties voor de marketing management praktijk, zoals “leg marketing kennis vast en maak het beschikbaar in de vorm van cases” en “verschillende typen beslissers hebben verschillende typen CBR-systemen nodig”.

Concluderend, deze dissertatie laat zien dat analoog redeneren helpt om marketing beslissingen te verbeteren. Om precies te zijn: we tonen aan dat een CBR-systeem helpt om betere, creatievere "sales promotie" campagnes te ontwerpen en om ze efficiënter te ontwerpen. Bovendien laten we zien dat de effecten van de beschikbaarheid van een CBR-systeem afhankelijk zijn van: (1) de inhoud van de "case-base" (d.w.z., nabije analogieën versus verre analogieën), (2) de grootte van de "case-base" (d.w.z., een groot aantal cases versus een standaard aantal cases), en (3) de karakteristieken van de beslisser (d.w.z., zijn of haar eigen creativiteit). Interessant is dat we vinden dat het effect van de beschikbaarheid van een CBR-systeem op de kwaliteit van de oplossing het grootst is voor beslissers die minder creatief van zichzelf zijn. Verder laten we zien dat beslissers problemen hebben bij het inschatten van de bijdrage van het CBR-systeem aan de objectieve kwaliteit van hun oplossing.

Curriculum Vitae

Niek Althuizen (1975) obtained his MSc-degree in Agricultural Economics, with specializations in Consumer Behavior & Marketing and Business Administration, from Wageningen University in March 2000. For his master thesis "The Role of a Product's Country-of-Origin in the Attitude Formation towards a Product", he received (together with Thijs Vroegh) the Unilever Research Award 1999. In September 2000, he joined the department of Marketing Management at the *Rotterdam School of Management* (*RSM Erasmus University*) to work on a PhD-project entitled "The Effectiveness of Knowledge-driven Marketing Management Support Systems". During his PhD-trajectory, Niek has taught several times a 3rd year "Bachelor Thesis" course in Marketing for the *Business Administration (BA)* program and has taught the 2nd year course "Applied Business Methods" for the *International Business Administration (IBA)* program. In addition, Niek has supervised several master theses, published his work in the ERIM working paper series and in international proceedings, and presented his research at major international academic conferences (*Marketing Science* and *EMAC*). For his PhD-project, he has actively sought cooperation with companies and marketing & sales promotion practitioners. And, last but not least, Niek has been player/coach of the infamous faculty's indoor soccer team *"Waar is Romario?"*
As of September 2006, Niek is assistant professor in the department of Marketing at the *ESSEC Business School* (*Ecole Supérieure des Sciences Economiques et Commerciales*) in Paris.

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Analogical Reasoning as a Decision Support Principle for Weakly-Structured Marketing Problems

Many marketing problems are weakly-structured. From the psychological literature, we know that analogical reasoning is an effective problem-solving method in weakly-structured decision situations. That is, when confronted with a problem, one of the first things managers will naturally do is to search their memory for previous, similar experiences (or cases) that could help to solve the problem at hand. Case-Based Reasoning (CBR) is a state-of-the-art artificial intelligence technique that mimics this kind of human reasoning and can be used to put the vast amount of experience-based marketing knowledge into action for decision making in situations for which model-based decision support is not available. In a series of experiments, we investigate the effectiveness and efficiency of CBR system availability under different conditions. We use the design of sales promotion campaigns as our weakly-structured application domain in marketing.

Part I of this dissertation provides a theoretical and methodological background for the studies carried out in Part II. This dissertation shows that analogical reasoning does help to improve marketing decision making. More specifically, we demonstrate that a CBR system helps to design better, more creative sales promotion campaigns and helps to design them more efficiently. Furthermore, we show that the effects of CBR system availability are dependent on: (1) the content of the case-base (i.e., near analogies versus far analogies), (2) the size of the case-base (i.e., large size versus standard size), and (3) the characteristics of the decision maker (i.e., innate creative ability). Interestingly, the effect of CBR system availability on solution quality is largest for decision-makers with a low creative ability (i.e., a compensation effect). Finally, we show that decision-makers have difficulties in recognizing the contribution of the CBR system to the objective quality of their solution. These findings have important managerial implications, which are discussed in the final chapter of this dissertation, such as "capture, store and make knowledge available in the form of cases" and "different types of decision makers need different types of CBR systems".

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