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Challenging Analogical Encoding under real Conditions in Business Education

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Abstract

Managers often fall back to prior experiences for current decisions. In fact, they often try to solve problems with the help of analogies. For a better educational process in advance, to acquire principles and successful retrieve and applicate those in future, analogical encoding is often suggested. With this technique, two examples are compared and, thereby, a common underlying schema will get abstracted. The received schema can be retrieved in later situations. In literature this technique is recommended to be also practicable in the context of teaching with case studies. However, the success of this technique is based on experimental cases that differ from real business cases regarding content and length. These cases are very short and foremost only include information related to the structural commonalities of both cases.

Significant research exists that people are sensitive regarding the amount of details and distracting information. This could affect the recognition of principles. Moreover, by comparing real business cases the cognitive load of the working memory is higher. The higher the working memory is demanded, the less people are able to recognize structural relations. With the conducted experiment, the performance of analogical encoding on schema abstraction with cases closer to real business cases was evaluated. 92 master and bachelor students in two groups took part in a paper and pencil study at the FOM University of Applied Sciences in Munich. Group 1 had compared two cases analogous to prior studies. Group 2 compared cases that were closer to real business cases. The results are somewhat surprising. Despite all distracting and detailed information group 2 had to deal with, the schema quality did not significantly differ between both groups (Schema evaluation on a scale from 0 to 2: group 1 M = 0,51, group 2 M = 0,59 (t = -0,62, n.s.); schema evaluation on a scale from 0 to 4: group 1 M = 0.88, group 2 M = 1.04 (t = -0.82, n.s.). Even though practical hurdles may exist, analogical encoding is principally applicable to cases as used in business education.

Keywords:

Analogies and Transfer

Two situations are analog if they are based on the same structural patterns, no matter if their superficial attributes differ (Holyoak, 2005, p. 117). For example, if it is said "an electric battery is like a reservoir" (Gentner, 1983, p. 155), both objects store energy to provide it to other systems. This is the core of the analogy whereas it does not play a role that they appear in totally different contexts and do not even look closely similar. Normally, one part of the analogy is well known (the reservoir) and used to explain the other part (the electric battery). In literature, the first one is often termed as "source" and the latter one is named "target" (Gentner and Holyoak, 1997, p. 32). The base for analogical transfer is about using the source to make some inferences about the target (Holyoak, 2005, p. 117). Accordingly, the former unknown target will be perceived as "another example of the same kind of thing" (Holyoak and Thagard, 1996, p. 101). If the electric battery is unknown, the transfer takes place by explaining its functionality with the help of a reservoir.

Analogies in Business

In the complex and fast changing global business environments managers often face novel contexts and need to make large-scale decisions. Additionally, the scissor of time¹ forces them to accelerate and simplify their decision making processes. In this context, managers often use their knowledge gained from previous experiences to reason by analogy (Gavetti and Rivkin, 2005, p. 1; Gavetti et al., 2005, p. 692). Beside a fast decision making process that could be supported by analogies, many famous examples exist that show how analogies could strategically lead managers. For example see Gavetti and Rivkin (2005, p. 1): in the 1990s the top management of Intel visited a training class at the Harvard Business School. Formerly, Intel declined to produce cheap processors and selling them to manufacture low budget personal computers. However, in the class they heard about the steel producing startup company Minimills. As the first, Minimills introduced cheap concretereinforcing bars in the market place. All other established players did strongly neglect the low end segment of the market and, therefore, did not take the company and its products for serious. However, after a few years they strongly regretted their behavior because Minimills also started to conquer higher price segments and became a strong competitor. Knowing these developments the CEO of Intel at this time drew the analogy: "if we lose the low end today, we could lose the high end tomorrow". After this lecture, Intel began to develop and promote lower priced processors.

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¹The dilemma between the need to show fast reactions in a highly dynamic environment and the fact to have decreasingly time to make them is known as the scissor of time (Bleicher, 2011, p. 59).

Analogies Are Challenging

However, even though they show promising characteristics and could lead to successful decisions, making analogies is challenging. One of the main reasons for failing at drawing correct analogies is that people do not recognize important structural similarities between situations. Or, in other words, they do not realize crucial differences between the novel situation and previous mastered challenges. Prior research shows that people tend to focus on superficial attributes instead of structural relations when looking for adequate sources (Gick and Holyoak, 1983, p. 31; Markman and Gentner, 1993b, p. 438). Looking for a familiar source to explain an electric battery people might get inspired by a bathtub, just because of its kind of a cylindrical form and storing capacity. However, a bathtub keeps something but does not supply it to other systems. In this cases the source was available but the analogies' core was not disclosed. The results of incorrect analogical inferences from prior experiences to a new situation can mislead managers to wrong decisions.

Teaching and Schema Abstraction

Educational processes try to provide people with knowledge that can be applied to solve later real life problems. Case studies are often based on real life examples and teaching with them in business administration is a worldwide established technique (Garvin, 2003, p. 61). Instead of abstract principles, cases could often be better understood (Gentner *et al.*, 2003, p. 393). The cases learned during studies should serve people as a collection of potential familiar sources later in life (Ross, 1987, p. 635; Gavetti and Rivkin, 2005, p. 3). With their help, inferences about less known targets (later problems) can be made.

Referring to the Intel example above, "losing the low end today, means losing the high end tomorrow" is a "generalizable abstraction" and, therefore, defined as a schema (Seel, 1991, pp. 101, 102). Having a well-defined schema of underlying core principles abstracted, people could retrieve it in later situations (Gick and Holyoak, 1983, p. 33; Loewenstein *et al.*, 1999, p. 586). The more core elements of the principle are included in the schema, the higher its schema quality. The higher the schema quality, the higher the probability for less superficial driven and, therefore, correct retrievals of the principle in later situations (Gentner *et al.*, 2003, pp. 394, 399). Following the classic teaching approach with case studies, only one case per class is submitted to students. In literature it is strongly discussed to what extent people can abstract schemata from only one case (Gentner *et al.*, 2003, p. 393). Therefore, some authors suggest to work with more than one case for better schema abstraction.

Prior Research and Analogical Encoding

By analogical encoding a higher schema quality is the result of comparing two cases with each other and, hereby, abstracting the common structural patterns of both analogs (Gick and Holyoak, 1983, p. 23). In fact, the results are persuasive. In many experiments (e.g. Loewenstein *et al.*, 1999, p. 586; Gentner *et al.*, 2004, p. 2; Gentner *et al.*, 2003, p. 393; Loewenstein *et al.*, 2003, p. 120), the positive effect of analogical encoding on schema quality and later retrieval was demonstrated. People were more often reminded to the source and were less driven by superficialities. As a consequence, the authors suggest to change existing teaching practice and work with additional analogical cases in class (Loewenstein *et al.*, 2003, p. 125).

Hurdles and Hypothesis

From the author's perspective the statement above is not enforceable in its generality. The cases of the experiments above, strongly differ from real business cases. According to guidelines of the Harvard Business School, case studies in business have an average of about 10-20 pages plus 5-10 additional pages with numerical data and illustrations and include relevant and irrelevant materials (Garvin, 2003, p. 60 et seq.). The cases in the above mentioned experiments only include about 200-300 words and are strongly focused on information of structural patterns. However, people are very sensitive regarding the amount of details they receive about a situation (Mandler and Orlich, 1993, p. 486). Therefore, many details in real case studies, could distract people from recognizing the underlying principles. Additionally, if people work with two larger cases their cognitive load in the working memory is higher. The higher the working memory is demanded, the less people are able to recognize structural relations (Tohill and Holyoak, 2000, p. 30). By preparing and using two cases that are closer to real business education conditions it should be evaluated to what extent the received schema quality via analogical encoding will be as high as in prior experiments.

Methodology and Experiment

For the experiment two groups of students were provided with a set of study materials. The experiments were conducted in five classes at the FOM University of Applied Sciences in Munich from January to March 2015. 92 students took place in the experiment (43 in group 1 and 49 in group 2), therefrom 11 men and 32 women in group 1 and 21 men and 25 women in group 2 (3 persons without statements). 31 students from a master study took part (13 in group 1 and 18 in group 2) and 58 students from bachelor classes (30 in group 1 and 28 in group 2) illustrates the mentioned frame data of participants.

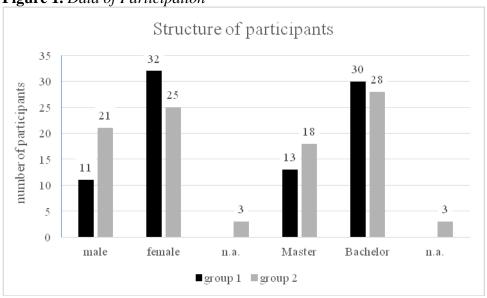


Figure 1. Data of Participation

For an increase in motivation concerning the participants, three amazon-vouchers with each a value of 30€ were raffled. Additionally, the experiment took place as a part of their regular lectures and, therefore, not as a part of their spare time.

One group received the identical cases as used in prior studies, taken from Loewenstein et al., 1999, p. 596 and Gentner *et al.*, 2009, p. 1382. The embedded principle in this cases is about building a trade-off. A "trade-off" is a well-known negotiation principle (Froman and Cohen, 1970, p. 180). Applying this principle one side gets what it really wants by abandoning interests that are not as important to them as their first priority objective (Loewenstein *et al.*, 1999, p. 595). Such differences in preferences provide chances for applying this principle (Bazerman *et al.*, 2000, p. 299). A famous example for a trade-off is about the two sisters having an argument about the last orange¹. Instead of just cutting the orange into two halves and only partly satisfying both sisters, the mother asked them what they want to do with the orange. One sister said she wants to make juice from its pulp. The other sister wanted to bake cookies and therefore needed the peel. That way, each sister could get her individual high priority by giving up the first mentioned objective of getting the whole orange.

After having read these cases the students had to answer questions asking to compare both cases with each other. The questions were identically to prior studies in analogical encoding, e.g. "what are the key similarities between these two cases?" (Loewenstein *et al.*, 1999, p. 590).

In the second group, the original cases were enlarged from about 200 respectively 300 words to about 1000 words, including many irrelevant information and figures and data (for one example case see appendix). In consequence, these prepared cases are closer to business cases as they are used

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¹This story is attributed to Mary Parker Follet, see Kolb (1995, p. 339)

in reality. However, the included principle was still identical to the cases of group 1. The questions for the students after having read the cases were also the same group 1 had to answer.

As mentioned in point 4, as an indicator for the sound understanding of the learned principle and their retrieval later, the schema quality of participants can be evaluated. For evaluating the schema quality both authors of this article independently judged the answers of the students. In order to receive objective evaluations, the second author did not know to which group the answers belonged. Regarding both judgments no significant disagreements existed. Different ratings could be harmonized. For the judgment the established scale for rating schema quality was applied (0=no elements of the schema were recognized, 1=the schema was partly recognized, 2=the schema was fully recognized; see Loewenstein *et al.*, 1999, p. 591). Additionally, in order to increase the differentiation the solution of participants were also rated on a scale from 0-4.

Results

As figure 2 shows, schema evaluation on a scale from 0 to 2 between group 1 and 2 were not significantly different (t = -0.62, n.s.).

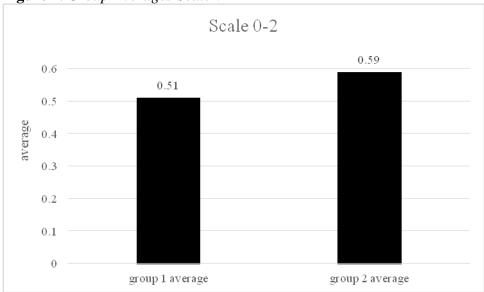


Figure 2. Group Averages Scale 0-2

The same result is obtained on a schema evaluation on a broader scale from 0 to 4 (figure 3). The schema evaluation between both goups is not significantly different (t = -0.82, n.s.).

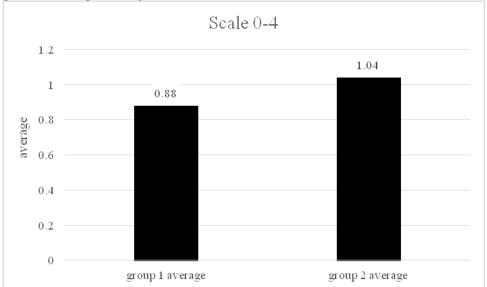


Figure 3. Group Averages Scale 0-4

Summarized, even though persons in group 2 had to deal with very much more details and distracting information, the schema quality of participants of both groups does not significantly differ. A t-test of both groups showed that their differences in schema rating were not significant, independently from the applied scale. The concept of analogical encoding is also applicable to cases as they are used in business education.

Remarks and Future Research

The new experimental cases are much closer to real business cases, but are still not equal to them. For future research, a qualitative study using real cases with less falling numbers could be conducted to confirm the results. Moreover, even though the results suggest a successful theoretical application of analogical encoding to regular business cases, some practical hurdles exist. First, structural identical second cases may not exist yet. Second, the development of such cases is challenging and time-demanding for lecturers. Third, the comparison process is very extensive for students. Finally, for both, lecturers and students time is a valuable and much-too-scarce commodity in class. In future, an alternative approach for effective schema abstraction that is more practicable in educational contexts has to be developed (see Mayer, 2016, work in progress).

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Appendix

Modified Case: The Meeting (based on Loewenstein et al., 1999, p. 596) MacGrant LLC, a large traditional whiskey distillery, has gone through difficult times after the heir and owner Dave Billing has left the company due to his age of 69 years. After his departure, external managers started to run the business. However, Dave still owned high shares of the company and, therefore, in fact never completely retired. Consequently, he still took influence on the operational business whenever possible. For the external managers this was not a base to work upon and, as a result, in the first three years after Dave's retirement, four external managers came and went. This led to very discontinuous strategy approaches and a low working climate. During these years the sales and revenues of the company were decreasing (see figure 1).

Figure 1. Sales and Revenues

MacGrant LLC	CEO: Dave Billing			Various New CEOs			Entry of CEO Michael Haynes					
	2006	2007	2008	2009	2010	2011	2012	2013				
Lower Price Segment												
Sold Bottles	3.282.658	3.492.367	3.320.380	3.369.611	3.006.430	3.644.294	3.238.547	3.259.489				
Revenue Thd. \$	\$45.301	\$46.099	\$44.825	\$42.120	\$42.090	\$40.087	\$42.101	\$43.025				
Average cost per bottle	\$13,80	\$13,20	\$13,50	\$12,50	\$14,00	\$11,00	\$13,00	\$13,20				
Middle Price Segment												
Sold Bottles	2.852.554	2.953.694	3.015.362	2.837.072	2.392.398	2.964.034	2.791.877	2.488.920				
Revenue Thd. \$	\$67.035	\$70.003	\$69.052	\$57.025	\$55.025	\$56.020	\$60.025	\$59.859				
Average cost per bottle	\$23,50	\$23,70	\$22,90	\$20,10	\$23,00	\$18,90	\$21,50	\$24,05				
Premium Price Segment												
Sold Bottles	377.576	393.624	395.878	349.401	335.755	363.737	376.743	384.107				
Revenue Thd. \$	\$22.353	\$23.846	\$23.001	\$20.125	\$21.153	\$19.005	\$20.856	\$22.785				
Average cost per bottle	\$59,20	\$60,58	\$58,10	\$57,60	\$63,00	\$52,25	\$55,36	\$59,32				
Total												
Total Sold Bottles	6.512.788	6.839.685	6.731.620	6.556.083	5.734.583	6.972.065	6.407.167	6.132.516				
Revenue Thd. \$	\$134.688	\$139.948	\$136.877	\$119.271	\$118.268	\$115.113	\$122.983	\$125.669				
Profit Thd. \$	\$13.460	\$14.524	\$13.426	\$10.569	\$10.621	\$8.526	\$11.958	\$12.603				

In 2012, the current CEO Michael Haynes came into business being the first able to implement his strategy and to deal with Dave's character. Before he came to MacGrant LLC he was a successful manager of marketing and sales at various German breweries. Therefore, due to many breweries are led by their owners, he knew a lot of people who could not totally disengage their responsibility of a business leader after their retirement. He was able to use the deep and profound experiences of Dave and his high reputation at distributors and long-run business partners. Michael gave Dave in that way the possibility of still being part of the business. At the first time after his official retirement Dave's needs for involvement and participation were fully satisfied. Therefore,

Michael himself could focus on the internationalization of sales, the global marketing strategy and the financial part of business.

In order to demonstrate that the turbulent years were past, Michael knew he had to do something to increase motivation in the marketing and in the sales divisions. This was one of his most important objectives in 2014. The marketing and sales divisions had particularly suffered from the permanent changes in strategy and had not been allowed to participate in the decision making processes at all. Therefore, he wanted to set up a meeting to work on the future course of MacGrant LLC. He knew that only by participating marketing and sales during the decision processes, he could increase motivation again.

He set up a meeting with the Head of Marketing Julia Singer, and the Head of Sales Roberto Toleti. In this meeting Michael told them about the backgrounds of his idea of the meeting. He gave both two weeks to define a concept and present this to him. His experiences have shown that often the ideas of marketing and sales regarding such a topic strongly differ, so he was quite curious about the concepts.

Julia and Roberto presented their ideas to Michael and he was proven right realizing that both did not create a common concept. In this case the ideas went into totally different directions. There were such substantial disagreements between the two divisions that they were even beginning to create conflict between them. Roberto wanted to go to a lodge in the mountains. He had researched this possibility already and due to the high popularity of such suitable locations he wanted to reserve a location as soon as possible. Julia wanted to set this meeting in a major city. She had already generated materials on the potential exposure of the company in several urban markets in preparation.

Due to their different approaches Julia and Roberto suggested to Michael to hold two meetings, one as proposed from marketing and one as proposed from sales. Michael denied this option immediately pointing on high costs and the hectic travel schedules of the executives involved. While thinking again on the proposals of Julia and Roberto he got confirmed in his decision to initiate a common meeting in order to improve cooperation and communication between the marketing and sales division.

After listening to both ideas and understanding the intensions of them he wanted to know more about the detailed backgrounds that led Julia and Roberto to their recommendations. Julia started and told about the current situation in the marketing department. Her employees were daily confronted with negative trends concerning the image and the reputation of the company in the market. She referred to still very much lower market reputation in 2013 than in 2008 (see Figure 2). This is also something Dave was aware of and stated this facts as often as possible to her.

Figure 2. *Marketing Key-Ratios*

MacGrant LLC	2008	2009	2010	2011	2012	2013				
Percentage of Whiskey Customers stated a										
positive Image Perception of the brand	86,2%	79,1%	75,2%	71,4%	72,0%	72,4%				
the brand as their first choice	9,1%	9,0%	8,4%	6,2%	6,8%	7,1%				
Market Share Top 3 Markets										
Scottland	14,2%	14,0%	13,9%	10,0%	10,4%	10,7%				
Germany	8,2%	8,3%	8,0%	7,7%	7,9%	8,0%				
England	7,9%	7,9%	7,9%	7,7%	7,8%	7,8%				

From Julia's perspective, this meeting should demonstrate to the employees that they still could be proud to work for MacGrant LLC and that a new era would start right now. She thought such a highly renowned location would contribute to this understanding. Also, external business partners and customers getting to know about the choice of such a location, would promote the company image.

Roberto listened carefully to Julia and then began to explain his understanding of the planned meeting. He said, that after these turbulent years the employees should get involved in the strategy process by working it out by themselves. They needed a quiet and simple, maybe totally unknown, location with enough space to work in groups and to discuss in teams. Moreover, he wanted a relaxed atmosphere, offering the possibility to work completely focused without any distractions. From his perspective all these characteristics were available choosing a lodge in the mountains. Finally, Roberto closed his explanations pointing out what Dave had often criticized before, that the sales team only tried to sell bottles without having any idea which products they should sell in which priority in order to increase profitability. For the sales teams, the more bottles are sold, the better it was. Only when working together in an atmosphere where the sales team could listen carefully, such important aspects could get taught

After these detailed information of both sides, Julia and Roberto understood each other better. All arguments were valid and comprehendible from both points of view. Also Michael understood both negotiation parties well. However, for the moment they could not see a solution fitting to all interests. They broke up the meeting and Michael went back to his office.

At the evening, Michael had a look at both presentations again. The interests were not as contradictory as it has appeared. Being separated from a stressful and hectic environment on the one hand and enjoying a high quality and elaborated location on the other hand does not necessarily need to exclude each other. Michael realized that Julia argued she wanted to hold the meeting in a big city, but what was really important to her was the reputation of the hotel in order to motivate the employees. Roberto did in fact not put full emphasis on the lodge in the mountains, for him it was all about having a quiet and relaxed place to be focused on work. The best solution was to look for a well-publicized meeting located in the mountains.