ANALOGY AS A TOOL FOR COMMUNICATING ABOUT INNOVATION

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Abstract

Many techniques have been developed to enhance innovative thinking within a company. However, many innovations never make it through the development process due to the difficulty inherent in communicating new ideas to others. This article discusses the obstacles to innovation that occur during the development process and how these obstacles can be overcome through the use of analogy. Described is an empirically derived seven-step process for constructing suitable analogies for communicating about innovations. The use of the seven-step processes to develop an analogy to communicate about an automotive "step-rim" innovation developed by General Motors and the lessons learned during the development of the analogy are also discussed.

In the modern world of business, it is useless to be a creative original thinker unless you can also sell what you create. Management cannot be expected to recognize a good idea unless it is presented to them by a good salesman.

David M. Ogilvy

1. The Difficulties of Pushing an Innovation through the Development Process

Companies recognize the importance of promoting innovation in order to survive in a rapidly changing, global, environment. However, there can be a significant disconnect between recognizing the importance of innovation and implementing those ideas and this disconnect appears to be endemic across industries. We have directly observed this phenomenon in our combined experiences working at research labs, academia, NASA, and companies that include Disney, General Electric, NASA, and General Motors. This has been the case even though the people working in these environments are intelligent, creative, supportive, reasonable, and value innovation. Why is it, then, that so few innovations make it from conception to implementation with their original vision intact?

The disconnect lies, in part, in the inherent difficulty of communicating innovative ideas to decision-makers[2]. Because an innovation is new and unusual it is difficult to describe in such a way that decision-makers fully understand the innovation and the benefits it offers [Gregan-Paxton & John, 1997]. This lack of understanding may cause decision-makers to discredit the innovation before it enters the development process. Furthermore, if the innovation is developed, lack of understanding during the development process may cause the product vision to drift, ultimately failing to meet the end consumers' needs. Frequently, the result of this drift is a product that is more similar

[2] "Decision-makers" refers to people at any point in the product development process making decisions that could affect the future of the innovation. Potential decision-makers range from management personnel deciding whether or not to allocate resources towards developing the innovation to the end consumer deciding whether or not to purchase the innovation.

to existing products than the innovation would have been had its vision been maintained - in essence, the innovation gets lost in translation.

An effective communication tool, such as analogy, is needed for pushing an innovation through the development process. By using the *familiar* to communicate about the *unfamiliar*, an analogy helps to overcome initial resistance to an innovation. An analogy then maintains the vision of the innovation as it passes from workgroup to workgroup during the product development process.

1.1. *Using analogy as a communication tool*

Analogy has a long history as an effective communication tool with Aristotle, himself, praising its usefulness as a rhetorical device. A large empirical knowledge base exists describing the basic processes underlying analogy and its use for communication and innovation [Gregan-Paxton & John, 1997; Herstatt & Kalogerakis, 2005; Holyoak & Thagard, 1995; McCroskey & Combs, 1969; Roehm & Sternthal, 2001]. What is missing is how this knowledge can be used to develop an effective technique for constructing analogies to communicate about specific innovations. The current article discusses the development and application of such a technique including 1) the barriers overcome through the use of analogy to communicate about innovation, 2) the steps necessary to develop a communication analogy, and 3) the process by which the technique was created.

1.2*. Developing and refining a structured methodology for developing analogies*

Research and Development (R&D) work teams at General Motors (GM) have been using the method of "Cross-Domain Analogical Analysis" (CDAA) to facilitate out-of-the-box thinking when developing new products or product development processes [Sifonis,

Chen, & Bommarito, 2003]. The Design and Technology Fusion team within R&D is a work team specifically tasked with leveraging advanced technologies and design and finding beneficial strengths between the two. Consequently, the team was familiar with the practice of using analogies to generate new product ideas. Like many innovators, they also realized the usefulness of analogy for describing innovations to others. This led the team to an important realization. If a structured methodology such as CDAA could be developed allowing people to use analogy to generate ideas, perhaps a structured methodology could be developed for creating analogies to describe those innovations. This led to a partnership between R&D and academia to develop such a methodology.

The resulting seven-step process for developing analogies to communicate about innovation is still in the experimental stages. The Design and Technology Fusion team have been using the process to communicate about a wide range of product and process innovations. In doing so, the analogy development process has been refined and streamlined so as to be applicable to a wide a range of innovations. The effectiveness of the analogies developed for pushing innovations through the development process is still being assessed. However, results to date suggest that the analogies generated using the seven-step process function are effective for overcoming typical barriers faced by innovative ideas during the development process.

2. Barriers to Innovation Overcome by Using Analogy

The analogy development process has been used by GM's Design and Technology Fusion team to communicate about innovations ranging from total vehicle systems to conceptual approaches for automotive design. Analogies generated using this process allow a communicator to overcome three barriers to innovation (See Figure 1). When

first introducing an innovation to an audience, a well-constructed analogy can be used to break members of the audience out of a problem-finding mindset. By allowing people to use familiar knowledge to structure their understanding of the innovation, the analogy allows people to more fully understand the innovation and the potential benefits it offers. Finally, the analogy ensures that the key message associated with the innovation does not drift as the innovation travels through the product development process.

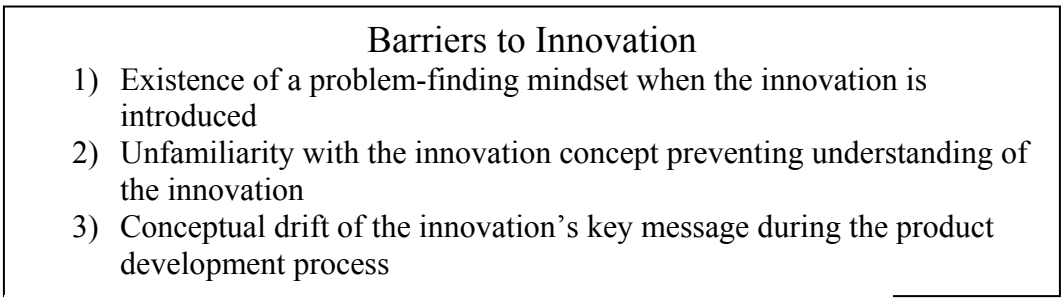

Fig. 1. Barriers overcome through the use of analogy to communicate about innovation

***2.1**. Breaking your audience out of their "problem-finding" mindset*

For any familiar situation, we have a set of expectations and guidelines for behaving in that situation. For example, when we go into a restaurant we expect to see tables, order from a menu, and eat. We also know that we are expected to pay for our food and to refrain from yelling loudly at those around us (enjoyable as that might be). Cognitive psychologists refer to the expectations associated with familiar events as "scripts" [Galambos, 1983; Galambos & Rips, 1982; Schank & Ableson, 1977]. People possess hundreds of scripts including scripts for birthday parties, restaurants, and business presentations. These scripts develop over time through repeated experiences with the common events. The more experience a person has with a particular situation, the more developed the script for that situation [Ross & Berg, 1990].

When a person has a well-developed script, they will automatically engage in script-appropriate behaviors [Bargh, Chen, & Burrows, 1996]. Herein lies one of the problems innovators face when pitching a new initiative. Most executives have well-developed business meeting scripts. In these meetings, there are typically a score of problems to solve and limited resources with which to solve them. Unfortunately, the very act of attending a business meeting causes these people to immediately engage in problem-finding and decision-making behaviors. This is true even if the meeting is explicitly directed towards providing information about an innovation. Executives and other decision makers are not necessarily close-minded or are in the habit of adopting a negative mindset. It is simply the case that such problem-finding behaviors are adaptive for navigating the day-to-day realities of managing an organization [Reger & Palmer, 1996]. The best executives are those that can foresee potential problems before they occur and take appropriate action. However, this normally adaptive behavior has the potential to destroy a good idea before it ever has a chance to mature.

Because innovations are new, it can initially be difficult to understand the innovation, its potential applications, and possible benefits. This makes an innovation an easy target for criticism arising from the activation of a problem-finding mindset during the initially presentation of an innovation. This is why an analogy can be a useful communication tool. By taking a novel approach to communication by using an analogy, script-driven problem-solving behaviors are less likely to be activated in an audience. As discussed subsequently, the analogy also provides the additional knowledge necessary for fully understanding the innovation, its applications and potential benefits.

The Design and Technology Fusion team has directly observed how an analogy can break an audience out of script-driven behaviors. On one occasion, a group of innovators were pitching ideas to senior management at GM. Each innovator began their presentation by describing the innovation's features, the problems it addressed and the benefits of developing it. In short, they gave typical presentations and management responded in a script-appropriate manner by finding faults in the innovations and questioning their usefulness and long-range benefits. However, beginning a presentation with an analogy between an innovative approach to addressing automotive interior design problems and a home repair project delayed the activation of problem-finding scripts. During the presentation the audience thought about the analogy and its relationship to the innovation rather than finding fault with the innovation. Consequently, the time invested drawing the analogy paid off by allowing the idea to be processed uncritically (at least initially) and fostering the audiences' subsequent understanding of the idea and the contexts in which it would be useful [Fitzgerald, 1998; Gregan-Paxton & John, 1997].

As the example illustrates, the use of analogy to communicate about innovation does more than just break an audience out of a problem-finding mindset. It also helps them to better understand the innovation. This, in turn, allows the audience to reason more effectively about the innovation [Chi, Feltovich, & Glaser, 1981].

2.2. *Facilitating understanding*

Analogies can be effective tools for communicating about innovation because of their proven ability to promote understanding of unfamiliar concepts [Halpern, Hansen, & Riefer, 1990; Holyoak & Thagard, 1995]. The function of an analogy is to activate an audience's existing knowledge and highlight correspondences between that knowledge

and the unfamiliar topic of conversation. These correspondences allow the audience to use their existing knowledge as a framework for understanding the unfamiliar topic [Fitzgerald, 1998; Gregan-Paxton & John, 1997; Halpern, Hansen, & Riefer, 1990; Holyoak & Thagard, 1995; Johnson-Laird, 1989; Markman & Moreau, 2001]. This framework can then be used for reasoning and decision-making [Chi, Feltovich, & Glaser, 1981, Holyoak & Thagard, 1995]. It also allows the audience to make inferences about the innovation that were not specifically stated by the communicator [Holyoak & Thagard, 1995; Markman & Moreau, 2001].

The use of analogy to describe an underhood design element developed by members of General Motor's Design and Technology Fusion Team provides an example of how an analogy allows an audience to use their existing knowledge to better understand a product with innovative components. GM's underhood design element is a stiff, form-fitted, protective heat shield completely covering the engine. The shield contains access to the receptacles necessary for checking and replacing essential fluids such as oil and radiator fluid, while hiding unsightly engine parts. Engine dressing components such as this are typically plastic aesthetic covers. In contrast, the underhood structural design element consists of a stiff shield that improves vehicle response and handling, absorbs shocks, and reduces engine noise. When presenting the underhood element to management, the innovator used an analogy to highlight a range of correspondences between the innovation and the, more familiar, athletic mouth guard. Feature correspondences included both products being internal, hidden from view, and form-fitted to their native environments. Functional correspondences included the protective function of the devices and the ability to take in fluids without the removal of the device. Highlighting

the correspondences between the devices allowed management to use their existing knowledge of the more familiar mouth guard to draw unstated correspondences between the devices and infer possible features of the underhood structural design element. For example, knowledge that mouth guards come in different colors led to the inference that the underhood design element could be manufactured to compliment the aesthetics of the vehicle. In short, the audience was able to use their existing knowledge to more fully understand the function and potential applications of the innovation.

2.3. *Maintaining focus throughout development process*

In many industries there is a significant hand-off component during the product development process. This is as true for vehicle development at General Motors, as it is for product development at companies such as IDEO or Design Continuum. Across industries, it is not unusual for the key idea associated with an innovation to "drift" as it passes between functional work teams. This drift occurs when each work team has its own interpretation of the product and modifies the product to reflect that vision. The process is similar to the telephone game played by school children. The children stand in a line and pass a whispered message from the first person in the line to the next until it reaches the last child. The message heard by the last child is usually substantially different from that whispered by the first child in the line. This distortion is not due to any one child. Incremental adjustments to the message occur as each child in the line misunderstands or miscommunicates a single portion of the overall message to the next child. Collectively, these small changes can be enough to distort the original message to the point where it is no longer recognizable. The same is true for innovations during the product development process. Without an easily understandable key concept associated

with the innovation to guide work team efforts during development, "conceptual drift" is likely to occur. Sometimes the drift is so extensive that the original concept is almost unrecognizable in the final product.

A good analogy can prevent conceptual drift by communicating the key message associated with the innovation. With a clear understanding of that key message, any modifications made to the product should be in keeping with the overall vision.

Fig. 2. The Autonomy "skateboard prototype

An example of how an analogy can maintain vision during the development process can be found in the Autonomy "skateboard." The Autonomy skateboard is a GM prototype vehicle consisting of a 14.5-by-6-foot board with sixteen-inch car tires at each corner (See Figure 2). The board contains the powertrain, the hydrogen fuel cells used to power the vehicle, as well as the vehicle's brakes, suspension, and control mechanisms. It also contains a snap-on guide allowing it to connect to interchangeable vehicle bodies. One of the authors (Adrian Chernoff) began referring to the Autonomy as a skateboard to emphasize the shape and configuration of the vehicle. The analogy also emphasized the correspondence between the skateboarder's ability to maneuver by interacting directly with the skateboard and the Autonomy driver's ability to control and propel the vehicle through the board.

The idea for an automobile body connecting to a "skateboard" undercarriage resulted in a paradigm shift in the conceptualization of transportation. However, this paradigm shift meant that the Autonomy concept car met all of the barriers to innovation discussed previously. Fortunately, the skateboard analogy proved its usefulness for maintaining the vision for Autonomy during development. When vehicle designers attempted to add fenders to drawings of the Autonomy chassis rather than to the snap-on body, the innovators had to say little more than "Skateboards don't have fenders." When discussion began concerning the ability of the design to scale up for transporting larger numbers of users in longer wheel base vehicles such as trucks and vans, the innovators simply stated that "even though the basic shape remains consistent, skateboards come in several different sizes." The skateboard analogy was so effective that it was used to communicate the innovation to the general public and maintained the vehicle vision through subsequent versions such as the Hy-Wire and Sequel concept cars.

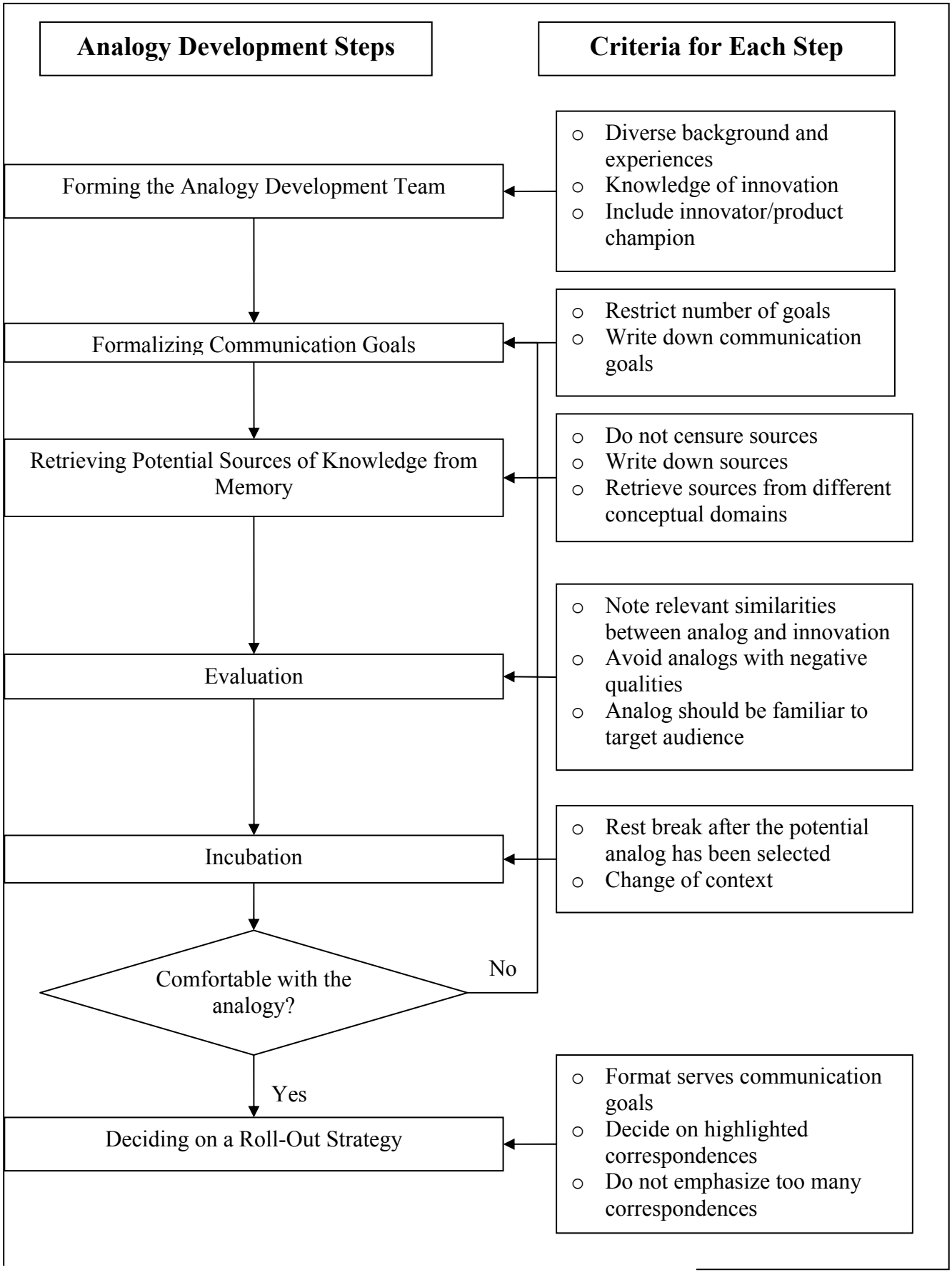

Figure 3. Steps and constraints in the analogy development process

3. The Analogy Development Process

As noted, using analogy to communicate about innovation provides several benefits to the communicator. What follows is a description of the process by which an innovator or product champion can develop effective analogies for communicating about the innovation to others (see Figure 3). The components making up the seven-step process were constructed based on research in the areas of cognitive psychology, linguistics, and consumer research. Insights gained while applying the process resulted in further process refinement and development. Applying the process also allowed potential pitfalls to be identified that, in turn, resulted in the development of a set of guidelines for their resolution.

GM's Design and Technology Fusion team's development of an analogy for a vehicle step-rim will be used as an illustrative example of the steps in the analogy development process. The step-rim was chosen as an illustrative example for the analogy development process because developing the step-rim analogy led to important insights about the process and was a key factor in refinements to that process. Also, unlike many of the Design and Technology Fusion team's innovations for which analogies have been developed, the step-rim has patents pending and is in the public domain.

The step-rim is an innovation allowing passengers access to typically inaccessible areas (i.e., pick- up beds, windshields, and luggage racks) on high profile vehicles such as Hummers and suburban utility vehicles (SUVs). The step-rim is a center hub that rides on its own bearing and appears to be a normal rim when not in use (See Figure 4). When needed, the operator can simply kick the bottom of the hub to make it flip open, converting it into a sturdy step (See Figure 5).

Figure 4. The step-rim in its closed and open positions

Figure 5. The step-rim in use

3.1. *Forming the analogy development team*

The first step in the analogy development process involves forming the analogy development team. Hargadon & Sutton [1997] suggest that analogy use in a group setting benefits by including group members with a diversity of work and/or life experiences. A diverse team can leverage its diversity when retrieving potential analogs to the innovation during Step 3 of the development process. The more diverse the experiences of analogy development team members, the wider the range of potential analogs the team can access during the development process.

Team members should also have a thorough understanding of the innovation. Compelling and sound analogies for an innovation are more likely to be generated by team members with a comprehensive understanding of an innovation [Dunbar, 2001; Hargadon & Sutton, 1997]. It is also useful to include a person on the analogy

development team who can link the innovation to business needs. This will allow the team to develop analogies for the innovation that are compelling to a business audience [Donatello & Sawyer, 2004].

The analogy development team should also include either the innovator or the product champion. It is the job of the product champion to maintain the vision of the innovation and push the innovation through the development process and the innovator frequently plays the role of the product champion. Because the innovation analogy will serve a function similar to the product champion during the product development process, it is important that the innovator, the product champion, or both take part in the analogy development process.

The value of the innovator/product champion's thorough understanding of the innovation during the product development process was discovered when developing the step-rim analogy .The step-rim innovator was one of several designers and engineers from the Design and Technology Fusion team developing the step-rim analogy. The analogy development team also included engineers from the Interior Center, and a university affiliate. The diverse backgrounds and work experience of the team members was useful when generating potential analogs during Step 3 of the analogy development process. However, it was the innovator's deep understanding of the step-rim innovation, its implementation, and the goals the analogy should address that proved indispensable to the analogy development process. The innovator's understanding allowed the formation and refinement of the analogy's communication goals (Step 2), the subsequent generation and evaluation of potential analogs (Steps 3 and 4), and the eventual rollout strategy (Step 7).

3.2. *Formalizing the communication goals*

The next step in the analogy development process is clarifying and formalizing the communication goals of the analogy. At this point, the team should be asking themselves "What is the key point I want my audience to understand about the innovation?" The goal could range from highlighting an important physical attribute of the innovation to describing the benefits obtained by adopting it. The communication goals should be written down and displayed so that they are visible to the entire team throughout the analogy development process. This will help guide the retrieval process in Step 3.

Holyoak and Thagard [1995] have predicted that the difficulty of generating an analogy increases as the number of goals needing to be satisfied by that analogy increase. The experience of developing an analogy for the step-rim confirmed this prediction. Initially, the innovator had a variety of communication goals for the step-rim. He wanted to highlight the physical attribute of the step-rim being hidden from view until it was needed. A second communication goal was highlighting the functional attribute of allowing access to areas of the vehicle that were previously inaccessible and, consequently, unused. Associated with this goal was an emotional attribute – the sense of accomplishment provided by allowing an individual to accomplish a task that could not otherwise have been accomplished. Finally, the innovator wanted to frame the innovation as a high-end product designed to make the vehicle stand out when compared to similar vehicles. As discussed in the following section, even though it was relatively simple to generate analogies for individual communication goals, it was difficult to generate an analogy that simultaneously satisfied all four communication goals.

3.3. *Retrieving potential sources of knowledge from memory*

After identifying the communication goals, the analogy development team uses those goals to search their memory for potential sources of knowledge to use for the analogy. The team can do this by asking the question "What other things do I know of that (*insert communication goal*).

Each communication goal will suggest a potential source of knowledge to use for the analogy. For example, the step-rim communication goal of "being hidden from view until needed" suggested analogies to drawbridges and hide-a-beds. The goal of "allowing access to previously inaccessible areas of the vehicle" suggested analogies to pitons for rock climbing, stepladders, and friends providing a "hands-up". The goal of "providing a sense of accomplishment" suggested analogies to pole pruners and booster chairs. Finally, the "high status product" goal suggested analogies to other high status products such as Air Jordan athletic footwear and Sherpa mountain guides[3].

As stated earlier, the greater the number of communication goals, the more difficult it will be to generate an analogy that simultaneously satisfies all the goals. The step-rim analogy development team spent many unsuccessful hours trying to retrieve a single analog that simultaneously satisfied all four communication goals and the criteria described in Step 4 of the analogy development process. This impasse forced the innovator to re-visit the communication goals and select a subset that communicated the most desirable characteristics of the innovation - "providing access to hard-to-reach places" and "hidden when not in use." The team found that analogs that satisfied the two critical communication goals were much easier to retrieve from memory and included

[3] Traditionally, Sherpas are people of Tibetan descent serving as expert guides on Himalayan mountaineering expeditions.

such things as attic stairs, the extendable steps of a recreational vehicle (RV), higher education, and the long tongue of a giraffe.

Step 3 should be treated similarly to a brainstorming session. Team members should have the freedom to express whatever source of knowledge they retrieve from memory without fear of censure from other members of the team. Even if the idea is an unlikely candidate for the analogy, it may serve as a retrieval cue for other team members as they search their memories for potential analogs to the innovation. As with Step 2, it is wise to write down items that have been generated so that they are visible throughout the analogy development process.

Markman and Moreau [2001] have demonstrated that analogies formed from conceptually distinct domains of knowledge result in the most compelling and persuasive analogies. However, as the team starts generating potential knowledge sources, it is likely that the information retrieved from memory will be from the same conceptual domain as that of the innovation [Holyoak & Thagard, 1995; Markman & Moreau, 2001]. For example, when generating analogies for automotive parts such as the step-rim, the first items to be retrieved from memory will be similar automotive parts such as the RV's extendable steps. In order to generate the most compelling analogies for communicating about the innovation, the analogy development team needs to be aware of this tendency and reject from further consideration potential analogs from the same conceptual domain as the innovation (e.g., rejecting RV steps as a potential analog because of their conceptual similarity to the step-rim).

3.4. *Evaluation*

During Step 4, each of the sources generated in Step 3 needs to be evaluated for its suitability as an analogy for the innovation. This is best done by noting the relevant similarities between the potential analogs and the innovation. Understandably, the most important similarities for the innovation and its analog to share are those specified in the communication goals. However, it is useful to carry the comparison further. In doing so, the analogy development team is better able to 1) choose the source of knowledge most likely to produce a compelling analogy, 2) guard against unforeseen negative inferences, and 3) tailor the analogy to specific audiences.

A compelling analogy is one in which the components of the analogy share extensive functional similarities. This allows the audience to use their existing knowledge to make inferences about the innovation beyond those explicitly stated in the analogy itself [Holyoak & Thagard, 1995; Markman & Moreau, 2001]. For example, an audience exposed to the attic stairs analogy could infer that the step-rim could provide access to storage space when the vehicle is full just as attic stairs provide access to the attic for storing items when the house is full.

The ease of forming analogy-based inferences can be a double-edged sword for the communicator. If there are negative qualities associated with a potential analog, they will be inferred to be true about the innovation as readily as any positive qualities [Markman & Moreau, 2001]. This is the reason the analog of "the long tongue of a giraffe" was rejected from further consideration as an analogy to the step-rim. Tongues, in general, are associated with the negative qualities of being slippery and slimy. Even though potential consumers might be consciously aware that a step-rim is unlikely to be either of

these things, the negative valence of the analog could potentially become associated with the innovation [Blanchette & Dunbar, 1997].

The familiarity of the analog to the target audience is another important consideration during evaluation. The more familiar the analog is to the target audience, the more likely it is that they will understand the analogy and be able to use it to reason about the innovation [Markman & Moreau, 2001; Roehm & Sternthal, 2001]. As stated earlier, the familiar knowledge will serve as a template for the audience's understanding and conceptualization of the innovation. It will allow them to make inferences about the innovation that were not explicitly stated by the communicator and engage in better decision making. An additional benefit of using a familiar knowledge source is that it allows a person to communicate with a diverse, heterogeneous audience. For example, most people are familiar with attic stairs, fewer are familiar with sherpas. Consequently, sherpa was rejected from further consideration as an analog for the step-rim.

To the extent that one has a more homogenous audience, analogies can be used that are known to be familiar to the specific audience if not to the population as a whole. In the case of the step-rim, the concept of sherpa could be used as an analog in the event that the communicator was attempting to sell Hummers to an audience of mountaineers. Such an audience potentially has a deep enough understanding of the concept that it would serve as an effective analog.

3.5. *Incubation*

The importance of including an incubation period during the analogy development process was discovered during the development of the step-rim analogy. The step-rim analogy development team initially decided on using the analogy of obtaining a higher

education to describe the step-rim. The analog shared important functional similarities with the step-rim. It remained hidden until in use, provided access to hard-to-reach places such as high-profile jobs and higher wages, and resulted in a sense of accomplishment associated with completing difficult tasks. There appeared to be no negative connotations associated with achieving a higher education and the concept is familiar to the majority of individuals.

Upon reaching the decision to use higher education as the step-rim analogy, the team decided to break for the weekend. At the following meeting, the team planned to continue to the next step in the analogy development process and define the roll-out strategy for the analogy. However, this was not what occurred.

At the subsequent meeting, several of the analogy team members admitted they had thought about the chosen analogy over the weekend and were no longer convinced of its suitability for the step-rim. For one, the analogy appeared to trivialize higher education. Only after years of self-sacrifice and hard work will higher education allow a person to achieve difficult-to-reach goals. In contrast, the step-rim allows access to previously unreachable areas both quickly and easily. The team realized that even though the analogy shared important characteristics with the innovation, there were a greater number of characteristics that were not shared between the two concepts. This was probably because higher education is, conceptually, very dissimilar to the step-rim. Even though it is important to choose an analog from a different conceptual domain from that of the innovation, it appears it is possible to choose domains that are too dissimilar.

After discussing the communication goals and reviewing the analogs that had been generated in response to those goals, the analogy development team subsequently,

decided on using attic stairs as the analog. Attic stairs shared the features with the step-rim that highlighted the innovator's communication goals. Because attic stairs are more similar to the step-rim than the concept of achieving a higher education, there were a variety of additional correspondences that could be drawn between attic stairs and the step-rim. The innovator realized these correspondences could be used when communicating about the innovation to address potential concerns of an audience. For example, if the audience was concerned about safety, the innovator could use the analogy to emphasize the fact that the step-rim is as unlikely as attic stairs to collapse or move when being used.

Even though the higher education analogy resulted in a minor setback, it illustrated the importance of including an incubation period in the development process. An incubation period following the decision to adopt a particular analog to the innovation is useful because it provides a period of time in which the correspondences between the analog and the innovation can be explored in depth. This exploration in conjunction with a change in context [Smith, 1995; Yaniv & Meyer, 1987] might reveal unforeseen difficulties with the analogy. The incubation period also allows team members to more fully assess and evaluate their emotional reaction and resultant comfort level to the proposed analogy.

3.6. *Assessing Comfort Level with the Analogy*

After identifying a likely candidate for the analogy, it is time for the analogy development team to evaluate whether the analogy "feels right". Does the analogy work on multiple levels or does it fall apart when examined too closely? Does it provide more information then that provided by the communicator when presenting the analogy? Does

it avoid coming across as trite or contrived? Does the product champion know enough about the analog to feel comfortable using it as an analogy to the innovation? If the answer to questions such as these is "yes," then the team is ready to move on to Step 7. If not, then it is up to the team to determine the reasons for the discomfort.

At this stage, it is not unusual for team members to differ in their comfort level with the analogy. When this occurs, the product champion should make the final decision whether to accept the proposed analogy or re-engage in the analogy development process. The bulk of the responsibility for selling the innovation lies with the product champion. Consequently, it is essential the product champion feels comfortable with the proposed analogy and their ability to use the analogy to communicate about the innovation.

3.7. The rollout strategy

The final stage in the analogy development process involves deciding how the analogy will be presented to an audience. This decision involves two components: the format in which the analogy will be presented and the correspondences that will be made explicit in the analogy.

Analogies can be presented in three types of formats. They can take the form of a simple picture with a tag line drawing the correspondences between the familiar knowledge and the innovation. This format is common when analogies are used in print media. An analogy can also take the form of a short comparison. The step-rim analogy development team decided to use this format when limited time was available for describing the innovation to an audience. In these situations, the product champion could physically demonstrate the operation of the step-rim while pointing out its similarity to attic stairs in that it allows access to hard to reach places while remaining hidden when

not in use. Explanatory analogies used in daily conversation frequently take the form of the short comparison. It is also possible for an analogy appear as a story in which a familiar scenario is described and the relevant correspondences to the innovation are elaborated upon. Many political or persuasive analogies take this form. The step-rim analogy development team decided to present the analogy as a story when they had a more time to describe the innovation to their audience. In these situations, the product champion would say to their audience, "Do you remember what it feels like knowing you have too many things in your new home and not enough closet space for storing it? Do you also remember the wonderful feeling you got when you saw that cord hanging from your ceiling? You pulled down the cord and the attic stairs were revealed allowing access to a clean, safe storage place for all of your things." The communicator then flips down the step-rim on a Hummer and states "Here are the attic stairs for your new vehicle." The audience is allowed to make the inference that the step-rim can be used to reach the luggage rack and use it for storage.

Independent of the form chosen for the analogy, it is useful if the audience has at least a superficial understanding of the innovation in question when introducing the analogy. This can be achieved by having a picture of the innovation or its prototype available when introducing the analogy. This allows the audience to actively process the analogy as it is being presented. It also makes it possible for the audience to draw correspondences between the familiar knowledge and the unfamiliar innovation beyond those stated explicitly by the communicator. This opportunity to actively process the analogy is an important component of its persuasiveness because it can lead to an "AHA!" experience.

An “AHA!” experience is a moment of illumination and insight that has been described as being akin to a light bulb turning on in one’s head. This experience occurs when correspondences drawn between the familiar knowledge and the unfamiliar innovation lead to inferences about the innovation that were not stated by the communicator. It also occurs when the audience begins thinking about the innovation in a new way as a result of the analogy. The “AHA!” moment can be a pleasurable experience and, as such, can be very persuasive. The work of understanding the analogy is conducted by the audience. The resulting insights are the product of their own mental effort and, as such, they are fully able to understand the logic leading up to the insight. In a sense, the audience constructs their understanding of the innovation as they interpret the analogy.

As a general rule, the fewer correspondences between the analog and the innovation explicitly described to the audience, the more persuasive the analogy will be [Fitzgerald, 1998]. If too many of the correspondences are made explicit, the analogy will be perceived as tedious and guilty of pointing out the obvious. Consequently, it is best for the communicator to explicitly state only those correspondences that highlight the communication goals of the analogy. For example, only a few correspondences between the step-rim and attic stairs were pointed out to the audience when using the story analogy (hidden when not in use, extra storage space in attic). The audience was allowed to make the inference that the step-rim could be used to reach the luggage rack and use it for storage just like attic stairs are used for storage in a house. Consequently, they were more likely to have an “AHA!” experience following the story analog than if the correspondence had been made explicit by the communicator.

4. Troubleshooting

It can be difficult to find a suitable source of knowledge for an innovation analogy. It needs to be familiar to the target audience, satisfy all communication goals, and correspond to the innovation. It also needs to be from a different conceptual domain from the innovation, and have no undesirable connotations. Failing to achieve any one of these constraints might force the analogy development team to return to the pool of ideas generated in Step 3. Sometimes a potential analog for the innovation that was not explored at the beginning of the process appears more relevant when returning to Step 3. If all the candidate sources of knowledge in this pool are deemed unfit for the analogy, the team will have to retrieve another set of potential analogs from memory.

Sometimes the team finds they are unable to generate any ideas that differ substantially from ones that have already been rejected. This problem can usually be traced back to the communication goals. At this point, the team needs to return to Step 2 and reevaluate those goals. Perhaps there are too many goals to satisfy with one source of knowledge. Perhaps the goals need to be restated to make them more concrete and actionable.

Even though having to restate and clarify the communication goals can be difficult, it has two important benefits. It makes it possible to generate a new list of potential analogs to the innovation while simultaneously encouraging deeper thinking about the communication goals. Product champions that have engaged in the analogy development process have expressed surprise at the degree to which the process results in clearer thinking about the innovation. The understanding that they gained about their innovation

subsequently allowed them to easily communicate the essential qualities of the innovation and to address any questions that their audience might pose.

Being able to think clearly about communication goals is an important component of being able to communicate effectively with an audience. This clarity is vital for persuading an audience to adopt and support an innovation. However, a product champion will need more than a good analogy to persuade an audience to adopt an innovation or push that innovation through the development process. To communicate persuasively it is important to employ a range of communication strategies [Conger, 1998]. The most central of these is gaining an understanding of the target audience. What is their background? Are certain key phrases likely to trigger either a positive or negative response? What has been their prior reaction to new ideas and what are their current roles and responsibilities? The communicator's understanding of the target audience will allow them to frame the analogy in such a way as to appeal to issues known to concern the audience.

5. Conclusion

The development of the step-rim analogy was an educational experience. It proved to the authors that the core of the research-based methodology was sound and could be used to develop effective analogies for discussing innovations. It also revealed certain considerations that needed to be taken into account when developing an analogy. These considerations included recognizing the difficulty of generating an analogy that satisfies multiple communication goals and the importance of including an incubation period in the process. Engaging in the analogy development process also illustrated unexpected

benefits of engaging in that process such as clarifying the innovator's understanding of the innovation.

The overall effectiveness of the analogies developed by the Design and Technology Fusion Team for overcoming the barriers associated with the development process is still being determined. There is evidence that using an analogy to initially present an innovation to an audience has the ability to break people out of a problem-finding mindset. The questions and interactions following an analogy-based presentation differ qualitatively from those following a more traditional presentation. For example, the time between presenting the idea and questions concerning the viability of the idea is increased. There is also less focus on the shortcomings of the innovation and a greater focus on potential applications. This is due, in part, to the audience possessing a greater understanding of the product as a result of the analogy. Their existing knowledge of the analog allows them to infer unstated properties or applications of the innovation.

The deeper understanding of an innovation engendered by the use of analogy should allow the initial vision of the innovation to remain intact throughout the development process. Since the analogy taps into a familiar source of knowledge possessed by all those involved in developing the innovation, they should possess the same vision and understanding of the innovation. However, the extent to which the analogies constructed using the analogy development process prevents conceptual drift during development is still being assessed. The usefulness of the skateboard analogy during the development of the Autonomy concept car was evident in the analogy's ability to maintain the skateboard look of the vehicle chassis as development progressed. However, most of the other GM products for which communication analogies were created are still in development.

Consequently, the data necessary for assessing extent to which the final products sold to consumers maintain the innovators' initial visions of those products still needs to be collected.

In summary, the seven-step process for developing analogies to communicate about innovation has the potential to be a valuable tool to innovators. It compliments current techniques for enhancing innovative thinking in the workplace. Once these innovative techniques have resulted in an innovative product, the analogy development process can be used to facilitate the innovation's progression through the product development process. The analogy helps to overcome a problem solving mindset during the initial introduction of the innovation to an audience. It also helps the audience to better understand the product and its potential applications and benefits. These factors will make it more likely that the innovation will enter the product development process and be accepted by the end consumer. Additionally, the communication analogy helps maintain the product vision as it travels through the product development process. Consequently, the end product is more likely to meet the end consumer's needs as originally intended by the product innovator. The result is a product that will be both valued and desired by the end consumer - a win-win situation for both the end consumer and the company producing the innovation.

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