

Dr Maciej Koszowski

## Multiple Functions of Analogical Reasoning in Science and Everyday Life<sup>1</sup>

### 1. Introduction

The importance of analogy in science and everyday life is difficult to overemphasize. Analogical reasoning serves here divergent aims and has many functions, ranging from the conception of ideas and the making of classifications, to solving concrete problem or even being a means of proof. In the bargain, analogy also finds use in literature, poetry and humor, which only makes its ubiquity all the more conspicuous.

In this paper, I will try to sketch these aims and functions, separately for science and everyday life, beginning with the former field.<sup>2</sup>

### 2. Analogy in science

It is commonplace that science as such is highly dependent on analogical reasoning. For instance Sunstein (1996) states that: "Much creativity depends on seeing patterns, or likenesses, where these had not been seen before. Advances in science are often founded on discerning new patterns of commonality" (pp. 63-64). Holyoak and Thagard (1996) indicate that: "[t]he role of analogy in science can be traced back at least two thousand years. The first recorded use of analogy to develop an enduring scientific theory produced the idea that sound is propagated in the form of waves" (pp. 10-11). And Biegański (1909, p. 2) notes that if we did not utilize analogical reasoning,

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<sup>2</sup> I will put aside the question of the definition of analogy, regarding it as beyond the scope of this paper. Contextually, analogy is commonly recognized as an argument/inference/reasoning based upon the similarity between the items, persons or events being compared. Thus, for instance, Nerhot (1991) notes that "[a]nalogy in logic consists in linking two terms by a resemblance, with the predicate attributed to the first of them being then attributed to the second. This relationship of resemblance between the two terms leads to a conclusion" (p. 183). Russell (1988) points out that "[a]nalogical reasoning is usually defined as the argument from known similarities between two things to the existence of further similarities" (p. 251). And Mill (1882), with respect to a more usual sense of analogy, invokes the formula: "Two things resemble each other in one or more respects; a certain proposition is true of the one; therefore it is true of the other" (pp. 393-394).

the progress of science based solely on induction and deduction would be relatively very limited. I shall show this dependence by splitting the role that analogical reasoning may play in the scientific field into several functions.

### 2.1. The heuristic function

It is sometimes said that the conviction on the heuristic value of analogy is so common that arguing for it seems to be trivial (see Biela 1989, p. 137). Indeed, above all, analogy constitutes an effective means of inventing scientific propositions, contributing to advancing so-called tentative or working hypotheses. It is mostly owing to analogy that the incubation of new ideas and thoughts is possible. Moreover, analogy provides us with suggestions as to possible experiments (and how to design them) and observations that are promising or at least not merely random or haphazard (see Dąmbaska 1962, pp. 31-33; Biegański 1909, pp. 74-75, 77, 28; Kotarbiński 1953, p. 150; Biela 1989, pp. 137-138; Dunbar, 2001, pp. 315-319; Niiniluoto 1988, pp. 276-277). Needless to say, such a capacity for putting forth in a sense ordered tentative propositions is indispensable for the development of any area of science (see Mill 1882, p. 397).

For instance, following Biela (1989, p. 138), *inter alia*, one may ascribe the view to such authors as H. Spencer, J. Welton, W. Wundt, W.S. Jevons, M.L. Ashley, that in science analogy has nearly cornered the market in inventing new hypotheses (also M.R. Cohen and E. Nagel, according to him, acknowledge the leading role of analogy in this respect). Biegański (1909, pp. 1-2, 77), in turn, asserts that reasoning by analogy is a very important medium that allows us to pass from that what is known to that what is unknown. Hence, as he observes, analogy – in comparison with other kinds of reasoning: deduction and induction – provides us with the most new import; without the benefit of analogy we would be trapped into the tight scope of that what is already known. That is, deduction and in principle induction too, cannot produce anything that is really new against the contents of their premises. Incidentally, as Radin (2012) intimates in the context of demonstrative sciences, specifically Euclidean geometry: “However involved and intricate the final theorems sound, they cannot possibly add an idea – not the smallest – that was not originally expressed in the definitions. Similarly, algebra is an extremely ingenious series of variations on the theme that  $A$  equals  $A$ ” (p. 7). In a similar vein, Perelman and Olbrechts-Tyteca (1969) point out that “[a]nalogies are important in invention and argumentation fundamentally because they facilitate the development and extension of thought” (p. 385).

This heuristic role of analogy in science may be – essentially – split into two spheres in which:

1. analogy can result in the invention of a new scientific problem/question that calls for being resolved,
2. analogy can lead not to the invention of the new problem/question one feels need to confront but to the very proposition as to how this problem/question could be resolved (see Biela 1989, pp. 138-141; Dąmbaska 1962, pp. 16-21, 31-33).

For example, given that the Earth resembles the Moon in many respects (both are round, tough, have volcanoes, receive light from the sun, revolve around their axes and so forth), one – by recourse to analogy – may pose the question of whether the Moon is – as the Earth – inhabited by humans, a question which seems to him/her worthy of being answered. At the same time, however, based upon the resemblance between these planets determined through analogical reasoning, one

may not ask the question but put forward the very hypothesis that the Moon is a place where human beings live (on an example with the potential use of analogy in the context of habitation of the Moon and the Earth see Mill 1882, pp. 394-395; Biegański 1909, p. 24; in relation to the Mars and the Earth see Biegański 1909, pp. 9-10, 25-27).

Within the second sphere, a specific usage of analogy concerns coping with the unexpected findings of a just conducted experiment, a situation which occurs in laboratory practice quite frequently. This consists of turning to other experiments that have been carried out in the past and in which similar results have been obtained under similar conditions – by doing this one may hit on an idea as to what should be changed methodologically in the current experiment in order for its results to be “expected” this time (Dunbar 2001, pp. 315-316, 317).

It is also noteworthy that the above-mentioned heuristic function of analogy does not meet any constraint in the field of science. As Perelman and Olbrechts-Tyteca (1969) contend: “Where the inventive aspect is concerned, there is nothing to prevent extension of an analogy as far as possible, to see what it will yield” (p. 386). Another thing is, however, that even if analogies contribute to a scientific discovery, they tend to promptly be forgotten without receiving the due amount of recognition and credit (see Dunbar 2001, pp. 318-319).

## **2.2. Other functions that are commonly linked to analogy in science**

Obviously, apart for the heuristic function, analogy can also serve other functions when employed in the field of science.<sup>3</sup> These functions are of a different nature, sometimes quite remote from one other.

Firstly, analogy is to be of considerable utility for the creation of notions and their systematization. It enables scientists to make generalizations and thus bring into being an abstract notion. By the discovery of an analogous structure between different events or objects, one may classify these objects/event under some common terms. Moreover, it is also possible to transpose – upon analogy – some notions from one field of science to another field due to the structural resemblance established among these fields. Analogy can also cause the need to distinguish one notion from another or help with ordering and categorizing groups of notions, including the building of typologies (see Dąmbaska 1962 pp. 33-35, Biela 1989, pp. 141-144; cf. also Fowler 1895, pp. 13, 16-17).

Secondly, the use of analogical reasoning may be of assistance in creating/explaining one theory (theoretical model) via the workings of another theory (theoretical model). This pertains in particular to the explicating of phenomena, laws that are present therein, that are less known for the audience by reference to the phenomena, the laws present therein, that are more familiar to this audience (cf. Dunbar 2001, pp. 315, 316, see also pp. 317-318; Biela 1989 pp. 144-148; Dąmbaska 1962, pp. 21-31). Incidentally, such an explanation and especially creation seem to be closely related to the heuristic function of analogy. Having one theory (its model) that is known, one may pattern on it and put forward a new theory (its model). Biegański (1909, p. 78) even states that the whole heuristic significance of analogy consists just in transferring the general relations, laws, known in a

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<sup>3</sup> Perelman and Olbrechts-Tyteca (1969) seem to be of the contrary view, while they assert that: “In the natural sciences, analogy – in our conception of the term [which is quite specific MK] – does nothing but provide a support for creative thought” (p. 396).

certain scope of events to other events that are separate from them and where the relations between phenomena have not been known yet. Likewise, Holyoak and Thagard (1996) who argue that “[a]nalogy by its very nature freely oversteps the traditional boundaries between knowledge domains, making it possible to use ideas from one domain to achieve insights in another” (Preface, pp. ix-x). Interestingly, this instance of the possible use of analogical reasoning seems to them even exhaustive in the sense that a relation which we try to clarify or assess by analogy has to belong to a different sphere than a relation that is known and constitutes the basis for comparison (see Perelman 2004, pp. 131-132; Perelman and Olbrechts-Tyteca 1969, pp. 373-374; as for an example of such a use of analogy in biology see Perelman and Olbrechts-Tyteca 1969, p. 374). Nonetheless, such a model (theory) building/explicating function of analogical reasoning seems to be treated as distinct from the heuristic function of this reasoning as well as from its didactic function (cf. Dąmbaska 1962, p. 30). The latter will be, therefore, described separately, directly below.

Thirdly, analogy may be employed in order to illustrate and teach. While discussing the relations that take place between or inside certain things/phenomena the teacher may make reference to other things/phenomena that students or pupils are more acquainted with. Such reference may be here slightly imperfect in the sense that the counterpart relations are not exactly the same as in the object being clarified. It is important, instead, that by invoking them the teacher contributes to the capturing of the gist of the subject matter, facilitating comprehension of abstract scientific theories and concepts on the part of the hearers. Similarly, while expounding some general law, the lecturer may give an example which makes the workings of this law more comprehensible or easy to remember. In consequence, analogy may thus also compensate sometimes for the defects and shortage of professional scientific and educational equipment. Furthermore, the use of analogy in education can also enhance memorizing, especially in areas where learning by heart is a must (see Biela 1989, pp. 154-156; on an illustrative function of analogy see also Perelman, 2004, p. 133 and Dąmbaska 1962, p. 15). As Biegański (1909, pp. 79-80) noted, a human mind perceives easier concrete matters (facts) than mere abstractions and generalizations, thereby through the using of examples or parables, one make it easier to comprehend the thought which due to its abstract form can be very difficult to fathom. Incidentally, to Perelman (2004, pp. 124-127; see also Perelman and Olbrechts-Tyteca 1969, pp. 357-362) an example which serves as a mere illustration, not as a very justification of a general rule, does not need to be realistic and uncontested. Instead, to be a good one, it has to be influential on the imagination, making the rule manifest in the consciousness. Thus, together with Olbrechts-Tyteca (1969, p. 357) he points out that the illustration “should strike the imagination forcibly so as to win attention.”

A good instance of such an illustrative/explanatory use of analogical reasoning is the passage from Robert T. Orr cited in this context by Walton (2008):

*“The name of the baleen whale is derived from the long flexible plates which hang down from the roof of the whale’s mouth, known as baleen or whalebone. The margin of each plate is frayed into a hairlike fringe, and the action of these fringed plates serves as a food strainer”* (p. 311).

On the margin, in some relation to education, it is also worth intimating here at an ‘ennobling’ function of analogical reasoning. When some phenomenon is explained by resort to something that presents a value for the audience, this value – be it negative or positive – is also transferred to this phenomena, effecting a pertinent connotation in the minds of the hearers (as to

the transferring of values between items being compared and the interactions that may take place here see especially Perelman and Olbrechts-Tyteca 1969, pp. 381-385).

### 2.3. The most controversial one: the probative function

The most disputable function of analogy in science is, undoubtedly, the probative one. Namely, this kind of reasoning may be used not merely as a vehicle for inventing new hypotheses or giving examples and illustrations but also as a very means of proof by which the correctness (truthfulness, aptness) of scientific propositions can be determined. Such a probative function can also be linked with the argumentative function of analogy as distinct from those of its functions that are non-argumentative [these have been presented hitherto] (Cf. Walton 2008, pp. 311-312).

The probative aspect of analogy is utterly denied by some scholars. There is even a maxim: "*simile est non ratio*" (see Biela 1989, p. 148). Accordingly, the outcomes of analogical thinking are maintained to have to be tested and be of no force at all until they have been confirmed on other grounds: empirical or logical. The propositions that one reaches by analogy need thus to be affirmed by conducting a pertinent experiment or an observation. Moreover, even if these experiments/observation are successful, the proposition that successfully undergoes the test is usually regarded only as probable since not all possible instances/configurations have been examined during the test and the application of the proposition to them may prove to be fallible. An outcome of analogy can be also confirmed by the use of rules of logic and if these exist, dogmas (axioms) that have been adopted a priori in the particular field of science. As a result, as indispensable and of high importance due to its inventive nature analogy is, it would only be of a subsidiary character in science: after producing a new idea (hypothesis), it becomes completely redundant in the workshop of a scientist (see Biegański 1909, p. 79, 81; Perelman and Olbrechts-Tyteca 1969, pp. 372, 396-397; Perelman, 2004, p. 131, 132; Dąbbska 1962 p. 43, 60).<sup>4</sup>

Such an extremely skeptical view seems, however, too strict. As Biela (1989, p. 149) points out, without probative analogies we would be compelled to regard many established scientific assertions as unjustified. Also Perelman and Olbrechts-Tyteca (1969) wonder that "[a]nd have any warrant for denying analogy any power to convince when the mere fact that it can make us prefer one hypothesis to another shows that it has argumentative value? Any complete study of argumentation must therefore give it a place as an element of proof" (p. 372). It is also noted that analogy at least changes the burden of proof and entails the need to invoke some counter argument if one wants to get rid of analogical conclusion (see Walton 2008, p. 311, 313).

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<sup>4</sup> Thus Perelman and Olbrechts-Tyteca (1969) state: "No one will deny the importance of analogy in the workings of the intellect. Yet, though everyone recognizes it as an essential factor in imaginative thinking, it has been viewed with distrust when used as a means of proof." "The empiricists (...) for the most part look on analogy as a resemblance of quite minor importance because of its weak and uncertain character." (pp. 371-372) "As a link in the chain of inductive reasoning, analogy finds a place in science, where it serves rather as a means of invention than as a means of proof." "In the natural sciences, analogy – in our conception of the term – does nothing but provide support for creative thought" (p. 396). Mill (1882, p. 397) appears to consider treating a hypothesis obtained by analogy as a scientific truth as an impediment to the real development of science (this, according to him, seems to have to be based upon the experiments that as far as possible confirm analogical conclusions). And Sunstein (1996) claims that: "Analogical reasoning is imperfectly reliable in science because we do not (by hypothesis) have a full sense of the relevant casual mechanisms. If we had that full sense, we would not need analogies, though analogies might serve a heuristic function" (p. 66).

At this juncture, however, a handful of general remarks appear to be necessary. First, it should be noted that analogy plays only a secondary role in the process of proving when some more credible means of proof are available. That is, one should use such means and only when they do not suffice may one consider conclusions reached by analogy in terms of proof (see Biela 1989, p. 149, 152, 153 and Biegański 1909, p. 81). In some kinds of science, however, empirical and/or logical testing is unavailable; due to which analogy can take there the place of the main method of reasoning and demonstrating the aptness of particular hypotheses (cf. Perelman, 2004, pp. 132-133). The most significant example of such fields of science are those whose scope of interest remains by definition beyond the cognition of traditional human senses. Of such characteristics are, for example, philosophy, theology or cosmology in part where it relates to those parts of the cosmos (the universe) that are not accessible for any empirical observation or other empirical activities and rest solely on the human imagination. Thus analogy – in its pure form or form of metaphor – seems to play a central role in religion and philosophy as concerns the ontological standpoints or relations between human beings and God(s) (cf. Perelman 2004 p. 131, 142, 143).<sup>5</sup> That is also why Holyoak and Thagard (1996) contend that one of fundamental purposes of analogy “is to gain understanding that goes beyond the information we receive from our senses” (pp. 9-10). In these applications, indeed, analogy is clearly something more than a mere way of putting forward new hypotheses or potentially viable theories. It becomes a direct method of finding out ‘the truth’ (see Dąmbaska 1962, pp. 43-44).

Second, it is noteworthy that the probative role of analogy drastically increases whenever the events, behaviors or objects which a particular sort of science is addressed to are often different from each other and it is difficult to discover or establish the general principles and laws that may govern them. Hence, Holyoak and Thagard (1996) assert that: “In general, analogies will be especially important when the decision maker is unable to base a decision on simple rules or principles. Such situations arise when the basis for the decision is changing dynamically and when each case is unique in some important way. In domains with these characteristics, analogy is not simply a way for novice to get started – it is also a basic form of reasoning by domain experts” (pp. 156-147). And Biela (1989, p. 149) finds it notable that analogy is particularly justified when the events and phenomena under examination are unique in the sense that they rarely reoccur/can be artificially provoked.

Third, analogy can and frequently has to be probative in the fields of science in which researchers are forced to make comparisons between events, objects and behaviors that belong to different ages, are of a different genus or for other reasons cannot be brought under common metrics. Within natural science one may consider as such: geology, paleontology, glaciology and climatology insofar as the present processes, phenomena they involve or their effects, are compared with the processes that took place in past days and epochs (see Biela 1989, p. 150). In ethnology and

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<sup>5</sup> Perelman and Olbrechts-Tyteca (1969) also claim that: “It is true that some philosophies – notably those of Plato, Plotinus, and Saint Thomas Aquinas – have justified the use of analogy in argumentation because of their particular conceptions of reality, but in such cases the use of analogy has been linked to a metaphysical conception, with which it stands or falls” (p. 372).

In general the share that analogy has in the understanding of religious concepts and beliefs is underscored by Holyoak and Thagard (1969, pp. 10, 167-184).

For a comprehensive study on analogy in philosophy broadly comprehended see: Maryniarczyk et al. 2005; Dąmbaska 1962, pp. 43-59; Maryniarczyk 2005, pp. 71-86; Krąpiec 1993; McInerney 1996; Mascall 1949; Buda, 2006, pp. 127-141; Bocheński 1993, pp. 50-78.

sociology as well, scientists focus sometimes on contemporary tribes that are at a primitive stage of development to obtain some insight into the shapes of their own societies as they were in bygone times (see Biela 1989, p. 150, Biegański 1909, p. 81). Also in historiography and futurology, since the object of study is not fully – if not scarcely – accessible at the time of the research, the analogy often seems essential for its cognition (see Niiniluoto 1988, p. 278). Similarly, in painting and sculpture (other kinds of art), having been familiar with certain items that has been made by an artist known by name or having been acquainted with some determined style, one may – through the observed resemblance – try to assess the authorship or date of a particular piece of art (cf. Mill 1882, p. 396). In social science, analogy of a probative nature seems also to be the basis of the method called introspection. Comparing our own experiences and feelings with those of other people, especially those who held prominent positions and are important in public life, we can project how these people will act or what motives stand behind their past behaviors (cf. Ossowski, 2001, pp. 164-171). Moreover, the recourse to the probative function of analogy appears to be indispensable in cases in which experiments on humans are prohibited. Indeed, in such circumstances one is condemned to conduct research on animals or other non-human organisms and apply the obtained results to human beings only upon analogy without having proven the aptness of these results in this point of reference in any other way. Among the sciences, the sharing of such characteristics may be seen for instance in: physiology, pathology, physiopathology, psychology or psychopathology (see Biela 1989, pp. 150-151; Niiniluoto 1988, p. 277; Biegański 1909 pp. 80-81). The same applies to the necessity of experimental study as to how people would behave in situations that cannot easily be provoked in reality such as an economic crisis, the outbreak of war or a nuclear catastrophe (Niiniluoto 1988, p. 277).

It is even more striking that all of the research experiments that are carried out in a laboratory presuppose in a sense the taking of the advantage of the probative aspect of analogy. It is due to the very assumption that laboratory conditions are comparable to those that occur outside. In this way, analogy with probative force would come into psychology, biology, chemistry, physics and other sorts of technical sciences (see Biela 1989, pp 151-152). *Mutatis mutandis*, the same goes for the presence of such analogy in the employment of induction whenever it leads to conclusions about instances (objects) that were not put under examination.

Another issue is the degree of the probative force of analogy. First of all, one must be here alert to Holyoak and Thagard's (1996) warning that "it is important to keep in mind that analogy carries with it the potential for traps as well as triumphs" (p. 12). Indeed, although analogy can serve as an effective means of proof in the above-described settings, that does not mean that its outcome are certain and unchallengeable. On the contrary, as a rule, these outcomes are more often than not only likely to be true/apt. How high this probability is seems, however, to be an open question. For instance, Biegański (1909, pp. 81-82) argues, in this respect, that when all the requirements that are prescribed for a good analogy are met, one can receive even a conclusion of high degree of probability [of substantial probative force] (as for such requirements see pp. 65-73).<sup>6</sup> Brewer (1995-1996) mentions in that context about "serious rational force" (pp. 954-955; as for his explanation of 'rational force of analogical argument' see also pp. 928, 951-955 and p. 1026). On the other hand, however, Perelman and Olbrechts-Tyteca (1969) point out that despite their being for unconstrained

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<sup>6</sup> Cf. also Biela 1989, pp. 152-153.

extension of analogy in the inventive sphere, “from the probative viewpoint, an analogy must be kept within certain limits if it is not to impair its function of strengthening conviction” (p. 386).

### 3. Functions of analogy in everyday life

Analogy occupies an important place in science but it occurs in daily life and ordinary decision-making as well. As Weinreb (2005) states, “it is the way all of us respond to countless ordinary problems in everyday life, (p. 4)” which thought he extends several dozen pages later in the following manner: “Practical analogical reasoning allows a person to take considered action and to achieve his purposes over a vastly larger range that would otherwise be possible. Without the capacity to reason in this way and to base one’s action on the outcome, a person would be effectively immobilized, except when the similarity between a present problem and past experience is so great that they are for practical purpose the same”(p. 73). “...[A]nalogical reasoning is used by all of us constantly, to conduct the most ordinary affairs. Our lives depend on it (p. 74).” Holyoak and Thagard (1996) stress that: “Analogy is a mental tool that everyone uses to some degree (preface).” And, as they indicate, among its diverse uses are also such as: “generating new ideas, producing inventions, making decisions about war and peace, communicating with other people (p. 6).” Sunstein (1996) and Brewer (1995-1996), in turn, note that “[e]veryday thought is informed by analogical thinking, we see things as we do largely because of analogies” (p. 63) and that “theorists and practitioners in all intellectual disciplines, scientific and nonscientific alike, routinely rely on analogical reasoning (p. 926)” respectively. What is also important, however, is that while ordinary people reason by analogy, they may be not aware of the fact that they have just used the aforementioned kind of reasoning. That is, they do not pay attention to how they think; they simply make pertinent decisions or form opinions which pop up in their minds.<sup>7</sup>

#### 3.1. Solving ordinary problems, making everyday choices or predictions and stating what is just

First and foremost, analogy helps with solving the problematic situations one may encounter in everyday life. When approaching some problem that needs to be resolved, it seems natural to look at a similar problem which has already been successfully resolved before in the past.<sup>8</sup> To illustrate this usage of analogical reasoning in ordinary matters, Weinreb (2005) draws two examples with Mary and Charlie who are here representatives of ‘regular’ individuals. In the first, Mary spills cranberry juice on a white tablecloth and her friend: Edna advises her: “Try pouring salt on it. It works with wine” (p. 68). In the second, Charlie cannot start his lawn mower and “[i]t occurs to him that when his car does not start, it sometimes helps to turn off the motor and let it stand for a while. He goes inside to watch television” (p. 68). Incidentally, what is characteristic of these examples is

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<sup>7</sup> As Burton (2007) noted, “[r]arely are they [regular individuals MK] quite aware that they are reasoning by analogy...”(p. 27) and Weinreb (2005) remarks, “[a]lthough they are not likely to notice it or to make much of it if they do, Edna and Charlie [characters representing ordinary people MK] are reasoning by analogy” (p. 68).

<sup>8</sup> As Holyoak and Thagard (1996) put that, “[n]ovelty can signal danger, a new problem that demands a solution before it is too late. If a primitive hunter is surprised by a unfamiliar large animal in the forest, or the leader of a modern democracy is confronted by the rise of a threatening dictator abroad, action cannot wait for gradual accumulation of knowledge over hundreds of similar occurrence” (p. 1). “A good way to proceed is to try understand the novel challenge in terms of what is already known, even if making the connection requires a mental leap” (p. 2).



that the solutions reached by analogy can easily be checked whether they are the right ones. When only Mary pours salt on the tablecloth, she will be able to observe if the stains have disappeared or remained. Similarly, after Charlie has turned off his lawn mower and waited a while, there will be no difficulty in determining whether such a solution works or not.

Undoubtedly everyday life is also full of the choices and predictions/assessments people have to do as the order of the day. In such cases, analogy can be of some guidance and is one that one may and usually – due to the lack of other pointers – actually does rely on. Comparing goods, events or behaviors, one is thus able to decide what to buy, what to do and of what opinion to be. Accordingly, Sunstein (1996) provides us with the following illustration: “I have a German shepherd dog, and I know that he is gentle with children. When I see another German shepherd dog, I assume that he too will be gentle with children” (p. 9). Or: “I have a Toyota Camry, and I know that it starts even on cold days in winter. I assume that my friend’s Toyota Camry will start on cold winter days as well” (p. 9). Walton (2008) notices: “I infer that a new pair of shoes will wear well on the grounds that I got good wear from other shoes previously purchased from the same store” (p. 310). And Posner (1990, pp. 87-88) invokes an example of his possessing Volvo automobiles for some longer time and having satisfaction from them, from which fact he infers the conclusion that a new Volvo should probably be satisfying too. The classic example of the use of analogy made by Aristotle refers also to the sort of practical decisions politicians make in everyday life. There, upon the fact that the war between Phocians and Thebans, who was neighbors, proved to be an evil to the Thebans, one comes to the conclusion (predicts) that the war between Athenians and Thebans would also turn out to be an evil to the former since the Athenians and Thebans neighbor to one another too (see Nowacki 1966, p. 18 footnote 15, Posner 1990, p. 87 and Biegański 1909, pp. 5-7). Equally good illustrations concerning the use of analogy in ordinary situations are those of Holyoak and Thagard (1996) and White (1996). With regard to estates appraisal, two former say: “During periods when market is changing rapidly, housing prices will be volatile. In addition, as every realtor knows, the most important factor that governs real estate prices is location, and no two properties are located in exactly the same place. ... The appraiser estimates a value by finding the most similar recent sales and making adjustments for the differences between the houses” (p. 147). White, in turn, unfolds the following scenario: “Mary, Joe, Tom, and Sue have all enjoyed many meals at Pat’s, their favorite restaurant; and Mary, Joe, and Tom have enjoyed the new entry in Pat’s menu, they might reasonably infer that Sue will enjoy the new entry if she orders it tonight” (p. 584).

Against the above-mentioned examples one may easily observe that the predictive, opinion-forming and choice-facilitating functions of analogical reasoning are very close to each other. When we decide which one from the variety of attainable goods to pick out we rely on our prediction/assessment/opinion on the qualities of the would-be chosen good. The same goes for the making of preferences and choices of other kind. It is additionally worth intimating that in all the aforementioned examples, as it was the case in problem-solving, one shall sooner or later get to know whether the analogical conclusions are the correct one. With time, we learn of whether a given shepherd dog is a gentle or aggressive one, whether Sue enjoys her new meal or dislikes it or whether another Toyota Camry also starts in the winter with ease.

Regarding options and choices, it is also noteworthy that analogies that seem plausible can in a sense delineate the range of possibilities that are subsequently taken into consideration (see Markman and Moreau 2001, pp. 364, 373-377). In addition, analogy can feature not only in choices that consist of comparing past with new situations but also in deciding on many alternatives alone.

That is, comparing commonalities and differences, especially 'alignable' ones, between available options, may help one to ascertain which of these options is better than others (see Markman and Moreau 2001, pp. 363, 377-382).

Moreover, analogy is readily employed in everyday life when the distribution of goods, partition of privileges or dispensing of other kind of treatment is at stake. People are eager to compare themselves with others in order to assess whether they are treated fairly or equally. Thus one demands to be paid as much as his/her colleagues at work, to receive no smaller portion of a meal than other customers in the same restaurant, or be given the same quality of dye as her predecessor while visiting a hairdresser. A good example of such a use of analogical argument in everyday situations is that which is presented by Burton (2007), i.e.: "Mother may allow Older Brother to stay up until 9:00 P.M., and Younger Brother may demand the same treatment. Younger Brother may make an argument for his view by claiming that he is like Older Brother because both are children. Therefore, he thinks, they should be treated alike. When Mother rejects his claim, explaining that older children need less sleep than younger children, she is arguing that there is an important difference between her two children. Therefore, she thinks, they should not be treated alike" (p. 26).

This time, however, the nature of the outcome reached by analogy is diametrically different from the nature of the outcomes one obtains in the previously presented applications of analogical reasoning in daily matters. That is, here, we cannot perform any empirical test that will objectively show if a given analogical conclusion is true or false. The passage of time is also of no aid here and aptness of an analogical conclusion cannot be perceived in terms of workability or treated as a verifiable fact. The same applies to the opinions one comes to via analogical thinking that concerns the issues of good and evil.

### **3.2. Argumentation**

Analogy in everyday life is amply utilized also for purpose of persuasion, attitude-formation and argumentation. As such its function consists more in providing justification (or rationalization) of a decision or option one endorses than in inventing plausible solutions to the problem at hand. Persuasive and argumentative use of analogy is especially prominent in politics (see Dunbar 2001, pp. 319-321; Thagard and Shelley 2001, pp. 344-345, 346-347; as to more cognitive than persuasive function of analogy in politics cf. however Markman and Moreau 2001, pp. 365-368, including the example with 'domino theory' in the post Second World War policy of the USA in respect to the means most appropriate for preventing Communist expansion in other countries), normative theories (cf. Hesse, 1970, pp. 62-63) and legal decision-making (as to analogy in law see, apart from authors already cited in this paper as Weinreb, Burton, Brewer, Sunstein, Hunter, Nerhot, White, Nowacki, for instance Smoktunowicz 1970; Koszowski 2014, pp. 61-87; Koszowski 2015, pp. 35-61).

Moreover, the persuasive force of a given analogy has its source not only in its very aptness, but also in the emotions, positive or negative, that are transferred from the item, person or event selected for sake of comparison (see Thagard and Shelley, p. 344).

### 3.3. Literature, poetics and humor

Analogy, as a means of thought expression, is very familiar to literature, poetry and humor (see Holyoak and Thagard 1996, pp. 211-235; Holyoak, Gentner and Kokinov 2001, pp 4-5; Perelman, 2004, pp. 134, 138-139; Dąbmska 1962, p. 16). In these domains, it often features, however, not in its pure form, but under the guise of metaphor. As a result, it can be also linked, here, with the transmission of one's thoughts and outlooks in an indirect and allusive manner (see Holyoak and Thagard 1996 pp. 8-9).<sup>9</sup>

Indeed, metaphor – if not being the same – appears to be closely akin to analogy. Thus Pelerman and Olbrechts-Tyteca (1969) explicitly state that, at least in the context of argumentation, they “cannot better describe a metaphor than by conceiving it as a condensed analogy...” (p. 399).<sup>10</sup> Moreover, according to them, “[m]etaphor, an analogical fusion, fulfils all the function of analogy itself. In certain regards it works even better, because it strengthens the analogy” (p. 410). Similar view seems to be endorsed by Brewer (1995-1996), who backs himself with the following meaningful example: “life is a pencil that death sharpens” against the less in his opinion good one: “a world processor is an electric pen”(p. 964, see also footnotes: 127 and 128 on this page). Posner (1990) also claims that metaphors are a form of analogy (p. 92). Analogously, Weinreb (2005) contends that “[a]nalogy and metaphor have much in common. The difference between them might be described (metaphorically) as the distance between things being compared. Whereas the similarities on which analogy is based are likely to be evident once they are pointed out and the strength of analogy depends on the relevance of the similarities to the matter in question, the similarity that supports a metaphor may be elusive; the metaphor's strength may depend on the striking juxtaposition of things that at first glance unlike one another” (pp. 166-167). Also, Hunter perceives some resemblance between analogy and metaphor, by stating that “[m]etaphors have a less constraining effect on reasoning than do analogies, but they “operate in a similar fashion” (p. 155). Likewise, Holyoak and Thagard (1996, p. 7) discern the presence of analogy in metaphor, myth, fable and parable and point out that “[m]etaphor is not the same as analogy, but [nonetheless MK] metaphorical thinking is based on the same mental process as analogy” (p. 235). To Sunstein (1996, p. 70), in turn, the difference between analogy and metaphor lies in the following feature. If we deal with metaphor, we know that the speaker believes that his or her statement is not true. Instead, she/he is seeking to cast some light on the subject precisely by departing from literal description. In analogy, things look different: the speaker is claiming, and understood to be claiming, that the objects being compared in his/her statement are really the same in some relevant respects. This statement is not acknowledged to be literally untrue. In a similar tone, Hunter subsequently elucidates that: “Analogical inference also shares a number of features with metaphorical inference. Metaphors have a less constraining effect on reasoning than do analogies, but they operate in a similar fashion. Metaphor is an expression forming a non-literal similarity comparison between two things, which has an expressive or affective content and thereby carries meaning. Unlike analogies, metaphors do not have a predictive content and do not strongly constrain the outcome of the

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<sup>9</sup> They discern some benefits of such an indirect communication. These benefits range from the very safety of the speaker to the more persuasive or engaging way of getting a message across to the readers from their standpoint. These authors, moreover, make allowances here for the following remark: “To see one thing as if it were another creates a tension between two perspectives: the thing as itself and the thing as something else. To resolve this tension by finding an integrated interpretation is a satisfying achievement” (p. 10).

<sup>10</sup> See also Perelman 2004, p. 138.

reasoning process” (p. 155).<sup>11</sup> Gentner, Bowdle, Wolff and Boronat (2001) go even further, suggesting that “metaphor is like analogy – that the basic processes of analogy are at work in metaphor”(p. 243, see also pp 196-245). Markman and Moreau (2001) contend, in turn, that “[i]n general, the border between metaphor and analogy is fuzzy” (note no. 1 on p. 394).

Analogy in its pure or metaphorical form is used in literature, poetry and other sorts of expression not only as a vehicle of more or less direct thought transfer but also in order to make people laugh. The humoristic value of analogy can easily be noticed in cartoons, comic performances, jokes and a multitude of funny sayings (see Holyoak and Thagard 1996, pp. 13-14; Thagard and Shelley 2001, pp. 348-351; Perelman and Olbrechts-Tyteca 1969, pp. 403, 404)<sup>12</sup> – as in Thagard and Shelley’s example with lawyers likened to rats in terms of the preference for use in a psychological experiment.<sup>13</sup> On top of that, apart from less positive emotions such as irony or despair, analogy is able to generate feelings of beautifulness or excellence (see Thagard and Shelley 2001, p. 351). Thus, following Holyoak and Thagard (1996), “analogy and metaphor can have diverse emotional applications, serving to evoke amusement, disgust, love and other reactions” (p. 235; cf. also Thagard and Shelley 2001, p. 335). Hence, according to these authors, analogy may also perform one more function, that is, it “can be put to use in many therapeutic situations, helping to overcome problems with families, individuals, and organizations. The technique of analogy therapy involves identifying toxic analogies and replacing them with ones that enable people to overcome their personal and social problems” (Holyoak and Thagard 1996, p. 235). Moreover, even empathy, as involving the imagining of one’s own emotional response if being in a position similar to the situation of somebody else, can be connected with analogy (see Thagard and Shelley 2001, pp. 335, 344, 347-348). The same goes for inspiration and self-confidence whenever they stem from the comparison of oneself

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<sup>11</sup> Interestingly, Perelman and Olbrechts-Tyteca (1969, pp. 405-410, see also Perelman 2004, p. 139) mention a specific kind of metaphors, i.e. “dormant metaphors”. These metaphors are dormant since with time they have become normal expressions in a particular [natural] language and people have just forgotten their metaphorical meaning – mainly due to the fact of their often [unreflective] repetition. Hence, to be alive once again, these metaphors need to be awakened, which can be made for instance by developing a fresh analogy with the metaphor as its starting point, or by using the same word twice. The resurrection can also be effected by “placing several metaphorical expressions side by side”, “taking a metaphorical expression and grafting onto it a new metaphor which completes it” or “change in its usual context”. Similarly, translation into another language or a change in the current audience/speaker may cause the revival of these metaphors.

As to analogy in the context of such figures of speech as: allegory, parable and hyperbole see Perelman and Olbrechts-Tyteca 1969, p. 403.

<sup>12</sup> Another thing is that in fairy tales and cartoons the reader is often confronted with configurations in which animals or other non-human creatures behave as if they were humans – the figure of speech which is professionally called ‘personification’ and which seems also to presuppose some kind of analogy, i.e. between the made up world of the characters and the real world of human beings. Thus, according to Holyoak and Thagard (1996), “[p]ersonification means to treat something that is not a person as if it were one. Such acts of imaginative creation lead into the realm of myth and metaphor, where death becomes not a mere physical process but the name of someone who walks the earth laboring as the Grim reaper, and the moon becomes a mother who watches over us as we sleep” (p. 3). On personification see also Lakoff and Johnsen 2003, pp. 28-29.

<sup>13</sup> The reasons that speak for choosing the former are to be: 1. there are now more lawyers than rats, 2. the psychologists found they were getting attached to the rats, 3 there are some things which rats will not do. There is, however, a counter-reason as well, namely the findings [contrary to experiments with rats] do not transfer to humans (see Thagard and Shelley 2001, pp. 349-350).

with the pertinent role model (especially someone famous and successful) (see Thagard and Shelley 2001, pp. 351-352).

### 3.4. Linguistic categorization and conceptualization

In everyday life conversations, as speakers of a natural language, we use a vast variety of general terms that denote innumerable objects, relations, features and behaviors.<sup>14</sup> We do not rather, however, think over how these terms came into existence, just communicate and describe reality through them.

Astonishingly or not, the emergence of such linguistic notions is likely to involve analogical argument too. These notions (be they divided into: common, singular, collective, attributive or abstract terms) may be brought into being just through the comparison of different things (acts, events, relations and so on) and noting what they have in common or in what aspects they differ from each other. That is, for instance, a shared or unshared feature may be named and form a linguistic term, like particular colors, patterns and many other epithets. From an external vantage point, we can readily observe that objects falling under a particular term are in effect similar (analogues) to each other in certain relevant respect or respects. Similarly, we may easily note that objects to denote which language uses two different terms are usually different in some aspects. Such a capacity to categorize appears also to be hard-wired in human minds and be a preliminary condition for effective communication and abstract thinking (see Fowler 1895, pp. 13, 16-17; cf. also in relation to terms present in science: Dąmbska 1962, pp. 33-35; Biela 1989, pp. 141-144). Furthermore, rendering a successful analogy may, incidentally, result in the extension or confining of the present ambit of notion, especially the abstract one, and thus to the pertinent modification in its current meaning. Such an analogy can also cause a confusion that calls for some other changes in the ongoing state of language, e.g. the introduction of a new term or the alteration of an already existing one (cf. Perelman and Olbrechts-Tyteca 1969, p. 398).<sup>15</sup>

Even more interestingly, it is not uncommon to consider that humans understand linguistic terms just through analogy or in a way which essentially resembles it. Thus Sunstein (1996, p. 84.), following the proposition expressed previously by Homes (which assumes that there is the picture that the words evoke in the common mind), points out that people have a mental picture of a model or typical example of the category and by comparing this picture with the present instance they may decide whether this instance is to be regarded as a member of a given class (general category). Holyoak and Thagard (1969) speculate that “the capacity to see analogies has much in common with the capacity to form and use concepts that represent categories of objects, events, and situations” (p. 20). And Weinreb (1996) states that the capacity for analogical reasoning “is not fundamentally distinct from the capacity, also hard-wired, to recognize the general in particular – the redness of apple, a fire engine, and a clown’s nose – without which we should be unable to describe or to refer to anything that is not immediately present and which, therefore, is implicit in all learning” (p. 124).

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<sup>14</sup> In this context “the problem of universals” is also sometimes brought up. See Weinreb 2005, pp. 163-165.

<sup>15</sup> In Perelman and Olbrechts-Tyteca’s (1969) view, too metaphors can influence the life of notions and add confusion in this respect (as examples of such metaphors they invoke: “slave of the employer” and “slave of passions”); p. 404.

The analogies of the aforementioned kind are, however, so fixed and automatic that it seems to be necessary to distinguish them from the other instances of analogical thinking. Accordingly, Sunstein (1996), differentiates [standard] analogies that consist in argument (explanation) from analogies that “are simply constitutive of the thinking of people in the relevant community. Such analogies, or perceptions of likeness, do not [as he goes on] depend on arguments, but rest instead on a widely shared way that human beings order their world. We do not really need an argument in order to say that one cat is in its catness, relevantly like other cats. We take the point for granted; it is part of our language, our way of seeing the world” (pp. 69-70).<sup>16</sup> Similarly, Tuner (1988, pp. 4-6) underlines that analogical and categorical connections between concepts are of the same kind but differ in the degree of entrenchment in our general conceptual systems. That is, analogical connections when deeply entrenched, as the connection between one zebra and another zebra or two red things, no seem longer creative and inventive thereby we regard them as straightforward category connections, not analogies. At any rate, however, the ability to reason by analogy in order to generalize appears to be intrinsic to the human mind, thus governing the human perception of the surrounding world and establishing a foundation for abstract thinking.<sup>17</sup> It develops as children grow, beginning around the age of three and four (see Holyoak and Thagard, pp. 75-100).<sup>18</sup> As Holyoak and Thagard (1996) indicate, such a mode of reasoning is also not unfamiliar to animals, not least chimpanzees (pp. 39-73).

Quite different – and in fact far more interesting – from the presence of analogy in making generalizations is the role that analogical reasoning plays in human conceptualizing and the ways in

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<sup>16</sup> Kratochwil (1989), for instance, seems to be of different view, claiming that: “Formally speaking, the task of analogies is to establish similarities among different cases or objects in the face of (striking) dissimilarities. The similarity established thereby concerns a (partial) equality among the compared objects or phenomena in regard to a relevant aspect” (p. 223).

<sup>17</sup> Holyoak and Thagard (1996) assert thus that: “The essential requirement for analogical thinking is the ability to look at specific situation and somehow pull out abstract patterns that may also be found in superficially different situation”....“The surface elements are very different, but the underlying pattern of relations among the elements is similar. Such abstract patterns of similar relation could not be detected by an organism whose every experience was inextricably tied to vivid sensation of sight, sound, smell, taste, and touch” (p. 19). Such an ability to generalize, abstract thinking, is in addition deemed by them as a necessary element of coping with daily matters, a thesis they support by reference to the fictional character described in Jorge Luis Borges’ story: “Funes the Memorious” who despite having excellent memory is unable to think in an abstract way, which makes him utterly paralyzed when confronted with the problems of everyday life (pp. 19-20).

Weinreb (2005), in turn, indicates – in a slightly tangled way – that one kind of study “in cognitive psychology has explored the pervasive presence of analogy and metaphor in thought and language, not as a deliberate step in reasoning and communication but as deeply embedded in the categories by which we understand and describe our experience” (p. 167) and that such studies “provide persuasive evidence that general terms are not more or less accurate (objective) abstract representations of what they describe, independent of the circumstances of their user and use; rather, they comprise a richly embodied conceptual system that depends heavily not only on our physical selves but on every aspect – psychological, social, historical, linguistic – of our humanness” (p. 167-168). After that he also enlighteningly announces that: “So it is argued, general terms are not susceptible to logical transformations in the manner of deduction but have to be analyzed contextually. And, it follows, the goal cannot be certain truth, any departure from which is unacceptable, but must be a more limited, situational kind of reasonableness that reflects this embedded humanness” (p. 168). See also Dąmbska 1962, p. 16

<sup>18</sup> As to the use of analogy by children see also Weinreb 2005, pp. 124-132 (among other things, he remarks that: “The evidence is convincing that capacity for analogical reasoning is hard-wired in us (and, incidentally, in animals), and develops initially at a very early age – within the first twelve months” (p. 124).

which people perceive the world and relate to each other. By this avenue, notably metaphors are claimed to be pervasive in everyday life, having an impact on our language, actions and thoughts. This pervasiveness finds its place, for example, in such a metaphorical concept that underlines the organization of our life as *time is money*. Many well-worn expressions of everyday speech presuppose such a likening of money to time: *wasting one's time*, *being worth one's while*, *thanking somebody for his or her time*, etc (See Lakoff and Johnsen, not least pp. 8-10; in relation to politics see also Musolff 2004).

#### 4. Conclusions

The divergent goals and functions that analogical reasoning can serve in science and in everyday life cannot be easily overlooked, much less disregarded. Nor does analogy seem possible to be replaced by some other mode of thinking. Such omnipresence testifies, however, to the need and considerable significance of doing thorough research on analogical inference. We should strive for a deep understanding of how this inference proceeds, what may constitute its premises and – above all – when we may trust it and in which circumstances should we show caution and treat it with reserve.

**Dr. Maciej Koszowski<sup>19</sup>**

#### The Abstract:

This article addresses the functions analogical reasoning may have in science and everyday life. The focus ranges from the heuristic and probative value of this kind of reasoning to its illustrative and didactic utility, not excluding the opinion-forming, choice-facilitating, argumentative and justice-dispensing aspects of the inference based upon similarity discernible between instances being compared. In this context, the Author reveals disagreements between the standpoints of several scholars and singles out their most interesting stances and statements.

In addition, the question of the making of generalizations and the understanding of notions (terms) present in ordinary language as well as the problem of conceptualization have been touched upon. The relation of analogy to metaphor and its occurrence in humor, literature and poetics have also been not passed over.

**Key words:** analogy, functions, science, everyday life, heuristic, probative, argumentation, reasoning

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<sup>19</sup> Łazarski University in Warsaw [Uczelnia Łazarskiego w Warszawie].

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