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**PERSONIFIED SEMANTIC ROLES IN POPULARIZED SCIENTIFIC TEXTS**  
Master's thesis

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## SUMMARY

The systemic functional approach deals with the communicative process of expressing experience via text by applying various resources of lexicogrammar provided by the language. This research paper focuses on the personified semantic roles present in popularized scientific texts in English and Lithuanian. Descriptive and componential analysis methods were employed in the present study. A hypothesis was established that English and Lithuanian do not differ in regards to the semantic functions that the personified words have in the place of the subject. Semantic roles are participants in various processes that fall into six different categories: material, mental, verbal, relational, behavioral and existential that are expressed by the verb and can be accompanied by various circumstances. Sentence is the medium of communication. The communication is based on the writer's perception of reality. Out of all the components of a situation, the most important one is the process. Popularized scientific texts has been established as a discourse that has been prepared by the scientific community for the society that makes use of stylistic expressions, enabling the reader to understand, despite having no prior experience in science. The research revealed that the personified semantic roles are associated with the Agent in material processes, the role of Sayer – in verbal processes, the Senser – in mental processes, the Carrier – in relational processes, the Behaver – in behavioral processes, and the Existent – in existential processes. In both languages the material processes were the most frequently used in popular science, while mental, verbal and relational processes were very rare. In addition, no personified semantic roles embedded in behavioral processes were found and only a few examples regarding the existential processes got discovered, indicating the rarity. Lastly, the English language showed a wider variety of verbs used compared to the Lithuanian language, which was often found to use the same verb on several occasions.

## SANTRAUKA

Sisteminis funkcinis požiūris susijęs su komunikaciniu procesu išreiškiančiu patirtį naudojant tekstą taikant įvairius kalbos išteklius. Šio tyrimo pagrindinis dėmesys skiriamas personifikuotiems semantiniams vaidmenims populiariamuose mokslo tekstuose anglų ir lietuvių kalbomis. Aprašomosios ir komponentinės analizės metodai buvo naudojami šiame tyrime. Buvo nusistatyta hipotezė, kad anglų ir lietuvių kalbos atlieka tas pačias semantines funkcijas veiksnio vietoje esantys personifikuoti žodžiai. Semantiniai vaidmenys yra dalyviai įvairiuose procesuose, kurie patenka į šešias skirtingas kategorijas: materialūs, mentaliniai, verbaliniai, reliatyvūs, elgesio ir egzistenciniai, kurie yra išreiškiami veiksmažodžio ir gali būti lydimi įvairių aplinkybių. Sakinys yra komunikacijos priemonė. Komunikacija yra grindžiama rašytojo realybės suvokimu. Iš visų situacijos sudedamųjų dalių, svarbiausias yra procesas. Populiarinamasis mokslinis tekstas buvo nustatytas kaip diskursas, parengtas mokslinės bendruomenės paprastajai visuomenei, pasitelkiant stilistines išraiškos priemones, kas leidžia skaitytojui suprasti teksto turinį, nepaisant to, kad skaitytojas neturi jokios ankstesnės patirties toje sferoje. Tyrimas atskleidė, kad personifikuoti semantiniai vaidmenys yra asocijuojami su Agentu materialiuose procesuose, su Pasakotoju – verbaliniuose procesuose, su Percipientu – mentaliniuose procesuose, su Nešėju – reliatyviuose procesuose, su Besielgenčiu – elgesio procesuose, ir Egzistentu – egzistenciniuose procesuose. Abiejose kalbose populiariame moksle materialūs procesai buvo dažniausiai naudojami, o mentaliniai ir verbaliniai procesai buvo labai retai sutinkami. Be to, nebuvo rasta jokių personifikuotų semantinių vaidmenų elgesio procesuose, ir tik keletas pavyzdžių tebuvo rasta egzistenciniuose procesuose, kas nurodo jų retenybę. Galiausiai, anglų kalba pasižymėjo veiksmažodžių įvairove, kai lietuvių kalba dažnai naudojo tą patį veiksmažodį.

# INTRODUCTION

Language is an ever-changing phenomenon that has spread far and wide. For the longest time language has incorporated various means of figurative approach that has been mainly used in fiction. Its main purpose was to imprint the information in a more easily understandable fashion as well as to trigger the imagination of the reader. Such expressive language has been steadily helping the scientific community to achieve greater reaches in readership. The popularized science has thus expanded exponentially. The main factor of this growth is personification. According to Lakoff & Johnsen (2003:28) personification “allows us to comprehend a wide variety of experiences with nonhuman entities in terms of human motivations, characteristics, and activities.” As some aspects of science tend to be difficult to comprehend using scientific terms, it is easier for the concept to be understood via personification that simplifies it using various human characteristics.

The sentence and its semantic framework are essential. The presence of the participant and the act performed by the participant is the key aspect of functional linguistics proposed by Halliday & Matthiesen (1997, 2004). In addition, the semantic framework of the sentence has also been thoroughly researched by Downing & Locke (2006), Eggins (2004), Valeika & Buitkienė (2006), Drukteinis (2007), etc. The semantic framework of the sentence includes many different types of semantic roles. These semantic roles appear in various situations. Strictly speaking, every sentence of a language has a participant that acts out a role in certain circumstances. Furthermore, such semantic roles can be easily personified enabling an inanimate object to act as animate, providing comprehension of the same information from a different perspective.

The **subject** of this thesis is the usage of personified semantic roles rooted in material, mental, verbal, relational, behavioral and existential processes in popularized scientific texts.

The **aim** of the thesis is to describe, identify and contrast semantic functions of personified semantic roles in popularized scientific texts in English and Lithuanian. To substantiate the aim, the following **objectives** have been set up:

1. To assess the theoretical background for systemic functional approach and the semantic system of the sentence.

2. To provide theoretical background related to personification and popularized scientific texts.
3. To define the basic concepts of semantic role functions as well as the processes in which they are embedded.
4. To illustrate and compare the personified semantic functions in English and Lithuanian.
5. To present the statistical data in order to compare the scope of found examples in each language.

In accordance with the aim and the objectives set in the present study, the following **hypothesis** can be formulated: English and Lithuanian do not differ in regards to the semantic functions that the personified words have in the place of the subject.

The below given research **methods** have been applied:

1. Descriptive analysis method was used to provide the theoretical data regarding the systemic functional approach, semantic framework of the sentence, popularized scientific texts and personification.
2. Componential analysis method was used to study the semantic features of the semantic roles and the structural components of the sentence.
3. The contrastive method was used to contrast the examples from both languages.
4. The statistical method was used to systematize the results of the gathered examples and illustrate the rate of frequency as well as compare the languages.

The **scope** of the study is 336 examples of personified semantic functions rooted in the material, mental, verbal, relational, behavioral and existential processes. 179 examples were gathered from the English language and 157 examples from the Lithuanian language. Due to space limitation, only 97 examples were presented and analyzed.

The **material** for this thesis has been drawn from the online popularized science portals like *Discovery.com*, *Sciencemag.org*, *Space.com*, *Sciencedaily.com*, and *Sciencenews.org* for the English language examples. The Lithuanian examples were chosen from *Technologijos.lt*, *Iliustruotasmokslas.lt*, and *Mokslasplius.lt* as well as the magazine *Iliustruotas Mokslas*.

The **structure** of the work is comprised of the introduction that briefly reveals the core components of the semantic framework of the sentence and the presence of personification. It also introduces the subject of the study, the aim, objectives, the working hypothesis, methods, the scope, and material from where the examples have been gathered. The theoretical part is

divided into four parts. The first part lays the background information about the systemic functional approach. The second part entails information on the semantic framework of the sentence and has six sub-categories dedicated to each process in the following order: material, mental, verbal, relational, behavioral and existential. The third part is about the popularized science text features. The fourth part explains the concept of personification. The next section called the methodological considerations explains the methodology of the thesis. The practical part investigates the gathered examples and is divided into six categories following the same order with the processes of the theoretical part. The summary of the theoretical part and the results of the investigation are explained in the conclusions. The reference and source list represent the materials used while writing the thesis.

# 1. THEORETICAL ASSUMPTIONS RELATED TO SYSTEMIC FUNCTIONAL APPROACH

Language is an intricate web of various parts stuck together to form a linear chain that has been carefully studied by Halliday & Matthiessen (1997, 2004), Valeckienė (1998), Eggins (2004), Downing & Locke (2006), Lock (1996), Labutis (2007) and others (Morley (2000), Thompson (1996), etc.). The main function and the main reason for its existence is the transfer of meaning from one person to another via text. The communicative process is used to exchange experience. Language carries a means of communication; there exist certain levels of importance, as in the phonetics, lexis and grammar as the main categories. The main point of focus is the text representation of experience in a language. Valeckienė (1998:15) points out that “grammar and words (lexemes) make up the ideational thought expression mechanism.” (Translation) Halliday put emphasis on the meaning of the language in use through the textual processes of social life, namely sociosemantics of a text. The linguist that unified the systematic functional approach to language indicated his aim as follows:

*“The aim has been to construct a grammar for purposes of text analysis: one that would make it possible to say sensible and useful things about any text, spoken or written, in modern English.”* (Halliday, 1994:xv)

Eggins (2004:4) provides a great insight on how language functions are understood, in that “intuition does not provide a sufficiently reliable source of data for doing functional linguistics.” Therefore, systemicists are instead analyzing the authentic speech and writing of people social contexts where they are happening naturally, namely, in a language phenomenon such as Text. Downing & Locke (2006:xvii) distinguish two separate meta-functions directly related to the life of a person and systematic functional grammar:

- The first function is to express the interpretation of the world as people experience it (sometimes called the ‘ideational’ or the ‘representational’ function);
- The second is to interact with others in order to bring about changes in the environment (the ‘interpersonal’ function).

From the grammatical standpoint of a sentence Valeckienė (1998:11) points out three metafunctions: 1) context or representational 2) interactional or interpersonal and 3) textual. The



first metafunction deals with the desires of the writer in regard to the expression of experience encountered in the real world in a full sentence to represent both the physical and mental aspects of the endeavor. Interactional or interpersonal pertains to the relationships of the participants of the communication act – with their views towards the intended message. This metafunction is directly related to the transitivity system of a language that perceives language in terms of six processes: material, mental, verbal, relational, behavioral and existential. These processes are recognized by verbs. The textual metafunction works in a descriptive way, i.e. it points out the theme and rheme.

Halliday & Matthiessen (2004:29) explain that “language provides a theory of human experience, and certain of the resources of the lexicogrammar of every language are dedicated to that function. We call it the ideational metafunction, and distinguish it into two components, the experiential and the logical.” As the textual metafunction is an enabling element it means it is used for “construing experience and enacting interpersonal relations – depend on being able to build up sequences of discourse, organizing the discursive flow and creating cohesion and continuity as it moves along.” (Halliday & Matthiessen, 2004:30) And according to Valeckienė (1998:18) there are several elements that are identified according to their functional interaction of words in a sentence. These elements are the predicate, subject, object, complement and the circumstance. In addition, Lock (1996:1) provides a clarification that functional grammar is different from the norm, in the way that “one approach sees grammar as a set of rules which specify all the possible grammatical structures of the language <...> a clear distinction is usually made between grammatical (sometimes called well-formed) sentences and ungrammatical sentences. <...>” Another approach sees language first and foremost as a system of communication and analyzes grammar to discover how it is organized to allow speakers and writers to make and exchange meanings.” The formal and functional approaches are different as evident, however, that does not mean that they are not reliant on one another. This fact is emphasized by Downing & Locke (2006:xviii) in that “this type of grammar is functional in that each linguistic element is seen not in isolation but in relation to others, since it has potential to realise different functions.” Meaning that speakers and writers, respectfully, are free to choose their own means of communication, whether it be by the use of certain patterns that adhere to a language, for example, nouns, verbs, other complements, etc. that best realize their purpose of making a communication that they deem suitable to them or others.

From a typological view, Labutis (2007:13) has identified the intricate scheme of the functional grammar that is comprised of many different parts in the following way:

*“The basic foundation is made up of the lexicon, that takes up the base and derivative predicates (i.e. process and specific feature names) that identify the frames of the predicates as well as the base and derivative terms – usually entity names. The predicates and terms join their formations. Predicate frames together with terms form the core predication. When range operators are put in <...> everything together forms the sentence structure. Then expression rules apply and we get linguistic expression. Up until the expression rules the functional sentence structure is formed, and after that the sentence expression. <...>”* (Translation)

What is most important that could be taken from this citation is that the sentence is made up of the language’s lexicon, which is the base from which the entities are expressing an action (predication), after which various stylistic expressions may apply. In other words, functional grammar is a process of construction using various available parts of the sentence and it is coexisting with other elements of a language (lexical, phonetic and others) to produce meaning or communication via text.

Taking everything into consideration, the systemic functional approach is a grammar for the purposes of text analysis. The main representation form that is analyzed is textual. There exist three metafunctions that are of importance: representational (direct representation of experience), interpersonal (relations inside the act of the representation) and textual (description and pointing towards theme and rheme). It should also be said that systemic functional grammar should not be confused with the classical grammar, as every element is seen in relation to one another to produce meaning in an intricate constructional process.

## 2. THE SEMANTIC FRAMEWORK OF THE SENTENCE

The sentence is a grammatical totality that is made up of four parts in an integral relation: 1) the clause 2) the group (one or more words) 3) word and 4) morpheme. The subject and predicate has a direct relation to the ‘on-goings’ of reality. Therefore, the sentence is a fundamental grammatical unit, because the communicative function (experience) is being formed in it. (Valeckienė, 1998:16) These representations can be looked upon as patterns that encode real world experience. Furthermore, Drukteinis (2007:6) states that “more or less all of semantic researches acknowledge the fact that the semantic structure of the sentence is not a direct projection of reality in a language, as it is of symbolic nature, it shows the perception of reality.” (Translation) From the point of semantics, the subject can be considered as a communication device that has a direct claim to the ‘on-goings’ of the situation and it is worthwhile to note that “It is the predicator that determines the number and type of these other elements.” (Drukteinis, 2007:6) While from the point of syntax, the Subject and the Predicator remain as the two main functional categories (Downing and Locke, 2006:35). If the phenomenon known as our World is a huge bundle of information clusters then in order to access them there is a need to participate in the on-going events and perceive the resulting data as an experience. Halliday (2004) further expands this notion by defining the specifics of concrete and abstract nouns, the processes involved in the ‘situation’ reflected in the clause as well as noun phrases that play an important part of semantic roles. According to him, “the transitivity system construes the world of experience into a manageable set of process types. Each process type provides its own model or schema for construing a particular domain of experience...” and the circumstances that are represented are, in a metaphorical sense, acted out by participants, namely, the Agent and the Patient or Affected. Therefore, semantic roles (also known as thematic roles, relations or theta roles) endeavor to distinguish the concordance and disparity of the verb that happens to be reflected in the circumstance or argument. Dowty (1986:345-349) conveniently characterizes thematic roles in the following fashion:

- (Completeness) Every individual thematic role contains some L-thematic role type (or as we may equivalently say, every argument position of every verb is “assigned” an L-thematic role type).

- (Distinctness) Every argument-position of every verb is distinguished from every other argument-position of the same verb by the L-thematic role types the two argument-positions are assigned.
- (Independence) The properties in an L-thematic role type must be characterizable independently of the relations (denoted by natural language verbs) that entail them.
- (Uniqueness) No individual other than the one mentioned bears that same role in that same event.

Therefore, a semantic role is assigned to every verb and it is distinct in position. In addition, it is independent as it is denoted by natural language verbs as well as unique in the way the participant that is mentioned has his or her role be the same.

Halliday, the linguist whose theory is based on ‘meaning potential’ together with Matthiessen (2004:170) point out two respective categories that dwell in functional grammar system that helps separate clauses building different types of meaning: a) material (doing) and b) mental (perception, affection and cognition). These processes are possible because of the way the verb is used. A matter of perspective is also important, as Drukteinis (2007:14) states that “different clauses show a different understanding of the purpose when it comes to participants in a circumstance, and that the verb is responsible for the functions involved in a semantic structure.” Material processes are defined as processes of doing as “they express the notion that some entity does something, which may be done to some other entity.” (Halliday & Matthiessen, 2004:103). While mental processes, rather predictably, deal with senses (smelling, hearing), the relationship of the agent and an object or an idea (fear, liking) as well as the thoughts of a participant (thinking, knowing, and understanding). However, while material and mental processes are considered to be the top contenders, and rightfully so they are, there exist other categories of processes that are as important in filling the gaps left by the two big shots. They are existential (existing), relational (attributive, having an identity), verbal (of saying) and behavioral. It is important to note that some of them do not display a clear distinctness from the others. Specifically the behavioral and relational, as the former can be construed to the category of doing and the latter to the relational aspects of the mental category. Nevertheless, regardless of their overlapping boundaries, all in all, it is possible to measure six process types identified by Halliday: material, behavioral, mental, verbal, relational and existential. As a matter of fact,

Halliday & Matthiessen (2004:175-177) outlined the elements that take part in the representation of the data that people experience in a grammatical clause:

1. A process unfolding through time;
2. The participants involved in the process;
3. Circumstances associated with the process.

For example, the part (1) can typically be named as the verbal group (the Sayer), (2) as the nominal group (participants like you, them or us) and (3) the adverbial group (the circumstance), in a given clause. Therefore, as the situation or process in the clause is quite the unlimited factor, as Downing and Locke (2006) explain that depending on “the nature of the process determines how many and what kind of participants are involved” the number of participants can vary from one or two or more and can range from animate (human), inanimate (object) or an abstract entity.

The process would not be possible without the participants, mainly due to the fact that their actions indicate the process which is unfolding through time in some kind of a circumstance or an argument. The involvement of this participant is a definite guarantee, although sometimes the subject may be hidden, however, the process itself is still there and therefore can be deduced by the change of flow in the energy, this allows the finding or deducing of the kind of participant as well. In order to get a general understanding of relations of various semantic roles and their interconnections, Van Valin (1999:2) categorized his understanding of semantic representation in grammar in the following figure:

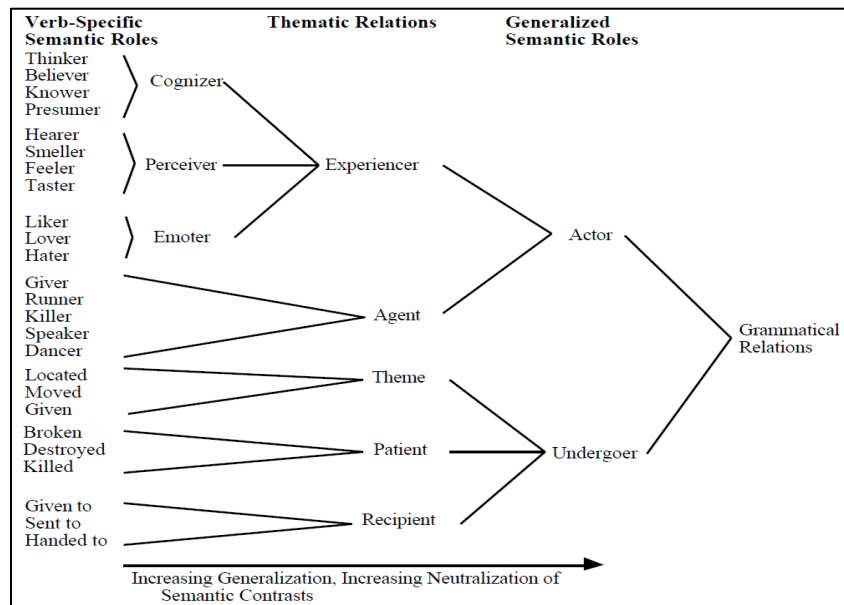


Figure 1. Relation of generalized semantic roles to thematic relations

This is a representation of different levels of generality of the semantic roles. It can also be understood as a theory that explains three different types of generality of semantic roles, going from specific to general (Verb-Specific Semantic Roles-Generalized Semantic Roles) where the aforementioned participants are placed. According to Van Valin (1999:3) the “crucial feature of all approaches is the distinguishing of GSRs from grammatical relations; they all distinguish actor from subject and undergoer from direct object.” There are three types of criteria where the difference is spotted. First of all, the subject and its active (actor) and passive (undergoer) voice usage. Secondly, depending on what type of class verb is used, in clauses with intransitive verbs, the subject, who is syntactic, may assume the role of either actor or undergoer. Lastly, the third identifying feature deals with the anti-passive, which allows the actor to properly function as a syntactic subject. However, it is important to remember that the variety of functions is determined from the interactive lexical word meanings as well as the semantic relations of those words. And that the actual selection of the words is regulated by the central part, the verb and its lexical meaning, i.e. which process type is marked by it. (Valeckienė, 1998:34)

To summarize, the sentence contains several different components that are in relation to one another: 1) the clause 2) the group (one or more words) 3) word and 4) morpheme. The clause has a subject, which is some sort of entity (participant) and a predicate which has a verb through which a certain process is performed as well as an object or circumstances, which may or may not be there. In addition, there are six processes in total (material, behavioral, mental, relational, existential and verbal) that appear in these represented experiences of the world. Furthermore, these thematic roles can be animate, inanimate or an abstract entity. The experience representation data contains the process which is unfolding through time, the semantic roles that instigate the change and the circumstance that follows it. The semantic roles can vary in their generality depending on how specific the writer wishes to make them; however, each and every semantic role should have completeness, be distinct, independent and unique.

## 2.1 The Material Process

The material process, just like the name suggests has to do with the physical interaction of entities in the real world. Actions such as walking, running, kicking, grabbing or touching make up the material process. According to Halliday & Matthiessen (2004:179) “a ‘material’ clause construes a quantum of change in the flow of events as taking place through some input of energy.” In other words, the focus point is a clause which experiences some alterations in the series of events which is fueled by an energy source of some kind. Activities such as running, grabbing, etc. require the use of a performer, who expends a set amount of energy to validate the act, otherwise known as a participant. Furthermore, Downing and Locke (2006:128) explain that “typically, the action of ‘doing’ is carried out by a volitional, controlling human participant: the Agent. A non-controlling inanimate agent is called Force, for instance an earthquake.” It should be noted that the distinction is made by the fact that the human participator can control the action (the process). This fact is reinforced by Sušinskienė (2011: 433) stating that “material processes are causative processes and Agents could be referred as to Causers.” This indicates a close relationship with the Affected, which experiences the change in energy directly. Furthermore, Valeika (2006:33) has identified the Agent, Affected/Effectuated Patient, the Recipient and the Beneficiary roles that are present in material processes.

Linguists use different names for this participant. For example, Halliday & Matthiessen (2004:179) and Thompson (1996:79) use Actor as a name, Valeika (1998:18) and Downing & Locke (2006:128) on the other hand uses Agent. The participation of this Agent is a definite guarantee, although sometimes the subject may be hidden, however, the process itself is still there and therefore can be deduced by the change of flow in the energy. Halliday & Matthiessen (2004:180) also point to the fact that material processes can be either intransitive or transitive. Intransitive processes are those that contain only a single participant – the *Actor* or the *Agent*, whereas transitive processes have two or more participants. The linguists further expand by adding that intransitive processes represent a happening while transitive clauses represent a doing. This specificity has also been confirmed by Valeckienė (1998:27) with a statement that “the verb, indicating a material physical action, typically is transitive, and the one indicating a material physical happening – intransitive.” (Translation) This means that intransitive material processes have a single participant the *Agent* and show the process of happening while transitive

processes have two or more participants and represent the process of doing. By looking at the table compiled by Downing & Locke (2006:138) below:

<b>Example</b>	<b>Participant(s)</b>	<b>Type</b>
The Prime Minister resigned	Agent	doing (intrans.)
Ed kicked the ball	Agent + Affected	doing (trans.)
The volcano erupted	Force	doing (intrans.)
The dog died	Affected	happening (intrans.)
Ed broke the glass	Agent initiator + Aff/Medium	causative-trans.
The glass broke	Affected/Medium	anti-causative
Glass breaks easily	Affected	pseudo-intrans.
The glass was broken (by Ed)	Affected (+ optional Agent)	passive
The glass got broken	Affected	get-passive
They made the road wider	Ag. + Aff + Attribute	analytical causative
Ed gave the cat a bit of tuna	Ag. + Rec + Aff	transfer (trans.)

**Table 1. Material Process Types**

The linguists have listed all the possible variations of the material processes. This table is a perfectly suitable illustration presented with a detailed, yet simplistic approach that enables the summarization of the material process.

To summarize everything, the material process is a representation of happening and doing of the real world experiences, with the verb as a center, which can be transitive or intransitive, followed by other participants and circumstances. There exist a wide variety of possible participants, which are called Agent, Causer, Affected/Effectuated Patient, Force, Recipient and the Beneficiary. Furthermore, the process can be carried out by an animate or an inanimate participant. Lastly, the way to identify this process is to monitor the change of the energy flow and identify the corresponding semantic roles present in the process.

## **2.2 The Mental Process**

If material processes deal with the physical aspect of the reality plain then the mental processes are related to the senses that perceive the experience. The focal point of such a process is the mind, which can experience a wide variety of senses to witness the world on a spiritual level. Halliday & Matthiessen (2004:197) state that “they are clauses of sensing: a ‘mental’ clause construes a quantum of change in the flow of events taking place in our own



consciousness. This process of sensing may be construed either as flowing from a person's consciousness or as impinging on it; but it is not construed as a material act." Take for instance the ability to see, although the eyes take in the information of the outside world physically, the brain then goes on to interpret it and presents the final vision to our mind or the consciousness. Valeika (1998:40) defines three different types of mental processes: perception, cognition and affection. Perception is a process that deals with interpreting the world through the five most distinct senses out of the many that the human body possesses, like touch, smell, sight, hearing and lastly taste. While perception is mostly an autonomous action, cognition is a process of volition (thinking, understanding and believing). Then there is affection that deals with seemingly simple things like fear, liking, wishing, etc.

The main difference between material and mental processes is that when analyzing them one has to apply different means. Downing and Locke (2006:140) propose that additional semantic roles could be added to fully understand the process: "the Experiencer (or Sensor) is the participant who sees, feels, thinks, likes, etc., and is typically human, but may also be an animal or even a personified inanimate object" because in the case of a material process it is basically 'one does something to another', however, mental processes are different. The Agent does not do but experience, hence the Experiencer; another parallel comes with the Affected, as there is nothing but the mental process itself that follows the former, Downing and Locke (2006:140) have named it the Phenomenon.

Therefore, the consciousness of the human brain is the focal point of the process as it involves the perception of senses and how through them the host is able to experience the world, albeit not always voluntarily. There are three types of mental processes: perception, cognition and affection. Perception is involuntary (seeing, smelling, touching, etc.) while cognition can be a controlled process (thinking, understanding and believing) and lastly there is affection, which falls upon an emotional spectrum. The participant is called an Experiencer (or Sensor) and he experiences various things (Phenomenon).

## **2.3 The Verbal Process**

The verbal process can also be known as a clause of Saying. The main participant is the Sayer (you, I, he, etc.) that usually is followed by a verb (most common variations include: says,

said, told, tells, etc.). According to Halliday & Matthiessen (2004:252-253) the verbal clause mainly finds use in establishing a narrative function in a story driven medium, however, it should also be noted that “they play an important role in academic discourse, making it possible to quote and report from various scholars while at the same time indicating the writer’s stance with verbs like point out, suggest, claim, assert.” Downing & Locke (2006:152) explains that “the Sayer can be anything which puts out a communicative signal (that clock, Jill, our correspondent). What is said is realized by a nominal group or a nominal what-clause (what she knew). As these examples show, verbal processes are intermediate between material and mental processes.” Because the verbal process has a unique standing among other process types and can be easily related to certain other processes in various means, Halliday & Matthiessen (2004:255) have identified it as follows:

*“In certain respects, ‘verbal’ clauses are thus like ‘behavioural’ ones, exhibiting certain characteristics of other process types — tense like ‘material’ or ‘relational’, ability to project like ‘mental’. But while ‘behavioural’ process clauses are not so much a distinct type of process, but rather a cluster of small subtypes blending the material and the mental into a continuum, ‘verbal’ process clauses do display distinctive patterns of their own. <...> they accommodate three further participant functions in addition to the Sayer: (1) Receiver, (2) Verbiage, (3) Target.”*

The Receiver is self-explanatory with his nature; or rather function to receive the intended message of the Sayer. The function of Verbiage can be understood separately, firstly as the content of what was said and secondly, the name of the saying. In other words, Verbiage can be understood as what is being said, while representing it as a class of thing, rather than a quote. The Target can be considered to be a sub-type of the verbal process, where the Sayer targets a specific entity in a negative fashion.

Therefore, the verbal process can be summarized as a clause of Saying, where the Sayer is the dominant semantic role that finds use mainly in narrative function. The Sayer does not need to be animate, it just needs to put out a communicative signal and have a Receiver that could interpret or receive the communication. Furthermore, the Sayer can have a Target to convey the message to, most often bearing a negative connotation.

## 2.4 The Relational Process

Processes of relation are set to identify the relation of a participant (Carrier) to another relative point in the clause. Valeika & Buitkiene (2006:83) have identified three different types of variations when it comes to the relational clause, which are as follows:

1. Attributive (e.g. Mary is beautiful);
2. Possessive (e.g. Mary has a daughter);
3. Circumstantial (e.g. Mary is in the room).

From this it is apparent that relational processes make use of the verb *be* and *have* to construct the clause. Attributive relational processes typically employ the use of a link verb to attach the characteristics of a person, aspect, number, tense, order and mood, from a syntactical point of view. Special mention should be given to the case when a Carrier becomes a Recipient (a participant in mental processes) and where they are separated. Possessive relational clauses tend to follow a simple formula: Carrier + Process (with an attribute that is possessed). In this case, a point could be made to rename the participant from a Carrier to a Possessor. And when it comes to circumstantial processes the clause includes three elements: a) the Carrier; b) the circumstantial process; and lastly c) the circumstance itself.

In addition, Halliday & Matthessien (2004:211-213) point out that “unlike ‘material’ clauses, but like ‘mental’ ones, ‘relational’ clauses prototypically construe change as unfolding ‘inertly’, without an input of energy – typically as a uniform flow without distinct phases of unfolding.” Therefore, a static location in space can easily be constructed by using the relational process and further clarifies the distinction by adding that “while one participant in a ‘mental’ clause, the Senser, is always endowed with consciousness, this is not the case with ‘relational’ clauses. If anything, the participants in ‘relational’ clauses are more like the Phenomenon of a ‘mental’ clause – not only things, but also acts and facts can be construed as participants in a ‘relational’ clause.” However, it should be noted that while facts, acts and other entities can be construed as participants they have to be relational to another participant in the same clause. In a way, a relationship forms between two separate beings.

All in all, the relational clause deals with two participants tied to one another in a relationship of being and that there are attributive, possessive and circumstantial variations of the

relational clause. Also, relational processes are mostly similar to mental processes where there is no change of the flow of energy.

## 2.5 The Behavioral Process

As the naming suggests the behavioral clauses deal with the psychological and physiological nature of humans (typically). Halliday & Matthessien (2004:250) identify behavioral processes with “the participant who is ‘behaving’, labeled Behavior, is typically a conscious being, like the Senser; the Process is grammatically more like one of ‘doing’.” Human behavior has many forms through which it can be expressed, for example, dreaming, speaking, laughing, crying, staring, etc. Downing & Locke (2006:152) note that “they are considered as typically involuntary; but it may be that there is a very slight agency involved. They can be deliberate, too, as in *he coughed discreetly, he yawned rudely*, in which the adjunct of manner implies volition.” In rare cases, there can be an additional participant present, which Halliday & Matthessien (2004:252) identify as a Phenomenon (e.g. I’m warning you).

While other processes have Agents that use their own energy to perform an action, behavioral processes are opposite in nature. Valeika & Buitkienė (2006:65) refer to such processes as processes of Happening. A peculiarity of such a process is that it presents an unanalyzable, or rather indivisible experience that often leaves analytical constructions. (Valeika & Buitkienė, 2006:66) Since the energy for the action is sourced from an unknown location and the fact that the subject is forced to do something involuntarily, it implies an Agentless process.

Therefore, psychological and physiological aspects of the human nature are the essence of the behavioral process. The participant is a Behavior and is similar to a Senser, which belongs to the mental category. Although the process is involuntary and can take very many forms to express itself, it can be deliberate at times and on rare occasions an additional participant called Phenomenon can be observed.

## 2.6 The Existential Process

In simple terms, the existential clause fixes the existence of a given entity in a specified location. Downing & Locke (2006:153) provide an explanatory formula for the process, where “the basic structure consists of unstressed there + be + a NG.” and explains it in the following fashion:

*“There is not a participant as it has no semantic content, although it fulfils both a syntactic function as Subject and a textual function as ‘presentative’ element. The single participant is the Existent, which may refer to a countable entity (There’s a good film on at the Scala), an uncountable entity (There’s roast lamb for lunch) or an event.”*

Furthermore, the removal of *There* in existential clauses is a defining characteristic of written English, especially when dealing with place descriptions, where they tend to be frequent. (Valeika & Buitkienė, 2006:93) Halliday & Matthessien (2004:257) characterize existential processes as clauses where “textually, the Theme is just the feature of existence (there), allowing the addressee to prepare for something that is about to be introduced; and this something is presented as New information.” In other words, existential clauses can be used to introduce points of interest in narratives of all kinds. Kalėdaitė (2008:129) clarifies that “existential constructions in both languages have identical structural elements which constitute the core of an existential assertion.” This means that the aforementioned formula by Downing & Locke (2006:153) is applicable to Lithuanian as well.

In addition, there are some factors which allow for a distinction between existential processes with *There*. The determining factor is the locative circumstance, which can be either explicit or implicit. (Valeika & Buitkienė, 2006:92) As a matter of fact, according to Downing & Locke (2006:153) existential processes usually expand the Existent in the following way:

- by adding a quantitative measure and/or the location of the Existent;
- with quantification and an Attribute characterizing the Existent;
- with quantification and expansion of the Existent by the addition of clauses.

In summary, the existential clause includes an entity that is fixed in a location that helps introduce something as new information to the addressee, where the entity can be animate or inanimate, however, no participant is present as there is no semantic content, only the presentative element which can be characterized according to locative circumstance.

### **3. FEATURES RELATED TO POPULARIZED SCIENTIFIC DISCOURSE**

The scientific discourse is often considered to be of the highest level because it features knowledge and terms of a specialized field. As Shreve (2001:772) points out that “developing competence in scientific and technical texts involves understanding the nature of technical terminologies, their relationship to the knowledge structure of a domain, and the way they are used in special language texts.” This in turn requires significant participation from the reader. However, there exists a different type of scientific discourse that has recently surfaced. It features a stylistic language that enables the reader to understand it with the bare minimum of participation. If one is to assume that there exist two separate discourses, one being the highly terminological scientific discourse that establishes communication with other scientists in the field, and then the other would be the popular scientific discourse, where the scientist has to alter the text with various stylistic expressions so it would be understood by the society. This fact is confirmed by Liao (2010:3) that “Popular science is written for lay people, and this difference tends to lead to the simple conclusion that popular science writing is a process of simplification from academic language to ordinary language, by, for example, avoiding technicalities and using everyday terms.” Myers (2003:2) provides significant insight towards such an outlook on the popularized scientific discourse with the following statements:

- that scientists and scientific institutions are the authorities on what constitutes science,
- that the public sphere is, on scientific topics, a blank slate of ignorance on which scientists write knowledge,
- that this knowledge travels only one way, from science to society,
- that the content of science is information contained in a series of written statements,
- and that in the course of translation from one discourse to the other, this information not only changes textual form, but is simplified, distorted, hyped up, and dumbed down. (The French term vulgarisation carries even more of this pejorative sense).

From these statements it is clear that scientists and their institutions prepare the material for the society, however, the reader has no control over the process. Therefore, the scientific community simplifies the text to accommodate the reader.

Another linguist, Petrėnienė (2011), has provided the essence of the specifics of a popularized scientific text and outlined the following means of expressing various terms:

- by giving a description of the object, phenomenon or action that the term denotes;
- by disclosing the origins of the term;
- with the use of synonyms;
- with figurative means of expression;
- with means of extra-verbal expression (charts, pictures, and so on.)

With the use of various stylistic means the discourse in turn becomes less heavy with continuous scientific terms. Personified semantic roles that can be found in the specified discourse also fall into such usage, despite having strong relations to functional syntax. As well as achieving the most efficient communication, in addition to representing various experiences of the world. Hyland (1998:3-4) points out that “academics negotiate the status of their knowledge claims with their peers through the medium of research articles, and success is at least partly dependent on their use of appropriate rhetorical and interactive elements.” Furthermore, Nilsen & Angell (2014:19) point out that “conceptual understanding in astronomy hence entails both a cognitive aspect ranging from knowing to applying and reasoning, as well as a content aspect which includes the scientific understanding of key astronomy concepts. These two aspects should hence be considered when measuring conceptual understanding in astronomy.” Indicating that Myers (2003:2) outlook on the popularized scientific discourse is very well suited to the task of providing the general populace with new information. As a matter of fact, readers accept the statements proposed by the scientific community not for the reason of faith or it being factual, but solely because of the persuasive power behind the writer’s appeal. (Hyland, 1998:4)

To sum up, there are two separate discourses that should not be confused with one another: the classical approach to the science and the popularized scientific discourse. Both discourses are written by the same science community, however, the public that receives the popularized discourse does not contribute in any way. The transfer of knowledge only goes one way and the information is constructed in a manner of easy to understand statements filled with stylistic expressions.

## 4. THE CONCEPT OF PERSONIFICATION

The sentence is where the experience of the on-going world reflected via text. Personification is often used to familiarize the reader with another concept. At the very basis of symbolism (personification) it is the simplest of forms of stylistic expression. It gives an abstract object the features of the living. Cohen (2011) points out “that “person” is more accurately described as a superordinate, social psychological category that includes, but is not limited to, the biological category “human.”” Even though it may be a physical object (e.g. the Large Hadron Collider) or some sort of natural entity (e.g. a star in a galaxy) through the addition of personification the abstract object can be reflected as a human-like being. Referring to Lakoff and Johnson’s (2003:28-29) theory regarding metaphors, the personification can function as a general category for a wide spectrum of metaphors. Nevertheless, what they all have in common is that “they are extensions of ontological metaphors and that they allow us to make sense of phenomena in the world in human terms”, therefore, it is possible to metaphorically perceive them as human entities. Furthermore, Cohen (2011) states that “person perception depends not only on the perceptible attributes of the entity, but also upon the relational style of the perceiver.” Therefore, depending on the reader the perception of the intended personification has the potential to be different.

In addition to the theory provided by Lakoff and Johnson, Long (2009) argues that “Personification and anthropomorphization are increasingly used interchangeably.” The anthropomorphization, according to the author is “to lend human qualities to something non-human” and is relevant when assigning agency to non-human subjects. However, while Long’s theory might be useful when working with animals or bacteria, it is limited in that sense to literature or biology publications. When analyzing that type of material anthropomorphization is indeed interchangeable. Then again, if one takes Ryder’s (2000:6) words that “without any need to resort to fantastic speculations as to the existence of any possible subjective states” the processes of anthropomorphization mentioned by Long might be considered to be a hindrance when trying to portray the intended message of science in Biology. Therefore, even though anthropomorphization, used in a specific environment can be thought of as interchangeable with personification, it lacks the flexibility when compared to personification.



The creation of public representations of scientific texts involves the classification and conceptualization of an unfamiliar phenomenon into a set of well-known categories. This particular process can be accomplished with the help of metaphors. They replace illustrative devices, and in this case they provide a significant key to model-building in every aspect of cognition. (Christidou, Dimoupoulos, Koulaidis, 2004:3-5) According to Schon (1997:2) “before there is a physicist, philosopher or poet who, in his specific way, seeks to unfold the unknown, there is a human being who takes on the role of physicist, philosopher or poet.” Therefore, it should be mentioned that the extent of figurative language use is determined by the writer’s perspective on the theme. Furthermore, the extensive study of scientific articles conducted by Christidou et al. (2004:6) indicates that “metaphors referring to Space Science & Astronomy are the most frequently found (29.4% of the total), closely followed by metaphors on Genetics & Biotechnology (27.5% of the metaphors).” This solidifies the fact that the less is known about the field that is investigated the more prone it is to metaphor usage.

Taking everything into consideration, it can be said that ultimately personification is a figure of speech that on one hand is a simplistic style of expression, while on the other hand it can function as a general category for a wide spectrum of metaphors that gives human properties to an abstract entity. It can also be used interchangeably with anthropomorphization in various discourses; however, it can only be used in biology and literature effectively. Moreover, it is important to establish the fact that the writer establishes his own humanistic perspective and this in turn determines which language tool is used. In addition, the less is known about the subject the more metaphors occur in the discourse.

## 5. METHODOLOGICAL CONSIDERATIONS OF THE RESEARCH

The number of examples collected for the comparative analysis of the semantic roles rooted in processes in popularized scientific articles is 336. There were 179 English language examples that were sourced from the popular websites like *Discovery.com*, *Sciencemag.org*, *Space.com*, *Sciencedaily.com*, and *Sciencenews.org*. In addition, there were 157 Lithuanian examples that were chosen from *Technologijos.lt*, *Iliustruotasmokslas.lt*, and *Mokslasplius.lt* as well as the magazine *Iliustruotas Mokslas*. All the examples were chosen from the Space Science & Astronomy fields, which have the most figurative language used with publishing dates varying from early 2015 to May of 2016. Due to the lack of space, 97 examples were given in the practical part of the research.

The paper focuses on the six processes, namely, material, mental, verbal, relational behavioral and existential and the semantic roles rooted in them. In order to perform the research several methods were outlined. Descriptive theoretical analysis was applied to analyze the systemic functional approach, the semantic framework of the sentence, the popularized scientific discourse and the concept of personification. Then the componential analysis method was used to study the linguistic material surrounding the personified semantic roles. It proved to be useful in analyzing the cases. The method entailed gathering the examples from the above mentioned sources; afterwards, in order to classify the examples, they were arranged according to their corresponding process types. Lastly, the contrastive method was used to contrast the examples from both languages and outline the differences.

The examples were analyzed according to the classifications put forth by such linguists as Halliday & Matthiessen (2004), Valeika (2006), Sušinskienė (2011), Drukteinis (2007), and Downing & Locke (2006). It was determined that semantic roles syntactically act as the subject as the semantic role is bearing the same semantic relation to the verb and each has its own syntactic realization. According to the classification, the six processes include semantic roles that are specific to each process.

Furthermore, the statistical method served the purpose of systematizing the gathered examples, providing their total count and determining the dominant process types in both

languages. The statistical data was prepared using Microsoft Excel 2010 software. Lastly, the gathered analysis of both languages was compared and the found discrepancies documented.

In conclusion, the methodology part of the research serves as the concise outline of the methods used in the research as well as the classification of the examples and their sources. All of the applied methods proved to be helpful while presenting the theoretical background, analyzing the examples and concluding the research.

## 6. PERSONIFIED SEMANTIC ROLES ROOTED IN THE CLAUSES OF POPULAR SCIENCE TEXTS

As a brief overview, it can be said that personification realizes the world in human terms. Semantic roles are the various entities that participate in the ‘on-goings’ of the world. The process is deeply rooted in such representations. The clause that contains the semantic role may also have other adjacent semantic roles present and or additives. The clauses can be classified into six processes: material, mental, verbal, relational, behavioral and existential, and are expressed by the verb.

### 6.1 The Personified Semantic Roles Rooted in Material Processes

The material process is directly involved with the physical aspect of the world. In most cases it involves an action like walking, running, kicking and the like, which influences the flow of energy directly by contact. The verb denotes the process or action and the semantic role or participant denotes the Agent. Usually, Agents vary from animate and inanimate, however, since this paper deals with personified semantic roles, which means that all of the examples will feature inanimate Agents. Take into consideration the following examples provided below:

- (1) ***Black hole** burps up gobbled gas and dust. ([Source](#))*
- (2) *Within a few million years, **the sun** had already eaten up most of its disk of gas and dust. ([Source](#))*
- (3) *Although several icy moons of **Jupiter and Saturn** spew plumes of ice particles into space, Ceres isn't flexed and heated by gravitational interactions with other celestial bodies, and so the energy driving its activity is suspected to come from another source. ([Source](#))*
- (4) *When some of these **small planets** slammed into Earth, they delivered a payload of precious metals. ([Source](#))*
- (5) ***Late harvest** from Pluto reveals a complex world. ([Source](#))*
- (6) ***The observation** also paves the way for testing general relativity as never before, Kamionkowski says. ([Source](#))*

(7) Occasionally **the black hole** bites off more than it can chew. ([Source](#))

(8) **Sandy ripples** point to Mars's past. ([Source](#))

(9) **Exploding star** solves cosmic mystery ([Source](#))

(10) **The Philae comet lander** has woken up from a 7-month slumber; now the European Space Agency is trying to communicate with it and get it to embark on new experiments. ([Source](#))

(11) **A few lucky stars** in spiral galaxies belong to beautiful clusters of young stars, but most roam the galaxy alone or with just a partner or two. ([Source](#))

(12) No matter how often **ancient black holes** feasted and combined forces, they would have had trouble growing by a factor of 100 million so quickly. ([Source](#))

The examples (1-12) that were provided above have personified Agents that act as the subject. For instance, example (9) features an Agent that is a star that is exploding when it comes to the surface structure of the sentence. It cannot be animate; however, the action it did changed the flow of energy and solved a cosmic mystery. From a grammatical perspective, the noun paired with an adjective constitutes the Agent, happen to be a lifeless object, which is involved in a process of solving a mystery, where the verb *solves* indicates the shift. Furthermore, *The Cambridge Online Dictionary*<sup>1</sup> defines *star* as: “a very large ball of burning gas in space that is usually seen from the earth as a point of light in the sky at night.” This confirms the use of personification as an action such as solving requires an intelligent life form to perform. Of particular interest is example (3), where a pair of planets has joined to form a single Agent. By using the verb *spew* a human like behavior has been achieved. The same Agents can be observed in Lithuanian popularized scientific discourse. Consider the examples given below:

(13) **Šviesos nueitas kelias** lygus atgrąžos laikui, padaugintam iš šviesos greičio. ([Source](#))

(14) Titane **metanas ir etanas** vaidina vandens Žemėje vaidmenį. (2015, Nr. 2:39)

(15) Kosminė drama: susidūrusios **dvi galaktikos** pagimdė tikrą monstrą. ([Source](#))

(16) „**Opportunity**“ 750 m pločio ir 75 m gylio krateryje tyrinėjo atsivėrusius uolienų sluoksnius. ([Source](#))

(17) **Spinduliuotė** sukuria į išorę nukreiptą slėgį, stumia dulkes ir dujas tolyn, tad nebegali priaugti svorio. (2015, Nr. 2:50)

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<sup>1</sup> Cambridge Online Dictionary. Available from: <http://dictionary.cambridge.org/>

(18) *Žvaigždė Betelgeizė taip išaugo, kad, susikeitusi vietomis su Saule, prarytų ir Žemę, ir Marsą. (2015, Nr. 2:50)*

(19) *Teleskopas ieško mūsų kosminės vaikystės. (2015, Nr. 4:14)*

(20) *Juodoji skylė išspjovė rekordinį žybsnį. (2015, Nr. 6:15)*

The examples presented above (13-20) all contain instances of personified Agents. To elaborate, in the example (13) the Agent is *Šviesa*, i.e. the one that performs the action. The verb which denotes the actual action is *nueitas*. This establishes a situation where light, which constitutes as a noun both in the Lithuanian and English languages, as well as being a lifeless object is involved in the process of walking, something which requires the use of legs, indicating personification. The *Collins Online Dictionary*<sup>2</sup> gives the following definition of light: “the medium of illumination that makes sight possible” confirming the fact that light cannot possibly walk.

In addition, depending on the transitivity of the verb the amount of semantic roles varies. In the case where a verb is intransitive there is only one participant, and when the verb is transitive it is possible to find additional participants that help determine the subject, which in this case is personified. These roles are identified as the Affected/Effectuated Patient, the Recipient, and the Beneficiary and can be understood as an object, which from a grammatical standpoint usually is an element that comes after the verb. The Affected Patient is in a particular state because some other force is influencing it, while the Effectuated Patient is the result of an already finished action. The Recipient is the one who receives something and the Beneficiary is the sort of semantic role where it can be best described as the one for whom something has been done or given. Take into consideration the examples given below:

(21) *Scientists have long thought cosmic rays from inside our galaxy come from supernova explosions, but a new study has fingered a second source: the supermassive black hole at the heart of the Milky Way. (Source)*

(22) *Move over Pluto, it's time for Charon to step into the limelight. (Source)*

(23) *With the government's coffers squeezed by low oil prices, RosCosmos has had to slash its budget for the 10-year plan to 1.4 trillion rubles (\$20.5 billion), down from the 3.4 trillion rubles the agency asked for a year ago. (Source)*

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<sup>2</sup> *Collins Online Dictionary*. Available from: <http://www.collinsdictionary.com/>

(24) *Take a trip to 25143 Itokawa, a peanut-shaped asteroid that kisses the orbit of Mars, and you might be surprised by what you see: hundreds of large, rounded boulders that dot the surface of the space rock. (Source)*

(25) *Within a few million years, **the sun** had already eaten up most of its disk of gas and dust. (Source)*

The example (21) contains an Agent and an Effected Patient, while (23) and (24) host the Agent and the Affected Patient, accompanied by various circumstances. Take for instance, example (23) where a controlled action is being performed by the Agent ‘low oil prices’, which is actively squeezing the government’s coffers, which happens to be the Affected Patient. Similarly, in example (24), the Agent has a controlled action of touching the orbit of a planet; however, the verb to kiss embodies the process, making the inhumane action seem humane. As for example (25), it can be understood as a bundle of variable scenarios. The Agent, the sun, can be the Recipient, the Beneficiary, the Affected and Effected Patient depending on how one interprets the circumstances. It can be interpreted as a situation where the sun received its own gases and dust, which could be understood as a material that was given to it for the benefit of survival, as indicated by the verb *eat*. The examples found in the Lithuanian popularized science discourse exhibited the same semantic roles, indicated by the examples given below:

(26) *Kai **elektronas** peršoka iš antros branduoliui artimiausios orbitalės į **artimiausią**, jis išspinduliuoja Lymano alfa fotoną. (Source)*

(27) *Arba **Saulės plėtimasis** išstums **Žemę** iš jos orbitos ir ji taps vieniša užšalusia planeta, neprisirišusia prie jokios žvaigždės. (Source)*

(28) *Net jei tokia **juodoji bedugnė** tiesiogiai nepaliestų Žemės, jei praskrietų arti, galėtų sukelti žemės drebėjimus, **Žemę** išspirti iš Saulės sistemos ar priartintų prie Saulės. (Source)*

(29) *Vėliau slėnių juosta pasislinko, kai **Tarsio ugnikalnis** tampė **Marso paviršių**. (Source)*

(30) *„Frontier Fields“ kloja pamatus „Hubble“ **ipėdiniui**. (2015, Nr.9:57)*

(31) ***Ikvepiantis tikslas** uždega žmones pakilti ir intis darbo. (Source)*

In example (26) the electron jumps to another orbit, which is the Receiver, i.e. a participant that receives something. On the other hand, examples (27) and (28) contain an Affected Patient the Earth. Additionally, example (31) also contains an Affected Patient

indicated as the humans. In example (29) Mar's surface plays the role of the Effected Patient, where the result is indicated to have happened. The Beneficiary can be observed in example (30) as the inheritor of Hubble that is given the foundation by the Agent Frontier Fields.

Out of 147 material examples gathered from the English popularized scientific texts a few verbs were more frequent than others, however, the frequency was rather low. Take for instance the verb *spew* and all its forms, there were three instances found. Consider:

(32) *But the narrow neck connecting the two lobes has no such features – a sign that the comet didn't start out as one round, layered object that then gained an unusual shape by spewing material unevenly.* ([Source](#))

(33) *Milky Way's black hole may be spewing out cosmic rays.* ([Source](#))

With the addition of the previously mentioned example (3) all of the found examples contain the continuous form of the verb, except for example (3). The *Collins Online Dictionary* describes *spew* as: “to eject (the contents of the stomach) involuntarily through the mouth; vomit”, but seeing as these entities do not possess such features, the personification can be seen and the participants distinguished.

Another verb that was met more than on one occasion was *swallow*. It tied the number of uses with the previously mentioned verb *spew*. For example:

(34) *A persistent whirling feature in Jupiter's atmosphere large enough to swallow Earth, aptly dubbed the Great Red Spot (upper right, above), may get some of its namesake color from sulfur compounds generated when cosmic rays and ultraviolet light zap a common substance in the planet's clouds, new research suggests.* ([Source](#))

(35) *They also thought that in 2003 **the galaxy** could have emitted a brief flare as it tore apart a star and swallowed it up, but other observations showed the quasar was still bright for years after 2003.* ([Source](#))

(36) *There is some hope for these cosmic behemoths: **They** can still grow by swallowing up other supermassive black holes.* ([Source](#))

Only example (36) contains a pronoun; however, as the entity that it refers to is far from human, therefore personification applies.

In contrast to the English examples, the Lithuanian examples showed less variety. Out of 117 collected examples with personified semantic roles embedded into the material process the verb *ryti* dominated, with 10 found uses. Consider:



(37) *Ją surijo ASASSN-14li pavadinta juodoji bedugnė, pirmąkart Ohajo valstijos universiteto mokslininkų pastebėta 2014 metais. (Source)*

(38) *Didesnės masės juodosios bedugnės žvaigždes gali praryti jų net nesmulkindamos. (Source)*

(39) *Kai galaktikos susijungia, jų centruose esančios **juodosios skylės** ima sukintis viena aplink kitą, rydamos masę, kol galiausiai susilieja ir vietoje jų atsiranda supermasyvi juodoji skylė, kuri toliau plečiasi. (Source)*

(40) *Tačiau **tokioms bedugnėms** ryjant materiją, ši kartais sugieda paskutinę savo giesmę, išmesdama šviesos, radijo bangų ar plazmos pliūpsnį, kuris sugeba įveikti juodosios bedugnės gravitaciją. (Source)*

(41) *Mokslininkai pirmąkart stebėjo, kaip **juodoji bedugnė** ryja žvaigždę. (Source)*

The examples from (37) to (41) all contain Agents which are personified, accompanied by a verb that expresses the material process of eating, and all the examples have an accompanying participant, for instance in example (41), the star that is being eaten is considered an Affected Patient. Of particular notice are examples (39) and (40), as it is possible to infer a circumstance where the Agent is vulnerable because of its own devices.

All in all, 264 examples of material process with rooted personified semantic roles were identified in total among the 336 collected examples. Due to space limitation, 41 examples were presented and analyzed in contrast of both languages. This segment of the study proved that material processes rooted with personified semantic roles in popularized scientific texts contain Agents, which were confirmed to be inanimate, meaning that there is no visible intent; however, the Agent can control the action. From the number of analyzed examples, the English language showed more variety in terms of verb usage, while Lithuanian popularized scientific texts were frequently found to use the same verb.

## 6.2 The Personified Semantic Roles Rooted in Mental Processes

The main focus point of a mental process is the mind, which can experience a wide variety of senses to witness the world on a spiritual level. Therefore, it can be understood as a

sensory input through which the experience is gained, i.e. perception, knowing or liking. Several semantic roles can be observed, like the *Senser*, the main participant who experiences or perceives the *Phenomenon*, which is the other participant usually found in these types of sentences. Typically, the *Senser* is animate and most of the time human, however, the examples below contain inanimate semantic roles where through the use of personification entities can perceive, know and experience other kinds of things just like a human would. For example:

(42) *But **the Fermi gamma-ray satellite** did see something interesting, astrophysicist Valerie Connaughton and colleagues report online February 14 at arXiv.org. ([Source](#))*

(43) *On September 14, **the Advanced Laser Interferometer Gravitational-Wave Observatory, or LIGO**, sensed a disturbance in spacetime caused by two massive black holes smashing together. ([Source](#))*

(44) ***The first probe**, designed to sniff for methane, was launched last month and is now en route to Mars, salvaging some of the sting of the earlier failures. ([Source](#))*

(45) *The search is limited by what **the telescopes** can see in a **planet's atmosphere**, however. ([Source](#))*

(46) *During each event, the **technology** sensed the irregularity and the appropriate photos were taken. ([Source](#))*

These examples all contain a *Senser* and a *Phenomenon*. Take for instance, the example (44), the *Senser* *the first probe* sniffs for the *Phenomenon* that is methane. Both of these participants are inanimate, however, only the *Senser* is personified.

Mental processes can be separated into three different kinds: perception, cognition and affection. The collected examples contained six cases of perception. Consider:

(47) ***It (Kepler)** does this by staring at a few select parts of the sky and monitoring the brightness of 150,000 target stars over long periods. ([Source](#))*

(48) *The mission, **a lander called InSight** that was to listen for tremors on Mars as a way of understanding the planet's interior, will not launch in March 2016, the agency said today. ([Source](#))*

Together with these two examples and examples (43), (44), (45) and (47) all of these six examples deal with the sensory input a human would experience to envision the world. Three of the examples make use of the visual sensory input, i.e. the eyes while example (44) is rather ambiguous.

While analyzing the examples, the cases where cognition was indicated are very few. This type of mental process deals with the presence of a mind, where there can be thoughts. Examples include the following:

(49) *On the other hand, it would have been very difficult for Saturn to do so because **Iapetus** would have been excessively unsettled, resulting in an orbit that is difficult to reconcile with its current trajectory. (Source)*

Example (49) indicates the intricate workings of a mind, which is not in a calm state that personifies the subject.

In contrast to the English language, there were a lot more examples found in Lithuanian popularized scientific texts that contained mental processes embedded with personified semantic roles. 11 of which were found to be in the perception category. Consider the following:

(50) *Taip **teleskopas** pažvelgs į ankstyvą visatos kūdikystę. (Source)*

(51) ***Lazeris** gali matyti urvo lubas, kurios kitaip nematomos. (2016, Nr.2:13)*

(52) *„Frontier Fields“ misijoje **teleskopai** žvelgs per šešis spiečius, kuriuos astronomai pasirinko dėl puikių lėšiams būdingų savybių. (2015, Nr.9:56)*

(53) ***Zondas** metė unikaly žvilgsnį į Titano ežerus. (Source)*

(54) *Tai bus didžiausias ir galingiausias **teleskopas** astronomijos istorijoje, sugebésiantis ižvelgti objektus, susiformavusius po Didžiojo sprogimo praėjus vos 200 mln. metų. (Source)*

(55) ***Žvaigždės** žiūri į Žemę: kvapą gniaužiančios naktinio dangaus dimensijos. (Source)*

(56) *Nuo tada šis **kosminis aparatas** žvelgė į dešimčių tokių planetų atmosferas ir sudarė mokslininkams sąlygas modeliuoti „karštųjų Jupiterių“ sudėtį ir klimatą. (Source)*

(57) ***ExoMars zondas** uos gyvybės ženklus Raudonojoje Planetoje. (Source)*

(58) *Gali būti, kad tinkami **infraraudonieji teleskopai** netgi gali įžiūrėti tokių atmosferos dujų, kaip anglies dvideginis ir metanas, parašus, tiesiogiai įspaustus potvyniais kaitinamo mėnulio paviršiaus švytėjime, nenustelbiamame žvaigždės šviesos. (Source)*

(59) ***Jis** (radijo teleskopas) gali pajausti menkiausius signalus, ir tai labai efektyvu. (Source)*

These ten examples all feature an inanimate object that is described to have a sensory input. While the Lithuanian examples used a wide variety of different verbs, examples (50), (52), (53) and (56) used the verb *žvelgti* in one way or another. Examples (53), (54) and (58) also fall

under the category of using eyes to see something, while example (56) is indicated to use the hearing apparatus to perceive the star systems, and example (57) makes use of the smelling ability that animate participants have.

Another category that was indicated among the mental processes was cognition. There were eight examples found to exhibit the presence of mind. Consider:

(60) *Kol kas tiksliai galime pasakyti, kad tai įvyko vėliau nei 380 tūkstančių ir anksčiau nei 600 milijonų metų po Didžiojo sprogimo, nes anksčiau **pirmosios ribos medžiaga ir spinduliuotė** buvo sumišusios ir negalėjo formuotis struktūra, o ties antrąja riba jau matome kažkiek galaktikų.* ([Source](#))

(61) *Kalbant statistiniais terminais, labai jau menkai tikėtina, kad astronomai į šiuos **milijardus metų gyvuojančius objektus** akį užmetė kaip tik tada, kai jie staiga nusprendė imti ir užgesti.* ([Source](#))

(62) *Kadangi **šios juodosios skylės** nežino viena apie kitą ir negali daryti įtakos viena kitai dėl milžiniško atstumo, išsirikiavimas turėjo atsirasti formuojantis galaktikoms ankstyvojoje Visatoje.* ([Source](#))

(63) *Šis **sąryšis** įvertina reliatyvistinį (c) ir kvantinį (h) dydžius elektromagnetinei (e) elektringųjų dalelių sąveikai tuščioje erdvėje (ε).* ([Source](#))

(64) *Tai padės mokslininkams suprasti, kaip **karštieji Jupiteriai** įsigudrina susiformuoti taip arti savo žvaigždės.* ([Source](#))

(65) *Aukštosiomis technologijomis paremtas „**Hitomi**“ palydovas šiuo metu turėjo siųsti signalus iš orbitos, tačiau vietoj to jis tiesiog pasimetė, teigia Japonijos kosmoso tyrimų agentūra JAXA.* ([Source](#))

Just like examples (48) and (50) the examples (60) and (65) exhibit the same manner of a disturbed mind. However, take into consideration example (61), where a clear decision was indicated, or example (62) where these entities seem to have their own identities, memories and everything else attributed to a human mind. Examples (63) and (64) make use of the calculative aspect of the mind, i.e. evaluating and devising a plan.

There were no examples of affection found among the English language examples, however, the case is very different for the Lithuanian language mental process examples that were present in popularized scientific texts. In total seven examples were identified. Take into consideration the following:

(66) *Orus mokslas.* ([Source](#))

(67) *Jų saulelė irgi negaili, ir jei Žemės negaubtų ozono sluoksnis, labai greitai pajustumė savo kailiu.* ([Source](#))

(68) *Pavydėk, Tatoonine: naujai atrastos egzoplanetos danguje šviečia ne viena, ne dvi, o net trys saulės.* ([Source](#))

(69) *Šiuo statusu mūsų planeta galės džiaugtis dar apie savaitę.* ([Source](#))

All of these feature some sort of emotion. Take for example (66) which indicates that science is either brave or dignified, an emotional attachment to the identity of the mind. Other emotions found include happiness in example (69), jealousy in (68), however, it should be mentioned that this emotion is attached to the entity, and whether it actually would exhibit such emotion is left unanswered, and lastly, example (67) shows generosity, a modern day phenomenon or hype attributed to humans.

In conclusion, out of the 336 examples collected, 8 examples containing personified semantic roles belong to the English language and 26 examples are Lithuanian, indicating that the Lithuanian writers are more prone to mental process types than their English counterparts. Moreover, no examples of affection could be found. A potential consideration could be made that the English language shies away from emotional expressions of the world. The English example size, apart from being very little, showed almost no signs of repeated verbs, unlike the Lithuanian language, where the verb *žvelgti* was found on four different occasions.

### 6.3 The Personified Semantic Roles Rooted in Verbal Processes

The verbal process is the clause of Saying, where the Sayer is the main semantic role. Apart from the Sayer there are several other possible participants: Receiver, Target and Verbiage. The Receiver is the recipient of the intended message, however, the Target is someone who the message is said to but usually bears a negative connotation. The Verbiage is the information that was said. This process is usually used to explore the narrative in literature but has also found its uses in academia. For example:

(70) *Once upon a time, there may have been a fifth gas planet in our solar system – that is, until **Jupiter** had its say.* ([Source](#))

(71) *Those techniques tell astronomers about a planet's mass or size but little about what it's like. (Source)*

(72) *Although many have been found and they appear to be the most abundant type of exoplanet in the galaxy, current telescopes can tell us little about them. (Source)*

(73) *Pratt adds that the delay also speaks to the extra challenges of trying to support international collaborations. (Source)*

(74) *A black hole weighing the same as about 100,000 suns could explain why gas in an interstellar cloud is swirling around at hundreds of kilometers per second, researchers suggest. (Source)*

All of the examples presented have a Sayer that is not an animate participant. Examples (70) and (74), however, lack the Target or Receiver, and in (70)'s case it even lacks a Verbiage. Examples (71), (72) and (73) have a Sayer, a Receiver and Verbiage attached. If we were to look closer at example (71), *those techniques* would be the Sayer, the verb that indicates the verbal process would be *tell* and the Receiver are the astronomers, the preposition *about* indicates the Verbiage.

None of the above examples illustrate the participant Target and among the collected examples only one instance turned up, indicating the rareness of the use. Take into consideration the following:

(75) *But budget cuts are threatening to drag the nation's space science revival back to Earth. (Source)*

In this example the Target is *the nation's space science revival*, the Verbiage could be understood as the action that is intended, which would be *to drag the nation's space science revival back to Earth* and the negativity is expressed through the verb *are threatening*.

There were similarly few examples of the verbal process among the Lithuanian examples. Take into consideration the following:

(76) *Mūsų naujoji teorija sako, kad tamsiosios medžiagos dalelė yra kelis šimtus kartų sunkesnė už protoną ir ji taip pat yra sudaryta iš kelių elektros krūvi turinčių dalelių. (Source)*

(77) *Mokslininkai baiminasi, kad šis reiškinys perspėja apie gyvybiškai svarbaus magnetinio lauko silpnėjimą. (2015, Nr.10:60)*

(78) *Fizikai nustebe: sukurta 5D juodoji skylė prieštarauja reliatyvumo teorijai. (Source)*

Just like the English examples, there exists a Sayer, which is followed by a verb and a Verbiage. However, only example (78) has a Recipient.

The most frequently used verb was found to be *užminti*. Here are some examples illustrating its use:

(79) *Marso krateris užminė daug mįslių: vyksta kažkas keista.* ([Source](#))

(80) *Nereguliarūs šviesos blyksniai užminė mįslę, jog tai gali būti kažkoks judantis objektas, kuris blokuoja žvaigždės šviesą.* ([Source](#))

(81) *K. de Souza Oliveira atkreipia dėmesį, kad žvaigždė užminė ir daugiau mįslių.* ([Source](#))

Examples (79) to (81) have no Target or Recipient and particularly example (81) has no Verbiage, however, all of them include the Sayer and the verb to indicate the process. Interestingly enough, there was only one clear instance where a Target was used in the Lithuanian language. Consider:

(82) *Jungtinių Amerikos Valstijų aeronautikos agentūra NASA turi savo atskirą programą, kurios tikslas yra stebėti visus kosminius kūnus, priartėjančius prie Žemės planetos ar bent jau jai grasinančius ataka ateityje.* ([Source](#))

These cosmic bodies perform the role of the Sayer and the Target is indicated to be the Earth and it uses the same verb as the only English example of this case that is example (75).

In conclusion, 13 examples were discussed in this part of the paper. Both the English and Lithuanian languages displayed the personified semantic roles of the Sayer, and additional participants, like Recipient, Target and Verbiage were observed, however, only one instance was found with the Target semantic role in both languages, interestingly, both used the same verb to express the verbal process.

#### **6.4 The Personified Semantic Roles Rooted in Relational, Behavioral and Existential Processes**

As it has already been discussed in the theoretical part of this paper, the processes of relation are set to identify the relation of a participant (Carrier) to another relative point in the clause. In addition, there exist three variations of the relational process: attributive, possessive



and circumstantial. However, what all of the relational processes have in common is that they all must be in relation to something, be it an attribute, or something that possesses something or just is in relation to the circumstance. Consider:

(83) *Indeed, **the star** itself is the asteroids' enemy. ([Source](#))*

(84) ***Saturn's moon** has a fluffy heart ([Source](#))*

(85) ***The heart** might be Pluto's wellspring. ([Source](#))*

(86) *While younger stars are often erratic, **KIC 8462852** is middle-aged and well past its temper-tantrum stage. ([Source](#))*

(87) ***Saturn's moon, Enceladus**, may not have a heart of stone – at least, not completely. ([Source](#))*

(88) *But a survey of the area has revealed an unexpected feature: **a disk of much younger stars** hidden among the veterans. ([Source](#))*

(89) *With the assumption that **water** is king, astronomers search for wet planets using powerful telescopes. ([Source](#))*

All of these examples have one thing in common – the Carrier. Like the example (83) or (85) that have an attribute. However, examples (84), (87) and (88) are distinguished by the verb *have* or *has* and are therefore possessive. Example (89) is a case where water is personified to be a king, a title expressing authority over other things that is usually given to animate entities. However, among the 179 English examples no circumstantial examples of the relational process rooted with personified semantic roles turned up.

Lithuanian language offers an even lesser amount of examples to go by. Take into consideration the following:

(90) ***Didžiausia rekordininkė** yra juodoji skylė Komos galaktikų spiečiuje, jos masė lygi 21 mlrd. saulų. ([Source](#))*

(91) *Jokia fizikos teorija nepaaiškina, kodėl šis **masių santykis** yra nepajudinamas mokslo piemuo. ([Source](#))*

(92) *Kitaip tariant, **Plutonas** – nediskutuotinas Kuiperio juostos karalius. ([Source](#))*

(93) *Dirbtinio palydovo kūrėjai taip pat teigia, kad **Majakas** orbitoje galėtų pasitarnauti ir kaip kosminių šiukšlių valytojas – parašiotine sistema jis galėtų nuleisti orbitines šiukšles žemiau, į tankiuosius atmosferos sluoksnius, kur orbitoje paliktas šlamštas tiesiog sudegtų. ([Source](#))*



(94) *Pagrindinė kaltinamoji – mįslingoji hipotetinė Saulės sistemos planeta.* ([Source](#))

The Lithuanian examples shown here all have a Carrier, just like their English counterparts and examples (90) and (91) are typical attributive relational clauses. However, what must be mentioned are that examples (92) and (94) have an omitted verb and makes use of dashes to attach relation. Example (93) uses a conjunction *kaip* to establish an attributive relation.

To sum up, both the English and Lithuanian languages use attributive relational processes with rooted personified semantic roles. However, not only were there less examples found in the Lithuanian language, unlike the English, there were no possessive relational clauses found, while both languages exhibited no circumstantial type of relational clauses. It should also be mentioned, that Lithuanian writers of the popularized scientific texts favored omitting verbs and used dashes instead, providing a more direct way of attaining relation.

The behavioral process is very similar to the material and mental processes in the way that it involves ‘doing’ and ‘behaving’, which indicates a consciousness, so the properties of a Senser applies. There are countless ways to express human behavior and just like the mental processes in rare occasions the Phenomenon can be observed. Typically it is very difficult to infer these types of processes as there are no clear characteristics of their own. However, during the investigation no personified semantic roles that are rooted in the behavioral processes were found.

Existential process is usually an introductory tool for the narrative. It fixes the entity to a location. The semantic role is named the Existent and sometimes involves the words *exist* and *there* (which sometimes can be omitted). Due to the small amount of examples found from both languages, all the examples have been presented together. Take into consideration the following examples:

(95) *Now, as chemists report online today in Nature, **buckyballs** – complex molecules with 60 carbon atoms arranged into what look like the geodesic domes of R. Buckminster Fuller – do indeed exist in the space between the stars.* ([Source](#))

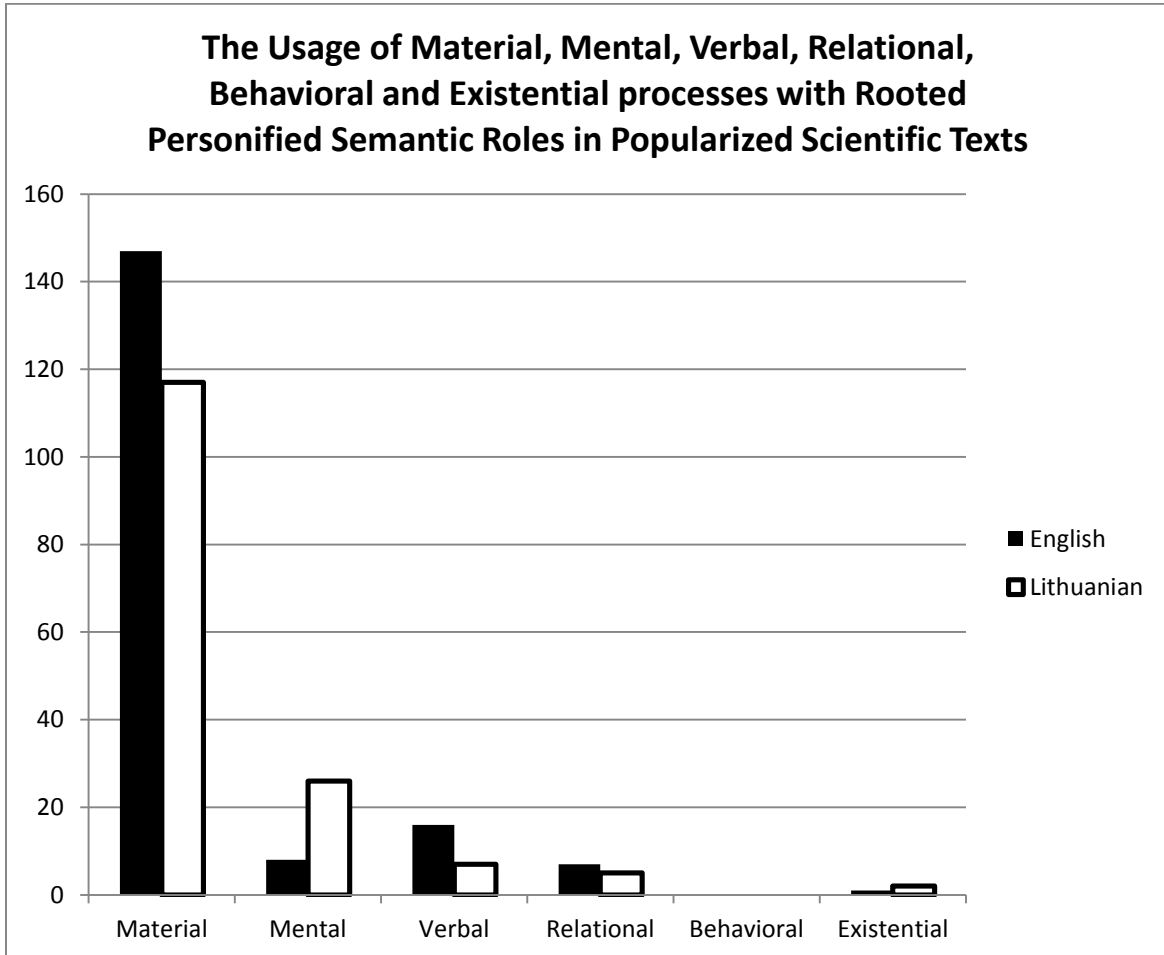
(96) *Šios žvaigždės gyvena prie pat galaktikos centro ir tikriausiai ten buvo beveik visą Visatos egzistavimo laiką.* ([Source](#))

(97) *Didžiausia rekordininkė yra juodoji skylė Komos galaktikų spiečiuje, jos masė lygi 21 mlrd. saulų.* ([Source](#))

All of the above express an Existent that is tied to a location. However, there were no cases with *there*, however, from that it is possible to imply that the English language shies away from the use of it. As can be evidenced there are no signs of *there* in any of the examples and only example (96) has *lives*. Other than that, example (97) uses a simple construction to tie the entity to a location.

All in all, the amount of established existential process examples is very miniscule compared to the other process type like the material. Both Lithuanian and English languages have been found to have the Existent and in all of the cases the personified semantic roles was tied to a location, however, there were no instances of *there*, and *exist* was featured once.

To conclude the results of each section of the practical part and to calculate the frequency of the examples used where the personified semantic roles were rooted in material, mental, verbal, relational, behavioral and existential processes in popularized scientific texts, consider the following Figure:



**Figure 2.** The Usage of Material, Mental, Verbal, Relational, Behavioral and Existential processes with Rooted Personified Semantic Roles in Popularized Scientific Texts.

The Figure indicates the exact number of examples of material, mental, verbal, relational, behavioral and existential processes with embedded personified semantic roles in popular science texts. There have been 336 examples found in total. Out of which 264 examples (78.6%), featuring the largest amount out of every section, were material processes. The second largest group was mental processes with 34 examples (10.1%), after which were the verbal processes with 23 examples (6.8%). The three smallest groups were relational processes with 12 examples (3.6%), existential processes with 3 examples (0.9%) and behavioral processes with 0 examples.

In contrast, both languages exhibited the largest amount of examples of material processes, from which the conclusion can be drawn that material processes rooted with personified semantic roles are significantly more frequent in popularized scientific texts than any other kind of process. Furthermore, Lithuanian language was found to use a lot more of mental processes than the English language; however, the opposite was true in regard to the verbal processes. There were a very similar amount of examples in both languages of relational and existential processes. Additionally, both languages did not have any behavioral process examples embedded with personified semantic roles in popularized scientific texts.

## CONCLUSIONS

The aim of the present study was to describe, identify and contrast semantic functions of personified semantic roles in popularized scientific texts in English and Lithuanian. It has been accomplished together with the objectives which were outlined in the Introduction part of this thesis: 1) to assess the theoretical background for systemic functional approach and the semantic system of the sentence; 2) to provide theoretical background related to personification and popularized scientific texts; 3) to define the basic concepts of semantic role functions; 4) to illustrate and compare the personified semantic functions in English and Lithuanian; 5) to present the statistical data of the collected examples. A thorough analysis of the use of material, mental, verbal, relational, behavioral and existential processes rooted with personified semantic roles allows to draw the following conclusions:

1. The systemic functional approach was created for the purpose of text analysis. The main representation form that is analyzed is textual. A key characteristic of the systemic functional approach are the three metafunctions: representational metafunction that is a direct representation of experience, interpersonal (relations inside the act of the representation) metafunction is related with the transitivity system of the language that perceives language in terms of six processes: material, mental, verbal, relational, behavioral and existential. These processes are recognized by verbs and the textual metafunction deals with description and pointing towards theme and rheme. All of the processes create the semantic framework of the sentence.

2. Material processes construe the physical aspect of our world. Furthermore, each material process involves a participant, which is called the Agent. Moreover, there are cases where there are secondary participants such as the Affected/Effectuated Patient, the Recipient and the Beneficiary. Mental processes work with the sensory system and the consciousness that is present in all animate beings. There are three types of mental processes: perception, cognition and affection and there exist two participants: the Senser and the Phenomenon that can be sensed. Verbal processes are the processes of Saying, where the participant is the Sayer. This process can have several secondary participants: the Receiver, the Verbiage as well as the Target. There are three types of relational processes: attributive, possessive and circumstantial. The participant in relational

processes is the Carrier that is attached to another relative point in the sentence. Behavioral processes are processes of behaving, where the participant is the Behaver and there is no control over the action being done by the participant. While existential processes tie an entity to a location and this participant is the Existent.

3. Scientific texts can be categorized into two categories: the classical and the popularized and the difference between them are the target audience. The classical scientific texts are directed towards the science community while the popularized texts are written for the general society. The authors of the popularized scientific texts use figurative language to simplify the content. The science community has total control over what constitutes as science. One of the expressive means that the authors use is personification. This figure of speech applies human terms to lifeless objects, turning them into animate entities. Moreover, the largest number of figurative language resides in the Space Science & Astronomy fields.

4. Overall, 336 examples of material, mental, verbal, relational, behavioral and existential processes rooted with personified semantic roles have been gathered. The largest amount of examples was the material processes consisting of 264 examples (78.6%) out of which 147 examples were English and 117 were Lithuanian. The second largest amount was 34 examples (10.1%) of mental processes, out of which 8 belonged to the English language and 26 to Lithuanian. The third group consisted of 23 examples (6.8%) and was the verbal processes where 7 examples were Lithuanian and 16 English. Relational processes made up 12 examples (3.6%) out of which 5 were Lithuanian and 7 English, and existential processes peaked at 3 examples (0.9%), here the English language was found to have only one example, and the Lithuanian, in contrast exhibited two examples. There were no examples of behavioral processes found. In addition, the English language showed a wider variety of verbs used compared to the Lithuanian language, which was often found to use the same verb on several occasions.

With the conclusions made it can be stated that the aim of the research paper has been achieved, the objectives have been done, and the hypothesis has been confirmed. Material processes embedded with personified semantic roles are frequently used in clauses of popular science texts while mental, verbal and relational processes are rare. In addition, behavioral and existential processes are extremely rare.

Because of the fact that the scope and scale of the research are limited, further investigation might be needed to extend the existing knowledge of personified semantic roles in popularized scientific texts in English and Lithuanian. Further investigations could also involve other types of figurative language.

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