THE MENTAL REPRESENTATION OF THE CONCEPT OF VIOLENCE

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აბსტრაქტი. კოგნიტური მეცნიერების დანერგვით ადამიანის საქმიანობის ყველა სფეროში, ამ სფეროში მოღვაწე მეცნიერებმა შემოგვთავაზეს ახალი მიდგომები და მეთოდები ცოდნის შეძენის, მეხსიერებაში შენახვისა და კლასიფიკაციისთვის. კოგნიტური მეცნიერება ფაქტიურად ფოკუსირებულია ადამიანის გონებაზე და მის შიგნით არსებულ ყველა პროცედურაზე. კოგნიტური მიდგომის გამო, ადამიანი მთელი თავისი თვისებებით მოექცა სხვადასხვა სამეცნიერო დისციპლინის ცენტრში. ისეთი დისციპლინები, როგორიცაა ფილოსოფია, ფსიქოლოგია, ბიოლოგია, ლინგვისტიკა, ხელოვნური ინტელექტი, ნეირომეცნიერება და რობოტიკა გაერთიანდა, რათა აღმოეჩინათ ყველაზე რთული და მისტიკური ფენომენი, რომელსაც ადამიანის გონება ჰქვია. გონებაში ცოდნის წარმოდგენის მოდელირება მნიშვნელოვანი ნაწილია იმის გასაგებად, თუ როგორ მუშაობს იგი. კოგნიტური მეცნიერების შემოღებამდე, რეპრეზენტაციის იდეები ძალიან აბსტრაქტული და თეორიული იყო. კოგნიტური მეცნიერებამ შემოგვთავაზა ცოდნის წარმოდგენისა და გონებრივი პროცესების სხვადასხვა პრაქტიკული მოდელები. მას შემდეგ, რაც კოგნიტური მეცნიერები ადარებენ ადამიანის ტვინს კომპიუტერთან, სხვადასხვა გამოთვლები, როგორიცაა მონაცემთა სტრუქტურირება და ალგორითმები, გამოიყენება ადამიანის გონებაში ინფორმაციის დამუშავების აღსაწერად. ერთ-ერთი მათგანია კონექციონიზმი, რომელიც აღწერს ცოდნის წარმოდგენას სხვადასხვა კავშირების დახმარებით ერთეულებს შორის, რომლებიც ასახავს ცნებებს, ობიექტებს, თვისებებს და ა.შ. სხვადასხვა ცნებებს შორის. ჩვენს კვლევაში ჩვენ შევეცადეთ მოგვეხდინა „ძალადობის“ კონცეფციის მოდელირება გამოთვლის კავშირების ხედვის მიხედვით. ძალადობის ცნება არჩეულია მისი რთული ხასიათისა და საფუძვლიანი შესწავლის საჭიროების გამო. ჩვენი კვლევის შედეგებს შეუძლია ხელი შეუწყოს ძალადობის კონცეფციის საბოლოოდ მოდელირებას, როგორც ეს არის წარმოდგენილი გარკვეული ავტორების შრომებში. კონცეფციის წარმოდგენის სარწმუნო მოდელის აღმოჩენა ხელს შეუწყობს ადამიანებისთვის სწავლისა და გაგების უნარების გაუმჯობესებას და ხელს შეუწყობს კონცეფციის გაგების, შეძენის, დამახსოვრებისა და გამოყენების გაფართოებას. მას ასევე შეუძლია ბევრი საფიქრალი მისცეს ხელოვნურ ინტელექტს.

საკვანძო სიტყვები: კოგნიტური მეცნიერება, მენტალური რეპრეზენტაცია, ძალადობა, სემანტიკური ქსელი, კონექციონიზმი, იერარქია.

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Abstract. With the introduction of cognitive science to all the spheres of human activity, new approaches and methods for knowledge acquisition, storage in memory, and classification have been offered by cognitive scientists. Cognitive science focuses literally on the human mind and all the undergoing procedures inside it. Due to the cognitive approach, a human with all his properties was put at the center of various scientific disciplines. Such disciplines as philosophy, psychology, biology, linguistics, artificial intelligence, neuroscience, and robotics came together to discover the most complex and mystic phenomenon called the human mind. Modeling the knowledge representation in the mind is an essential part of understanding how it works. Before the introduction of cognitive science, the ideas of representation were very abstract and theoretical. Cognitive science came to offer various practical models for knowledge representation and mental processes. Since cognitive scientists compare the human brain with a computer, different computations such as data structuring and algorithms are used to describe the processing of information in the human mind. One of them is connectionism which describes knowledge representation with the help of different connections between units that stand for concepts, objects, properties, etc. Connectionism developed to prove once more that the human mind has that exceptional ability to think relationally and make connections or associations between different concepts. In our research, we have tried to model the concept of **"violence"** according to the connectionist view of computation. The concept of violence has been chosen because of its complex character and the need for a thorough examination. The results of our research can help to finally model the concept of violence as it is represented in certain authors' minds and finds its reflection in their writings. Finding out a plausible model for concept representation will help improve learning and comprehension skills for people, and will contribute to expanding the comprehension, acquisition, memorization, and usage of the concept. It can also give a lot of food for thought to Artificial Intelligence.

Keywords: cognitive science, mental representation, violence, semantic network, connectionism, hierarchy.

Introduction. Science is all about knowledge. The processes promoting knowledge acquisition, digestion, and application have always interested scholars and common people. However, to be able to acquire, digest, and apply any type of knowledge, a human needs to have a human brain. The human brain is the most important organ of homo sapiens not only from the point of biology but also from the point of linguistics as the human mind which is the mental reflection of the brain is studied with the help of language. Since the human brain is a physical thing that can be touched, measured, and weighed, it is more realistic to use the results of the biological studies of the brain to define the human mind as an abstract category. Consequently, cognitive science developed as an interdisciplinary study of the mind which combined the results of the studies from such disciplines as philosophy, psychology, linguistics, and neuroscience. Cognitive science is based on representations and computations. Mental representations are objects, concepts, images, propositions, states as well as perceptions with all their semantic properties represented in the human mind, whereas computation is the processing of any type of knowledge in the human mind. Mental representations are the basic concepts of the Computational Theory of Mind which develops the idea that all the processes and states in the human mind should be analyzed, interpreted, and explained with the help of mental representations (Pitt, David, Spring 2020).

Discussion. The notion of mental representation is also one of the main issues in Semantics that deals with the theory of meaning in general. According to Semantics, there is some extra dimension between the denotational meaning of the words and the real world, and that is the association of the word with something which already exists in the speaker's or hearer's mind, the so-called mental representation (John I. Saeed, 2009, p. 32-33).

According to Paul Thagard, there are four classes of mental representation – concepts, propositions, rules, and analogies (2005). The concept is the most basic form of mental representation, it appears in the studies of philosophers, logicians, lingu,ists, and psychologists. From the point of view of cognitive linguistics, the notion of concept is widely used, but it is still highly controversial and requires a multi-level and multi-sided analysis and final plausible modeling. From the perspective of cognitive science, modeling is very important for information processing and knowledge representation.

Within the scope of our research, we have tried to model the mental representation of the concept of "v**iolence**". The research is based on the studies of the works of certain authors and the results of the associative experiment. The focus of our interest is the authorial representation of the concept of violence. The highest or the most abstract level of analysis was carried out - the computational analysis. According to the computational level of analysis, we have taken the concept of violence per se and broken it down into its main constituents or parts with the help of the cognitive method.

Thus, to be able to model the mental representation of the concept of "violence", we first try to define its content. The content of the mental representation of "violence" can be objects, properties, propositions, concepts, functions, associations, etc. Using the fundamental capacity of our brain to think relationally, we distinguish 3 main relations to determine the content of the mental representation of "violence"; **the causes**, **manifestations**, and **impacts** of "violence". Undoubtedly, the causes are intentionally related to the participants of the mental event of "violence", manifestations are related to the event in which the participants are involved, and the impacts to the outcome of the event. Thus, we can say that the mental representation of "violence" consists of the following relata; **the participants**, **the event,** and **the outcome**. As it is practically impossible to study all the types of events involving violence in the frame of one research work, we chose a **homicide event** as an extreme manifestation of violence for further studies.

However, the main question is how to represent those concepts or objects and how to specify the relations between them. There are different approaches to knowledge representation that have their strengths and weaknesses. We have taken the **connectionist** view under study. As opposed to the classical view that suggests knowledge representation in the form of symbols (e.g., Turing 1950, Fodor 1975, 2008, Fodor and Pylyshyn 1988, Marr 1982, Newell and Simon 1976), the connectionist view offers the idea of an artificial neural network (ANN) in knowledge representation (e.g., McCulloch & Pitts 1943, Rumelhart 1989, Rumelhart and McClelland 1986, Smolensky 1988). However, ANNs have limited capabilities and can just recognize and classify patterns and do not represent complex concepts. Semantic networks have more capabilities for knowledge representation and information modeling as they use "a rich set of interconnected concept and concept property nodes to represent information" (Friedenberg, Silverman, 2006, p. 208).

Semantic networks are constructed in such a way that the nodes, each representing a separate concept, are connected with different relations and the activation of one of them causes the activation of the other. Each element in a network represents a **node** that has a specific meaning and properties and the connections between nodes are represented as **links**. We have tried to represent the content of the concept of "violence" by constructing its semantic network with the help of a **hierarchy.** The idea of the hierarchical organization of semantic networks was first introduced by Collins and Quillian in 1969. They suggested that semantic networks represent concepts from the most abstract down to the most concrete. Semantic networks allow us to represent and understand complex aspects of the concept of "violence" by spreading out each of its nodes and activating as many nodes as possible. The process is known as spreading activation which begins to lose its strength as it spreads outward and the connections between the nodes of the upper level are stronger than the connections between the lower-level nodes and the upper nodes of the hierarchy.

So, we take the abstract concept of "violence" as an **ordinate** category at the top of our hierarchy which then spreads out to **subordinate** categories in different layers of the hierarchy. Each

concept or object corresponds to a node in the network. Thus, the node Violence activates the nodes **Participants**, the **Homicide Event** and the **Outcome**. The node Participants in its turn activates the nodes **Murderer**, **Victim**, and **Audience** (see Figure 1).

It is obvious that the node Murderer is connected with the node Victim and the activation of the node Murderer activates the node Victim or vice versa. So, in this case, we can state that the two nodes are in reciprocal relations with one another. The activation of the node Accomplice takes place if we think of the node Murderer but not vice versa, so there is a different type of link between the nodes Murderer and Accomplice as compared to that of the Murderer and the Victim. Links can be one-way, with activation flowing from one unit to another, or symmetric, with activation flowing back and forth between two units (Paul Thagard, 2005, p. 113). As it can be inferred from the above mentioned, the link between the node Murderer and the node Victim is symmetric which can be accounted for by the fact that the activation flows back and forth, whereas the link between the node Murderer and the node Accomplice is one-way as the activation flows from the node Murderer to the node Accomplice. In our hierarchy, the symmetric links are represented by lines that have two arrows at both ends and the one-way links by lines that have one arrow at one end (see Figure 1).

Depending on special cases of homicide events as well as the authorial portrayal, the node **Audience** may or may not be activated while trying to mentally represent the participants of a homicide. For example, if there is a police investigation, and the crime is being studied thoroughly, then, of course, it's very important to discover all the people who were, by any chance, present at the event such as **Witnesses.** Thus, the node Audience stands separately from the other nodes.

When we activate the node **Homicide Event** we discover that it has links at the equal level with the node Participants and the node Outcome, and at the subordinate level with nodes **Mode of the Event** and **Crime Scene**. The node corresponding to the Mode of the Event in its turn has such general elements or nodes at the subordinate level as the **Commission of the Violent Act** and **the Weapon Choice**. The Commission of the Violent Act can be classified into more concrete cases such as **Face-to-face, Drive-by, Shoot-out**, etc depending on how the crime was committed. The node the **Weapon Choice** is also classified into more concrete objects such as **Hands-on materials** like strangulation cords, knives, or drowning objects and **Weapons** like firearms, guns, etc. Thus, we see that the concepts representing each node in the network tend to go from general or abstract to more concrete down the layers of the hierarchy.

The node **Crime Scene** is a separate topic for further discussion and studies as there can be multiple descriptions depending on the writers' intent and techniques of depiction.

The **Outcome** of a homicide event has one-way links from the nodes Violence and Homicide Event. It is activated only when we think of violence or a violent act that is a homicide event, while the nodes Participants, Homicide Event, and Violence are interconnected via symmetric links. The outcome of the event can be different for the Victim and the Murderer. The outcome for the victim is the **Loss of Life**, whereas the outcome for the Murderer includes nodes corresponding to **Acquisition, Riddance**, and **Punishment**. Punishment includes different types of sentences, such as **Imprisonment** and **Capital Punishment**, and others.

Thus, by activating different elements connected through different links, we constructed a multi-layer semantic network to represent the concept of violence. In addition to interconnected nodes corresponding to different concepts, semantic networks also represent factual properties of the objects or concepts in the content of the mental representation which can be depicted by different links, for example, "is" link or ''has" link. We attempt to define the properties of each node in our network using the above-mentioned links.

So a Murderer **is** "clever/illiterate", "guilty/non-guilty'', "rational/emotional", "moral/immoral", "vindictive/merciful", "greedy", "jealous, "envious", "hateful'', "aggressive'', etc. A Murderer **has** "a psychic disorder'', "moral degradation'', " an inborn inclination to violence'', "an incentive to kill'', "low self-esteem'', "a desire for status'', "childhood traumas", "superiority/ inferiority", "equanimity", etc.

A Victim **is** "helpless", "defenseless'', "ignorant'', "a role model'', "rascal'', etc. A victim **has** a "good reputation/ bad reputation'', "relationship with the murderer/no relationship with the murderer'', etc.

An Accomplice **is** "guilty''/non-guilty'', "decisive/indecisive'', "greedy", "calculating", "jealous'', "hateful'', "aggressive'', "rational/emotional", "moral/immoral", "vindictive/merciful".

An accomplice **has** "a psychic disorder'', "moral degradation'', "an inborn inclination to violence'', "a motivation to kill'', "an incentive to kill'', "low self-esteem'', "a desire for status'', "childhood traumas", "superiority/ inferiority", "equanimity". An attempt is made to draw some parallels between the properties of the accomplice and the criminal. It is worth mentioning that in most cases the properties of the Accomplice are overlapping with the properties of the Criminal, as both of them can be enrolled in a criminal act.

To single out the properties of a Homicide Event, we will attempt to start from the lower layer nodes. The Commission of Homicide **is** ''brutal''/''merciful'', "justified"/ "condemned", "considered a crime"/ ''not considered a crime'', ''accidental"/premeditated". The node Weapon Choice **is** ''intentional'' or ''opportunistic''.

The properties of the node **Acquisition** are defined by the "**of** " link; the Acquisition of "salvation from evil/immorality'', "power'', ''dominance'', "wealth'', "recognition''. The properties of **Riddance** are represented with the "of" link, too: Riddance **of "**the targeted person'', "complexes'', "fears''. The element of **Punishment** is in juxtaposition with the node **Acquittal** among the properties of which the central role can be attributed to the following; "Guilty'' or "Nonguilty'', "Acceptance of Guilt'' or "Rejection of Guilt'', "Justified'' or "Unjustified''.

Taking into consideration the fact that semantic networks are very flexible and can be restructured depending on the person's level of intelligence, the number of properties of the nodes can be continued and changed. The higher the level of intelligence of the person, the more associations and connections he can make for the concept in mind. We have constructed the model on the materials of the works of fiction writers which have been studied so far in the scope of our research. The way the writers depicted the concept of violence in their writing via the psychological portrayal of the characters, the plethora of stylistic devices, and the overall plot of the stories allowed us to build up the above model of the mental representation of the concept of "violence". The semantic network of the universal concept of violence is subject to changes and supplements as transformations from the stereotyped properties can be defined in the psychological portrayal of murderers depicted by different writers. Therefore, in our further research, we find it important to enlarge the list of the relevant fiction and carry out a comprehensive analysis including all the transformations the psychological portraits of the criminals may undergo in different scenarios which in turn will throw light on the authors' perception of the concept of "violence".

To sum up the results of the studies, we can state that the mental representation of any concept is a complex and variable phenomenon. The building of the model for the concept representation through the semantic networks discovers how the information is stored, processed, and used in the human mind. In our case the modeling of the mental representation of the concept of "violence" is based on the results of the associative experiment and the certain authors' perception of the concept under study. The modeling helps to clarify the following questions; What exactly is violence? What does it entail? What are some ways a homicide event is carried out? What are the reasons underlying any violent act? Why do people resort to violence?

According to our semantic network, we can state that in general "violence" is an event that has got participants and an outcome. The properties of the node Murderer come to prove that the reasons people inflict force can be different ranging from psychic disorder to inborn inclination. The actual process of the violent act, in our case the homicide, can take different forms (Face-to-face, Drive-by, Shoot-out, etc) and can be brutal or merciful, justified or condemned, etc. Even the choice of weapon in homicide plays a role to define the intentionality of the criminal. The outcome of the violent act can be very controversial; for the murderer, it can be negative (punishment) or positive (acquisition of wealth, etc.) for the victim, it's always negative (loss of life). To answer the most important question " What exactly is violence?", the semantic network with all its nodes and properties requires further investigation which should be supplemented by the conceptual field study of the concept to provide a multidimensional analysis of the concept.

Conclusion. As a conclusion and support to the connectionist view of knowledge representation, we can state that semantic networks are productive tools for concept acquisition, generalization, and classification. They can contribute to the overall learning procedures and can have a great impact on the development in the fields of Linguistics, Artificial Intelligence, and Cognitive Science in aggregate.

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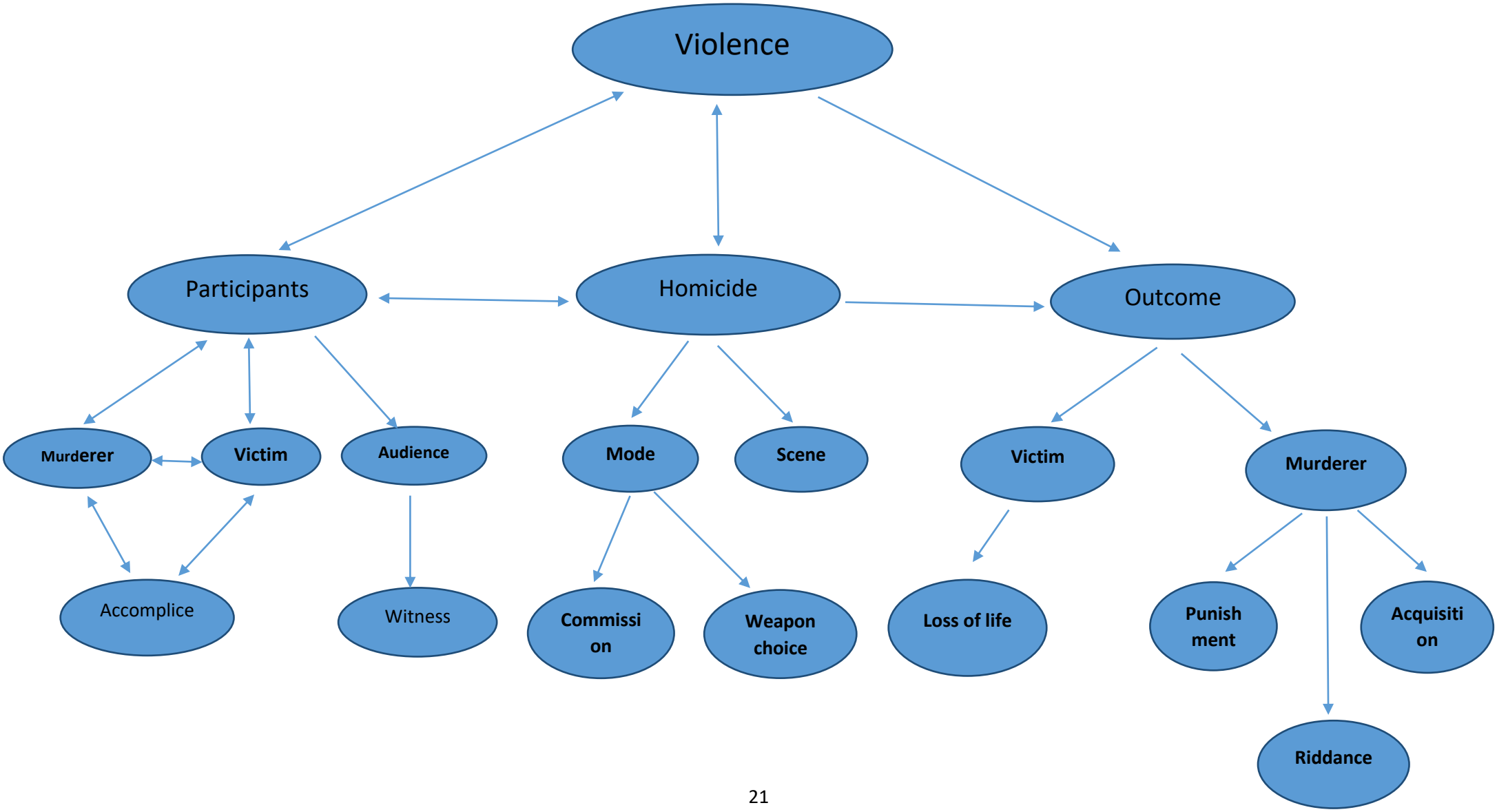
Figure 1


Violence
Participants
Homicide
Outcome
Murderer
Victim
Audience
Mode
Scene
Victim
Murderer
Accomplice
Witness
Commission
Weapon choice
Loss of life
Punishment
Acquisition
Riddance