
Categorizing Security for Security Management and Information Resource Management

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Categorizing Security for Security Management and Information Resource Management

Abstract

There are various definitions and dimensions of security, and there is no comprehensive taxonomy of security. The existing classifications of security are fragmented, scattered, and divergent, bringing challenges in the management of security and the management of information resources about security. This research aims to study the problems of security categorization in existing knowledge organization systems, and to develop a comprehensive taxonomy of security. Through thematic analysis of the literature about security, we found that, despite the various definitions and dimensions of security, there is a common feature of security. That is, security is expressed in this pattern: subject wants to protect object against source of insecurity using certain methods. Through facet analysis, we identified four facets of security - subject/scope of security, object of protection, source of insecurity, and method of security. By nesting the four facets to reveal the content of comprehensive security terms (such as national security, human security), we can build comprehensive taxonomies of security for various user groups. This paper develops a tetra-facet model of security, and demonstrates the application of thematic analysis and facet analysis to solve a complex problem of security categorization.

Introduction

Security in this article is a concept related to threat, safety, and protection. Security has been one of the top concerns of human being since ancient times, although the connotation of security has been changing along with the development of our society. Security is an “ambiguous term” and there is not “a precise and universally accepted definition of security.”¹ Different schools of security studies such as realism, social constructivism, common security approach, neorealism (structural realism) and functional organizations such as United Nations Development Program have various theoretical perspectives on security. Various aspects of security are studied in various disciplines and application domains, and the community of security studies has largely expanded the scope of security in the past 30 years. Interestingly, there is no comprehensive classification of security. The existing classifications of security are scattered, fragmented, incomplete, and divergent, causing challenges in the management of security and the management of information resources about security. The goal of this research is to study various definitions and dimensions of security and the existing classification schemes of security for developing a comprehensive classification scheme of security. The research questions of this study are:

- What are the definitions, dimensions, and features of security?
- How do existing classification systems classify security?
- How can we categorize security for facilitating security management and security information resource management?

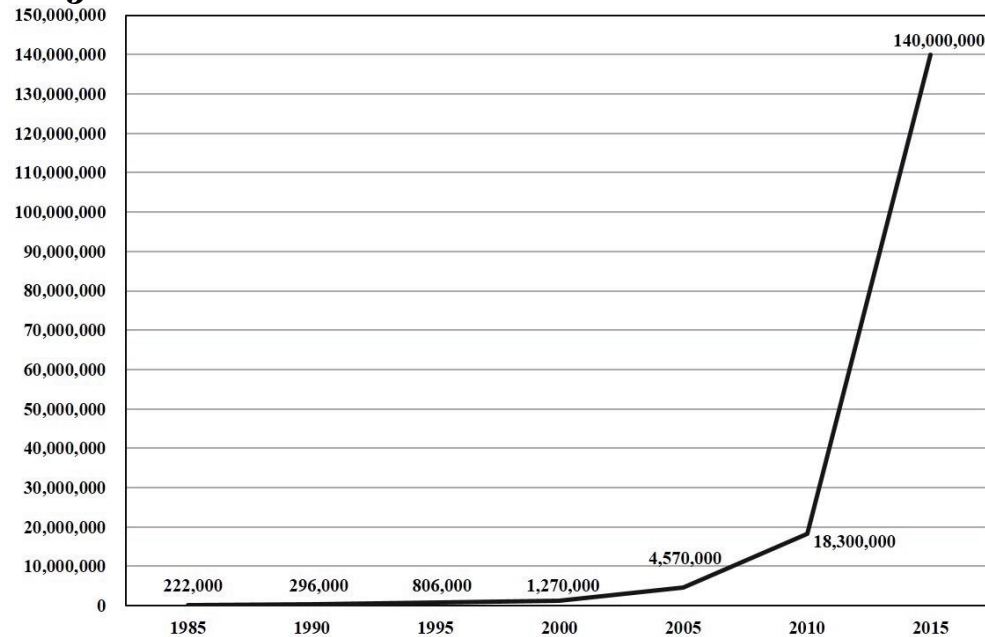
To answer these questions, we reviewed a body of literature about “security definition, dimension, feature, taxonomy and classification,” and found that although there are various definitions and dimensions of security, security has a common feature, based on which we identified four facets of security. We can use one or more of the facets to build a comprehensive taxonomy of security. We discuss why we want to build such a comprehensive taxonomy of security in the next section.

Motivation and Significance

Security is one of the basic needs of human beings. Safety and security is at the second level of Maslow’s five-level hierarchy of needs, which are physiological needs, safety and security, love and belonging, self-esteem, and self-actualization.² With the development of globalization and universally proliferating information technology network in our society, more and more factors are related to, or have an influence on, security. Concerns and discussions on security have dramatically increased in the past 30 years, especially after 2008. This is roughly indicated by Google search hits of the keyword “security” in different years from 1985 to 2015.

See Figure 1 for Google search results of “security.” The scope of security has also been expanded. Some scholars of security studies want to “expand dramatically the definition of security to include freedom from a range of threats, including economic deprivation and environmental degradation” from the traditional state/national security and international security.³ Since security is an important and dynamic topic, we ask two questions: How shall we categorize security to facilitate security management? If we have a collection of information resources about security, how shall we organize and manage it? A comprehensive understanding of security is required for security management and the management of information resources about security.

Figure 1. Google Search Hits of “Security” from Year 1985 to 2015



Notes. We collected the search hits on 13 January 2018 at three times: Midnight, noon, and evening. In the figure, the maximum number of hits of the three times is used for a certain year.

Source: Authors.

A taxonomy of security can provide a basic understanding of the scope and content of security. However, there is no comprehensive taxonomy of security. Various aspects of security are studied in various disciplines or application areas, and a taxonomy of a certain aspect of security, such as the Security and Privacy section of the Association for Computing Machinery (ACM) Computing Classification System (ACMCCS), may have been built for that domain.⁴ The Association for Computing Machinery Computing Classification System is the standard classification system for the computing field, which contains the categories and concepts that reflect the state of the art of the computing discipline. Existing classifications of security are fragmented, and scattered, which may cause

challenges in understanding security correctly. A comprehensive taxonomy of security may be useful for the management of security and the management of information resources about security. This research aims to develop a comprehensive taxonomy of security by comparing various perspectives of security to find the features of security, and comparing the existing classifications of security to find overlaps and gaps.

The users of the taxonomy can be organizations (such as government agencies) that manage all aspects of security, libraries, and information centers that manage information resources about security, and researchers who study security. Imagine an academic library of a university (such as the National Intelligence University of the United States) that has a special collection of security-related information resources. A taxonomy of security can be useful for the library to organize the collection for information access.

Methodology

This study took three steps of data collection and analysis. Firstly, we collected the literature about security studies from 102 security-related journals and the Web. We collected 120 journal articles, book chapters, and online documents that are closely related to “security definition, dimension, feature, taxonomy, and classification.” We then applied thematic analysis to the 120 documents to find the definitions, theories, features, dimensions and classifications of security in the literature. Thematic analysis as a qualitative descriptive approach is “a method for identifying, analyzing, and reporting patterns (themes) within data.”⁵ Thematic analysis takes the following six steps: Familiarizing with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report.⁶ We would like to see the conceptual and theoretical space of security without knowing particular concepts of and theories about security, so we used both an inductive (or bottom-up) approach and a deductive (or top-down) approach to generate the security-related themes from the literature. Secondly, we collected existing classification snippets of security from knowledge organization systems such as Library of Congress Classification (LCC), Library of Congress Subject Headings (LCSH), and ACMCCS, or inferred classification snippets of security from functional components of major government agencies and international organizations with security management tasks, such as the Department of Homeland Security, the Social Security Administration, and the World Bank.⁷ We analyzed the problems and deficiencies of present security classifications by piecing together various theories, definitions, and taxonomies of security. The definitions of security, and the taxonomy snippets also provided the security terms that were to be classified. Finally, based on the outcomes of the previous two steps, we found a common feature of security and conducted a facet analysis on the concept of security based on the feature,

and developed a tetra-facet model of security. We then built a comprehensive taxonomy of security based on the model by combining the facets and synthesizing existing classifications of various aspects of security.

Findings

Fragmented, Scattered, and Divergent Taxonomies

Only a few knowledge organization systems (such as LCC, LCSH) contain fragmented taxonomies of security, and security-related terms are often scattered into multiple categories. Taxonomies of some aspects of security can be found in a few intensively studied domains, such as international security, national security, and information security. For example, ACMCSS has a Security and Privacy section, which covers information security categories and concepts in the computing field. Since a certain domain studies only a certain aspect of security, these taxonomies cover divergent aspects of security.

Various Definitions and Dimensions of Security

Security is an “essentially contested concept” without consensus.⁸ There is no common academic definition for security other than a dictionary definition. The Cambridge English Dictionary defines security as the protection of a person, building, organization, or country against threats such as crime or attacks by foreign countries.⁹ The dictionary definition has the sense of internal physical security and international security, but does not include all aspects of security. Table 1 shows several definitions of security from various security theories or perspectives. Table 2 shows various dimensions of security from various security perspectives.

Table 1. Several Example Definitions of Security from Various Theories or Perspectives

Theories or Perspectives	Definitions
Realism	“Security is achieved once threats to security can be prevented or at least managed.” ¹⁰ Objective sense (absence of threats). ¹¹ A realist believes conflict between states is inevitable. ¹²
Social Constructivism	“Security is ... intersubjective; constituted by a process of interaction and negotiation. Once the perception of security has changed, and the fear of one another is overcome, security is achieved.” ¹³ Subjective sense (absence of fear). ¹⁴
Common Security Approach	International security must rest on a commitment to joint survival rather than on the threat of mutual destruction. ¹⁵

Idealism	An idealist seeks “solution to international problems through collective security regimes and related methods... Tools favored by idealists include international norms, legal codes, and the use of collective international pressure for the adoption of agreed moral-ethical values by all nations.” ¹⁶
United Nations Development Program	Protection from sudden and hurtful disruptions in the pattern of our daily lives - whether in our homes, in our jobs, in our communities or in our environment. ¹⁷
Neorealism (Structural realism)	Security is treated as an attribute of situation of the state, equivalent to absence of military external conflict. ¹⁸

Source: Authors.

Table 2. Some Examples of Security Dimensions

Major Dimensions	Other Dimensions
Economic security	Individual security
Human security	Community security
International security	Ecological security
Military security	Food security
Political/cultural security	Global security
Resource/environmental security	Health security
State/National security	Personal security
	Regional security
	Social security
	Societal security

Source: Compiled by authors based on ¹⁹.

Overlaps in Major Aspects of Security

Major top-level aspects of security that are collected from LCC, LCSH, ACMCCS and security sectors’ research reports are international security, national security, human security, information security, economic security, homeland security. These categories may not be mutually exclusive. For example, “human security can be said to have two main aspects. It means, first, safety from such chronic threats as hunger, disease, and repression. And second, it means protection from sudden and hurtful disruptions in the patterns of daily life – whether in homes, in jobs or in communities.”²⁰ Most threats to human security “can be considered under several main categories:

- Economic security
- Health security
- Personal security
- Political security.”²¹
- Food security
- Environmental security
- Community security

National security encompasses within it economic security, monetary security, environmental security, military security, political security and security of energy and natural resources.²² Therefore, human security and national security have overlaps. The security dimensions listed in Table 2 may have overlaps.

Common Attributes of Security

Despite different definitions and various dimensions of security, there is a common feature of security. That is, we can express security in this pattern: Subject wants to protect object against source of insecurity using certain methods. Security has four aspects: Subject, object, source of insecurity, and method. According to the classical categorization theory, “all the entities that have a given property or collection of properties in common form [*sic*] a category. Such properties are necessary and sufficient to define the category.”²³ This common feature lays a foundation for the facet analysis of the complex security concept, which is discussed in the next section.

Developing a Tetra-Facet Model of Security

Library scientist S.R. Ranganathan first introduced facet analysis to denote the technique of separating the elements of complex subjects in relation to a set of abstract fundamental concepts.²⁴ Facets are “homogeneous or semantically cohesive categories” which are used to create term groupings of a subject discipline with a manageable size.²⁵ Facet analysis can “provide a framework within which all the various types of terms can be accommodated, together with rules for their combination.”²⁶ Facet analysis is conducted based on Ranganathan’s five fundamental categories that can be used to demonstrate the facets of a subject:

- Personality (P, the focal subject),
- Matter (M, the substance, properties or materials of the subject),
- Energy (E, including the processes, operations and activities),
- Space (S, which relates to the geographic location of the subject) and
- Time (T, referring to the time of the subject).²⁷

First, security is related to an entity that feels insecure and wants to protect something. The entity can be a person, organization, group, community, or nation. We can consider the entity to be the subject of security, and the scope of protection. Second, security is related to the objects that are to be protected, such as physical entities, economy, information, and environment. We can consider this to be the object of protection. Third, security is closely related to sources of insecurity, including threats, fears, vulnerabilities, and risks. Finally, people develop methods of protection or measures that mitigate sources of insecurity.

Subject, object, source, and method are the facets of security, which can correspond to Ranganathan’s personality (P), matter (M), energy (E), and energy (E) if we stretch his PMEST model a little bit. Subjects are entities

that concern security. Objects are what the subjects want to protect. Sources refer to the sources of insecurity. Methods are what subjects use to protect objects against the sources of insecurity. The four facets and some of their values are:

- Subject/scope of security: Entirety, individual, family, organization (government, military, company, school), ethnic/social group, community, region, nation/state, cross-nation, global system. The category of “nation/state” can have all the countries and regions as its members. Since security is often associated with a certain country, we can also separate “nation/state” from Subject/Scope, and treat it as a special facet. The category of “cross-nation” and “global system” can have international organizations as its members.
- Object of protection/concern: Entirety, body, property or asset (such as infrastructure, buildings, vehicles, and computer systems), territory, governance, economy, finance/income, environment, food/water, job, health, energy, information, internal stability (border). Note that property or asset may be expanded to include finance/income, job, and information.
- Source of insecurity: Threats, fears, vulnerabilities, and risks, such as war, war and violence within states, weapons proliferation, migration, hunger, infectious disease, environmental degradation, hazards, climate change, poverty, underdevelopment, social inequalities, man-made risks due to modernization (such as financial crisis), and socially-created disasters (such as destruction of water and electricity systems).
- Method of protection: Physical method, economic method, financial method, technological method, military method, cultural/psychological method, legal/political/social method (such as strategies, policies, laws, regulations, practices), comprehensive method.

Interestingly, Mesjasz proposed a core scheme of security, which includes reference object (corresponding to Subject/scope), security areas (corresponding to the security dimensions shown in Table 2), and methods for prediction of threats and planning of actions (corresponding to Method here).²⁸ Our facet analytical framework addressed above incorporated Mesjasz’s scheme of security.

The Space (S) and Time (T) facets can be added when needed. For example, if we would like to classify an article about “United States/Mexico border control in 1990s,” it is about U.S. National Security (that is, the subject facet) at the United States/Mexico border (that is, the space or location facet) in 1990s (that is, the time facet). However, the four facets (that is, subject/scope, object, source, and method) constitute the common core of the security concept.

The Method facet is much less systematically studied in the literature than the subject and object facets. ACMCSS has a section of security and privacy, which presents information security methods and services. Since security measures are critical in security management, a systematic study of security measures is needed in the future.

Developing a Comprehensive Taxonomy of Security

We can build a comprehensive taxonomy of security by using one of the four facets, or by combining two, or three, or four facets. For example, a list of Sources of insecurity or a taxonomy of Methods may be sufficient for some simple applications of security management. We can combine two or more facets to generate a category for more complicated applications. In the following, we illustrate the snippets of three taxonomies by nesting three facets in different orders using some of the facet values, considering that using three facets is sufficient to generate a comprehensive taxonomy of security. The three facets are Subject/Scope, Object, and Method. We use four security terms or topics – personal economic security, national security, and global anti-terrorism, U.S. National Security Strategy – to illustrate how to use the three taxonomies to categorize the four security terms or topics. In the three taxonomy snippets, S represents Subject/Scope, O represents Object, and M represents Method. For simplicity reason, we do not provide all values of any facet of S, O, and M.

Table 3. Taxonomy I Snippet: (Leading facet is Subject/Scope. Nested facets are Object and Method)

Subject/Scope	Object	Method	Category Instance
S1 Individual & Family	O1 Entirety		
	O2 Body		
	O3 Property	M1 Comprehensive method	1. Personal economic security
		M2 Physical method	
		M3 Financial method	
	M4 Legal, Political & Social Method		
S2 Community & Organization			
S3 Nation	O1 Entirety	M1 Comprehensive method	1. National security
		M2 Physical method	
		M3 Financial method	
		M4 Legal, Political, Social Method	1. U.S. National Security Strategy
	O2 Body		
	O3 Property		

S4 Cross-Nation & Globe	O1 Entirety	M1 Comprehensive method	1. Global anti-terrorism
		M2 Physical method	
		M3 Financial method	
		M4 Legal, Political & Social Method	
	O2 Body		
	O3 Property		

Source: Authors.

Table 4. Taxonomy II Snippet: (Leading facet is Object. Nested facets are Subject/Scope and Method)

Object	Subject/Scope	Method	Category Instance
O1 Entirety	S1 Individual & Family		
	S2 Community & Organization		
	S3 Nation	M1 Comprehensive method	1. National Security
		M2 Physical method	
		M3 Financial method	
		M4 Legal, Political & Social Method	1. U.S. National Security Strategy
	S4 Cross-Nation & Globe	M1 Comprehensive method	1. Global anti-terrorism
		M2 Physical method	
		M3 Financial method	
		M4 Legal, Political & Social Method	
O2 Body	S1 Individual & Family		
	S2 Community & Organization		
	S3 Nation		
	S4 Cross-Nation & Globe		
O3 Property	S1 Individual & Family	M1 Comprehensive method	1. Personal economic security
		M2 Physical method	
		M3 Financial method	
		M4 Legal, Political & Social Method	
	S2 Community & Organization		
	S3 Nation		
	S4 Cross-Nation & Globe		

Source: Authors.

Table 5. Taxonomy III Snippet: (Leading facet is Method. Nested facets are Subject/Scope and Object)

Method	Subject/Scope	Object	Instance	
M1 Comprehensive Method	S1 Individual & Family	O1 Entirety		
		O2 Body		
		O3 Property	1. Personal economic security	
	S2 Community & Organization			
	S3 Nation	O1 Entirety	1. National Security	
		O2 Body		
		O3 Property		
	S4 Cross-Nation & Globe	O1 Entirety	1. Global anti-terrorism	
		O2 Body		
		O3 Property		
	M2 Physical Method			
	M3 Financial Method	S1 Individual & Family		
S2 Community & Organization				
S3 Nation				
S4 Cross-Nation & Globe				
M4 Legal, Political, and Social Method	S1 Individual & Family			
	S2 Community & Organization			
	S3 Nation	O1 Entirety	1. U.S. National Security Strategy	
		O2 Body		
		O3 Property		
S4 Cross-Nation & Globe				

Source: Authors.

The three taxonomies can be useful to different user groups. Suppose we want to classify an article about “approaches to achieving economic security for individuals.” Taxonomy I, with Subject/Scope as its leading facet, can be useful to persons and organizations for managing security and information resources about security from a comprehensive perspective of security. We can classify the article as S1O3M1.1 Personal economic security. It emphasizes the Individual (S1) facet. Taxonomy II, with Object as its leading facet, can be useful to organizations for managing a certain aspect of security and information resources about a certain aspect of security. We can classify the article as O3S1M1.1 Personal economic security. It emphasizes the Property-Economy (O3) facet. Note that Economy can be a sub-category of Property, which is not shown in Table 4 due to limited space. Taxonomy III can be useful to organizations (such as government agencies and security service companies) which

study and develop security measures. We can classify the article as M1S1O3.1 Personal economic security. It emphasizes the Comprehensive Method (M1) facet. Since multiple organizations (subjects) may use certain security methods to manage multiple aspects of security (objects), Taxonomy III is worth further study and development.

Conclusion and Future Work

Security has various definitions and an expanding scope, and there is no comprehensive taxonomy of security. Only a few knowledge organization systems contain fragmented taxonomies of security, and security-related terms are often scattered into multiple categories. There are overlaps in major dimensions of security. Through thematic analysis of the literature of security, we learned various definitions and dimensions of security, and found a common feature of security. That is, we can express security in this pattern: Subject wants to protect object against source of insecurity using certain methods. This common feature allows us to do a facet analysis of the complex security concept, which reveals four facets: Subject/scope of security, Object of protection, Source of insecurity, and Method of security. We can build a comprehensive taxonomy of security by using one of the four facets, or by nesting two, three, or four facets. By nesting the facets in different orders to reveal the content of comprehensive security terms (such as national security, human security), we can build taxonomies of security for various user groups to manage security and information resources about security.

This study makes three contributions. First, it develops a tetra-facet model of security, which may be useful to security management. Second, it makes a methodological contribution by combining thematic analysis and facet analysis to build taxonomies of security, which is a complicated cross-disciplinary area. The method may be useful to domain experts, knowledge workers, and library and information science professionals for building taxonomies of other complicated domains. Third, it demonstrates three prototype taxonomy snippets of security, which may be useful to build full-blown taxonomies for managing information resources about security. In the future, a taxonomy of security methods is worth further study since multiple organizations may use certain security methods to manage multiple aspects of security, and security measures are critical in security management. The comprehensive taxonomy of security needs to be evaluated by security experts, information users, and perhaps to be revised based on their needs and feedback.

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