Ontology for Customer Reviews

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Summary

The present thesis provides a software solution which helps marketing expert to annotate customer reviews and gives an insight of the important aspects that marketing is interested. Customer reviews are important because they provide insight of the interests and concerns that clients have. This project is based in strong background research and real customer reviews found in recognized and widely used web pages, such as BestBuy and Amazon. The CRO ontology constructed in this project is founded in three main branches that surround Customer Reviews, which are Product, Customer and E-Business. The ontology defines the concepts found in the knowledge glossary.

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1 Project Outline

1.1 Problem

Today, the users of Internet generate large amount of data called User Generated Content (UGC) defined by the OECD (Michahelles, Tan, & Steiner, 2009) as content created outside professional practices, which is available to the public through the internet. The content comes in different forms like blogs, social networks, customer reviews and wikis. UGC is becoming an invaluable source for e-commerce to gather information about the opinions of users toward products. This project will address in particular the customer reviews.

The analysis of customer reviews can be used by marketing to understand and track their audience social behaviour and find what users think about the products. Web sites that implement UGC are interested in making activities that give users power over their content, because in consequence they add business value (van Dijck, 2009).

Ontology is defined as a way to describe concepts and relationships that enables knowledge sharing and reuse. The ontology consist on terms, definitions and axioms that relate them together (Burton-Jones, Storey, Sugumaran, & Purao, n.d.). In other words, Ontology is a "specification of conceptualization" (Gruber, 1993) that refers to objects, concepts and other entities in a knowledge domain.

Researchers analyse the customer reviews with generic ontologies, for instance DBpedia or Freebase, but they are not suitable because they are not able to capture the key aspects that they are looking for. Capturing the key aspects is one of the major challenges of the project.

Today, marketing researchers don't have a systematic way of approaching customer reviews. Therefore a research will be made to know if there are existing ontologies that could be used as a baseline. I will develop an ontology that captures the main concepts corresponding to the actual needs of marketing.

1.2 Aim and Objectives

The **aim** of this project is to define an ontology for analysing customer reviews and apply it over an existing corpus of customer reviews.

The specific **objectives** of the project are:

- Adopt an appropriate ontology methodology.
- Select appropriate knowledge sources, considering product review data sets and existing ontologies.
- Define the ontology constructs in the T-Box for domain specific and generic knowledge.
- Populate the A-Box with instances of the main concepts which will be seen in the product reviews.
- Conduct an appropriate ontology evaluation using an existing customer review corpus.

1.3 Minimum Requirements and Further Enhancements

Minimum Requirements:

- Analysis of the important aspects that marketing researchers look for in customer reviews.
- Ontology T-Box with the key concepts in RDF or OWL.
- Semantic Tagging of a corpus with the ontology.

Further enhancements of the project:

- Populate the ontology A-Box with instances
- Analyse the ontology fitness for purpose based on the augmentation.
- Test ontology with different corpus than selected and see its behaviour.

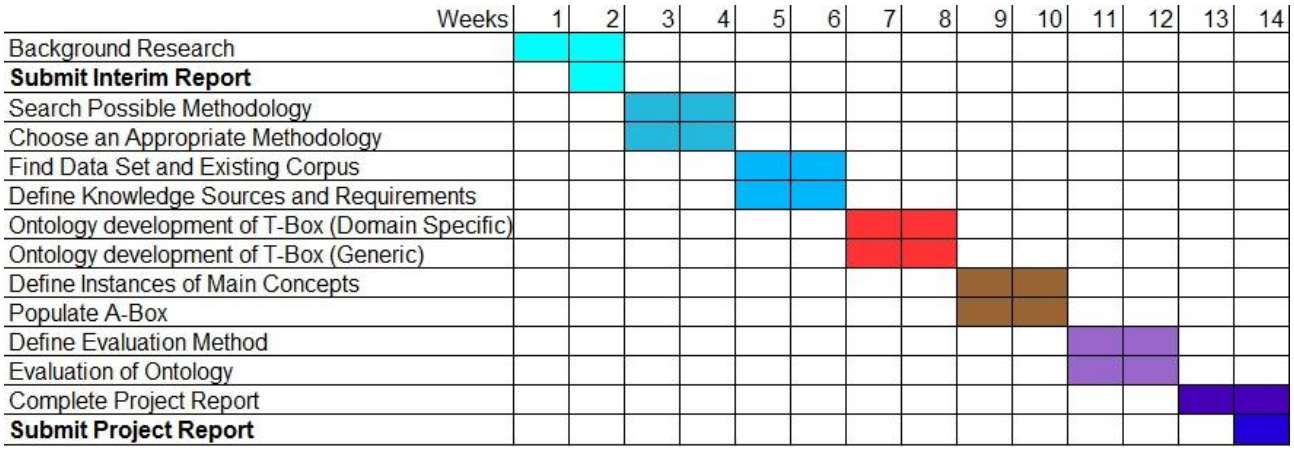
1.4 Deliverables

The deliverables for the project are:

- A project report with the adopting methodology, implementation and evaluation of ontology.
- Ontology that permits the analysis of customer reviews and applies it over an existing corpus.

1.5 Schedule and Progress

The schedule for the project work has been designed with the following Gantt Chart, contains the weekly tasks that will be conducted during the project starting from week June 13 and finishing in September 5th:



2 Background Research

The background research for the project will provide insight into the following areas:

- Customer reviews: This section will provide an overview of the different forms of User Generated Content, specifically Customer Reviews. The importance of Customer Reviews in marketing and the concepts marketing researchers are interested.
- Ontologies: Visualize different ontologies for e-commerce and the concepts they consider. There will be a particular focus on ontology methodologies and ontology evaluation.

2.1 Customer Reviews and Marketing

The goal of this section is to describe the importance and functions of customer reviews in marketing. Also, refer to key concepts marketing search in customer reviews.

User Generated Content is having a rapid growth and is currently present in e-commerce. Is also becoming a viable electronic medium to consume content generated by persons outside the professional practices; it also captures the user as a product feature (Krishnamurthy & Dou, 2010). An important type of online advertising that makes use of UGC is the electronic word of mouth (eWOM). This type of advertising is applied in online forums in which the consumer refers products or services to other consumers on the Internet(Cheung, Luo, Sia, & Chen, 2009).

Marketing is trying to become part of the communications process and making the consumers engaged with their brand by making use of UGC. The main reason is that consumers trust and are persuade by UGC. For example, Amazon invites consumers to write product reviews to help influence buying decisions in other customers. Therefore, in general the UGC is being considered in different areas of marketing. A classification of them is given in Table 1, was purposed by (Krishnamurthy & Dou, 2010) . We can observe that customer reviews is highlighted in bold because is the particular UGC addressed in this project.

The classification divides in different categories divided in rational and emotional. The rational category is related to sharing knowledge and advocating a particular stand towards different issues like opinion of products. The emotional category is related to building social connections or entertainment. Also we can classify the UGC by the way is created, either by a group of persons or individually.

Table 1 Classification of User Generated Content

		Psychological Motivation for Engaging in UGC Creation			
		Rational		Emotional	
		Knowledge Sharing	Advocacy	Social Connections	Self-Expression
Platform Base	Group	Wikis	Centric communities	Multiplayer online games	Virtual presences
	Individual	Blogs	**Customer reviews**	Social networks	Consumer creative inventions

The Customer Reviews are important for marketing research, this reviews have to be recollected and analysed in order to obtain valuable information. Today that job is hard to do regarding that the reviews are recollected manually ("How Can User-Generated Content Fit in Your Marketing Mix? » iAcquire," 2014). Also marketing research has different approaches to use customer reviews and an automated process for using them has not being developed. Service providers have a limited understanding of online customers and usage behaviours. Regarding this reasons, one of the aims of the project is to provide a solution tool for helping marketing researchers to understand customer reviews and obtain aggregated value from them.

Firstly, attempts have been developed to make a classification of customer reviews. Service providers (Journal, Management, & Complete, 2004) should uncover the important attributes that customers utilize in their assessment of service quality and satisfaction. Secondly, there are different attempts for developing a systematic approach of eWOM. Examples are seeking and providing behaviours, motivations, types and format, features of advertising and consumer psychological responses to advertising (Eastin et al., n.d.).

The product knowledge exchanged by the eWOM has great quantity and diversity of information. The users discuss a brand from different perspectives that are important to them, they mention attributes like price, reputation of the brand, effectiveness of the products and also potential problems they had with the use of the product or service (Lee & Youn, 2009). The eWOM builds trust and fosters cooperation which has important impact in activities of marketing in terms of brand building, customer acquisition, customer retention and product development ("The Digitization of Word of Mouth : Promise and Challenges of Online Feedback Mechanisms," 2003). Likewise, eWOM is

present routine life of customers, making it critical for firms and organizations to understand the effects it has on their managerial decisions (Duan, Gu, & Whinston, 2008).

Customer Reviews (CR) can:

- Confirm that the buyer is making the right choice to look for this product and to buy it, giving the customer confidence and trust. Good reviews minimize the risk of a buyer. According to an eMarketer survey, Customer Reviews are significantly more trusted (nearly 12 times more) than descriptions that come from manufacturers.
- Improve customer trust, with a mix of positive and negative reviews. Reevoo suggest that the presence of bad reviews actually improves conversions by 67%.
- Increase the click-through rate, CR increase the possibility of being seen when persons search for a query before entering the website. It gives a better idea of the content and products on that particular page. Also, increases the traffic on the site and the conversion rate.
- Provide Fresh content updating CR, having unique and updated content which is optimized for future customer search and queries.
- Give power over negative reviews. CR show how well the business can improve the service. Taking the reviews and solving the issues, leads to a place where the customers are happy and shows that your business is real. People appreciate the honesty, an answer to a complaint, with a well reply, shows that the business listens to its customers.
- Provide customers with a better understanding of the products, having as a result, less complaints and less returns.
- Give insight that reveals specific values, behaviours, habits, needs and expectations of the customers.
- Offer an improve understanding of the market. This affects diverse areas such as product development and merchandising. The more CR are read, the more knowledge marketing acquires.
- Helps identify the weaknesses that need to be corrected or strengths that need to be reinforced. They also highlight dimensions and detailed attributes of service quality that are of great concern.

To win and retain customers, companies need to understand what customers want and know how they behave. Focusing on the right data and involving the customers in the planning process is essential and necessary.

Online reviews are now essential to must purchasing decisions, reason why the businesses cannot afford to ignore them anymore.

According to a Review Survey from BrightLocal, 2013:

- 79% of consumers trust online reviews as much as personal recommendations.
- 73% of consumers say positive customer reviews make them trust a business more.
- 68% of consumers place greater trust in business with with good and bad reviews.

(Source: Local Consumer Review Survey 2013 from BrightLocal)

"88% of online shoppers admit to using customer reviews as part of their purchase decision-making process". Therefore, online reviews define the buying process. CR are the second most influential factor in shopping decisions (recommendation from friends is the first).

Reevoo is an online company that contains CR that are genuine, impartial and independent. According to Reevoo, 50 or more reviews per product can mean a 4.6% increase in conversion rates.

Also 63% of customers are more likely to make a purchase from a site which as customer reviews (iPerceptions, 2011). Customers tend to navigate towards products that have good reviews and give an overall picture of the performance of the business.

"Most online services providers have encountered substantial problems and challenges in furnishing online service quality." One of the reasons is the limited understanding of online customers usage behaviour. It is desirable, for online service providers to uncover what attributes customers utilize in their assessment of overall service quality and satisfaction. Few studies have been made to identify which attributes are more important, identify quality dimensions and detail aspects of online service and their relationships with customer satisfaction.

There are different aspects that marketing is searching in customer reviews and UGC, in this section I will describe the important concepts that will be taken as a base to build the ontology and understand the key aspects that marketing is expecting to find in UGC, particularly customer reviews.

A research was conducted to understand service quality and satisfaction in consumer reviews. The paper purposed by Yang and Fang, established the service quality dimensions that lead to online customer satisfaction. They purpose a framework built on different aspects. Firstly, online services share some common territory related to traditional interpersonal services. Secondly, Web-based technologies have been used to automate product distribution and customer services.

An interesting area for obtaining insight of the aspects marketing is searching is netnography which Wikipedia defines as the branch of ethnography that analyses the behaviour of individuals on the

internet and uses online marketing research techniques to provide useful insights ("Netnography - Wikipedia, the free encyclopedia," 2014). Netnography is important because it studies the impact of customer reviews. Netnography identifies the different motives when customers seek information, mainly from opinion platforms like Amazon. The motives are general drivers that direct the consumer to satisfy their needs. As a result, the consumers read reviews from other persons (Hennig-Thurau & Walsh, 2004).

Classic challenges in marketing are pricing, brand positioning and new product development are rooted in an analysis of product substitutes inferred from market structure. Customer Reviews help the analysis by identifying attributes and brand's relative positions. Context is an important factor to personalized recommender systems. Today, most of the recommendation techniques aim at item level contextual information for modelling users preferences. There is a proposed approach to use UGC to infer and combine the preferences of customers. The contextual preference, is related mainly to the overall and evaluation of an item, rather than multiple aspects of the item, such as atmosphere and service. CR let us derive the relation between aspects and context.

A phrase that resumes the information mentioned in the previous section is from Brandwatch, a marketing research company, establishes: "Consumer insights don't just come from conversations about brands. The more broadly you look, the more aspects you will discover about your target consumers' behavior, feelings, and interests" (Listening, 2014).

The aim of this section is to understand the different aspects of semantic augmentation such as: concepts, importance, evaluation and its relation with ontologies.

Semantic Augmentation (SA) is "a process of attaching semantics to a selected part of a text to assist automatic interpretation of the meaning conveyed by the text" (Thakker, 2012). In simple words, SA is the glue that combines ontologies with documents like web pages. SA is a powerful method that can be used to get insight of UGC, but is dependent on the quality of the ontology.

The functions of Semantic Augmentation is organize, search and browse in online web-pages and infer knowledge on a selected domain.

Semantic Augmentation has three phases (Sanusi, 2013) which are:
Text Processing which applies Natural Language Processing modules to textual input for obtaining an initial form. This form is base for the following phases. The aim is understand the structure of the

textual content by arranging it into sentences and phrases; also identifying grammar tags like verbs and nouns.

Enrichment that takes the initial form of text processing and enriches it with linguistic and semantic resources to increase the probability of a word being mapped to the domain ontology in the following phase (semantic annotation)

Semantic annotation links the base form and the enriched form from the ontology entities. It has different modules e.g. Sentence splitter, named entity recognizer, and orthographic matcher.

Semantic augmentation has ontology as a baseline. The ontology is defined as a way to describe concepts and relationships that enables knowledge sharing and reuse. The ontologies consists on terms, definitions and axioms that relate them together (Burton-jones et al., n.d.). In other words, Ontology is a "specification of conceptualization" (Gruber, 1993) that refers to objects, concepts and other entities in a knowledge domain. The ontology is a reference model that plays a key role in inferring semantics behind User Generated Content (Sheth & Nagarajan, 2009).

Semantic augmentation is evaluated based on hand-annotated gold standard which will be used to evaluate the output of semantic augmentation. Gold standard (Sabou, 2012) regulates information extraction and information retrieval, uses quantitative measures of precision, recall and F-measure. Is also an evaluation metric for interoperability, clarity, taxonomical and relation similarity.

2.2 Ontologies for E-Commerce

Different ontologies exist for User Generated Content, in areas of social networks and media, but today ontologies for customer reviews not satisfy the general requirements of marketing. The aim of this chapter is to provide different examples of existing ontologies to provide a picture of the actual ontologies and their components, and most important to mention and extract key concepts and relevant information to create the ontology for costumer reviews.

Firstly, we have **ontologies of classification** of products in e-commerce. These are lightweight ontologies which have concepts and some relations. The ontologies are (Corcho, 2007) :

- UNSPSC: United Nations Standard Products and Services Codes that is organized in five level taxonomy products that are segment, family, class, commodity and business function. It contains an approximate of twenty thousand products organized in fifty five segments.
- NAICS: classifies products and services in general. Identified by a six digit code that enables flexibility with sectors and subsectors.

- E-cl@ss: contains approximately twelve thousand products organized in twenty one segments, process control systems and computer devices with approximately four hundred concepts.
- RosettaNet: classification based on the names of product it defines, based on UNSPSC classifications with two levels in product taxonomy: RN Category (group product) and RN Product (specific product). The order of its components is relevant because the relationship and category is given by the order they appear.

The previous ontologies only categorize the products in five different classifications, which are very general. Marketing research obtains poor results using these ontologies because they are very common and are only used as basic concepts.

Secondly, **Good Relations Ontology** (Hepp, 2008) has as a goal to make a unified view on e-commerce data. It considers manufacturers, payments, shop offerings, auctions, spare parts and consumables, warranty, delivery and retailers.

The Good Relations Ontology considers more things than the previous classification ontologies; it takes more aspects of e-commerce. Is not enough for analyzing customer reviews because is lacking of specific concepts such as aesthetics, color, tags, manuals, etc.

Thirdly, **CEO-Consumer Electronics Ontology** ("CEO: Consumer Electronics Ontology - An Ontology for Consumer Electronics Products and Services," 2014) is domain specific of consumer electronics services, product and their specific features. Consist of forty nine classes and approximately five hundred instances. Examples of features are memory and resolution. Products like cameras, computers, and tablets.

The CEO ontology considers more specific attributes regarding the domain of electronics. This ontology will be used as the baseline to evaluate (Gold Standard) the ontology created in this project. Also, the ontology will be considered to specify more domains and requirements.

3 Ontology Methodology

The creation ontologies require the adoption of an appropriate methodology. This section will describe the constraints of the domain ontology, the different model methodologies for building ontologies and the steps of diverse methodologies adopted to construct the customer reviews ontology.

3.1 Ontology Methodologies

Several methodologies exist for building an ontology, in the following pages we will review the main methodologies and mention which one is going to be adopted in this project.

The methodology that will be adopted in the project requires tasks and methods that correspond with the specific constraints of our domain (marketing research). The domain experts are involved at the beginning of the development; examples of the task are the performed marketing research interview, background established in UGC and previous basic knowledge that the author had. The motivating scenario was shaped by the literature review and questionnaires with domain experts. In a following stage, the purpose and scope can be established. Iterative design will be used to build the ontology.

METHONTOLOGY (Blázquez, Fernández, & Jm, 1998) is based on a methodology for developing knowledge system, is detailed in general. The analyst and developers require knowledge to use ODE tools. Enables the construction of ontologies, is application independent and the recommended lifecycle is evolving prototypes.

Uschold and King´s method (Uschold & Gruninger, 2009) has stages of acquisition, coding and evaluation but doesn't have prototyping or feasibility study. The method lacks of techniques and activities in detail. The main steps of the methodology are:
Identify purpose and scope. Build the ontology (capture and coding), integrate existing ontologies. Evaluation and Documentation. They are guidelines for each phase.

Gruninger and Fox methodology (Gruninger & Fox, 1995) consist in six purposed steps:

1. Capture motivating scenarios
2. Formulation of competency questions
3. Specification of the terminology of the ontology in first order logic
4. Formulation of formal competency questions
5. Specification of axioms and definitions for terms (axioms)
6. Establish conditions for completing the ontology (theorems).

3.1.1 Constraints of the Project

To find and adopt a methodology, the specific constraints of our domain have to be considered as follow:

- The availability of domain experts of marketing researchers is to some degree limited. Their views are important to establish the requirements of the ontology. Is important to mention that marketing researchers lack of ontology engineering skills.
- General requirements, as mentioned in previous sections, are not specified in a concrete manner and have different approaches. Making a practical solution proposal for solving this problem.
- Since the scenario is complex and not clear about the concepts that will be consider, is important to establish a realistic scope.
- The author has a basic idea about the domain and needs to get more expertise regarding marketing and customer reviews.
- The author has little experience in ontology engineering skills and needs to develop them in a more efficient way for acquiring the knowledge.
- The iterative design is needed (at least one complete cycle) because of the inexperience with ontology engineering and with the domain.

3.1.2 CRO Methodology

The methodology implemented in this project is based on the best practices mentioned before.
The main steps of the methodology are:

1. Identify the requirements specifications:
    - Identify the purpose of the customer reviews ontology.
    - Identify the scope of the customer reviews ontology, using interviews and requirements established in previous ontologies and scenarios of marketing.
2. Create a conceptual model:
    - Identify the key concepts (general and specific) and relationships.
    - Building a conceptual glossary.
3. Code the logical model.
4. Validate the ontology and evaluate semantic augmentation.

4 CRO Requirement Specifications

4.1 Ontology Purpose and Scope

Ontologies are developed for domain experts, in this case marketing researchers. For example, the united nations develop the ontology UNSPSC which provides a general classification of products and services to help the supply management of businesses across the world.

The purpose of this ontology is to identify the key aspects which marketing experts are looking in customer reviews. The intended use of the ontology is to provide answers to marketing queries regarding CR.

4.2 Knowledge Sources

Defining the knowledge sources, permit the analysis and clarification of relevant information needed to understand the concepts of CR that marketing is interested.

An interview with a marketing researcher was made in order to obtain an initial draft of the main concepts which the ontology should include, the following figure shows a concept map with the concepts gathered in the interview.

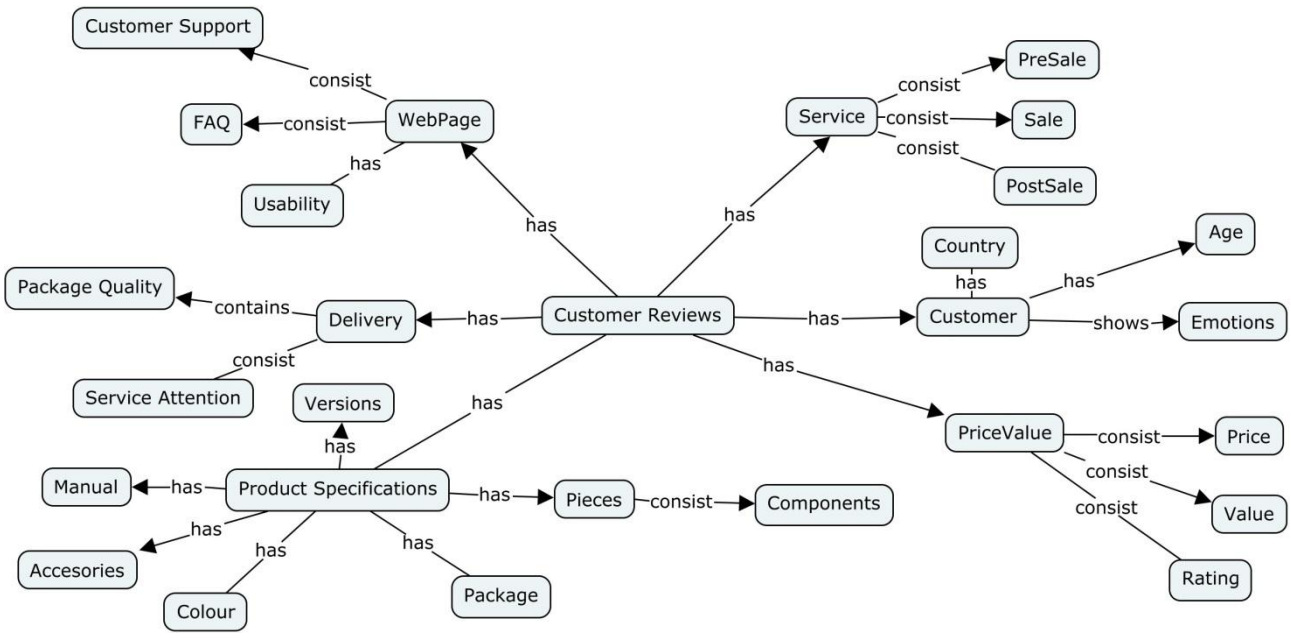


Figure 1 Customer Reviews Concept Map with marketing concepts

During the interview was mentioned an important concept in marketing, which is the strategic framework of marketing mix**.** After the meeting, research of this concept was made regarding the importance it has in marketing. An abstract is presented in the following paragraphs.

Marketing mix is a strategy tool for developing competitive strategies. It helps the companies to review and define key issues that have effect in the marketing department of the company (involving products and services). Marketing mix was proposed by Jerome McCarthy in 1960,the term is referred as the 4 Ps of Product, Price, Place and Promotion. In these days, is still used as essential part of marketing strategy. Recently, the marketing mix has been extended to 7 Ps which reflect service delivery, they are People, Process and physical evidence. (Booms and Bitner, 1981).

The internet provides opportunities for the marketer to vary the marketing mix. Marketing mix is a framework used for marketing development. The following image provides the uses of internet and the 7Ps of marketing mix.

Table 2 Internet and essential features of marketing mix

Internet and essential features of marketing mix						
Product	**Promotion**	**Price**	**Place**	**People**	**Process**	**Physical evidence**
▪ Quality	▪ Marketing communications	▪ Discounts	▪ Trade channels	▪ Individuals on marketing activities	▪ Customer focus	▪ Online experience
▪ Design	▪ Sales promotion	▪ Credit	▪ Sales support	▪ Customer service	▪ IT-supported	▪ Product packaging
▪ Usability	▪ Branding	▪ Free or value-added elements			▪ Design features	
▪ Value	▪ Endorsment				▪ Research and development	
▪ Quality	▪ Gifts				▪ Service delivery	
▪ Brand					▪ Complaints	
▪ Features						
▪ Variants						
▪ Customer service						
▪ Use ocassion						
▪ Availability						
▪ Warranty						
▪ Accesories						

The features of the marketing mix that apply to Customer Reviews will be taken in consideration to build the concepts of the ontology.

Another relevant concept is marketing aesthetics. These are experiences of brand output that contribute to the brand's identity. In this days, globalization provides ideal conditions for marketing

aesthetics. The term marketing aesthetics refers to the structural and the referential qualities of brands aesthetics. The domain of marketing interested in aesthetics is:
Product and graphic design, where function and form are distinguished. Function involves the different attributes of a product or services. Form is the packaging of the product or service. Also, Internet offers different ways to vary the product the consumer is buying, for example, in electronics, when the consumer buys a new computer, it consist on the tangible computer and service it contains, such as: instruction manual, packaging, warranty and follow-up technical service. The internet can be used to vary the extended product with warranties, awards and customer service.

Sanusi (2013) provides in-depth analysis of semantic augmentation in CR, using as a base the CEO ontology and tools such as:

- WordNet for synonyms over thesaurus (SUMO for mapping)
- Disco for synonyms over text corpus
- BestBuy corpus for obtaining the data sets.

4.3 NEON Requirements Form

The goal of the ontology specification is to specify the reason which the ontology is being built, its intended uses and users, as well as the ontology requirements. The NeOn methodology contains a filling card to specify the requirements in a clear way, the NeOn requirement form is shown in the following table:

Table 3 NeOn Requirements Form

CR Ontology Requirements Specification		
1	Purpose	
	The purpose of building the CR Ontology is to provide marketing experts a model that represents the main aspects contained in customer reviews.	
2	Scope	
	The ontology focus on general aspects of customer reviews, its been validated particularly in the domain of electronic products.	
3	Implementation Language	
	The ontology is implemented in OWL	
4	Intended Users	
	User 1. Marketing expert who needs to gather aspects of Customers Reviews.	
	User 2. CEO of company which offers E-Business services and needs an abstract of important data in Customer Reviews.	
	User 3. Marketing researcher which wants to analyze the situation of its clients and prepare a marketing campaign.	
5	Intended Uses	
	Use 1.	Provide annotation of Customer Reviews
6	Pre-Glossary of Terms	
	a.	Product
	b.	Feature
	c.	Function
	d.	Package
	e.	Brand
	f.	Usability
	g.	Version
	h.	Installation
	i.	Quality
	j.	Size
	k.	Portability
	l.	Durability
	m.	Aesthetics
	n.	Coupon
	o.	Discount
	p.	Manual
	q.	Warranty
	r.	Component

	s.	Accessory	
	t.	Occupation	
	u.	Purpose	
	v.	Experience	
	w.	Affect	
	x.	Content	
	y.	Service delivery	
	z.	Availability	

5 CRO Conceptualization

Based on the information found of the Knowledge Sources mentioned in the previous section, the first version of the T-Box was made. The T-Box descries the conceptualization, in other words describes the set of concepts and properties.

5.1 First Version of Conceptualization

As mentioned before, the marketing requirements gathered previously in the interview, literature review and previous ontologies, the first version of the T-Box was elaborated. The result of the ontology is shown in the following figure:

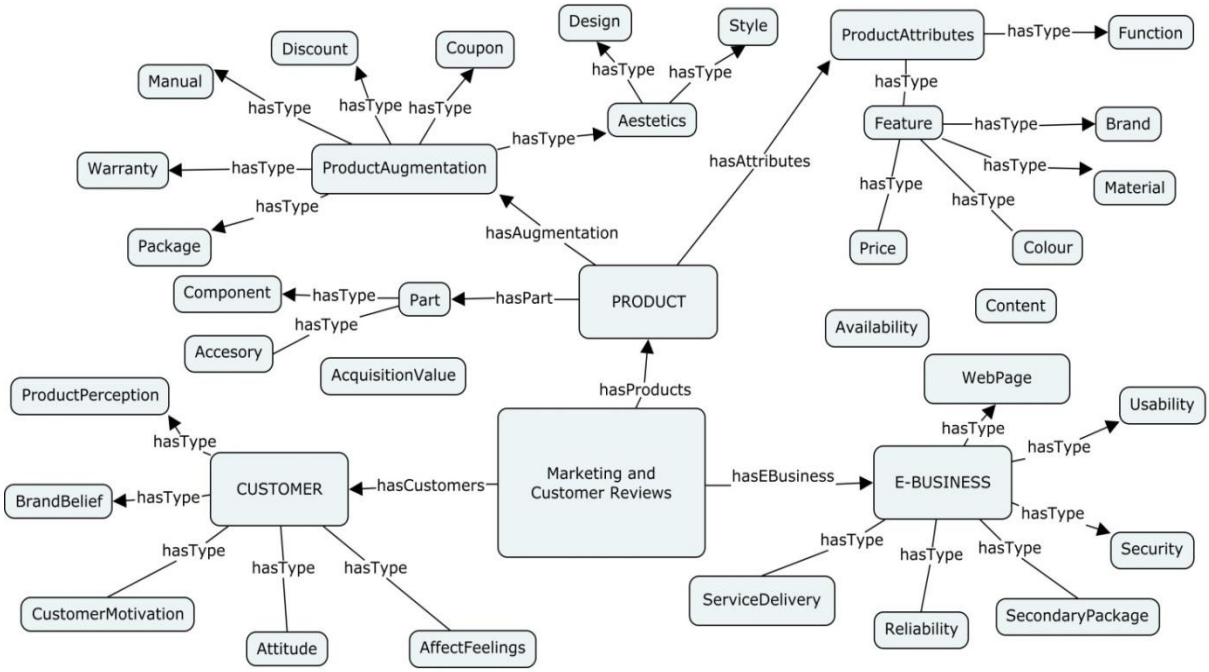


Figure 2 First Version of the T-Box

5.2 Validation based on BestBuy and Amazon Datasets

The stage of validation is part of ontology evaluation which gives us the answer to the following question: are we producing the right ontology? Validation is the activity that compares the meaning of the definitions against the intended model that aims to conceptualize, in this part a comparison within two different datasets is made against the ontology, which gives as a result the concepts that match with the ontology, the concepts that are not consider and the concepts that are misclassified.

The BestBuy dataset was adopted from Sanusi´s thesis (Sanusi, 2013). This particular dataset is specific in the field of electronics, while Amazon, the data set used for this project is broader. The ontology developed in this project is generic; therefore it should work on the CEO ontology. To evaluate the results of the semantic augmentation, she used a gold standard composed by human annotators (seen as potential customers). For the annotations, Sanusi used CrowdFlower,, a human computation to conduct non-expert annotations, taking the majority view as a gold standard. The BestBuy dataset was based in 50 different reviews of eight electronic products which were a playbook, printer, smart tv, monitors, camcorder, digital camera and MP3 player. The reviews were selected by a random calculator and were selected with a representative 10% out of the total count reviews.

The following table shows a representative annotation of two products in which the ontology captures the concept, being a direct matches or has approximate matches where the concept is not completely considered in the ontology or there are doubts of its classification. Appendix D contains the complete dataset of the BestBuy reviews annotations.

Table 4 Example of BestBuy dataset.

Product Category	Customer Review ID	Annotation	Ontology Concept	Instance	UserPerception Value	Validation	Comments concepts of Ontology
Tablet (Blackberry)	TBR01	1. Browser is faster	Component	Browser	fast	Direct match	
Tablet (Blackberry)	TBR01	2. Multitasking capability	Function	Multitasking		Direct match	
Tablet (Blackberry)	TBR02	1. Doesn't sync with macs	Function	Device synchronisati	lacking	Approximate match	Not sure that synchrinisation is a feature
Tablet (Blackberry)	TBR02	2. Lacks features such as auto capitalization	Function	Auto capitalisation	lacking	Approximate match	User says that auto capitalisation is a feature
Tablet (Blackberry)	TBR02	3. Love the size	Size		love	Direct match	
Tablet (Blackberry)	TBR02	4. Touch capabilities	Function	Touch		Approximate match	User says that this is capabilities
Tablet (Blackberry)	TBR02	5. Not being able to attach docs to emails	Function	Attach documents to	lacking	Direct match	

The Amazon dataset was manually elaborated in during this project. The domain considered was also the field of electronics because Sanusi´s dataset was annotated by potential clients and the Amazon dataset was annotated by a person that has knowledge in marketing. Also, the reviews were selected

by a random calculator, in which there is a probability that negative comments were not consider or comments which are classified with three stars out of five, for this reason, in the Amazon dataset, the reviews were taken by the same electronic type of products and with a random calculator considering two reviews in each star ranking (Amazon gives one to five stars in which the customer gives a ranking, being one in disagreement with the product and five absolutely recommending the product). This way, the negative and positive comments are considered.

The following table has two parts, it shows a customer review from Amazon which was annotated and shows the validation made with the ontology. Appendix E contains the Amazon Reviews and its annotations. Appendix F contains the Amazon Reviews dataset with the correspondent validation.

Table 5 Example of Amazon annotation and validation

Product Category	Review ID	Customer Review	Annotation
Tablet (Android)	TAR01	For the price this is a great tablet. Dispatched very quickly. And i have found fusion very helpful when i asked question about this tablet. Works great through the LG TV with the Hdmi cable, super picture. Would recommend this tablets to every body, for the price a great buy	1. great tablet 2. dispatched very quickly 3. fusion very helpul 4. works great 5. LG TV 6. super picture 7. for the price a great buy

Product Category	Customer Review ID	Annotation	Ontology Concept	Instance	User Perception Value	Validation	Comments concepts of Ontology
Tablet (Android)	TAR01	1. great tablet	Component	tablet	great	Direct Match	
Tablet (Android)	TAR01	2. dispatched very quickly	Service Delivery	dispatched	very quickly	Direct Match	
Tablet (Android)	TAR01	3. fusion very helpul		fusion	very helpful	Uncertain about concept	fusion describes quality, concept that will capture fusion
Tablet (Android)	TAR01	4. works great	Function	works	great	Uncertain about concept	not sure if works correspond to a function or to experience concept
Tablet (Android)	TAR01	5. LG TV	Brand	LG TV		Direct Match	
Tablet (Android)	TAR01	6. super picture	Component	picture	super	Direct Match	
Tablet (Android)	TAR01	7. for the price a great buy	Acquisition value	price	great buy	Uncertain about concept	Clear price and acquisition value in this type of cases mentioning price but also value

For easy visualization, a table with the overall of both datasets was made, in which we can observe the total reviews and annotations that were made. As well as the concepts that the CRO ontology captures, misses, or its uncertain where is classified.

Table 6 Overall View of BestBuy and Amazon datasets

	BestBuy Data Set	Amazon Data Set
Direct Matches	114	112
Approximate Match	15	21
Missing Concept	26	24
Uncertain Concept	15	24
Uncertain Property	9	13
Total Annotations	**179**	**194**
Product	BestBuy Reviews	Amazon Reviews
Tablet	8	7
Printer	5	8
TV	17	7
Camcorder	4	6
Camera	8	8
MP3 Player	8	8
Total Reviews	**50**	**44**

5.3 Final Conceptualization

The previous validation gave the metrics of strong and weak precision, vagueness and missing concepts, which are represented in the following table:

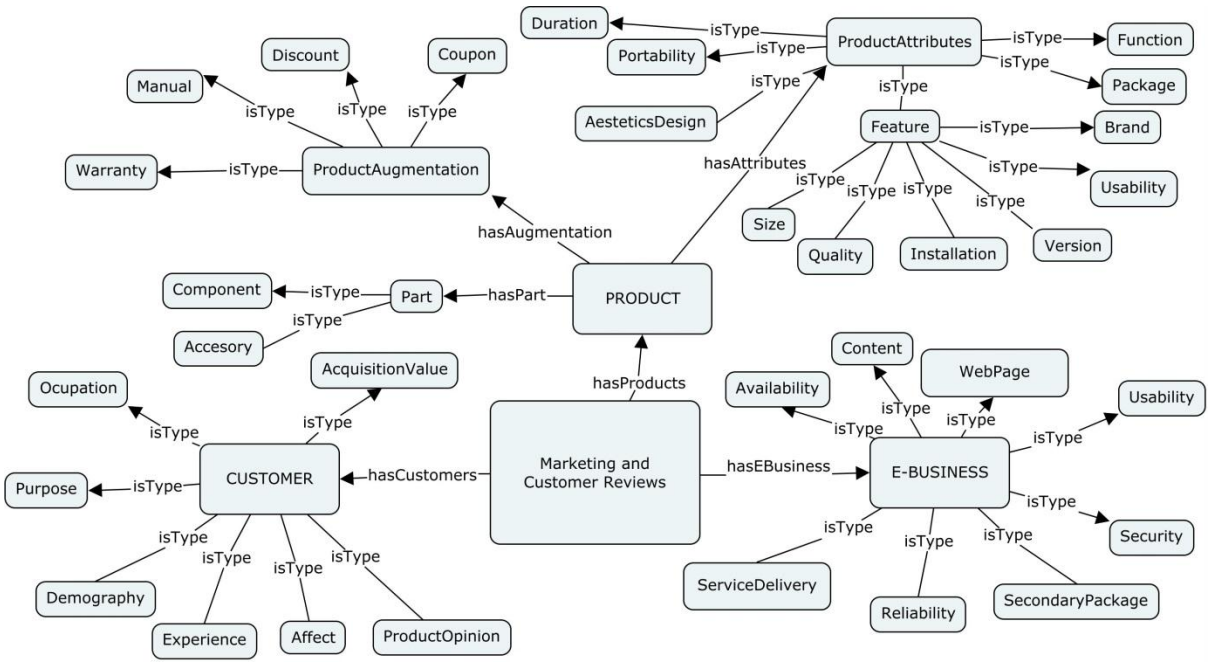
Table 7 Validation metrics and concepts

Validation	Concepts
Strong Precision Direct match from both data sets	1. Component 2. Function 3. AcquisitionValue 4.Affect 5. Size 6. Brand 7. Package 8. Design 9. Price 10. Accesory
Weak Precision Direct match in one of the data sets	1. Service Delivery 2. Secondary package 3. Experience 4. Manual 5. Demography 6. Purpose
Vagueness Either approximate match or some uncertainty (concept or property)	1. Aesthetics (Design or Style) 2. Component (Material) 3. Acquisition Value (Price) 4. Usability (Easy to use) 5. Innovation (Packaging)
Missing Concepts (false negatives) **A**nnotations not included in ontology	1. Quality 2. Usability 3. Evaluation of product 4. Installation 5. Weight 6. Product name 7. Portability 8. Version/Model 9. Recommendation 10. Product lifecycle/duration
Unused concepts (false positives) Concepts are in ontology but not appear in annotations	1. Coupon 2. Usability (e-business branch) 3. Availability 4. Content 5. Security

The previous validation metrics were used to do a final conceptualization of the ontology where , the missing concepts were considered and added to the ontology T-Box, the

vagueness concepts were analysed and the changes in the T-Box were made, consequently the concepts were re-established. For example, in the case of aesthetics, design and style of aesthetics were previously considered, but for the customer the concept is the same. Regarding this, the aesthetic concept was finally considered as aesthetic design by its own. The next figure represents the T-Box after the validation.

Figure 3 Second Version of the T-Box



With this version of the T-Box, the beginning of the coding of CRO ontology was about to start. Before coding, The Knowledge Glossary was needed. The Knowledge Glossary gives the definition of the concepts.

5.4 Knowledge Glossary

Concept	Synonym	Natural Language Description	Source
Product		A bundle of attributes (features, functions, benefits, and uses) capable of exchange or use; usually a mix of tangible and intangible forms. Thus a product may be an idea, a physical entity (a good), or a service, or any combination of the three. It exists for the purpose of exchange in the satisfaction of individual and organizational objectives. The term for tangible products is goods, and it should be used with services to make the tangible/ intangible pair, as subsets of the term product.	AMA Dictionary
Product Attributes	Attributes	The characteristics by which products are identified and differentiated. Product attributes usually comprise features, functions, benefits, and uses.	AMA Dictionary
Feature		Is one of the distinguishing characteristics of a product or service that helps boost its appeal to potential buyers.	Business Dictionary
Function		An action performed by a product or person that produces a result. Function remains fix whereas the purpose (which indicates intention or objective) generally changes. For example, the function of a hammer is to strike something nearby whereas its purpose (what to strike and why) could be anything the person has in mind.	Business Dictionary
Package		The container used to protect, promote, transport, and/or identify a product. The package may vary from a plastic band wrap to a steel or wooden box or drum. It may be primary (contains the product), secondary (contains one or more primary packages), or tertiary (contains one or more	AMA Dictionary
Brand		A brand is a "Name, term, design, symbol, or any other feature that identifies one seller's good or service as distinct from those of other sellers."	AMA Dictionary
Usability		Ease, speed, and intuitiveness in operating or using a device, service, or facility. Usability arises from a combination of well thought-out architectural and design factors, and translates into user's ability to successfully perform tasks and solve problems with customary effort.	Business Dictionary
Version	Model	One or several releases of the same product containing major changes.	Business Dictionary
Installation	Set up	Connection to services required to make the product equipment ready for operation.	Business Dictionary
Quality		The measure of any particular attribute a product has (what flavor, how much, how lasting). The measure of the intended customer's reactions to that attribute, how it is liked, its affect.	AMA Dictionary
Size		Those sizes that are usually large, small, or extraordinary in some respect.	AMA Dictionary
Aesthetics Design		Concerned with beauty or the appreciation of beauty.	Oxford Dictionary
Durability		Assurance or probability that an equipment, machine, material will have a relatively long continuous life, without requiring an inordinate degree of maintenance.	Business Dictionary
Portability		Able to be easily carried or moved, especially because being of a lighter and smaller version than usual.	Oxford Dictionary

Part		In manufactured products are bought as components of other goods being produced. Parts are often sold simultaneously in industrial channels (original equipment) and in consumer channels for replacement purposes	AMA Dictionary
Component		Uniquely identifiable input, part, piece, assembly or subassembly, system or subsystem, that is required to complete a product or is intended to be included as a part of a finished, packaged and labeled item.	Business Dictionary
Accessory		An essential or useful auxiliary item that can be attached to or removed from a product without damaging either or the product which it can be attached.	Business Dictionary
Product Augmentation		This is the view of a product that includes not only its core benefit and its physical being, but adds other sources of benefits such as service, warranty, and image. The augmented aspects are added to the physical product by action of the seller, e.g., with company reputation or with service.	AMA Dictionary
Warranty		A statement or promise made to the customer that a product being offered for sale is fit for the purpose being claimed. The promise concerns primarily what the seller will do if the product performs below expectations or turns out to be defective in some way.	AMA Dictionary
Manual		Comprehensive and step-by-step guide to a particular product that also serve as a reference book.	Business Dictionary
Discount		A reduction in price.	AMA Dictionary
Coupon		A printed certificate entitling the bearer to a stated price reduction or special value on a specific product, generally for a specified period of time. The value of the coupon is set and redeemed by the seller.	AMA Dictionary
Customer		The actual or prospective purchaser of products or services.	AMA Dictionary
Acquisition Value		The buyers' perceptions of the relative worth of a product or service to them. It is formally defined as the subjectively weighted difference between the most a buyer would be willing to pay for the item less the actual price of the item. Also related to price, in which any particular lower price item might be said to have good quality for the money; this use equates product quality with product value.	AMA Dictionary
Affect	Feeling	The feelings a person has toward an attitude object such as a brand, advertisement, salesperson, etc.	AMA Dictionary
Occupation		Job or profession.	Business Dictionary
Purpose		The intention, objective or reason for which the customer bought the product.	Business Dictionary
Demography		The composition of a particular human population.	Business Dictionary
Experience		The overall experience of a person using a product such as a website or computer application, especially in terms of how easy or pleasing it is to use.	Business Dictionary

Product Opinion		A view or judgement formed about something, estimation of the quality of the product.	Business Dictionary
E-Business		A term referring to a wide variety of Internet-based business models. Typically, an e-commerce strategy incorporates various elements of the marketing mix to drive users to a Web site for the purpose of purchasing a product or service.	AMA Dictionary
Web Page		A HTML (Hypertext markup Language) document on the web, usually one of many together that makeup a web site.	AMA Dictionary
Web Page		The ease with which visitors are able to use a Web site.	AMA Dictionary
Security		Use authentication and encryption to protect interactions and transactions conducted through the Web.	AMA Dictionary
Secondary Package		This usually refers to multiple-unit packaging, but it also refers to situations in which a product has a primary package such as foil, bottle, or polyurethane, a secondary package such as a paper carton, and a tertiary package such as a corrugated shipping carton.	AMA Dictionary
Reliability		The ability of the web page to consistently perform its required function on demand without failure.	Business Dictionary
Service Delivery		The process of taking the product to the consumer after placing an order, it considers the degree in which the product is deliver according to schedule and time of receiving the product.	AMA Dictionary
Availability		Percentage of time a computer system is available to use.	Business Dictionary
Content		Glue that makes a website sticky makes visitors return and keeps them from leaving.	Business Dictionary
Customer Review		A customer review is a review of a product or service made by a customer who has purchased the product or service. Customer reviews are a form of customer feedback on electronic commerce and sites. There are also dedicated review sites some of which use customer reviews as well as or instead of professional reviews. The reviews may themselves be graded for usefulness or accuracy by other users.	Business Dictionary

6 CRO Logical Coding

The following section will describe the software and tools used for constructing the ontology. Also the different parts of the ontology, its main branches and properties.

6.1 Ontology Authoring Tools

The tool used for developing the ontology was ROO which is an intuitive authoring tool that simplifies the process because it does not require to write in OWL; reason which was selected for this project. Other authoring tools like protégé, require knowledge of OWL and understanding of knowledge engineering. OWL is a data modelling language, is the most common language used in semantics being a W3C standard. OWL is built on top of RDFS.

The main differences between OWL and RDFS (Cambridge Semantics, 2014) are the following:

- First, RDFS allows to express the concepts and relationships in triples format, OWL also allows it and provides annotations that links the data models to the real world.
- Second, OWL provides a larger vocabulary that is used to say different things like describe data in terms of operations or restrict property values.
- Third, OWL also gives you control over the triples that you use, telling which vocabulary you can and cannot use.
- Also, OWL allows to express with a standard annotation framework, the relationships between different ontologies.

The ontology presented in this project is made in OWL, because it has more advantages than RDF, as mentioned before.

6.1.1 ROO + Rabbit

ROO stands for rabbit to OWL Ontology authoring. ROO is a tool used for ontology construction which supports knowledge engineers which have limited experience building ontologies. ROO has an interface for describing concepts and relationships using Controlled Natural Language. From the knowledge glossary established in section 5.4 and the relationships shown in the next table, Rabbit sentences were written using the structure of a subject concept, relationship and object concept.

Table 8 Relationship table derived from T-Box

Relationship	Source Concept	Target Concept
isKindOf	ProductDiscount	ProductAugmentation
hasAugmentation	Product	ProductAugmentation
hasAuthor	CustomerReview	Customer
hasCustomerOpinion	Customer	CustomerOpinion
hasCustomerProfile	Customer	CustomerProfile
hasEBusiness	CustomerReview	Ebusiness
hasFeature	Product	ProductFeature
hasFunction	Product	Function
hasPart	Component	ProductPart
hasProduct	CustomerReview	Product
hasSpecificFeature	Product	SpecificFeature
hasServiceDelivery	EBusiness	ServiceDelivery
hasWebPage	EBusiness	WebPage

Examples of Rabbit sentences describing concepts and relationships are giving in the following section, which the main branches of the ontology are described. ROO has an editor which corrects the Rabbit sentences introduced to the editor by highlighting keywords, concepts and relationships, and also showing messages of invalid Rabbit sentences and missing concepts or relations. ROO is based on protégé 4, tool used for viewing and editing OWL ontologies and takes plug-ins for visualising and verifying the ontology which benefit knowledge engineers.

ROO was used to create the classes shown in the previous Rabbit Sentences. For example, with the ROO editor, the following sentence was introduced: “Every Product hasFeature at least 1 ProductFeature.” Next ROO checks whether the class 'Product', 'ProductFeature' and the relation 'hasFeature' were previously created. If they are not present, ROO provides a message asking the user

to create those properties and then the sentenced is accepted, once they are created. Other scenario, is when the class is already created, but the user misspells the word and ROO does not accept the sentence regarding this error, once the user corrects the mistake, ROO accepts the sentence. Once the sentence is accepted, ROO converts it to OWL format.

6.2 Ontology Branches

The following image shows the Example of the Class Product:

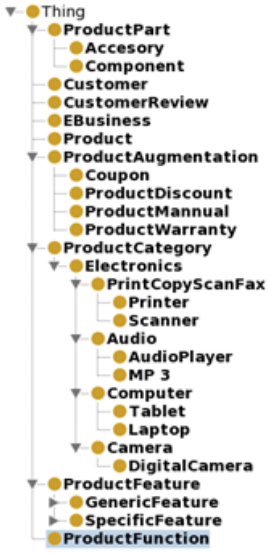


Figure 4 Class Product

The class hierarchy shown in the image is obtained one of the three main branches of the T-Box Version 2. The process followed to obtain the class hierarchy was taking Product, Customer and E-Business branches separately, and began to form Rabbit Sentences with the concepts contained in each branch. For example, Product branch contains four groups of concepts ProductAugmentation, ProductFeature, Part and Function. Each group with their individual concepts.

The Rabbit Sentences are shown in the following image:

Branch	Rabbit Sentence
Product	Every Product hasPart at least 1 ProductPart.
	Every Product hasFunction at least 1 ProductFunction.
	Every Product hasFeature at least 1 ProductFeature.
	Every Product hasAugmentation ProductAugmentation.
	Every Coupon is a kind of ProductAugmentation.
	Every ProductDiscount is a kind of ProductAugmentation.
	Every ProductManual is a kind of ProductAugmentantion.
	Every ProductWarranty is a kind of ProductAugmentation.
	Every GenericFeature is a kind of ProductFeature.
	Every Aesthetic is a kind of GenericFeature.
	Every Brand is a kind of GenericFeature.
	Every SpecificFeature is a kind of ProductFeature.
	SpecificFeature and GenericFeature are mutually exclusive.
	Every ProductCategory hasSpecificFeature SpecificFeature.
	Every Electronics hasSpecificFeature Durability.
	Every Electronics hasSpecificFeature Installation.
	Every Electronics hasSpecificFeature Portability.
	Every Electronics hasSpecificFeature Usability.
	Every Electronics is a kind of ProductCategory.
	Every Audio is a kind of Electronics.
	Every AudioPlayer is a kind of Audio.
	Every MP3 is a kind of Audio.
	Every Computer is a kind of Electronics
	Every Laptop is a kind of Computer.
Customer	Every Customer hasCustomerOpinion at least 1 CustomerOpinion.
	Every Customer hasCustomerProfile at least 1 CustomerProfile.
	CustomerProfile and CustomerOpinion are mutually exclusive.
	Every CustomerProfile hasCustomerProfile at least 1 CustomerProfile.
	Every Occupation is a kind of CustomerProfile.
	Every Purpose is a kind of CustomerProfile.
	Every AcquisitionValue is a kind of CustomerOpinion.
	Every Affect is a kind of CustomerOpinion.
E-Business	Every EBusiness hasServiceDelivery ServiceDelivery.
	Every Ebusiness hasWebpage WebPage.
	Every WebPageReliability is a kind of WebPage.
	Every WebPageUsability is a kind of WebPage.
	Every SecondaryPackage is a kind of ServiceDelivery.
	Every ServiceDeliveryAttention is a kind of ServiceDelivery.

Figure 5 Rabbit Sentences from each ontology branch

6.3 Customer Perception Property

Customer perception is a property that captures the sentiments (either positive or negative) that the customer has towards different concepts of the ontology. It captures words such as good, pretty, fast, fun, ugly, etc. That give qualitative value to the marketing expert regarding the customer reviews. This is very important because it gives important insight towards what the customer thinks regarding a concept.

6.4 Division between Domain Specific

The following image shows how the Electronic Domain is introduced. As well as how the feature problem is solved. There are different categories and kind of products, each which its own characteristics. There are characteristics in common of all products, such as price, package, aesthetics, brand, version and size. But other characteristics are specific to the category of the different products. As we observe in the Electronic domain, the customer mention features such as usability, portability, durability, etc. For this reason the problem is solved dividing the features in two branches: Specific feature and Generic feature. Generic features contains the characteristics that all type of product have in common and Specific feature the characteristics of the different categories.

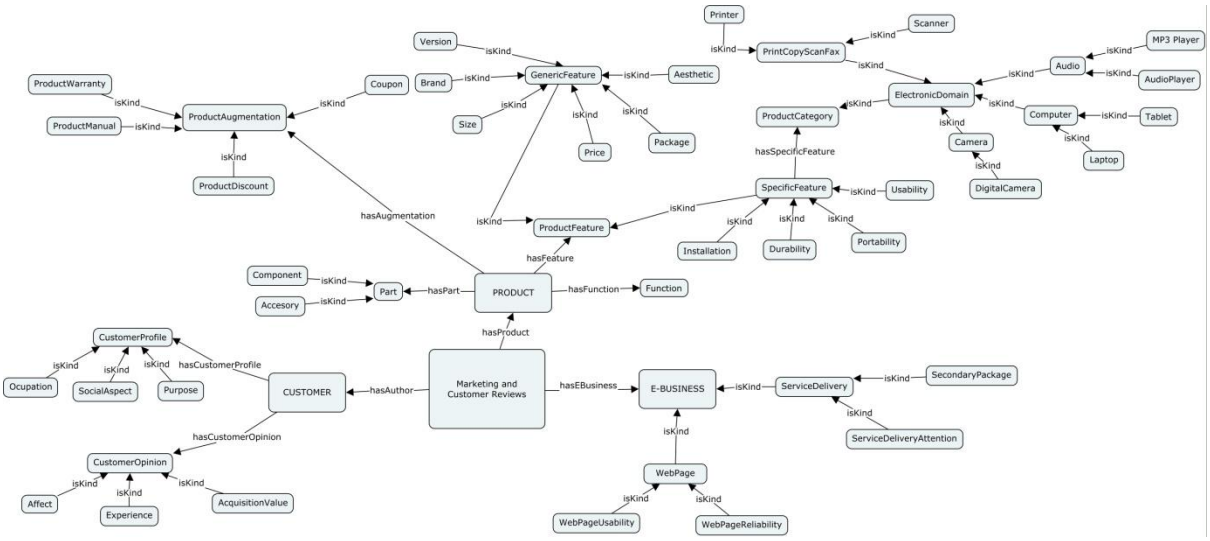


Figure 6 Product Categories, Specific and Generic features

6.5 Expanding the Domain Categories

The ProductCategory concepts were based on Google Product Taxonomy that helps categorized the diverse product attributes and its categories. It can be downloaded in Plain text or Excel from this webpage: https://support.google.com/merchants/answer/1705911?hl=en

The classification of the diverse products of audio, computer, printer and camera correspond to the Electronic Domain. For showing how the Domain Categories are expanded, another domain has been added to the ontology, corresponding to the media domain. The following figure shows how the the branch of ProductCategory is expanded with the media domain.

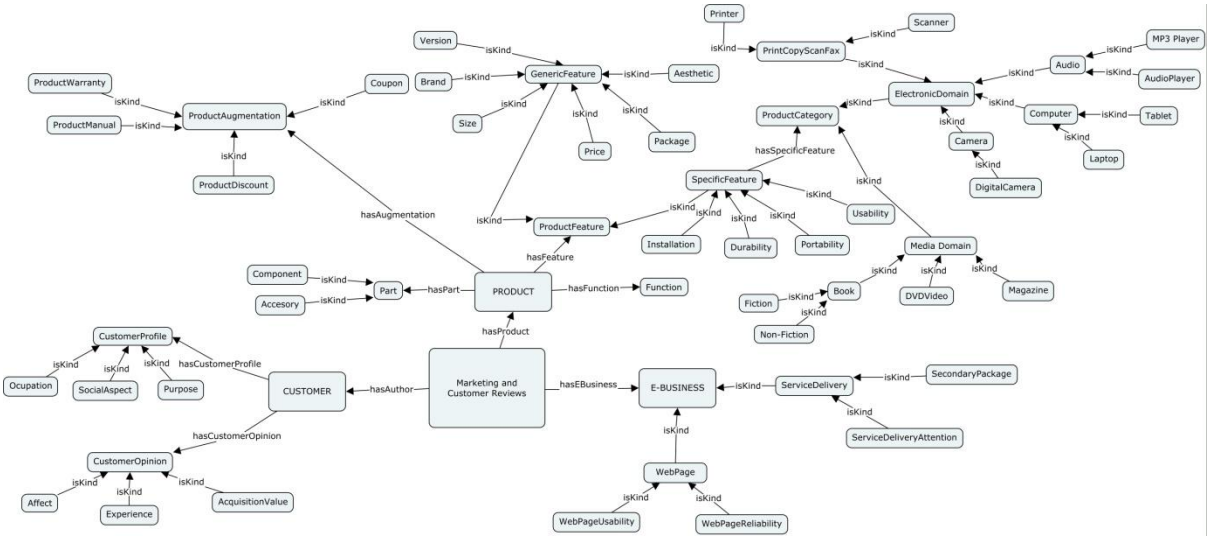


Figure 7 Media and Electronic Domain in Product Category

6.6 Ontology Metrics

The metrics are:

Class count	54
Object property count	15
Data property count	0
Individual count	3
DL expressivity	ALCQ

The expressivity means:

AL stands for attributive language which allows atomic negation, concept intersection, universal restrictions and limited existential qualification.

C stands for complex concept negation.

Q stands for qualified cardinality restrictions.

Class Axioms:

SubClass Axioms count	79
Disjoint classes axioms count	1
Entity annotation axioms count	232

7 CRO Evaluation

Ontology evaluation is the activity of checking the ontologies technical quality against a frame of reference (Marta Sabou, 2012). The ontology evaluation is important for ontology validation and knowledge selection, is also used to assess the quality and correctness of the ontology that is being built.

The NeOn glossary identifies two types of ontology evaluations. These types are ontology validation and ontology verification, which depend on the frame of reference used.

Ontology Validation: activity that compares the meaning of the definitions against the intended model that aims to conceptualize. Evaluation that answers the question: are you producing the right ontology?

Ontology verification: activity that compares the ontology against its requirements. Evaluation that answers the question are you producing the ontology in the right way?
The questions will be answered in the following chapter. They depend on the frame of reference being used.

7.1 Ontology Evaluation Approach

The evaluation is based on the best practices that are described in theNeOn methodological guidelines to evaluate the ontology. This component-based evaluation approach is proposed by Martha Sabou and Miriam Fernandez. In the approach, each element of the network is evaluated as an individual and then the findings of the evaluations in the diverse tasks are summed up.

7.1.1 Existing Approaches

The different tasks of the evaluation approach based on components is mention in this section, consist in five different tasks:
Task 1. selecting individual components of the ontology network.
Identify the elements that need to be evaluated in the ontology, ontology statement and relations. Decision based on which ontology elements are critical for the ontology and which elements can be evaluated against a frame of reference (in principle) which can be defined by a human evaluator.

Task 2. Selecting an evaluation goal and approach.

Decide the goal of the evaluation and select an appropriate evaluation approach.

The goals can be of different nature, such as: Domain coverage where the question does the ontology cover a topic domain? is answered. The extent in which the ontology covers the domain of marketing is a very important during the development of the ontology. There are different evaluation goals in this tasks which are domain coverage, quality of the modelling, suitability for a task, and adoption of use.

In the domain coverage goal, the evaluation approach is to compare the ontology to a gold standard. For quality of modelling, the humans assess to evaluate the syntactic, structural and semantic quality of the ontology (García-castro, Esteban-gutiérrez, & Gómez-pérez, n.d.).

Task 3. identifying a frame of reference and evaluation metric.

Frame of reference refers to what are we comparing against? Denotes a set of representative resources that sets a baseline value against which the ontology should be compared. It includes the evaluation metrics such as precision and recall. Another frame of reference can be assessed by humans where the measures are syntactic quality, accuracy, trust, etc.

Task 4. Applying the selected evaluation approach.

Evaluation approaches that rely on human judgment are generally more time consuming, although they often offer more valuable insight. (Guarino and welty, 2004;Lozano Tello and gomez perez 2004).

Task 5. Combining and presenting individual evaluation results.

Results derived from individual components are combined to understand the ontology quality. The results of the evaluation are presented in an appropriate form for possible corrections, improvements and future evolution of the ontology.

7.1.2 Selected Approach

In this project, a previously evaluation was made. With the validation of the (Sanusi, 2013) Best Buy dataset and Amazon dataset mentioned previously in the report. Stage in which the Reviews were annotated and the ontology concepts were evaluated with different metrics of precision, vagueness, false positive and false negatives.

The domain coverage goal and quality of modelling were selected to evaluate this project.
For the domain coverage goal, a marketing expert evaluated the ontology.
For the quality modelling goal, a ontology engineering evaluated the ontology.
Both of the experts gave comments which are described in the following sections, respectively.

7.2 Domain Coverage

The following observations were made:
For the Product augmentation definition that states "This is the view of a product that includes not only its core benefit and its physical being, but adds other sources of benefits such as service, warranty, and image. The augmented aspects are added to the physical product by action of the seller, e.g., with company reputation or with service." Mentions that the benefits are service, warranty and image, company reputation or service.

And in the CRO ontology, the following Rabbit Sentences are established:
Every Coupon is a kind of ProductAugmentation.
Every ProductDiscount is a kind of ProductAugmentation.

Regarding the previous points, the concepts Coupon and ProductDiscount should be added to the definition of the Knowledge Glossary.

Other comment made by the marketing expert was that CustomerProfile is not defined in the ontology. She defined profile as demographic data of the customer, such as age, occupation, location, physical aspects, etc.

The following Rabbit Sentence was established: Every Purpose is a kind of CustomerProfile. Where the marketing expert is not sure whether the purpose should be part of the CustomerProfile. This should be clarified in the Knowledge Glossary.

7.3 Ontology Coding

The comments made by the experts were:
The ontology in overall shows that a good background research on the topic was done and considered multiple knowledge sources. However he cannot judge the soundness or completeness but can comment on the modelling.
Most of the suggestions are based on a purist view of how ontology models should be defined.
First, Improving richness in the specification:

For example, the concept of Customer Perception- which is not defined further and only related to “Thing” hence carries little or no semantics at all. Same applies to “Purpose” and “Occuppation.

Second, Making properties meaningful and distinctive:

For example, while defining customer profile, it would have made more sense to use meaningful and distinctive properties rather than “hasPart”. For example, “hasOccupation” “hasPurpose”. Making them distinct also has other benefit - the range and domain of the property will be very clear. At the moment if you look at the range and domain of the “hasPart” it is multiple classes.
This has done correctly for some of the classes though, for example “Customer Review".

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Appendix A: Personal Reflection

I take valuable lessons with me that had shape my life. I learned a lot of things during the development of this project. I improve my English learning taking different workshops. I learned how to develop a large project scale and to deal with the obstacles in the way. Even though I couldn´t make it on time I learned lessons of life.

As an international student this experience is unique, enriches your life and gives you knowledge, not only academic but cultural and of personal growth. I take with me a lot of lessons and I am grateful for being able to live and experience studying in the UK. I met persons from all over the world and learned from them, gain intellectual knowledge that I dreamed for a long time and become true. I learned an academic system different from the one in Mexico. And most important I grew as a person, I´m thankful for that.

Appendix B: External Source Code

Part of the datasets (BestBuy) used in the annotations come from Josephine Sanusi thesis.

Appendix C: Ethical Issues

There are no ethical issues in this project, the data used in the project is completely anonymous.

Appendix D: BestBuy Reviews Annotations

Product Category	Customer Review ID	Annotation	Ontology Concept	Instance	UserPerception Value	Validation	Comments concepts of Ontology
Tablet (Blackberry)	TBR01	1. Browser is faster	Component	Browser	fast	Direct match	
Tablet (Blackberry)	TBR01	2. Multitasking capability	Function	Multitasking		Direct match	
Tablet (Blackberry)	TBR02	1. Doesn't sync with macs	Function	Device synchronisati	lacking	Approximate match	Not sure that synchrinisation is a feature
Tablet (Blackberry)	TBR02	2. Lacks features such as auto capitalization	Function	Auto capitalisation	lacking	Approximate match	User says that auto capitalisation is a feature
Tablet (Blackberry)	TBR02	3. Love the size	Size		love	Direct match	
Tablet (Blackberry)	TBR02	4. Touch capabilities	Function	Touch		Approximate match	User says that this is capabilities
Tablet (Blackberry)	TBR02	5. Not being able to attach docs to emails	Function	Attach documents to	lacking	Direct match	
Tablet	TBR03	1. The interface is smooth	Component	Interface	smooth	Direct match	
Tablet (Blackberry)	TBR03	2. It's quick		quick		Missing concept	Quick may indicate quality for a tablet
Tablet (Blackberry)	TBR03	3. It's pretty	Aestetics		pretty	Uncertain about concept	pretty can be related to design or style
Tablet	TBR03	4. Fastest browsers	Component	Browser	fast	Direct match	
Tablet (Blackberry)	TBR03	5. The build quality is solid		solid		Missing concept	Solid is referred to as quality, which is missing in the concepts
Tablet	TBR03	6. Takes great pics	Function	take pictures	great	Direct match	
Tablet (Blackberry)	TBR03	7. The battery can last two days with moderate use	Component	Battery	durable	Uncertain about property value	Not possible to detect what exactly the user opinion is
Tablet (Blackberry)	TBR03	8. It's the perfect size for portability	Size		perfect	Uncertain about property value	The user actually means perfect for portability but no way to link both. Portability is missed, may be put to quality or to function if seen as capability.
Tablet (Blackberry)	TBR03	9. Multi tasking	Function	Multitasking		Direct match	
Tablet (Blackberry)	TBR04	1. easily multitask	Function	Multitasking	Easy	Direct match	
Tablet (Blackberry)	TBR04	2. possible to transfer files directly by flash drive	Function	Transfer files	possible	Direct match	
Tablet (Blackberry)	TBR04	3. Video-resolution fantastic	Component	Video-resolution	fantastic	Direct match	
Tablet (Blackberry)	TBR04	4. Overall build-solid		overall build	solid	Uncertain about concept	overall build can be related to component or material
Tablet	TBR05	1. Features seem more attractive	Affect	features	attractive	Direct match	
Tablet (Blackberry)	TBR05	2. Higher MP cameras	Component	MP cameras	higher	Uncertain about property	Not possible to detect what exactly the user opinion is
Tablet (Blackberry)	TBR05	3. Multitasking	Function	Multitasking		Direct match	
Tablet (Blackberry)	TBR05	4. Flash web browser	Component	Flash web browswer		Direct match	
Tablet (Blackberry)	TBR05	5. More memory	Component	Memory	more	Direct match	
Tablet (Blackberry)	TBR05	6. Faster processor	Component	processor	faster	Uncertain about property value	Not possible to detect what exactly the user opinion is
Tablet (Blackberry)	TBR06	1. Tablet is amazing	Component	tablet	amazing	Direct match	
Tablet (Blackberry)	TBR07	1. Good product	Component	product	good	Direct match	
Tablet (Blackberry)	TBR07	2. Great picture quality		picture	great	Missing concept	Picture is referred to as quality, which is missing in the concepts
Tablet (Blackberry)	TBR07	3. Usability as a tablet was very good			very good	Missing concept	Usability is being used as a product feature in tablets, in the concepts it exists for the e-buisness branch, but we need the concept also for product features.
Tablet (Blackberry)	TBR07	4. It had the great idea of utilizing the frame area	Component	Frame area	great	Direct match	
Tablet (Blackberry)	TBR07	5. It was a great travel size	Size	travel size	great	Direct match	
Tablet (Blackberry)	TBR08	1. Thick	Size	thick		Direct match	
Tablet (Blackberry)	TBR08	2. Stunning multimedia	Component	multimedia	stunning	Direct match	

Tablet (Blackberry)	TBR08	3. True multitasking	Function	multitasking	true	Direct match	
Printer (HP)	PHR01	1. No printout	Function	printout	lacking	Direct match	
Printer (HP)	PHR01	2. Permantly broken	Component	broken	permanently	Direct match	
Printer (HP)	PHR01	3. Do not buy				Missing concept	Do not buy is part of customer's opinion refering to the product.
Printer (HP)	PHR02	1. Low price	Price	price	low	Direct match	
Printer (HP)	PHR02	2. Very light		light	very good	Uncertain about concept	light can be related to size or material or need of adding a concept of weight
Printer (HP)	PHR03	1. Doesn't print	Function	print	lacking	Direct match	
Printer (HP)	PHR03	2. Data gets stuck	Component	data	stuck	Direct match	
Printer (HP)	PHR03	3. Ink hog	Component	ink hog		Direct match	
Printer (HP)	PHR04	1. The install went smoothly		installation	smoothly	Missing concept	Installation is a feature of the electronic products that is missing in the concepts
Printer (HP)	PHR04	2. Fussiest printer	Component	printer	fussiest	Uncertain about property value	Not possible to detect what exactly the user opinion is
Printer (HP)	PHR05	1. Laser-quality text		laser-quality text		Missing concept	laser is referred to as quality, which is missing in the concepts
Printer (HP)	PHR05	2. Vivid color	Colour	color	vivid	Direct match	
Printer (HP)	PHR05	3. Easy to set up and use		set up and use	easy	Uncertain about concept	easy to set up is missing as a concept (installation) and use can be consider as customer experience or usability of product, also a missing concept. But there is no way to link both.
Smart TV (Samsung)	STR01	1. The upgrade in brightness, color clarity and response time was great	Function	Upgrade	great	Direct match	
Smart TV (Samsung)	STR01	2. Packaging was clean and easy to open	Package	Package	easy	Direct match	
Smart TV (Samsung)	STR01	3. The installation was straight forward		installation	straight	Missing concept	Installation is a feature which is missing in the concepts
Smart TV (Samsung)	STR01	4. Netflix	Brand	brand		Direct match	
Smart TV (Samsung)	STR02	1. LCD TV. 50" size	Size	50" size		Direct match	
Smart TV (Samsung)	STR02	2. Fantastic picture	Component	picture	fantastic	Direct match	
Smart TV (Samsung)	STR02	3. Incredibly clear and detailed	Component		incredibly clear and detail	Uncertain about property value	Not possible to detect the concept what exactly the user opinion is
Smart TV (Samsung)	STR02	4. 3D is fascinating	Component	3D	fascinating	Direct match	
Smart TV (Samsung)	STR03	1. Lots of picture adjustment options	Function	picture adjustment	lots	Direct match	
Smart TV (Samsung)	STR03	2. Simple set up		set up	simple	Missing concept	Setup/Installation is a feature which is missing in the concepts
Smart TV (Samsung)	STR03	3. Cool features and remote	Component	features and remote	cool	Approximate match	User mentions features instead of components
Smart TV (Samsung)	STR04	1. Menu super easy	Component	menu	super easy	Direct match	
Smart TV (Samsung)	STR04	2. Sound quality not great		sound quality	not great	Missing concept	Solid is referred to as quality, which is missing in the concepts
Smart TV (Samsung)	STR05	1. Picture on this TV is absolutely stunning	Component	picture	stunning	Direct match	
Smart TV (Samsung)	STR05	2. Internet features are great	Component	internet	great	Approximate match	User mentions that internet is a feature instead of component
Smart TV (Samsung)	STR05	3. It's worth the price	Acquisition value	price	worth	Direct match	
Smart TV (Samsung)	STR05	4. Devices that supports HBO Go	Function	supports HBO Go		Direct match	
Smart TV (Samsung)	STR06	1. Web content is excellent	Component	Web content	excellent	Direct match	
Smart TV (Samsung)	STR06	2. Voice control	Component	Voice control		Direct match	
Smart TV (Samsung)	STR06	3. Setup was strait forward		set up	straight forward	Missing concept	Setup/Installation is a feature which is missing in the concepts
Smart TV (Samsung)	STR06	4. Touchpad is also a fabulous addition	Component	Touchpad	fabolous	Direct match	
Smart TV (Samsung)	STR07	1. 3D	Component	3D		Direct match	
Smart TV (Samsung)	STR07	2. Picture quality is exceptional		picture	exceptional	Missing concept	Picture is referred to as quality, which is missing in the concepts

Smart TV (Samsung)	STR08	1. Features and functions	Functions	functions		Uncertain about concept	features can be consider as component and user doesn't specify what functions and features is refering to. There is no way to link both
Smart TV (Samsung)	STR08	2. The picture is crisp, clean	Component	picture	clean	Direct match	
Smart TV (Samsung)	STR08	3. Buying experience quite	Experience	Buying experience	quite	Uncertain about property value	Not clear what the user refers by quite
Smart TV (Samsung)	STR09	1. I love this television	Component	television	love	Direct match	
Smart TV (Samsung)	STR09	2. Color is awesome	Colour	color	awesome	Uncertain about concept	User can be refering to color as a function instead of the feature, not clear.
Smart TV (Samsung)	STR09	3. Easy to use	Experience	easty to use		Uncertain about concept	Can be part of user experience or add a concept usability
Smart TV (Samsung)	STR09	4. Samsung is truly awesome	Brand	Samsung	truly awesome	Direct match	
Smart TV (Samsung)	STR10	1. Tv is excellent	Component	tv	excellent	Direct match	
Smart TV (Samsung)	STR10	2. Great picture and sound	Component	picture and sound	great	Direct match	
Smart TV (Samsung)	STR10	3. Easy setup		setup	easy	Missing concept	Setup/Installation is a feature of the electronic products that is missing in the concepts
Smart TV (Samsung)	STR10	4. Looks great	Design	looks	great	Direct match	
Smart TV (Samsung)	STR11	1. Best picture	Component	picture	best	Direct match	
Smart TV (Samsung)	STR11	2. Deep black background	Component	black background	deep	Uncertain about property value	Not possible to detect what exactly the user opinion is
Smart TV (Samsung)	STR11	3. Very easily convert regular HD to 3D	Function	convert regular HD to 3D	very easily	Direct match	
Smart TV (Samsung)	STR11	4. Quality is incredible		quality	incredible	Missing concept	Quality is a non existing concept
Smart TV (Samsung)	STR11	5. Amazing quality		quality	amazing	Missing concept	Quality is a non existing concept
Smart TV (Samsung)	STR11	6. Reasonable price.	Acquisition value	price	reasonable	Direct match	
Smart TV (Samsung)	STR12	1. Picture is so much better	Component	picture	better	Direct match	
Smart TV (Samsung)	STR12	2. 3D is great	Component	3D	great	Direct match	
Smart TV (Samsung)	STR12	3. Pretty cool	Aestetics	cool	pretty	Uncertain about concept	pretty can be related to design or style
Smart TV (Samsung)	STR13	1. Fits perfectly	Size	fits	perfectly	Approximate match	Fits can refer to portability, concept that is missing.
Smart TV (Samsung)	STR13	2. Picture is stunning	Component	picture	stunning	Direct match	
Smart TV (Samsung)	STR13	3. Sound is amazing	Component	sound	amazing	Direct match	
Smart TV (Samsung)	STR13	4. Smart features	Component	features	smart	Approximate match	User says that this is features
Smart TV (Samsung)	STR14	1. Easy setup		setup	easy	Missing concept	Setup/Installation is a feature of the electronic products that is missing in the concepts
Smart TV (Samsung)	STR14	2. Picture is great	Component	picture	great	Direct match	
Smart TV (Samsung)	STR14	3. 3D is significantly better	Component	3D	better	Direct match	
Smart TV (Samsung)	STR14	4. Internet capabilities	Component	internet		Approximate match	User says that are capabilities and not components
Smart TV (Samsung)	STR15	1. WiFi	Component	wifi		Direct match	
Smart TV (Samsung)	STR15	2. Apps	Component	apps		Direct match	
Smart TV (Samsung)	STR15	3. Smarthub	Component	Smarthub		Direct match	
Smart TV (Samsung)	STR15	4. DirecTV DVR	Brand	DirecTV		Direct match	
Smart TV (Samsung)	STR15	5. Sound is not that great	Component	sound	not great	Direct match	

Smart TV (Samsung)	STR16	1. This one has more than the LG	Brand	LG		Direct match	
Smart TV (Samsung)	STR16	2. Lots of picture adjustment options	Function	picture adjustment	lots	Uncertain about property value	Not possible to detect what exactly the user opinion is
Smart TV (Samsung)	STR16	3. Simple set up		setup	simple	Missing concept	Setup/Installation is a feature which is missing in the concepts
Smart TV (Samsung)	STR16	4. Cool features and remote	Component	features and remote	cool	Approximate match	User mentions features instead of components
Smart TV (Samsung)	STR16	5. Works great	Function	works	great	Direct match	
Smart TV (Samsung)	STR17	1. TV looks great	Aestetics	looks	great	Uncertain about concept	pretty can be related to design or style
Smart TV (Samsung)	STR17	2. Like the interface	Function	interface	like	Direct match	
Smart TV (Samsung)	STR17	3. A little double vision	Function	double vision	little	Direct match	
Camcorder (Canon)	CCR01	1. Many features	Component	features	many	Approximate match	User mentions feature instead of component
Camcorder (Canon)	CCR01	2. Two SD card slots	Component	SD card slot		Direct match	
Camcorder (Canon)	CCR01	3. Optical zoom function	Function	optical zoom		Direct match	
Camcorder (Canon)	CCR01	4. Easy to use		use	easy	Missing concept	usability concept is not included, or maybe considered as user experience.
Camcorder (Canon)	CCR01	5. Screen is clear and crisp	Component	screen	clear	Direct match	
Camcorder (Canon)	CCR01	6. Weight of the camera is nice		weight	nice	Missing concept	weight is missing
Camcorder (Canon)	CCR01	7. Touch screen is a little difficult to use	Component	touch screen	difficult	Uncertain about concpet	The user referse to the touch screen as difficult to use. Usage is missing and theres no way to link both. Usage is missed and may be related to usability or function.
Camcorder (Canon)	CCR02	1. Ample storage	Component	storage	ample	Direct match	
Camcorder (Canon)	CCR02	2. Two SD card slots which hold up to 32 gig cards	Accesory	SD card slot		Direct match	
Camcorder (Canon)	CCR02	3. 200 X digital zoom	Component	digital zoom		Direct match	
Camcorder (Canon)	CCR02	4. Manual focus ring	Component	manual focus ring		Direct match	
Camcorder (Canon)	CCR02	5. View finder	Function	view finder		Direct match	
Camcorder (Canon)	CCR02	6. Low light capabilities	Component	light	low	Approximate match	User refers light as capability and not component
Camcorder (Canon)	CCR02	7. Easy to off load video onto the computer	Function	offload video	easy	Direct match	
Camcorder (Canon)	CCR02	8. Incredible picture quality	Function	picture	incredible	Missing concept	quality concept not included.
Camcorder (Canon)	CCR02	9. Light weight		weight	light	Missing concept	weight concept not included.
Camcorder (Canon)	CCR02	10. It is as good as it gets	Affect		good as it gets	Direct match	
Camcorder (Canon)	CCR03	1. Easy to use		use	easy	Approximate match	usage can be considered as part of experience or added as a concept because is missing
Camcorder (Canon)	CCR03	2. Easy to transfer files	Function	Transfer files	easy	Direct match	
Camcorder (Canon)	CCR03	3. Crystal clear beautiful video	Component	crystal video	clear beautiful	Direct match	This annotation has to be splitted in order to consider the two different concepts they are talking about.
Camcorder (Canon)	CCR04	1. High-definition videos and photos	Function	videos and photos	high-definition	Direct match	
Camcorder (Canon)	CCR04	2. Up to 1920 x 1080 resolution	Component	resolution		Direct match	
Camcorder (Canon)	CCR04	3. Super Range	Component	range	super easy	Direct match	
Camcorder (Canon)	CCR04	4. Optical image stabilization	Component	optical image stabilization		Direct match	
Camera (Nikon)	CNR01	1. Focus was a major problem	Component	focus	problem	Direct match	
Camera (Nikon)	CNR01	2. Battery life is short	Component	battery life	short	Direct match	
Camera (Nikon)	CNR02	1. Compact	Size	compact		Direct match	
Camera (Nikon)	CNR02	2. Excellent pictures	Function	pictures	excellent	Direct match	
Camera (Nikon)	CNR02	3. Zoom worked like a dream	Function	zoom	dream	Direct match	
Camera (Nikon)	CNR02	4. Low-light (think museum) photography turned out beautifully.	Function	low light photography	beautiful	Direct match	

Camera (Nikon)	CNR03	1. Camera flash is horrible	Component	Flash web browswer	horrible	Direct match	
Camera (Nikon)	CNR03	2. Had to wait five to six seconds for the camera to take the photo	Function	take photo	wait	Direct match	
Camera (Nikon)	CNR03	3. Video however does look great	Function	video	great	Direct match	
Camera (Nikon)	CNR04	1. Ease of operation	Function	operation	ease	Approximate match	It can be considered as a function or user experience, can be proper to add a concept for usage/operation
Camera (Nikon)	CNR04	2. Built-in flash	Component	Flash web browswer		Direct match	
Camera (Nikon)	CNR04	3. Sharp photos	Function	photos	sharp	Direct match	
Camera (Nikon)	CNR05	1. Price was good	Price	price	good	Direct match	
Camera (Nikon)	CNR05	2. Ease of use	Function	use	ease	Approximate match	It can be considered as a function or user experience, can be proper to add a concept for usage/operation
Camera (Nikon)	CNR05	3. Picture/video quality	Function	picture/video	quality	Missing concept	association to concept of quality
Camera (Nikon)	CNR05	4. Good value	Acquisition value	value	good	Direct match	
Camera (Nikon)	CNR06	1. Small sized	Size	size	small	Direct match	
Camera (Nikon)	CNR06	2. Superbly high quality featured digital device	Component	Device	Superbly	Uncertain about concept	Can be consider as component and the quality cannot be captured at the same time because there is no way to link both
Camera (Nikon)	CNR06	3. The very reasonable pricing	Acquisition value	pricing	very reasonable	Direct match	It can also be considered as price, regarding previous stages in evaluation will be factible to consider only acquisition value and take out price because general they refer to the same concept
Camera (Nikon)	CNR07	1. Small	Size	small		Direct match	
Camera (Nikon)	CNR07	2. Awful	Affect		awful	Direct match	
Camera (Nikon)	CNR07	3. Focus	Function	focus		Direct match	
Camera (Nikon)	CNR07	4. Blurred		blurred		Missing concept	may refer to quality of the camera
MP3 Player (Sony)	MSR01	1. Expensive	Acquisition value		expensive	Direct match	
MP3 Player (Sony)	MSR01	2. Worked out fine	Experience	worked out	fine	Uncertain about concept	can be considered as experience or function, also adding new usability/use concept
MP3 Player (Sony)	MSR02	1. Good name		name	good	Missing concept	Product name concept is missing
MP3 Player (Sony)	MSR02	2. Work well	Experience	work	well	Uncertain about concept	can be considered as experience or function, also adding new usability/use concept
MP3 Player (Sony)	MSR03	1. Great product	Affect		great	Uncertain about concept	can be considered as affect or experience. The overall evaluation of the usability is missing
MP3 Player (Sony)	MSR03	2. Easy to use	Function	use	easy	Uncertain about concept	It can be considered as a function or user experience, can be proper to add a concept for usage/operation
MP3 Player (Sony)	MSR03	3. Great sound quality	Function	sound	great	Approximate match	It refers to the quality of the sound, concept whicht is missing.
MP3 Player (Sony)	MSR04	1. Really nice player	Design	nice	really	Direct match	
MP3 Player (Sony)	MSR04	2. Very easy to put music on	Function	put music	easy	Direct match	
MP3 Player (Sony)	MSR04	3. Cannot charge the battery unless its hooked up to a computer	Function	charge battery	connected	Direct match	
MP3 Player (Sony)	MSR05	1. Equalizer functions	Function	equalizer		Direct match	
MP3 Player (Sony)	MSR05	2. Volume limiting	Function	volume	limited	Direct match	
MP3 Player (Sony)	MSR05	3. Create multiple playlists	Function	Create multiple playlist		Direct match	
MP3 Player (Sony)	MSR05	4. Good value for the money	Acquisition value	value	good	Direct match	
MP3 Player (Sony)	MSR06	1. It is large enough to see & work buttons	Size	large enough		Uncertain about concept	It refers to the quality of the key control buttons
MP3 Player (Sony)	MSR06	2. Screen is great	Component	screen	great	Direct match	
MP3 Player (Sony)	MSR06	3. Music was easy to install	Function	install music	easy	Direct match	
MP3 Player (Sony)	MSR07	1. Sound quality is so much better		sound quality	better	Missing concept	quality concept not included
MP3 Player (Sony)	MSR07	2. Wasnt expensive	Acquisition value		not expensive	Direct match	
MP3 Player (Sony)	MSR08	1. FM Tuner works well	Component	FM Tunner works	well	Direct match	

Appendix E: Amazon Reviews

Product Category	Review ID	Customer Review	Annotation
Tablet (Android)	TAR01	For the price this is a great tablet. Dispatched very quickly. And i have found fusion very helpful when i asked question about this tablet. Works great through the LG TV with the Hdmi cable, super picture. Would recommend this tablets to every body, for the price a great buy	1. great tablet 2. dispatched very quickly 3. fusion very helpul 4. works great 5. LG TV 6. super picture 7. for the price a great buy
	TAR02	I love it. Light, easy to handle, not difficult to use. Fantastic value for the money. Well packed and arrived well within the time limit. Would recommend the company wholeheartedly.	1. Love it 2. Light 3. Easy to handle 4. Not difficult to use 5. Fantastic value for money 6. Well packed 7. arrived well within time limit
	TAR03	i have always had pcs, its our first tablet and it was purchased for my wife who is a novice, but she has taken to it with ease, the quality is great and it does what it says on the box, if you are new to tablets or thinking of changing yours this is such a good buy you wont be dissapointed.right from start to finish the service and quality of the goods have been A1.	1. First tablet 2. wife who is novice 3. quality is great 4. it does what it says on the box 5. good buy
	TAR04	This is the first tablet I have bought and I am very pleased with it. It arrived quicker than the delivery date stated which was nice and it was well packaged. It is easy to use and came loaded with some useful apps, the screen is a good size and the touch screen response is very good. I would and have already recommended this tablet to other people.	1. first tablet I bought 2. pleased with it 3. arrived quicker than delivery date 4. well packaged 5. easy to use 6. loaded with useful apps 7. screen is good size 8. touch screen response is very
	TAR05	After being pleased with the general abilities of this machine, I was very disappointed to find the screen cracked and unusable after a fairly gentle fall of less than a foot onto a soft carpet. I would expect a modern tablet to be able to take that kind of knock without breaking. I'm not sure I'll spend the £49 getting it fixed, I may use it to buy something rather more robust, I guess you get what you pay	1. Pleased with general abilities 2. disappointed screen cracked 3. unusable after gentle fall
	TAR06	The tablet being 10" is a good size but it is hard to work out what to do, for example I would like to move the icons around and delete some but there are no instructions to do this. The tablet works well with wireless not tried it on anything else. I bought a keyboard and case but there is an inbuilt keyboard so did not really need it. Cons: little storage Pros: good all rounder for the price.	1. 10" is a good size 2. hard to work out what to do 3. no instructions 4. works well with wireless 5. inbuilt keyboard 6. little storage 7. good all rounder for the price
	TAR07	Got this tablet in june the screen is so scratched im not very happy with it not at all . Got it for my wife birthday . should have gone to pcworld or currys I know next time . Not happy . Should come with a screen protector on it	1. screen is scratched 2. not very happy with it 3. for my wife birthday 4. not happy 5. should come with screen protector
Printer (Epson)	PER01	I am so glad i bought this printer, it's quick and really easy to install and wifi is quick and easy to use. It's lovely having not to connect your laptop to the printer each time. Print from another room. The printing quality is brilliant and scans really well. The ink is cheaper than most printers too. Great buy	1. so glad I bought 2. quick and easy to install 3. wifi is quick and easy to use 4. printing quality is brilliant 5. scans really well 6. ink is cheaper 7. great buy
	PER02	easy to follow set up instructions and to connect to wireless internet printing is easy with very good quality prints	1. easy to follow set up instructuions 2. connect to wireless printing is easy 3. very good quality prints
	PER03	Excellent printer and should work with your iPad and iPhone on AirPrint. Great value for money - go for it!	1. excellent printer 2. should work with iPad and iPhone 3. Great value for money
	PER04	Very good printer, had n Epsom before and this is better than previous model. Only problem is scanning takes a bit longer than previous machine but I am happy otherwise. Ideal size for desktop	1. Very good printer 2. better than previous model 3. scanning takes longer 4. happy 5. ideal size for desktop

	PER05	Three stars say "It's OK" and that's it. Attractive appearance; control panel needs thought initially; paper feed noisy. Very quick and clear font and colour. (English word!) Worth the money. Am generally well pleased, but cheeseparing startup inks.	1. It's OK 2. attractive appearance 3. paper feed noisy 4. very quick 5. clear font and colour 6. Worth the money 7. Generally well pleased
	PER06	The print quality is fine for a cheap device. Unfortunately my Macbook hates the thing and refuses to talk to it via my router so it doesn't do the wireless bit that I was quite interested in. Maybe my computing skills are a bit lacking ... or maybe it doesn't do what it says on the box?	1. print quality is fine 2. Macbook doesn't do wireless
	PER07	I had a lot of trouble connecting this wirelessly, and still yet to find a solution. Print quality is good.	1. Trouble connecting wirelessly 2. print quality good
	PER08	I purchased this primarily as a scanner for home use. Its terribly complicated to set up and even the instruction manual sucks! As printer this product might serve its purpose . As a scanner - thumbs down!	1. purchased as a scanner 2. home use 3. terribly complicated to set up 4. instruction manual sucks 5. printer serve purpose 6. scanner thumbs down
Smart TV (Panasonic)	PTR01	A fantastic TV for the price. None of the bells and whistles of the SMART TV's, but also without the price tag. I cannot fault the TV for the picture or the quality. The only downside is the omission of picture in picture when looking through the guide and selecting a channel with the OK button doesnt then take you to the channel you have to EXIT the guide instead. However in terms of quality of the product and of the picture and sound this is an excellent TV. I use it as a secondary PC screen, Apple TV and Freeview TV. All work perfectly. I have the 50" version.	1. fantastic TV for price 2. quality of product, picture and sound is an excellent TV 3. use as secondary PC screen and Apple TV work perfectly 4. 50" version
	PTR02	Excellent TV Great picture really good quality I would recommend it that's for sure and the Delivery was right on time as well excellent service.	1. Excellent TV 2. Great picture 3. Good quality 4. delivery on time 5. excellent service
	PTR03	love the tv,but am sooo disappointed with the sound,as to me it sounds tinny. I've tried adjusting the sound bars,but still sounds tinny to me !!!! Bit sad as the picture is lovely !!!	1. love the tv 2. disappointed with sound 3. picture is lovely
	PTR04	Compact and lightweight, good picture and sound.	1. Compact 2. lightweight 3. good picture and sound
	PTR05	Only get a clear picture when viewed from front. Also, difficult to view when room exposed to bright sunlight. Has fixed stand and therefore cannot be rotated. Otherwise, easy to set up and light to carry. Probably best position is fixed to wall where all viewing chairs are directly in front and room not brightly lit during the day.	1. Clear picture from front 2. difficult to view when sunlight 3. cannot be rotated 4. easy to set up 5. light to carry
	PTR06	Amazon should stop as a matter of urgency describing this TV as "slim". It is actually 7cms deep - nearly three inches - compared to genuine slimline models which tend to be no more than around 2 cms or less than an inch. Seen sideways on in the flesh it's huge, and the absence of any such picture in the gallery rather gives the very dishonest game away.	1. not slim 2. 7cm deep
	PTR07	Very disappointed. Very poor sharpness and poor colour (too blue) and low brightness. Would like to return it for a refund. Does not compare with my previous Panasonic Veira model which is excellent (model TL-32LZD85)	1. very disappointed 2. very poor sharpness 3. poor colour 4. low brightness 5. return it for a refund 6. no comparison with previous Panasonic
Camcorder (Sony)	CSR01	Love this camera my 5thsony ccdcamera or more every time Sony produce great camera lines which are up there with the best and the parts and quality is improving as we write this cannot fault review on this superb camera.	1. love this camera 2. Sony 3. great camera 4. best parts 5. quality improving
	CSR02	Very compact and versatile. Use it for recording my sons jamming on guitars, then play it back for them. Also, good for every other occasion. I really like this item.	1. very compact 2. versatile 3. use for recording my sons jamming 4. good for very other occasion 5. I really like this item

	CSR02	Very compact and versatile. Use it for recording my sons jamming on guitars, then play it back for them. Also, good for every other occasion. I really like this item.	1. very compact 2. versatile 3. use for recording my sons jamming 4. good for very other occasion 5. I really like this item
	CSR03	It is compact, easy to use and gives good results. It also fits easily into your pocket. However, in strong sunlight it is not always that easy to see the subject matter in the screen.	1. compact 2. easy to use 3. gives good results 4. fits easily into your pocket 5. strong sunlight not always easy to see
	CSR04	Good camera.Instruction booklet was vague about defining certain terms crucial to setting up procedure.Look out for meaning of e.g."Select"..(yes!)..The four available positions of the joystick screen button are hardly discernible:not helpful at the initial stage.	1. Good camera 2. instruction booklet was vague
	CSR05	Camera very good. have yet to master a quick way of downloading videos on to PC in order to edit	1. camera very good
	CSR06	Product not what expected and not useful if you want to record onto DVD from DVD player as not able. wouldn't recommend. but more upto date !!	1. product not what expected 2. not useful for record onto DVD 3. wouldn't recommend
Camera (Canon)	CCR01	I have just come back from 2 weeks holiday and have taken over 100 pictures with it and all are really good quality. The zoom function is really good as it does not lose any of the quality and sharpness with the pictures. It also copes really well with moving objects. Very pleased with it.	1. good quality 2. zoom function is really good 3. copes really well with moving objects 4. very pleased
	CCR02	I bought this, as I take loads of pictures, but have now reached an age where I need image stabilising. This was at just the right price at the right time and I've found it quite easy to use and to navigate the menu's.	1. I take loads of pictures 2. image stabilising 3. right price 4. easy to use and navigate menu's
	CCR03	Great Camera- Took a while to work out the wifi download. Like the different features. Larger screen gives great clarity.	1. Great camera 2. like different features 3. large screen gives clarity
	CCR04	I wanted a point and shoot compact camera capable of taking photos of satisfactory quality, especially one with image stabilisation. I spent some time looking and decided on the Canon Powershot A3500 IS. The first time I took it out it was borrowed by my daughter. She kept it and took it to some SF conventions rather than one of her DSLRs as it was much more convenient. She has put some of her photos on her Facebook page. I had been very impressed with it in my brief time with it, so I bought another one for myself. I am now looking for excuses to take it out and use it.	1. compact camera 2. impressed 3. borrowed by daughter
	CCR05	Cheap quality and doesnt look really nice. Photos/videos were not as good as expected. STILL ok for this price.	1. cheap quality 2. doesn't look really nice 3. photos/videos not good as expected 4. still ok for this price
	CCR06	It's a fine camera and does most stuff perfect (especially video). I just cannot feel the picture quality is not that good. It's a nice light, small (yet comfy) camera and the battery life is good. I actually went back to my 8mp Lumix as the picture quality was way better on it to be honest.	1. fine camera 2. picture quality not that good 3. nice 4. light 5. small camera 6. baterry life is good 7. Lumix
	CCR07	It do have better light sensor than my phone, hence the picture s taken in low light is more visible. However, except for that, I cannot tell any advantages of it over my phone (its a £110 Samsung with a 8MP camera), the quality and resolution is just the same as my phone.	1. light sensor 2. low light is more visible 3. Samsung
	CCR08	This is a useless piece of rubbish, I used it once on a weekend away and it has fried my 16GB SD card. The card was in excellent condition and barely used. I now cannot send it back due to Amazon's stupid 30 day policy, where other retailers will accept the item back after 6 months.	1. Useless piece 2. fried SD card 3. Amazon's 30 day policy
MP3 Player (SanDisk Sansa)	PSR01	this product is great. the issue about low volume is easy to solve. when you first get the item it asks you to choose where you are from. i.e. europe, north usa, usa etc. at this point choose north usa. do not choose europe. if you choose europe it restricts the volume that can be played back. this is due to stupid EU regulations on potential damage to your ears. choosing north usa gets around this and you will find that the volume nearly doubles. if you have already set up, no worries go back to "reset settings" and start again. you too can have pain in your ears again!!!	1. product is great 2. low volume easy to solve
	PSR02	This little mp3 player is by far the best i've owned. It is the size of a matchbox (a small one.. not those massive matches for lighting cookers). It has the most simple menu and readable display which in itself is impressive in a player this small.... however the most amazing thing is that through the insertion of a micro sd card this becomes a 32Gb player in the size of a matchbox...seriously. Surely this is wrong? 32Gb is bigger than that isn't it?...apparently not. In addition, like the old sansa clip it sounds absolutely superb (slightly better,slightly less harsh.. really picking holes in the old one, there which i own, i feel guilty).. as always an earphone upgrade is a good idea but the ones provided with this player are no worse than those given with ipods and sonys. I use seinheisers which are great. I'm serious, buy one and, if you have no need for video, this is better than anything out there regardless of the price.. which is also daft. I think Sandisk are mad..Wonderful thing this.	1. little 2. size of a matchbox 3. simple menu 4. readable display 5. insertion micro sd card becomes 32Gb 6. sounds absolutely superb 7. ipods 8. sonys

	PSR03	This is a fantastic MP3 player. I've bought two, an 8gb for myself and a 4gb one for my other half! They are so easy to set up and transferring my music collection and playing the songs is a doddle!! My only gripe and the reason for not giving it 5 stars is the packaging. I'm normally pretty adept at gaining entry into all manner of plastic packaging but the protective plastic around this MP3 player nearly beat me. After going at it with scissors and knives to gain entry I was almost ready to give up when I nearly slipped with the knife and narrowly avoided causing serious injury. There should be a health warning for the packaging! It took me the best part of 30 mins to break into both packages! I'm glad I persevered though and I would strongly recommend the manufacturer re-thinks its packaging for the future.	1. fantasticMP3 player 2. I've bought two 3. one for myself and my other half 4. easy to set up 5. transferring music collection 6. playing songs 7. packaging 8. protective plastic nearly beat me 9. should be a health warning for the packaging 10. re-think packaging for the future
	PSR04	Excellent product, could do with a better operating manual. Took me three weeks to find out how to get the FM radio to work. Needed an eight year old to teach me how to really use it properly.	1. excellent product 2. bettter operating manual 3. teach how to use it properly
	PSR05	screen is too small for mother in law and i have to agree. Would be a good idea to show the actual size of screen ie credit card size or match box etc	1. screen too small 2. mother in law 3. show the actual size
	PSR06	A delightful little gadget with just one failing. The volume is mediochre and has to be turned fully up to get a reasonable level. Tried different earbuds and went through the menu but there was no increase in volume. It is fine for late night listening when the ambient noise levels are really low but for everyday use, i'm afraid it doesn't come up to scratch. It's such a shame	1. delightful 2. little gadget 3. volume is mediochre 4. no increase in volume
	PSR07	brought this as a Valentine for my wife she's not tried putting any music on it yet but say's the radio good	1. valentine for wife 2. radio good
	PSR08	Loved this little gizmo, once I worked out how to expand the volume limits. However stopped turning on after 5 months, won't register an attempt to be charged - is totally unresponsive. Would of been a great item if it actually worked for more than a couple of months.	1. loved 2. little 3. expand volume limits 4. stopped turning after 5 months 5. totally unresponsive

Appendix F: Amazon Review Annotations

Product Category	Customer Review ID	Annotation	Ontology Concept	Instance	User PerceptionValue	Validation	Comments concepts of Ontology
Tablet (Android)	TAR01	1. great tablet	Component	tablet	great	Direct Match	
Tablet (Android)	TAR01	2. dispatched very quickly	Service Delivery	dispatched	very quickly	Direct Match	
Tablet (Android)	TAR01	3. fusion very helpul		fusion	very helpful	Uncertain about concept	fusion describes quality, concept that will capture fusion
Tablet (Android)	TAR01	4. works great	Function	works	great	Uncertain about concept	not sure if works correspond to a function or to experience concept
Tablet (Android)	TAR01	5. LG TV	Brand	LG TV		Direct Match	
Tablet (Android)	TAR01	6. super picture	Component	picture	super	Direct Match	
Tablet (Android)	TAR01	7. for the price a great buy	Acquisition value	price	great buy	Uncertain about concept	Clear price and acquisition value in this type of cases mentioning price but also value
Tablet (Android)	TAR02	1. Love it	Affect		love	Direct Match	
Tablet (Android)	TAR02	2. Light		Light		Missing Concept	Light refering to weight concept
Tablet (Android)	TAR02	3. Easy to handle		handle	easy	Missing Concept	Relates to experience but also with portability, concept which is missing
Tablet (Android)	TAR02	4. Not difficult to use	Experience	use	not difficult	Approximate Match	Relates to experience but also with usage, concept which is missing
Tablet (Android)	TAR02	5. Fantastic value for money	Acquisition value	value	fantastic	Direct Match	
Tablet (Android)	TAR02	6. Well packed	Secondary Package	packed	well	Direct Match	
Tablet (Android)	TAR02	7. arrived well within time limit	Service Delivery	arrived	well	Direct Match	
Tablet (Android)	TAR03	1. First tablet	Demography	first		Approximate Match	Is related to being a new user, using it for first time, so is related to demography, is specific to user
Tablet (Android)	TAR03	2. wife who is novice	Demography	novice wife		Direct Match	
Tablet (Android)	TAR03	3. quality is great		quality	great	Missing Concept	Quality is a non existing concept
Tablet (Android)	TAR03	4. it does what it says on the box	Package	box		Uncertain about concept	It mentions package but also it functions property, but no way to link both
Tablet (Android)	TAR03	5. good buy	Experience	buy	good	Uncertain about concept	user comment also relates to acquisition value and the experience
Tablet (Android)	TAR04	1. first tablet I bought	Demography	first		Approximate Match	Is related to being a new user, using tablet for first time, so is related to demography, is specific to user
Tablet (Android)	TAR04	2. pleased with it	Affect		pleased	Direct Match	
Tablet (Android)	TAR04	3. arrived quicker than delivery date	Service Delivery	arrived before delivery date	quicker	Direct Match	
Tablet (Android)	TAR04	4. well packaged	Secondary Package	packaged	well	Direct Match	
Tablet (Android)	TAR04	5. easy to use	Experience	use	easy	Uncertain about concept	Can be part of user experience or add a concept usability
Tablet (Android)	TAR04	6. loaded with useful apps	Component	loaded with apps	useful	Direct Match	
Tablet (Android)	TAR04	7. screen is good size	Component	screen	good	Uncertain about property	Also related to size, talking about component and size at the same time, no way to link both.
Tablet (Android)	TAR04	8. touch screen response is very good	Component	touch screen response	very good	Direct Match	

Tablet (Android)	TAR05	1. Pleased with general abilities	Component	general abilities	pleased	Uncertain about property	User talks about abilities, when the concept is consider component or its functions
Tablet (Android)	TAR05	2. disappointed screen cracked	Component	screen cracked	disappointed	Direct Match	
Tablet (Android)	TAR05	3. unusable after gentle fall	Experience	unusable		Approximate Match	User experience is unusable after an accident, a concept accident/defect/failures has to be added.
Tablet (Android)	TAR06	1. 10" is a good size	Size	10" size	good	Direct Match	
Tablet (Android)	TAR06	2. hard to work out what to do	Experience	work out what to do	hard	Direct Match	
Tablet (Android)	TAR06	3. no instructions	Manual	no instructions		Direct Match	
Tablet (Android)	TAR06	4. works well with wireless	Component	wireless	works well	Uncertain about concept	user is talking about a component but also functionality
Tablet (Android)	TAR06	5. inbuilt keyboard	Component	inbuilt keyboard		Direct Match	
Tablet (Android)	TAR06	6. little storage	Component	storage	little	Direct Match	
Tablet (Android)	TAR06	7. good all rounder for the price	Acquisition value	price	good all rounder	Uncertain about concept	Case they mention price instead of value
Tablet (Android)	TAR07	1. screen is scratched	Component	screen	scratched	Direct Match	
Tablet (Android)	TAR07	2. not very happy with it	Affect		not happy	Direct Match	
Tablet (Android)	TAR07	3. for my wife birthday	Demography	wife birthday		Direct Match	
Tablet (Android)	TAR07	4. not happy	Affect		not happy	Direct Match	
Tablet (Android)	TAR07	5. should come with screen protector	Accesory	screen protector	lacking	Direct Match	
Printer (Epson)	PER01	1. so glad I bought	Affect		glad	Direct Match	
Printer (Epson)	PER01	2. quick and easy to install		install	quick and easy	Missing Concept	concept install not considered
Printer (Epson)	PER01	3. wifi is quick and easy to use	Component	wifi	quick and easy	Direct Match	
Printer (Epson)	PER01	4. printing quality is brilliant		printing quality	brilliant	Missing Concept	quality of printing is not considered
Printer (Epson)	PER01	5. scans really well	Component	scans	really well	Direct Match	
Printer (Epson)	PER01	6. ink is cheaper	Component	ink	cheaper	Direct Match	
Printer (Epson)	PER01	7. great buy	Affect		great buy	Uncertain about concept	Great buy can be considered as the affect or acquisition value
Printer (Epson)	PER02	1. easy to follow set up instructuions	Manual	set up instructions	easy to follow	Uncertain about property	Considering the instructions are in the manual is correct, but set up concept is missing, no way to link both
Printer (Epson)	PER02	2. connect to wireless printing is easy	Function	connect to wireless printing	easy	Direct Match	
Printer (Epson)	PER02	3. very good quality prints		quality prints	very good	Missing Concept	quality concept is missing
Printer (Epson)	PER03	1. excellent printer	Experience	printer	excellent	Approximate Match	is related to experience, concept of overall evaluation can be added to make it clear when they talk about the characteristic of product
Printer (Epson)	PER03	2. should work with iPad and iPhone	Function	should work with different devices		Uncertain about property	user talks about function but also mentions other brands, capturing only the function and no both.
Printer (Epson)	PER03	3. Great value for money	Acquisition value	value for money	great	Direct Match	
Printer (Epson)	PER04	1. Very good printer	Experience	printer	very good	Approximate Match	is related to experience, concept of overall evaluation can be added to make it clear when they talk about a characteristic of product
Printer (Epson)	PER04	2. better than previous model		previous model	better	Missing Concept	version or model is missing
Printer (Epson)	PER04	3. scanning takes longer	Function	scanning	longer	Direct Match	
Printer (Epson)	PER04	4. happy	Affect		happy	Direct Match	
Printer (Epson)	PER04	5. ideal size for desktop	Size	size for desktop	ideal	Direct Match	

Printer (Epson)	PER05	1. It's OK	Affect		ok	Direct Match	
Printer (Epson)	PER05	2. attractive appearance	Design	appearance	attractive	Direct Match	
Printer (Epson)	PER05	3. paper feed noisy	Component	paper feed	noisy	Direct Match	
Printer (Epson)	PER05	4. very quick		quick	very	Missing Concept	concept quick can be related to quality in printers
Printer (Epson)	PER05	5. clear font and colour	Component	font and colour	clear	Direct Match	
Printer (Epson)	PER05	6. Worth the money	Acquisition value	money	worth	Direct Match	
Printer (Epson)	PER05	7. Generally well pleased	Affect	well	pleased	Direct Match	
Printer (Epson)	PER06	1. print quality is fine		print quality	fine	Missing Concept	quality of print is missing
Printer (Epson)	PER06	2. Macbook doesn't do wireless	Function	Macbook doesn't do wireless		Uncertain about property	User mentions other brand and a function of product, considering the function which is important, no way to link both
Printer (Epson)	PER07	1. Trouble connecting wirelessly	Function	connecting	trouble	Direct Match	
Printer (Epson)	PER07	2. print quality good		print quality	good	Missing Concept	quality of print is missing
Printer (Epson)	PER08	1. purchased as a scanner	Purpose	purchased as a scanner		Direct Match	
Printer (Epson)	PER08	2. home use	Purpose	home use		Direct Match	
Printer (Epson)	PER08	3. terribly complicated to set up		set up instructions	terribly complicated	Missing Concept	concept of set up/installation is missing
Printer (Epson)	PER08	4. instruction manual sucks	Manual	instruction manual	sucks	Direct Match	
Printer (Epson)	PER08	5. printer serve purpose	Purpose	printer purpose	function	Direct Match	
Printer (Epson)	PER08	6. scanner thumbs down	Purpose	scanner	useless	Direct Match	
Smart TV (Panasonic)	PTR01	1. fantastic TV for price	Price	price	adecuate	Direct Match	
Smart TV (Panasonic)	PTR01	2. quality of product, picture and sound is an excellent TV	Component	product, picture and sound	excellent	Uncertain about concept	user mentions components but also quality, concept that is missing. No way to link both
Smart TV (Panasonic)	PTR01	3. use as secondary PC screen and Apple TV work perfectly	Function	use as a secondary pc screen	works perfectly	Uncertain about property	user talks about usage, not exactly function and also mentions other brands, but there is no way to link both
Smart TV (Panasonic)	PTR01	4. 50" version	Size	50" version		Approximate Match	user mentions size as a version
Smart TV (Panasonic)	PTR02	1. Excellent TV	Affect	tv	excellent	Uncertain about concept	user mentions an evaluation of the product, not exactly its affect.
Smart TV (Panasonic)	PTR02	2. Great picture	Component	picture	great	Direct Match	
Smart TV (Panasonic)	PTR02	3. Good quality		quality	good	Missing Concept	quality is not considered
Smart TV (Panasonic)	PTR02	4. delivery on time	Service Delivery	delivery on time		Direct Match	
Smart TV (Panasonic)	PTR02	5. excellent service	Service Delivery		excellent	Approximate Match	user is talking about quality in delivery
Smart TV (Panasonic)	PTR03	1. love the tv	Affect		love	Direct Match	
Smart TV (Panasonic)	PTR03	2. disappointed with sound	Component	sound	disappointed	Direct Match	
Smart TV (Panasonic)	PTR03	3. picture is lovely	Component	picture	lovely	Direct Match	
Smart TV (Panasonic)	PTR04	1. Compact	Size	compact		Direct Match	
Smart TV (Panasonic)	PTR04	2. lightweight		lightweight		Missing Concept	user mentions weight of product
Smart TV (Panasonic)	PTR04	3. good picture and sound	Component	picture and sound	good	Direct Match	
Smart TV (Panasonic)	PTR05	1. Clear picture from front	Component	picture from front	clear	Direct Match	
Smart TV	PTR05	2. difficult to view when sunlight	Experience	difficult to		Direct Match	
Smart TV (Panasonic)	PTR05	3. cannot be rotated	Function	rotation	no	Uncertain about concept	user can refer also to experience or component, is not clear
Smart TV (Panasonic)	PTR05	4. easy to set up		set up instructions	easy	Missing Concept	set up concept is missing
Smart TV (Panasonic)	PTR05	5. light to carry	Component	carry	light	Missing Concept	related to weight or portability which is missing
Smart TV (Panasonic)	PTR06	1. not slim	Size	slim	no	Approximate Match	relates to tickness not exactly size
Smart TV (Panasonic)	PTR06	2. 7cm deep	Size	7cm deep		Direct Match	

Smart TV (Panasonic)	PTR07	1. very disappointed	Affect		disappointed	Direct Match	
Smart TV (Panasonic)	PTR07	2. very poor sharpness	Component	sharpness	poor	Direct Match	
Smart TV (Panasonic)	PTR07	3. poor colour	Component	colour	poor	Direct Match	
Smart TV (Panasonic)	PTR07	4. low brightness	Component	brightness	low	Direct Match	
Smart TV (Panasonic)	PTR07	5. return it for a refund	Reliability	refund	return	Approximate Match	Related to service function
Smart TV (Panasonic)	PTR07	6. no comparison with previous Panasonic	Brand	Panasonic		Approximate Match	Relates to brand but mainly with previous version, concept unexistant
Camcorder (Sony)	CSR01	1. love this camera	Affect		love	Direct Match	
Camcorder (Sony)	CSR01	2. Sony	Brand	Sony		Direct Match	
Camcorder (Sony)	CSR01	3. great camera	Affect		great	Direct Match	
Camcorder (Sony)	CSR01	4. best parts	Component	parts	best	Direct Match	
Camcorder	CSR01	5. quality improving		quality	improve	Missing	quality non existing concept
Camcorder (Sony)	CSR02	1. very compact	Size	compact	very	Approximate Match	related to size or portability concept, which is missing.
Camcorder (Sony)	CSR02	2. versatile	Affect		versatil	Uncertain about concept	related to affect but also with innovation, concept which is missing
Camcorder	CSR02	3. use for recording my sons	Purpose	recording		Direct Match	
Camcorder (Sony)	CSR02	4. good for very other occasion	Purpose	different ocassion	good	Direct Match	
Camcorder (Sony)	CSR02	5. I really like this item	Affect		like	Direct Match	
Camcorder (Sony)	CSR03	1. compact	Size	compact		Uncertain about concept	related to size but also to portability, concept that is missing
Camcorder (Sony)	CSR03	2. easy to use	Experience	easy to use		Approximate Match	can be also related to function
Camcorder (Sony)	CSR03	3. gives good results	Experience	gives good results		Direct Match	
Camcorder (Sony)	CSR03	4. fits easily into your pocket	Size	fits into pocket	easily	Approximate Match	related to portability, unexistent concept
Camcorder (Sony)	CSR03	5. strong sunlight not always easy to see	Experience	strong sunlight not see	not easy	Uncertain about concept	also related to function
Camcorder (Sony)	CSR04	1. Good camera	Affect		good	Uncertain about concept	related to evaluation of product, unexistent concept
Camcorder	CSR04	2. instruction booklet was vague	Manual	instruction	vague	Direct Match	
Camcorder (Sony)	CSR05	1. camera very good	Affect		very good	Approximate Match	related to evaluation of product, unexistent concept
Camcorder (Sony)	CSR06	1. product not what expected	Affect		unexpected	Approximate Match	related to evaluation of product, unexistent concept.
Camcorder	CSR06	2. not useful for record onto DVD	Function	record onto	not useful	Direct Match	
Camcorder (Sony)	CSR06	3. wouldn't recommend		recommend	no	Missing Concept	adding a concept related to recommendations
Camera (Canon)	CCR01	1. good quality		quality	good	Missing Concept	concept of quality non existing
Camera (Canon)	CCR01	2. zoom function is really good	Component	zoom	really good	Approximate Match	user mentions zoom as function and not component
Camera (Canon)	CCR01	3. copes really well with moving objects	Experience	moving objects	really well	Uncertain about property	user mentions as experience in a way but also as a function
Camera (Canon)	CCR01	4. very pleased	Affect		pleased	Direct Match	
Camera (Canon)	CCR02	1. I take loads of pictures	Function	take pictures	loads	Direct Match	
Camera (Canon)	CCR02	2. image stabilising	Function	image stabilising		Direct Match	
Camera (Canon)	CCR02	3. right price	Price	price	right	Uncertain about concept	Case when price is related to value
Camera (Canon)	CCR02	4. easy to use and navigate menu's	Function	navigate menus	easy	Approximate Match	Is a function but also mentions usage, concept that is missing
Camera (Canon)	CCR03	1. Great camera	Affect		great	Uncertain about concept	related to affect, is talking about product and evaluation.
Camera (Canon)	CCR03	2. like different features	Component	different features	like	Approximate Match	user talks about features instead of functions or components and is not clear what is refering to

Camera (Canon)	CCR03	3. large screen gives clarity	Component	large screen	clarity	Uncertain about property	user mentions component but also its size, no way to link both
Camera (Canon)	CCR04	1. compact camera	Size	compact		Approximate Match	user mentions product size in a way, but specifically portability
Camera (Canon)	CCR04	2. impressed	Affect		impressed	Direct Match	
Camera (Canon)	CCR04	3. borrowed by daughter	Demography	daughter		Direct Match	
Camera (Canon)	CCR05	1. cheap quality		quality	cheaper	Missing Concept	quality concept is missing
Camera (Canon)	CCR05	2. doesn't look really nice	Design	doesn't look	not nice	Direct Match	
Camera (Canon)	CCR05	3. photos/videos not good as	Function	photos/vide	not good	Direct Match	
Camera (Canon)	CCR05	4. still ok for this price	Acquisition value	price	ok	Uncertain about concept	Case also isrelated to price because user mentions it
Camera (Canon)	CCR06	1. fine camera	Style	fine		Uncertain about property	Is related also to evaluation of product
Camera (Canon)	CCR06	2. picture quality not that good	Function	picture	not good	Approximate Match	Is related to the quality of picture and not the function itself
Camera (Canon)	CCR06	3. nice	Aestetics		nice	Uncertain about concept	Not clear if design or style
Camera (Canon)	CCR06	4. light		light		Missing Concept	related to weight (unexisting concept)
Camera (Canon)	CCR06	5. small camera	Size	small		Direct Match	
Camera (Canon)	CCR06	6. baterry life is good	Component	battery life	good	Direct Match	
Camera (Canon)	CCR06	7. Lumix	Brand	Lumix		Direct Match	
Camera (Canon)	CCR07	1. light sensor	Component	light sensor		Direct Match	
Camera (Canon)	CCR07	2. low light is more visible	Function	low light	visible	Direct Match	
Camera (Canon)	CCR07	3. Samsung	Brand	Samsung		Direct Match	
Camera (Canon)	CCR08	1. Useless piece	Affect		useless	Uncertain about concept	user is talking about evaluation of the product in overall not is affect
Camera (Canon)	CCR08	2. fried SD card	Component	SD card		Direct Match	
Camera (Canon)	CCR08	3. Amazon's 30 day policy	Warranty	30 day policy		Direct Match	
MP3 Player (SanDisk Sansa)	PSR01	1. product is great	Affect		great	Direct Match	
MP3 Player	PSR01	2. low volume easy to solve	Function	low volume	easy	Direct Match	
MP3 Player (SanDisk Sansa)	PSR02	1. little	Size	little		Direct Match	
MP3 Player (SanDisk Sansa)	PSR02	2. size of a matchbox	Size	matchbox		Direct Match	
MP3 Player (SanDisk Sansa)	PSR02	3. simple menu	Component	menu	simple	Direct Match	
MP3 Player (SanDisk Sansa)	PSR02	4. readable display	Component	display	readable	Direct Match	
MP3 Player	PSR02	5. insertion micro sd card becomes	Accesory	Micro sd		Direct Match	
MP3 Player (SanDisk Sansa)	PSR02	6. sounds absolutely superb	Function	sound	superb	Direct Match	
MP3 Player (SanDisk Sansa)	PSR02	7. ipods	Brand	ipod		Direct Match	
MP3 Player	PSR02	8. sonys	Brand	sony		Direct Match	
MP3 Player (SanDisk Sansa)	PSR03	1. fantastic MP3 player	Affect		fantastic	Direct Match	
MP3 Player (SanDisk Sansa)	PSR03	2. I've bought two			two	Missing Concept	quantity of products is missing
MP3 Player	PSR03	3. one for myself and my other half	Demography	myself and		Direct Match	
MP3 Player (SanDisk Sansa)	PSR03	4. easy to set up		set up instructions	easy	Missing Concept	set up concept is missing
MP3 Player (SanDisk Sansa)	PSR03	5. transferring music collection	Function	transferring music		Direct Match	
MP3 Player (SanDisk Sansa)	PSR03	6. playing songs	Function	playing songs		Direct Match	
MP3 Player (SanDisk Sansa)	PSR03	7. packaging	Package	packaging		Uncertain about property	user is not clear about what package is refering to
MP3 Player	PSR03	8. protective plastic nearly beat me	Secondary Package	protective	beat	Direct Match	
MP3 Player (SanDisk Sansa)	PSR03	9. should be a health warning for the packaging	Secondary Package	packaging	dislike	Direct Match	
MP3 Player (SanDisk Sansa)	PSR03	10. re-think packaging for the future	Secondary Package	package	new	Uncertain about property	user is giving an idea of innovating package that doesn't entirely correspond to the concept

MP3 Player (SanDisk Sansa)	PSR04	1. excellent product	Affect		excellent	Uncertain about concept	user is refering to evaluation of product or is quality
MP3 Player (SanDisk Sansa)	PSR04	2. bettter operating manual	Manual	manual	better	Direct Match	
MP3 Player (SanDisk Sansa)	PSR04	3. teach how to use it properly	Manual	theach how to use it	properly	Uncertain about concept	is related also to usage or to usability.
MP3 Player (SanDisk Sansa)	PSR05	1. screen too small	Component	screen	small	Uncertain about property	user talks about size and also component, no way to link both
MP3 Player (SanDisk Sansa)	PSR05	2. mother in law	Demography	mother in law		Direct Match	
MP3 Player (SanDisk Sansa)	PSR05	3. show the actual size	Size	actual size	show	Direct Match	
MP3 Player (SanDisk Sansa)	PSR06	1. delightful	Aestetics		delightful	Uncertain about concept	not clear if is the style or design
MP3 Player (SanDisk Sansa)	PSR06	2. little gadget	Size	little		Direct Match	
MP3 Player (SanDisk Sansa)	PSR06	3. volume is mediochre	Component	volume	mediochre	Direct Match	
MP3 Player	PSR06	4. no increase in volume	Component	volume	fail	Direct Match	
MP3 Player (SanDisk Sansa)	PSR07	1. valentine for wife	Purpose	valentine for wife		Uncertain about property	mentions the purpose but also demography, no way to link both
MP3 Player	PSR07	2. radio good	Component	radio	good	Direct Match	
MP3 Player (SanDisk Sansa)	PSR08	1. loved	Affect		love	Direct Match	
MP3 Player (SanDisk Sansa)	PSR08	2. little	Size	little		Direct Match	
MP3 Player (SanDisk Sansa)	PSR08	3. expand volume limits	Component	volume	expand	Direct Match	
MP3 Player (SanDisk Sansa)	PSR08	4. stopped turning after 5 months		5 months		Missing Concept	user refering tolife cycle of the product or duration
MP3 Player (SanDisk Sansa)	PSR08	5. totally unresponsive	Component		unresponsive	Missing Concept	user refering to life cycle of product or property of quality

Appendix G: CRO Ontology

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    <!ENTITY dc "http://purl.org/dc/elements/1.1/" >
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#" >
    <!ENTITY owl2xml "http://www.w3.org/2006/12/owl2-xml#" >
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema#" >
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
    <!ENTITY osmethodology "http://www.ordnancesurvey.co.uk/ontologies/osmethodology/1.0/" >
    <!ENTITY                                                    Ontology1407497427514
"http://www.semanticweb.org/ontologies/2014/7/Ontology1407497427514.owl#" >
]>


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     xmlns:dc="http://purl.org/dc/elements/1.1/"
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     xmlns:owl2xml="http://www.w3.org/2006/12/owl2-xml#"
     xmlns:osmethodology="http://www.ordnancesurvey.co.uk/ontologies/osmethodology/1.0/"
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     xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
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427514.owl#"
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    </Annotation>
    <Annotation annotationURI="&dc;creator">
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>The ontology focus on general aspects of customer reviews, its been validated particularly in the domain of electronic products.</Constant>
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        >The buyers&amp;#39; perceptions of the relative worth of a product or service to them. It is formally defined as the subjectively weighted difference between the most a buyer would be willing to pay for the item less the actual price of the item. Also related to price, in which any particular lower price item might be said to have good quality for the money; this use equates product quality with product value. [AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
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>Uniquely identifiable input, part, piece, assembly or subassembly, system or subsystem, that is required to complete a product or is intended to be included as a part of a finished, packaged and labeled item.
[Business Dictionary http://www.businessdictionary.com/]</Constant>
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>A printed certificate entitling the bearer to a stated price reduction or special value on a specific product, generally for a specified period of time. The value of the coupon is set and redeemed by the seller.
[AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
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>A customer review is a review of a product or service made by a customer who has purchased the product or service. Customer reviews are a form of customer feedback on electronic commerce and sites. There are also dedicated review sites some of which use customer reviews as well as or instead of professional reviews. The reviews may themselves be graded for usefulness or accuracy by other users.
[Business Dictionary http://www.businessdictionary.com/]</Constant>
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>Every CustomerReview hasAuthor exactly 1 Customer.</Constant>
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</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Customerreview"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">

<Constant
>Every CustomerReview hasEBusiness exactly 1 EBusiness.</Constant>
</Annotation>
</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Customerreview"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Every CustomerReview hasProduct at least 1 Product.</Constant>
</Annotation>
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>DeliveryFeature is a concept.</Constant>
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>Every DeliveryFeature is a kind of ServiceFeature.</Constant>

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    <Class URI="&Ontology1407497427514;Camera"/>
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    </Annotation>
</EntityAnnotation>
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    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
        <Constant
            >Every DigitalCamera is a kind of Camera.</Constant>
    </Annotation>
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    <Annotation annotationURI="&rdfs;label">
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</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Digitalcamera"/>
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<Class URI="&Ontology1407497427514;Durability"/>
<Class URI="&Ontology1407497427514;Specificfeature"/>
</SubClassOf>
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<Class URI="&Ontology1407497427514;Durability"/>
<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>Assurance or probability that an equipment, machine, material will have a relatively long continuous life, without requiring an inordinate degree of maintenance. [Business Dictionary http://www.businessdictionary.com/]</Constant>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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>Durability is a concept.</Constant>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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>Every Durability is a kind of SpecificFeature.</Constant>
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</EntityAnnotation>
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<Annotation annotationURI="&rdfs;label">
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</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Durability"/>
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</SubClassOf>
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<ObjectProperty URI="&Ontology1407497427514;hasservice"/>
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<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>A term referring to a wide variety of Internet-based business models. Typically, an e-commerce strategy incorporates various elements of the marketing mix to drive users to a Web site for the purpose of purchasing a product or service. [AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
</Annotation>
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>EBusiness is a concept.</Constant>
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         >Every EBusiness hasService ServiceFeature.</Constant>
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   <Class URI="&Ontology1407497427514;Electronics"/>
   <Class URI="&Ontology1407497427514;Productcategory"/>
</SubClassOf>
<SubClassOf>
   <Class URI="&Ontology1407497427514;Electronics"/>
   <ObjectSomeValuesFrom>
      <ObjectProperty URI="&Ontology1407497427514;hasspecificfeature"/>
      <Class URI="&Ontology1407497427514;Durability"/>
   </ObjectSomeValuesFrom>
</SubClassOf>
<SubClassOf>
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    <Class URI="&Ontology1407497427514;Electronics"/>
    <ObjectSomeValuesFrom>
      <ObjectProperty URI="&Ontology1407497427514;hasspecificfeature"/>
      <Class URI="&Ontology1407497427514;Installation"/>
    </ObjectSomeValuesFrom>
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  <SubClassOf>
    <Class URI="&Ontology1407497427514;Electronics"/>
    <ObjectSomeValuesFrom>
      <ObjectProperty URI="&Ontology1407497427514;hasspecificfeature"/>
      <Class URI="&Ontology1407497427514;Portability"/>
    </ObjectSomeValuesFrom>
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    <Class URI="&Ontology1407497427514;Electronics"/>
    <ObjectSomeValuesFrom>
      <ObjectProperty URI="&Ontology1407497427514;hasspecificfeature"/>
      <Class URI="&Ontology1407497427514;Usability"/>
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    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
      <Constant
        >Every Electronics hasSpecificFeature Durability.</Constant>
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  </EntityAnnotation>
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    <Class URI="&Ontology1407497427514;Electronics"/>
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    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
      <Constant
        >Every Electronics hasSpecificFeature Usability.</Constant>
    </Annotation>
  </EntityAnnotation>
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    <Class URI="&Ontology1407497427514;Electronics"/>
    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
      <Constant
        >Every Electronics is a kind of ProductCategory.</Constant>
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    <Annotation annotationURI="&rdfs;label">
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<Class URI="&Ontology1407497427514;Genericfeature"/>
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<Class URI="&Ontology1407497427514;Specificfeature"/>
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>Every GenericFeature is a kind of ProductFeature.</Constant>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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>GenericFeature is a concept.</Constant>
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<Annotation annotationURI="&rdfs;label">
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</Annotation>
</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Specificfeature"/>
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<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>Connection to services required to make the product equipment ready for operation.
[Business Dictionary http://www.businessdictionary.com/]</Constant>
</Annotation>
</EntityAnnotation>
<EntityAnnotation>
<Class URI="&Ontology1407497427514;Installation"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Every Installation is a kind of SpecificFeature.</Constant>
</Annotation>
</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Installation"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Installation is a concept.</Constant>
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</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Installation"/>
<Annotation annotationURI="&rdfs;label">
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</EntityAnnotation>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">

<Constant
>Every Laptop is a kind of Computer.</Constant>
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>Laptop is a concept.</Constant>
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<Annotation annotationURI="&rdfs;label">
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</SubClassOf>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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>Every MP3 is a kind of Audio.</Constant>
</Annotation>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>MP3 is a concept.</Constant>

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  </Declaration>
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    <Class URI="&owl;Thing"/>
  </SubClassOf>
  <EntityAnnotation>
    <Class URI="&Ontology1407497427514;Occupation"/>
    <Annotation annotationURI="&osmethodology;natural_language_description">
      <Constant
        >Job or profession.
[Business Dictionary http://www.businessdictionary.com/]</Constant>
    </Annotation>
  </EntityAnnotation>
  <EntityAnnotation>
    <Class URI="&Ontology1407497427514;Occupation"/>
    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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    </Annotation>
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    </Annotation>
  </EntityAnnotation>
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<Class URI="&Ontology1407497427514;Overallopinion"/>
</SubClassOf>
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<Class URI="&Ontology1407497427514;Overallexperience"/>
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>Every OverallExperience is a kind of OverallOpinion.</Constant>
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<Constant
>OverallExperience</Constant>
</Annotation>
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<Class URI="&Ontology1407497427514;Overallexperience"/>
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<Class URI="&Ontology1407497427514;Overallopinion"/>
<Class URI="&owl;Thing"/>
</SubClassOf>
<EntityAnnotation>

<Class URI="&Ontology1407497427514;Overallopinion"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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>OverallOpinion is a concept.</Constant>
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</EntityAnnotation>
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<Annotation annotationURI="&rdfs;label">
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</Annotation>
</EntityAnnotation>
<Declaration>
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</Declaration>
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<Class URI="&Ontology1407497427514;Genericfeature"/>
</SubClassOf>
<EntityAnnotation>
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<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>The container used to protect, promote, transport, and/or identify a product. The package may vary from a plastic band wrap to a steel or wooden box or drum. It may be primary (contains the product), secondary (contains one or more primary packages), or tertiary (contains one or more secondary packages).
[AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
</Annotation>
</EntityAnnotation>
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>Every Package is a kind of GenericFeature.</Constant>
</Annotation>

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      <Constant>Package</Constant>
   </Annotation>
</EntityAnnotation>
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</Declaration>
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   <Class URI="&Ontology1407497427514;Servicefeature"/>
</SubClassOf>
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   <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
      <Constant
         >Every PackageFeature is a kind of ServiceFeature.</Constant>
   </Annotation>
</EntityAnnotation>
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   <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
      <Constant
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   </Annotation>
</EntityAnnotation>
<EntityAnnotation>
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<Annotation annotationURI="&rdfs;label">
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<Class URI="&Ontology1407497427514;Packagefeature"/>
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<Class URI="&Ontology1407497427514;Portability"/>
<Class URI="&Ontology1407497427514;Specificfeature"/>
</SubClassOf>
<EntityAnnotation>
<Class URI="&Ontology1407497427514;Portability"/>
<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>Able to be easily carried or moved, especially because being of a lighter and smaller version than usual.
[Oxford Dictionary http://www.oxforddictionaries.com/]</Constant>
</Annotation>
</EntityAnnotation>
<EntityAnnotation>
<Class URI="&Ontology1407497427514;Portability"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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>Every Portability is a kind of SpecificFeature.</Constant>
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</EntityAnnotation>
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    <Class URI="&Ontology1407497427514;Genericfeature"/>
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    </Annotation>
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    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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    <Annotation annotationURI="&rdfs;label">
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    </Annotation>
</EntityAnnotation>
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    <Class URI="&Ontology1407497427514;Price"/>
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<SubClassOf>
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<Class URI="&Ontology1407497427514;Printcopyscanfax"/>
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</SubClassOf>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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>Every PrintCopyScanFax is a kind of Electronics.</Constant>
</Annotation>
</EntityAnnotation>
<EntityAnnotation>
<Class URI="&Ontology1407497427514;Printcopyscanfax"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>PrintCopyScanFax is a concept.</Constant>
</Annotation>
</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Printcopyscanfax"/>
<Annotation annotationURI="&rdfs;label">
<Constant
>PrintCopyScanFax</Constant>
</Annotation>
</EntityAnnotation>
<Declaration>
<Class URI="&Ontology1407497427514;Printcopyscanfax"/>
</Declaration>
<SubClassOf>
<Class URI="&Ontology1407497427514;Printer"/>
<Class URI="&Ontology1407497427514;Printcopyscanfax"/>
</SubClassOf>
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<Class URI="&Ontology1407497427514;Printer"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Every Printer is a kind of PrintCopyScanFax.</Constant>

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    </Annotation>
</EntityAnnotation>
<EntityAnnotation>
    <Class URI="&Ontology1407497427514;Printer"/>
    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
        <Constant
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    </Annotation>
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    <Class URI="&Ontology1407497427514;Printer"/>
    <Annotation annotationURI="&rdfs;label">
        <Constant>Printer</Constant>
    </Annotation>
</EntityAnnotation>
<Declaration>
    <Class URI="&Ontology1407497427514;Printer"/>
</Declaration>
<SubClassOf>
    <Class URI="&Ontology1407497427514;Product"/>
    <Class URI="&owl;Thing"/>
</SubClassOf>
<SubClassOf>
    <Class URI="&Ontology1407497427514;Product"/>
    <ObjectSomeValuesFrom>
        <ObjectProperty URI="&Ontology1407497427514;hasaugmentation"/>
        <Class URI="&Ontology1407497427514;Productaugmentation"/>
    </ObjectSomeValuesFrom>
</SubClassOf>
<SubClassOf>
    <Class URI="&Ontology1407497427514;Product"/>
    <ObjectMinCardinality cardinality="1">
        <ObjectProperty URI="&Ontology1407497427514;hasfeature"/>
        <Class URI="&Ontology1407497427514;Productfeature"/>
    </ObjectMinCardinality>
</SubClassOf>
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<SubClassOf>
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<ObjectMinCardinality cardinality="1">
<ObjectProperty URI="&Ontology1407497427514;hasfunction"/>
<Class URI="&Ontology1407497427514;Productfunction"/>
</ObjectMinCardinality>
</SubClassOf>
<SubClassOf>
<Class URI="&Ontology1407497427514;Product"/>
<ObjectMinCardinality cardinality="1">
<ObjectProperty URI="&Ontology1407497427514;haspart"/>
<Class URI="&Ontology1407497427514;Productpart"/>
</ObjectMinCardinality>
</SubClassOf>
<EntityAnnotation>
<Class URI="&Ontology1407497427514;Product"/>
<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>A bundle of attributes (features, functions, benefits, and uses) capable of exchange or use; usually a mix of tangible and intangible forms. Thus a product may be an idea, a physical entity (a good), or a service, or any combination of the three. It exists for the purpose of exchange in the satisfaction of individual and organizational objectives. The term for tangible products is goods, and it should be used with services to make the tangible/ intangible pair, as subsets of the term product.
[AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
</Annotation>
</EntityAnnotation>
<EntityAnnotation>
<Class URI="&Ontology1407497427514;Product"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Every Product hasAugmentation ProductAugmentation.</Constant>
</Annotation>
</EntityAnnotation>
<EntityAnnotation>
<Class URI="&Ontology1407497427514;Product"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">

<Constant
>Every Product hasFeature at least 1 ProductFeature.</Constant>
</Annotation>
</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Product"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Every Product hasFunction at least 1 ProductFunction.</Constant>
</Annotation>
</EntityAnnotation>
<EntityAnnotation>
<Class URI="&Ontology1407497427514;Product"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Every Product hasPart at least 1 ProductPart.</Constant>
</Annotation>
</EntityAnnotation>
<EntityAnnotation>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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>Product is a concept.</Constant>
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<Class URI="&owl;Thing"/>
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</SubClassOf>
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<Constant
>This is the view of a product that includes not only its core benefit and its physical being, but adds other sources of benefits such as service, warranty, and image. The augmented aspects are added to the physical product by action of the seller, e.g., with company reputation or with service. [AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
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</EntityAnnotation>
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>Every ProductAugmentation hasCustomerPerception CustomerPerception.</Constant>
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<Class URI="&Ontology1407497427514;Genericfeature"/>
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>Every ProductCategory hasGenericFeature GenericFeature.</Constant>
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<Constant

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        >Every ProductCategory hasSpecificFeature SpecificFeature.</Constant>
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      <Annotation annotationURI="&osmethodology;natural_language_description">
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          >A reduction in price.
  [AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
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    </EntityAnnotation>
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    <Class URI="&Ontology1407497427514;Productfeature"/>
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        <Class URI="&Ontology1407497427514;Customerperception"/>
    </ObjectSomeValuesFrom>
</SubClassOf>
<EntityAnnotation>
    <Class URI="&Ontology1407497427514;Productfeature"/>
    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
        <Constant
            >Every ProductFeature hasCustomerPerception CustomerPerception.</Constant>
    </Annotation>
</EntityAnnotation>
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>ProductFeature is a concept.</Constant>
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<Class URI="&Ontology1407497427514;Customerperception"/>
</ObjectSomeValuesFrom>
</SubClassOf>
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<Class URI="&Ontology1407497427514;Productfunction"/>
<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>An action performed by a product or person that produces a result. Function remains fix whereas the purpose (which indicates intention or objective) generally changes. For example, the function of a hammer is to strike something nearby whereas its purpose (what to strike and why) could be anything the person has in mind.
[Business Dictionary http://www.businessdictionary.com/]</Constant>

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    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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    <Class URI="&Ontology1407497427514;Productaugmentation"/>
  </SubClassOf>
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    <Class URI="&Ontology1407497427514;Productmanual"/>
    <Annotation annotationURI="&osmethodology;natural_language_description">
      <Constant
        >Comprehensive and step-by-step guide to a particular product that also serve as a reference
book.
 [Business Dictionary http://www.businessdictionary.com/]</Constant>
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    </Annotation>
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    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
        <Constant
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    <Class URI="&Ontology1407497427514;Productmanual"/>
    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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    <Annotation annotationURI="&rdfs;label">
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    <Class URI="&owl;Thing"/>
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    <Class URI="&Ontology1407497427514;Productpart"/>
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        <ObjectProperty URI="&Ontology1407497427514;hascustomerperception"/>
        <Class URI="&Ontology1407497427514;Customerperception"/>
    </ObjectSomeValuesFrom>
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<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>In manufactured products are bought as components of other goods being produced. Parts are often sold simultaneously in industrial channels (original equipment) and in consumer channels for replacement purposes
[AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
</Annotation>
</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Productpart"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Every ProductPart hasCustomerPerception CustomerPerception.</Constant>
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<Class URI="&Ontology1407497427514;Productpart"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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<Class URI="&Ontology1407497427514;Productaugmentation"/>

</SubClassOf>
<EntityAnnotation>
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<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>A statement or promise made to the customer that a product being offered for sale is fit for the purpose being claimed. The promise concerns primarily what the seller will do if the product performs below expectations or turns out to be defective in some way.
[AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
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<Class URI="&owl;Thing"/>
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<EntityAnnotation>
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<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>The intention, objective or reason for which the customer bought the product.
[Business Dictionary http://www.businessdictionary.com/]</Constant>
</Annotation>
</EntityAnnotation>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
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<Annotation annotationURI="&rdfs;label">
<Constant>Purpose</Constant>
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>Every Scanner is a kind of PrintCopyScanFax.</Constant>
</Annotation>

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         >Scanner is a concept.</Constant>
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   <Class URI="&Ontology1407497427514;Scanner"/>
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   <Class URI="&owl;Thing"/>
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<SubClassOf>
   <Class URI="&Ontology1407497427514;Servicefeature"/>
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      <ObjectProperty URI="&Ontology1407497427514;hascustomerperception"/>
      <Class URI="&Ontology1407497427514;Customerperception"/>
   </ObjectSomeValuesFrom>
</SubClassOf>
<EntityAnnotation>
   <Class URI="&Ontology1407497427514;Servicefeature"/>
   <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
      <Constant
         >Every ServiceFeature hasCustomerPerception CustomerPerception.</Constant>
   </Annotation>
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<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>Those sizes that are usually large, small, or extraordinary in some respect.
[AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
</Annotation>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Every Size is a kind of GenericFeature.</Constant>
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>SocialAspect is a concept.</Constant>
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<Constant>SocialAspect</Constant>
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<Class URI="&Ontology1407497427514;Productfeature"/>
</SubClassOf>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Every SpecificFeature is a kind of ProductFeature.</Constant>
</Annotation>
</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Specificfeature"/>
<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>SpecificFeature and GenericFeature are mutually exclusive.</Constant>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>SpecificFeature is a concept.</Constant>
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</SubClassOf>

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>Every Tablet is a kind of Computer.</Constant>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
<Constant
>Tablet is a concept.</Constant>
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<Class URI="&Ontology1407497427514;Tablet"/>
<Annotation annotationURI="&rdfs;label">
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<Class URI="&Ontology1407497427514;Specificfeature"/>
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<Class URI="&Ontology1407497427514;Usability"/>
<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>Ease, speed, and intuitiveness in operating or using a device, service, or facility. Usability arises from a combination of well thought-out architectural and design factors, and translates into user's ability to successfully perform tasks and solve problems with customary effort.
[Business Dictionary http://www.businessdictionary.com/]</Constant>
</Annotation>

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    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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        >Every Usability is a kind of SpecificFeature.</Constant>
    </Annotation>
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    <Class URI="&Ontology1407497427514;Usability"/>
    <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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    </Annotation>
  </EntityAnnotation>
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    <Class URI="&Ontology1407497427514;Usability"/>
    <Annotation annotationURI="&rdfs;label">
      <Constant>Usability</Constant>
    </Annotation>
  </EntityAnnotation>
  <Declaration>
    <Class URI="&Ontology1407497427514;Usability"/>
  </Declaration>
  <SubClassOf>
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    <Class URI="&Ontology1407497427514;Genericfeature"/>
  </SubClassOf>
  <EntityAnnotation>
    <Class URI="&Ontology1407497427514;Version"/>
    <Annotation annotationURI="&osmethodology;natural_language_description">
      <Constant
        >One or several releases of the same product containing major changes.
[Business Dictionary http://www.businessdictionary.com/]</Constant>
    </Annotation>
  </EntityAnnotation>
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      <Constant
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   </Annotation>
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   <Class URI="&Ontology1407497427514;Version"/>
   <Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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   <Annotation annotationURI="&rdfs;label">
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   </Annotation>
</EntityAnnotation>
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   <Class URI="&Ontology1407497427514;Version"/>
</Declaration>
<SubClassOf>
   <Class URI="&Ontology1407497427514;Webpagefeature"/>
   <Class URI="&owl;Thing"/>
</SubClassOf>
<SubClassOf>
   <Class URI="&Ontology1407497427514;Webpagefeature"/>
   <ObjectSomeValuesFrom>
      <ObjectProperty URI="&Ontology1407497427514;hascustomerperception"/>
      <Class URI="&Ontology1407497427514;Customerperception"/>
   </ObjectSomeValuesFrom>
</SubClassOf>
<EntityAnnotation>
   <Class URI="&Ontology1407497427514;Webpagefeature"/>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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<Constant
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</Annotation>
</EntityAnnotation>
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<Constant>WebPageFeature</Constant>
</Annotation>
</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Webpagefeature"/>
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<Class URI="&Ontology1407497427514;Webpagereliability"/>
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</SubClassOf>
<EntityAnnotation>
<Class URI="&Ontology1407497427514;Webpagereliability"/>
<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>The ability of the web page to consistently perform its required function on demand without failure.
[Business Dictionary http://www.businessdictionary.com/]</Constant>
</Annotation>
</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Webpagereliability"/>

<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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>Every WebPageReliability is a kind of WebPageFeature.</Constant>
</Annotation>
</EntityAnnotation>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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</EntityAnnotation>
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<Class URI="&Ontology1407497427514;Webpagefeature"/>
</SubClassOf>
<EntityAnnotation>
<Class URI="&Ontology1407497427514;Webpageusability"/>
<Annotation annotationURI="&osmethodology;natural_language_description">
<Constant
>The ease with which visitors are able to use a Web site.
[AMA Dictionary https://www.ama.org/resources/Pages/Dictionary.aspx]</Constant>
</Annotation>
</EntityAnnotation>
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<Annotation annotationURI="&osmethodology;related_rabbit_sentence">
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