Construal Level Theory and Maslow's Hierarchy with Machine Learning for Enhanced Consumer Demand Analysis

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Keywords: Construal Level Theory (CLT), Maslow's Hierarchy of Needs, Brand Differentiation, Supervised Classification Learning, Psychological Labeling.

Abstract: This study delves into the intersection of Construal Level Theory (CLT) and Maslow's Hierarchy of Needs through the lens of advanced machine learning. By adopting psychological labeling and supervised classification learning, it engages with Maslow's model to scrutinize the market's terrain—differentiating emergent brands from established counterparts and examining the fulfillment of consumer needs. This inquiry provides a granular view of how brands cater to the various psychological and spatial dimensions outlined by Maslow and CLT. The fusion of these psychological frameworks with computational analytics serves to shed light on the subtleties of brand performance and consumer preferences. The methodology bridges the gap between abstract psychological theories and their tangible implications in machine learning. The resultant insights afford a richer comprehension of consumer behavior, equipping businesses with the means to fine-tune their marketing endeavors. The enhanced understanding gained through this interdisciplinary approach paves the way for more targeted marketing interventions, thereby improving business decision-making processes and fostering more effective consumer engagement.

1 INTRODUCTION

As psychological research has deepened our understanding of how psychological processes affect behaviors in various fields such as communication, memory, decision-making, and emotion (British Psychological Society, 2021), people are increasingly interested in applying these insights to consumer research. This method helps to better understand the intricacies of consumers' personal thoughts, desires, and experiences (Malter et al., 2020).

In addition, psychology has recognized the great potential of machine learning to explain theoretical constructs and build more dynamic and predictive models (Yarkoni & Westfall, 2017). This paper proposes to combine CLT and Maslow demand hierarchy theory with machine learning technology. These methods can handle complex nonlinear relationships and huge data sets to better understand consumer needs.

Our goal is to explore how to apply these advanced technologies to enhance the brand's product strategy, improving efficiency as well as addressing the psychological and emotional contours of consumer decisions. As a result of such integration, the interaction between the brand and the consumer should be closer to their psychology, as well as increase artificial intelligence's ability to understand and respond to the subtle needs of digital users.

2 BACKGROUND AND RELATED WORK

This chapter explains three theories, starting with objects as part of the extension of the self, as a means of rationalizing the movement toward ownership, control, and proximity in the theory of mental framing, and proposing Maslow's needs as a model for a staged interpretation of consumer needs. This is used as a theoretical basis for the following chapter on mental labeling.

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2.1 Theories

2.1.1 Sartre and Belk

In his 1988 study, Property and the Extended Self, Belk explores how objects play an integral role in who we are and introduces the concept of the extended self as an extension of us. In addition to examining individual ownership of objects, the study examines the way we relate to them from a broader perspective. Objects define our sense of self, as the writer Yi-Fu Tuan (1980) points out, because we are, in a large part, what we own and possess. He states, "Our fragile sense of self needs support, and we get that support by owning and possessing objects."

It is advisable to keep all the given values. Belk's view further clarifies how objects are seen as an extension of our self-concept, from a part of our body to the physical environment around us. According to Jean-Paul Sartre's (1943) theory, the ways in which objects become "extensions of the self" primarily involve controlling, creating, and making sense of them. These processes extend beyond the individual to include collective identities such as families, groups, subcultures and nations. David (1951) suggests that by creating or deeply understanding an object, an individual can internalize it as part of their own identity. This involves both the creation of material objects and abstract concepts and the process of becoming intimate with the object and seeing it as part of the self.

Belk's (1988) research suggests that by owning and controlling objects, consumers effectively reduce the psychological distance between themselves and those objects. For example, by knowing and customizing a smartphone to reflect personal tastes and preferences, an individual may feel that the phone is an integral part of him or her, thereby significantly reducing the psychological distance from the object.

2.1.2 Construal Level Theory

The core motivation for viewing objects as extensions of the self is partly motivated by the quest for completeness, which evolves into control and possession of objects. This dovetails with Construal Level Theory (CLT), which focuses on narrowing psychological distances and emphasizes four types of distances - temporal, social, spatial, and hypothetical - that converge psychologically to form psychological distances that influence decision-making in different contexts.

Jean-Paul Sartre (1943) theorized that controlling and owning objects effectively reduces the psychological distance between us and those objects. Ownership extends beyond the physical to include the perception of consumer goods, their personalization, and their reflection of one's identity and social status. For example, personalizing smartphone settings to reflect personal preferences makes the phone an integral part of the individual, thus significantly reducing psychological distance. Psychological distance is positively related to the level of mental representation an individual establishes of an object, event, or person (Sordi et al., 2022).

Influenced by emotional or cognitive processes, consumer decision-making varies depending on the level of abstraction of their thinking, with higher levels of abstraction preferring modern products that are feature-rich (Ding et al., 2017). Direct experience with a product shortens the psychological distance and makes the consumer's interaction with the product more concrete (Trope & Liberman, 2010).

Combined with the insights of Sam Maglio (2019), psychological distance also influences how consumers envision and act on possibilities. Even at the initial decision-making stage, this distance can cause systemic shifts, as what is psychologically distant must be mentally visualized, while what is close can be directly observed. For organizations, managing social distance is critical to managing relationships with customers, and it influences how consumers perceive brands that are psychologically close or distant. Therefore, understanding and applying cultural communication techniques can have a significant impact on marketing strategy and consumer engagement by addressing the psychological distance that affects consumer perception and behavior.

2.1.3 Maslow Demand

When discussing consumer goods as extensions of the self, it is clear that the symbolism of consumer goods varies over time, cultures, and individual and collective contexts. Such variations reflect the diversity exhibited by the different characteristics and attributes of consumer goods. Maslow's (1943) Hierarchy of Needs describes human needs as ranging from basic physiological needs like food and air to higher level needs like self-esteem and self-actualization.

Jordan (1999) extended this framework to the hierarchy of needs of product users, defining levels of functionality, usability, and pleasure, highlighting how products evolve to satisfy these multiple levels of human needs. Oghenemaro (2023) updated Maslow's hierarchy of needs by emphasizing that

once the individual has met the basic needs, he progressively seeks to satisfy more complex needs that motivate behavior until self-actualization. This refined understanding allows us to better recognize and satisfy the different needs of consumers and to understand the tendency of products to migrate to higher Maslowian needs during their gradual formation and maturation.

By further exploring Maslow's Hierarchy Theory, we can categorize needs into multiple dimensions, such as product value, social value and personal value, thus laying a solid foundation for understanding consumer behavior and designing products and services that satisfy these needs.

2.2 Gaps

2.2.1 Theoretical Gaps

The theoretical gaps identified through the review and analysis of the existing literature suggest that while Construal Level Theory (CLT) has been widely used in various fields, especially in marketing and online retailing through high-frequency word analysis, there is a relative paucity of research on the intersection of CLT and consumer behavior. Furthermore, an important theoretical gap in the consumer decision-making process relates to the mental representation of unchosen alternatives. Existing literature emphasizes how mental representations of situations influence product choice, but there is still little discussion on how non-selective decisions are constructed. For example, Sordi et al. (2022) argue that consumers may also employ rejection strategies that systematically eliminate options until a final choice is made. As noted by Mourali & Nagpal (2013), such strategies can produce different outcomes even when the same set of options is considered.

Cultural linguistics has been used in many different domains, but few studies combine its analysis with other theories or models (such as Maslow's Hierarchy of Needs) or with artificial intelligence to model and annotation consumer demand. There is an urgent need for research that explores the intricate relationship between culture and consumer behavior, with a particular focus on how to incorporate machine learning to analyze consumer demand and the corresponding product offering strategies of brands.

2.2.2 Methodology Gaps

In relation to Maslow's classification of needs, Jastrzebska and Homenda (2012) provide a detailed categorization of needs, including applying Maslow's Hierarchy Theory to their model to quantify the impact of needs on an individual's behavior on a scale of zero to one. They categorized needs into physiological, safety, love and belonging, esteem and self-actualization needs and defined these needs throughout the needs space. This helps to differentiate consumer need vectors based on their similarities and dissimilarities and provides a methodological basis for further exploration of consumer similarity measurement.

However, there are obvious limitations to these models, as well as the fact that the research relies primarily on qualitative rather than quantitative analysis, which results in a lack of relevant word frequencies to label needs and limits the effective integration of consumer cues into the algorithm. In addition, while cluster analysis has been used to identify CLT or Maslow's high-frequency words, these words have not been used in conjunction with machine learning methods to model consumer needs. This identifies a theoretical gap where the application of CLT in consumer behavior research, combined with advanced computational techniques, can increase the depth of consumer demand models.

3 METHOD

Using online retail data and psychographic labels, I will categorize products and brands in this section. My approach is to use Maslow's Hierarchy of Needs Theory in conjunction with Constructive Level Theory (CLT) to develop a comprehensive demand model for each brand that primarily addresses Maslow's hierarchy of needs.

3.1 Data Preparation

To analyze the relationship between product sales and consumer needs, sales data from 16 e-commerce brands were collected, covering the top 30-50 best-selling products for each, resulting in 600 data points. This data was processed and labeled according to Maslow's hierarchy of needs—basic, safety, social, esteem, and self-actualization—and four CLT distance metrics: temporal, spatial, social, and hypothetical.

With the use of automatic keyword matching technology (see table 1), products or brands were categorized based on Maslow's needs and CLT distances, allowing branch and node modeling to take place.

Table 1: Synonyms and keyword matching.

	CLT Distance Synonyms
Physiological Needs	• **Time Distance**: Instant Delivery, 24/7 Service • **Space Distance**: Locally Produced, Local Supply Chain • **Social Distance**: Group Buying Offers, Family Packages • **Hypothetical Distance**: Product Quality Guarantees, Satisfaction Refunds
Safety Needs	• **Time Distance**: Extended Warranties, Ongoing Maintenance Services • **Space Distance**: Safety-Certified Products, Traceability Systems • **Social Distance**: User Safety Ratings, Trusted Seller Badges • **Hypothetical Distance**: Insurance Services, Risk Alerts
Social Needs	• **Time Distance**: Seasonal Social Events, Holiday Sales • **Space Distance**: Community Stores, Social Media Interactions • **Social Distance**: User Groups, Social Sharing Rewards • **Hypothetical Distance**: Influencer Endorsements, Customer Testimonials
Esteem Needs	• **Time Distance**: Limited Edition Products, Loyalty Reward Programs • **Space Distance**: Exclusive Merchandise, Customization Services • **Social Distance**: Brand Membership Privileges, User Rating Systems • **Hypothetical Distance**: Excellence Service Certifications, Elite User Groups
Self-Actualization Needs	• **Time Distance**: Personal Development Courses, Creative Workshops • **Space Distance**: Global Creative Marketplaces, International Cultural Products • **Social Distance**: Creator Communities, Artist Live Sessions • **Hypothetical Distance**: Self-Expression Tools, Inspiration-Triggering Products

3.2 Demand Model

Using Maslow's five hierarchies of needs as nodes, the model is represented as a node-and-branch diagram (see Figure 2). These need nodes are interconnected through specific links, known as "branches", and each branch describes the physiological distance associated with a product through the four characteristics of CLT.

With CLT features, this model maps the dynamic relationship between needs and assesses the degree of connection between products and needs. For example, how a product meets a user's security needs through its functionality and features, while at the same time adapting to the consumer's social needs in time and space. By analyzing these connections and distances in detail, we can gain insights into how a product "moves" or evolves between different levels of needs.

3.3 Result

The categorization of brands into clusters according to how they satisfy these needs and their respective CLT distances provides an insightful approach to analyze brand market. Particularly, Cluster 1 (see Figure 1), featuring brands like Xiaomi and Lululemon, showcases an extensive coverage of Maslow's demands, each paired with a unique CLT distance feature. It's notable how these brands span all five of Maslow's demands (see Figure 2), suggesting a comprehensive strategy to meet diverse consumer needs.

The additional observations from Cluster 1 align with the principles of CLT. By minimizing hypothetical and temporal distances, these brands help consumers more vividly imagine using their products in the near future. Detailed presentations enable a clearer and more immediate vision of product use, fostering a sense of proximity and tangibility.

In addition, the study emphasizes the value of reducing spatial and hypothetical distances. Many of these brands categorized as Cluster1 have their own offline physical stores. By providing a direct product experience, these brands are able to reduce spatial distance, thereby enhancing the tangibility and credibility of their products. These factors greatly influence consumer trust and confidence, which is crucial for an in-person shopping experience. Through the presence of a physical store, brands are able to not only provide an opportunity to physically touch and feel the product, but also enhance consumers' willingness to buy through direct human interaction and immediate service feedback.

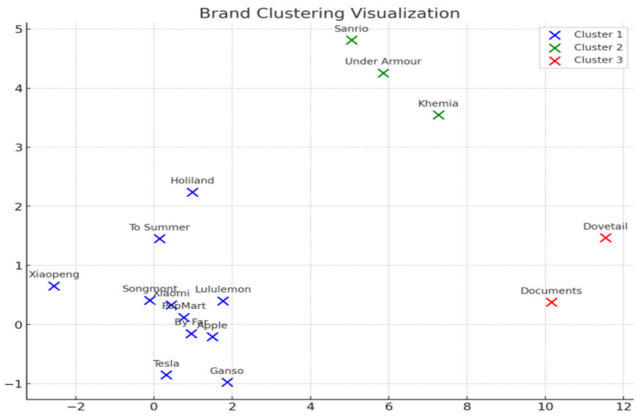

Figure 1: Brand Clustering Visulization.

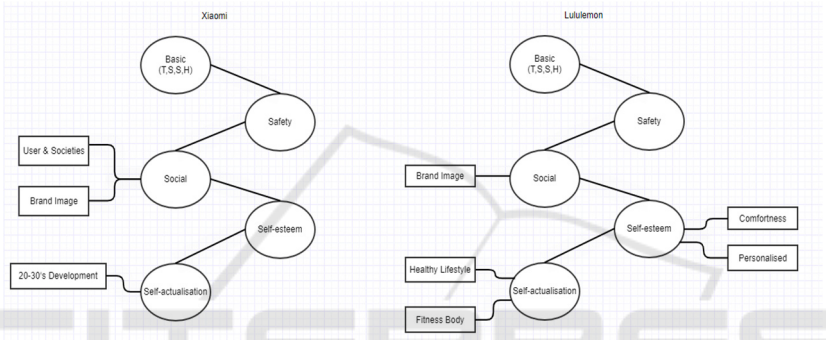

Figure 2: Demand Model.

4 CONCLUSION

4.1 Summary

In this study, we constructed a graph that reflects the aggregation of similar brands. This analysis initially involved labeling the data according to Maslow's hierarchy of needs, which are satisfied by the products, and proceeded with additional labeling and clustering in relation to the psychological distances—such as temporal, spatial, and social distances—outlined in Construal Level Theory (CLT). This methodology allows us to uncover how various brands meet distinct consumer needs and deepen our understanding of brand positioning in terms of consumers' perception of psychological distance.

Drawing on insights from existing literature and leveraging recent advancements in Clustering, this research demonstrates the effective combination of CLT with Maslow's Hierarchy of Needs theory. As a result of aligning products and services with Maslow's hierarchy and psychological labels provided by CLT, we enable an accurate assessment of consumer needs, which benefits consumers as well as third parties in achieving their strategic goals.

4.2 Recommandations and Future Agenda

Based on the insights derived from combining Construal Level Theory (CLT) and Maslow's Hierarchy of Needs Theory with machine learning models, future research could utilize more sophisticated techniques such as Graphical Neural Networks (GNNs) to enhance the personalization and effectiveness of customer experience strategies. As described by Posner and Rothbart (2007), neural networks mimic the functioning of brain regions that work together to perform complex psychological and physiological functions. GNNs are very similar to the model presented in this article, and this analogy extends to how neural networks interact in a dynamic, nonlinear manner that may not be captured by traditional models to synthesize and process consumer needs Modeling.

As highlighted by Perez-Vega et al. (2021), there are high expectations for AI systems to personalize

the customer experience and improve marketing outcomes through active and inactive forms of customer engagement. Combining GNN with this model can enhance the ability of these systems to provide real-time, context-aware personalization that psychologically satisfies consumers' individual needs.

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