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A Semiotic Exploration of AI-Driven Personalization in Advertising

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Abstract - *This paper embarks on a pioneering exploration of the intersection between Semiotics and Artificial Intelligence (AI) within digital advertising. Three critical objectives guide this research: 1) Analyzing the nuanced role of visual and linguistic semiotics in advertising to discern how personalized content is created through signs and symbols; 2) Investigating real-world applications by dissecting existing advertising campaigns where AI technologies have utilized semiotics to enhance personalization and targeting, including the provision of semiotics theories used wherever possible; 3) Assessing the cutting-edge AI techniques that interpret and employ semiotics, such as machine learning, computer vision, and Large Language Models (LLMs), to accentuate their contribution to mass personalization. The study also delves into fascinating examples, highlighting innovative practices employed by brands to connect with audiences. As digital advertising stands at an intriguing crossroads, the intertwining of semiotics and AI offers an unexplored path with far-reaching implications. The insights and findings presented in this paper serve as a beckoning call to scholars, advertisers, and technologists to venture into this uncharted territory. The full exploration holds the promise of unlocking unseen potentials and transforming the very fabric of advertising in the digital age. For those eager to understand the future landscape of personalized advertising through the lens of semiotics and AI, this paper offers a thrilling and illuminating journey.*

Key Words: Semiotics, Artificial Intelligence (AI), Digital Advertising, Personalization, Linguistics, Visual Culture, Computer Vision, Brand Communication, Advertising, Natural Language Processing (NLP), Large Language Models (LLMs)

1.INTRODUCTION

1.1 Background

1.1.1 Semiotics and Its Relevance to Advertising

Semiotics, the study of signs and symbols within culture, holds a significant position in the field of advertising. Originating from Saussure's work on structural linguistics (Saussure [1]), semiotics involves both linguistic signs (words, phrases) and non-linguistic signs (images, sounds) (Chandler [2]). In advertising, semiotics helps in interpreting how signs create meaning, connecting products with broader cultural symbols and narratives (Williamson [3]).

1.1.2 Digital Advertising and the Rise of Personalization

Digital advertising has revolutionized the way brands communicate with their audience. With the surge of online platforms like the web, Meta, Instagram, etc., personalization has become central to advertising strategies (Li & Kannan [4]). Brands have realized that personalization enhances engagement, leading to higher conversion rates (Tam & Ho [5]). For a brand, personalization means showing the Ad (visual and linguistic) with which users can relate. For example, a laptop company brand can have multiple laptops gaming laptops, office laptops, general-purpose laptops, etc. If the brand wants to bring personalization brand will show gaming laptops to only those who are interested in Gaming, similarly, office laptops to office going and so on.

1.1.3 Artificial Intelligence in Digital Advertising

The integration of Artificial Intelligence (AI) in digital advertising has opened new horizons for personalization. AI-powered computer vision techniques allow for precise visual content analysis (LeCun et al. [6]), and Large Language Models (LLMs) empower natural language understanding at an unprecedented scale (Brown et al. [7]). The synergy between AI and semiotics offers the potential for deeper, more effective personalization in advertising (Smith & Zook [8]).

1.2 Aim and Objectives

The primary aim of this paper is to investigate the convergence of semiotics and AI in personalized digital advertising. The objectives include:

Analyzing Semiotics in Digital Advertising: A comprehensive examination of the role of visual and linguistic semiotics in advertising, identifying how signs and symbols are used to create personalized content.

Real-World Case Studies: Using case studies from existing advertising campaigns, the research will dissect how AI technologies have practically applied semiotics concepts to enhance advertising personalization and targeting.

Assessing AI's Role in Leveraging Semiotics: A thorough investigation into the advanced AI techniques that interpret and apply semiotics, including machine learning, computer

vision, and Large Language Models (LLMs), highlighting their contribution to personalization

1.3 Scope

This paper will focus on the fusion of semiotics and AI within the digital advertising landscape, specifically in achieving Personalization. Emphasizing both theory and practice, it will involve a critical analysis of semiotics and its application in advertising, alongside an exploration of cutting-edge AI technologies that enable these applications. Real-world case studies will be central to the paper, providing practical insights into how leading brands have successfully harnessed the combination of semiotics and AI to achieve personalization at an unprecedented scale. Additionally, the research will delve into the ethical implications of these practices, providing a rounded perspective on this complex and rapidly evolving field.

Disclaimer: Given the nature of this short research paper, it is not possible to delve into every intricate detail and cover all the aspects of how AI utilizes semiotics in the real world. A few examples have been provided to demonstrate the core ideas and principles, with the understanding that further extensive research would be needed to explore the subject comprehensively.

2. LITERATURE REVIEW

2.1 Semiotics in Advertising

2.1.1 Definition and Historical Development

Semiotics' origins can be traced back to Saussure's division of the sign into the signifier and signified (Saussure [9]), leading to various interpretations of how signs create meaning. Peirce's triadic model further expanded this, introducing the symbolic, iconic, and indexical signs (Peirce [10]).

2.1.2 Visual Semiotics

In advertising, visual semiotics explores how images convey meanings (Kress & van Leeuwen [11]). Studies have focused on visual rhetoric, composition, and the interpretation of visual signs in advertising (Messaris [12]).

2.1.3 Linguistic Semiotics

Linguistic semiotics examines how language functions as a system of signs. Barthes' application of semiotics to analyze advertising and popular culture has been influential (Barthes [13]). His work emphasized the connotative meanings in advertising texts (Cook [14]).

2.2 Digital Advertising and the Importance of Personalization

2.2.1 Evolution of Digital Advertising

The transition from traditional to digital advertising has been studied extensively (Rodgers & Thorson [15]). Scholars have examined digital advertising's ability to target and engage audiences (Li & Kannan [16]).

2.2.2 Role of Personalization

Research shows that personalization enhances user experience and satisfaction (Tam & Ho [17]). Studies have explored algorithms that drive personalization, along with their effectiveness in increasing conversion rates (Hauser et al. [18]).

2.3 Artificial Intelligence in Digital Advertising

2.3.1 Overview of AI Techniques

The application of AI in digital advertising includes machine learning, computer vision, and natural language processing (Russell & Norvig [19]). Research on AI's effectiveness in targeting and engagement is burgeoning (Provost & Fawcett [20]).

2.3.2 AI in Natural Language Processing (LLMs)

Large Language Models represent a significant advancement in NLP. These models, such as GPT-3, have been studied for their capabilities in understanding and generating human-like text (Brown et al. [21]).

2.3.3 AI in Computer Vision

Computer vision's application in advertising includes image recognition and analysis (Szeliski [22]). Studies have explored its use in personalized advertising, such as targeted content based on visual behavior analysis (Smith & Zook [23]).

3. SEMIOTICS IN PERSONALIZING DIGITAL ADVERTISING

Semiotics, as the study of signs and symbols within culture, has an immense role in the realm of digital advertising. The application of semiotics allows advertisers to tap into shared cultural meanings, thus creating messages that resonate deeply with specific target audiences. This chapter explores both visual and linguistic semiotics, shedding light on their profound impact on personalizing digital advertising.

3.1 Visual Semiotics

Visual semiotics studies the meanings associated with visual signs, including colors, shapes, and imagery. The understanding and manipulation of these visual cues lead to personalized and targeted content that appeals to diverse consumer groups.

3.1.1 The Role of Visual Cues in Personalizing Content

Color: Colors carry specific emotional and cultural connotations. For instance, red often symbolizes excitement, passion, or danger, while blue can signify trust and stability (Kaya & Epps [24]).

Shapes: Shapes also play a vital role in conveying meanings. Angular shapes may denote strength and dynamism, while rounded shapes often signify comfort and warmth (Lundholm [25]).

Imagery: Imagery taps into shared cultural narratives and values. An image can convey complex messages instantly, tapping into shared cultural myths, symbols, or archetypes (Barthes [26]).

3.1.2 Case Studies of Brands Using Visual Semiotics Effectively

3.1.2.1 Coca-Cola's Color Scheme:

Target Audience: Youth, families, and generally those seeking fun and refreshment.

Why Chosen: The red color is associated with excitement, passion, and energy, mirroring Coca-Cola's positioning as a lively and refreshing beverage.

Impact: The consistency in the color scheme helps create an instant visual connection with the consumers and aligns with the brand's promise of joy, happiness, and shared experiences (Schmitt & Simonson [27]).

3.1.2.2 Apple's Minimalist Design:

Target Audience: Tech-savvy, modern professionals, and design enthusiasts.

Why Chosen: Simple, sleek lines, and monochromatic color schemes represent modernity, innovation, and sophistication, aligning with the brand's image as a leader in technology and design.

Impact: The minimalist design resonates with an audience looking for products that symbolize cutting-edge technology and elegance. It's more than just a product; it's a statement of identity and status (Gardner & Levy [28]).

3.2 Linguistic Semiotics

Linguistic semiotics deals with how language, as a system of signs, conveys meaning. It explores how words, phrases, and other linguistic symbols are used to create messages that resonate with specific audiences.

3.2.1 The Importance of Language, Signs, and Symbols in Conveying Personalized Messages

Syntax and Semantics: Advertisers employ specific syntactical structures and semantics to create slogans or phrases that resonate with particular cultural or social groups (Chandler [29]).

Metaphors and Symbolism: Metaphorical language and symbolism enable brands to convey abstract ideas and values, creating connections with audiences that go beyond literal meanings (Lakoff & Johnson [30]).

3.2.2 Real-World Examples of Linguistic Strategies in Advertising Campaigns

3.2.2.1 Nike's "Just Do It" Slogan:

Target Audience: Athletes, fitness enthusiasts, and those aspiring to overcome personal challenges.

Why Chosen: This slogan transcends the literal, resonating as a broader call to action and self-empowerment, reflecting the brand ethos of determination and achievement.

Impact: The phrase "Just Do It" has become synonymous with a mindset of determination, appealing not only to sportspeople but to anyone looking to overcome obstacles and achieve goals (Keller [31]).

3.2.2.2 McDonald's "I'm Lovin' It":

Target Audience: Families, young adults, and those seeking convenient, enjoyable meals.

Why Chosen: The informal phrase reflects universal, casual enjoyment of life, mirroring the brand's positioning as a provider of simple pleasures.

Impact: This slogan appeals to a broad audience who connect with the simplicity and joy that the brand promises, resonating with the core brand value of providing enjoyment through food (Lannon & Cooper [32]).

4. AI LEVERAGING SEMIOTICS TO FOSTER PERSONALIZATION IN DIGITAL ADVERTISING AT SCALE

Artificial Intelligence (AI) and semiotics have emerged as interconnected disciplines in the field of digital advertising. This section explores the integration of AI's cutting-edge

technology, such as Natural Language Processing (NLP) and Computer Vision, with semiotic principles from linguistics and visual studies. This synergy enables brands to understand and interpret the complex signs and symbols inherent in human communication, both verbal and visual. By harnessing these insights, advertisers can craft personalized and resonant messages that reach millions of users in a cost-effective manner.

The section delves into specific applications, including Large Language Models (LLMs) that interpret linguistic signs, and computer vision techniques that analyze visual cues. Through the combination of AI's computational power and the rich theoretical framework of semiotics, brands can perform personalization at an unprecedented scale, making advertising more effective, engaging, and tailored to individual needs and preferences.

With an emphasis on case studies and quantitative benefits, this chapter provides a comprehensive view of how AI and semiotics are transforming the advertising industry, allowing for nuanced understanding, wide-scale personalization, and operational efficiency, ultimately enhancing user engagement and contributing to a brand's bottom line.

4.1 LLMs in NLP

Large Language Models (LLMs) have given power to advertising brands to create personalized content at an unprecedented scale. LLMs are deep learning models that utilize transformer architectures to process and generate human-like text. They leverage attention mechanisms and massive training datasets to capture complex patterns and relationships within language, allowing them to understand, interpret, and respond to textual input in a contextually relevant manner (Vaswani et al., [33]; Devlin et al. [34]).

4.1.1 Introduction to LLMs and their Capabilities

Understanding Context: LLMs are designed to grasp the nuances of human language and context. They can interpret and generate text that aligns with specific user preferences and needs.

Scalability: LLMs can process vast amounts of data, allowing for wide-scale personalization, tailoring content to millions of users simultaneously.

4.1.2 Specific Use Cases where LLMs Enabled Targeted Advertising

4.1.2.1 Amazon's Personalized Email Campaigns:

Target Audience: Various customer segments based on purchasing behavior.

What Was Done: Amazon utilized LLMs to craft personalized email recommendations, promoting products aligned with individual purchasing histories and preferences.

Why and Impact: By providing highly relevant recommendations, Amazon enhanced user engagement, driving higher click-through rates and conversions (Kumar et al. [35]).

Semiotic Links: The personalized emails act as signs that communicate particular meanings to individual users. These signs are constructed through LLMs, recognizing patterns and preferences in user behavior.

Linguistic Theories Supporting This: Saussure's structuralism theory (Saussure [36], [37]), which emphasizes the importance of the relationship between the signifier (the form of the word) and the signified (the concept it represents), can be applied here. In this case, the personalized recommendations are the signifiers, and the user's perceived needs and wants are the signified.

Connection to Semiotics: Peirce's theory of semiotics emphasizes the interpretant, or the understanding a person has of a sign. Amazon's use of LLMs takes into account the interpretant by crafting personalized content based on an individual's past interactions, thus bridging the gap between symbol and meaning (Peirce [37]).

4.1.2.2 Spotify's Tailored Playlists:

Target Audience: Music enthusiasts with varying tastes and preferences.

What Was Done: Spotify used LLMs to analyze user listening habits, creating personalized playlists and song suggestions.

Why and Impact: This personalization deepened user engagement and loyalty, keeping users engaged and returning for more tailored music experiences (Oestreicher-Singer & Sundararajan [38].

Semiotic Links: Similar to Amazon, Spotify's playlists are signs crafted to communicate individualized meanings to listeners (Barthes [39]).

Linguistic Theories Supporting This: Barthes' Semiotic theory of myth, where signs become the symbols of culture, can be applied here. Different playlists may resonate with different cultural or subcultural meanings, making the user feel understood and seen (Barthes [39]).

Connection to Semiotics: Through detailed analysis of user behavior, Spotify crafts playlists that align with the user's cultural and social identity, reflecting semiotics' principle of signs conveying broader meanings.

4.1.3 Quantitative Benefits in Terms of ROI and Efficiency

Increased Conversion Rates: LLMs can enhance conversion rates by delivering personalized and relevant content, increasing engagement and purchase likelihood (Li et al. [40]).

Operational Efficiency: LLMs allow for the automated creation of personalized content at scale, reducing operational costs while maintaining high relevance and quality (Joulin et al. [41]).

4.2 AI in Computer Vision

The application of computer vision in advertising analyzes user behavior and preferences, enabling unprecedented personalization.

4.2.1 Application of Computer Vision in Analyzing User Behavior and Preferences

User Engagement Analysis: Brands can use computer vision to track how users interact with content, such as where they look and for how long. This information is then used to optimize content placement, design, and messaging (Papoutsaki et al. [42]).

4.2.2 Case Studies Showing How Computer Vision Assists in Personalized Content Delivery

4.2.2.1 Unilever's Facial Recognition Campaign:

Target Audience: Various consumer segments interested in personal care products.

What Was Done: Unilever used facial recognition to analyze user reactions to different advertisements, tailoring content accordingly.

Why and Impact: This allowed for real-time adaptation of content, enhancing relevance, and increasing user engagement and brand perception (Levi & Hassner [43]).

Semiotic Links: Facial recognition analyzes the signs (expressions) on a person's face, interpreting those signs to tailor content (Eco [44]).

Linguistic Theories Supporting This: Eco's theory on open and closed texts might be applicable here. Unilever's approach considers facial expressions as open texts, allowing for multiple interpretations that can be used to tailor content (Eco [44]).

Connection to Semiotics: By analyzing these 'signs,' Unilever's campaigns can be more precisely tailored to individuals' reactions, engaging at a deeper, more nuanced level.

4.2.2.2 Walmart's In-Store Personalization:

Target Audience: In-store shoppers.

What Was Done: Walmart implemented computer vision to analyze in-store customer behavior, providing personalized discounts and recommendations through their mobile app.

Why and Impact: By aligning in-store experiences with individual preferences, Walmart created a more personalized shopping experience, boosting sales and customer satisfaction (Davenport [45]).

Semiotic Links: The signs in this context include customers' physical movements and interactions within the store.

Linguistic Theories Supporting This: The work of Jakobson on communicative functions can be linked here, where the customer's behavior can be seen as a code that needs to be translated (Jakobson [46]).

Connection to Semiotics: Walmart deciphers these signs, translating them into personalized recommendations that communicate specific meanings to individual shoppers.

4.2.3 Monetary Benefits to Advertisers from Implementing Computer Vision Techniques

Cost-Effective Targeting: By understanding and predicting user preferences, advertisers can create more targeted and relevant campaigns, reducing waste and improving ROI (Rao et al. [47]).

Enhanced Customer Lifetime Value (CLV): Personalized experiences foster customer loyalty and satisfaction, leading to increased CLV and profitability (Venkatesan et al. [48]).

4.3 Creative Analytics

Creative Analytics involves the application of computer vision to understand and measure engagement with digital ads through eye tracking and sentiment analysis.

4.3.1 Eye Movement Analysis

Understanding Engagement: Brands can analyze where and how long a viewer looks at an ad. This information helps in understanding which parts of the content engage the audience the most (Poole & Bal [49]).

4.3.1.1 Case Study: DoubleVerify's Engagement Tracking:

Target Audience: Advertisers seeking to optimize ad content.

What Was Done: DoubleVerify uses computer vision to track eye movements, gauging which visual elements attract attention.

Why and Impact: This allows advertisers to refine and optimize their content, ensuring that key messages are prominently placed and visually appealing, thus increasing engagement and efficiency [50].

4.3.2 Sentiment Analysis through Facial Expression

Understanding Reactions: By analyzing facial expressions, brands can determine how viewers feel about their content, whether they are happy, surprised, confused, or disinterested.

4.3.2.1 Case Study: DoubleVerify's Sentiment Analysis:

Target Audience: Brands looking to gauge consumer reaction to new ad content.

What Was Done: DoubleVerify's technology analyzes facial expressions to assess viewer sentiment toward different ads.

Why and Impact: This provides real-time feedback on content effectiveness, allowing for agile adjustments and more emotionally resonant advertising [50].

Semiotic Links: Analyzing facial expressions involves reading the signs of emotion on a person's face.

Linguistic Theories Supporting This: Halliday's Systemic Functional Linguistics, where language (or in this case, facial expressions) is seen as a social semiotic system, can be connected here. The facial expression conveys meaning, and DoubleVerify translates this meaning to adjust the content accordingly (Halliday [51]).

Connection to Semiotics: The application of semiotics here is profound as it enables advertisers to read 'texts' of faces and derive meanings that can be used to adjust advertising strategies.

4.3.3 Hogarth's Creative Analytics for Target Audience Alignment

Analyzing Creatives' Effectiveness: Hogarth's solution uses computer vision to analyze the visual elements constituting the creatives, such as color, imagery, and placement, to understand what resonates with different audience segments.

4.3.3.1 Case Study: Hogarth's Audience-Specific Creative Analysis:

Target Audience: Brands that want to personalize ad content based on previous engagement metrics.

What Was Done: Hogarth's technology analyzes historical engagement with various creatives and identifies patterns linking visual elements to audience preferences.

Why and Impact: By recognizing what works for specific target groups, Hogarth can score or recommend new creatives for similar or look-alike target groups. This creates a feedback loop that continually refines and enhances the effectiveness of advertising content, thereby ensuring that ads resonate with the desired audience [52].

An extension of this can be the rise of probabilistic Data Enrichment – Such as at the beginning, we might not know much about a user, but if they show a preference for the Red color, which symbolizes energy and youth, there is a high chance that the user belongs to the youth category. This information can be used to create a probabilistic attributes list. Then, AI could serve different creatives that were developed specifically for the youth group. Similarly, it can work the other way around. If we know that a user belongs to the youth category and they have responded well to certain features in ads, such as witty texts with funky fonts, we can enrich the user's profile with these preferences and try to replicate this strategy with other youth users.

4.4 Automated Ad Creation through AI

AI's ability to use both Computer Vision and NLP in automatically creating images for ads has revolutionized advertising production, offering increased efficiency and cost savings.

4.4.1 AI-Generated Ad Variations

Creating Multiple Versions: AI can create hundreds of different ad combinations, ensuring that content is personalized and relevant for various audience segments.

4.4.1.1 Case Study: Hogarth's Automated Ad Production:

Target Audience: Brands needing to target multiple demographics with diverse ad content.

What Was Done: Hogarth employs AI to automatically create various ad designs and messages, tailored to different audience segments.

Why and Impact: By generating multiple ad variations quickly and efficiently, Hogarth's AI-driven approach reduces production time and costs, while maintaining high quality and relevance [53].

Semiotic Links: Automated ad creation takes into account various signs (text, images, colors) to create meaningful content for different audiences.

Linguistic Theories Supporting This: Ferdinand de Saussure's dyadic model of semiotics (Saussure [54]) which includes the signifier and the signified, is applicable here. The AI-generated ads (signifiers) aim to invoke specific responses or emotions (signified) in the target audience.

Connection to Semiotics: The use of AI in crafting these signs showcases the blend of technology and semiotics in modern advertising, creating a dynamic and responsive communication strategy.

5. CONCLUSION AND FUTURE DIRECTIONS

The landscape of digital advertising is rapidly evolving. Semiotics and AI have been revealed, through our in-depth examination, to not only be complementary fields but fundamentally intertwined. This paper has navigated the symbiotic relationship between semiotics, as the foundational theory of understanding signs and symbols, and AI as its technological manifestation.

5.1 Key Takeaways

5.1.1 Semiotic Foundations in Digital Advertising:

Semiotics acts as the guiding principle in ensuring resonance, cultural relevance, and depth in advertisements. It delves deep into the human psyche, understanding how messages are encoded and decoded, and ensures content carries nuanced meanings.

5.1.2 AI's Role in Personalization:

AI has emerged as a tool of unprecedented power, personalizing advertisements at scale. Leveraging NLP and computer vision, AI platforms dissect and analyze vast amounts of data to tailor advertisements in real-time.

5.1.3 Interplay of Semiotics and AI:

Far from being isolated disciplines, AI in advertising is essentially semiotics realized through technological means. The algorithms powering AI's capabilities in ad personalization draw inspiration and foundation from semiotic theories.

5.2 Future Directions: A New Paradigm

5.2.1 The Emergence of "Semiotic Learning"

Semiotics and AI, when combined, give rise to an exciting possibility: Semiotic Learning. This is a new paradigm wherein machines don't just learn patterns from data, but they understand, interpret, and even predict how humans assign meaning to those patterns.

Deep Emotional Resonance Algorithms: Beyond the surface-level emotional analysis, future AI might be able to craft messages that tap into deeper, more complex human emotions, perhaps even those that consumers themselves aren't consciously aware of. This could be achieved by integrating psychoanalytic theories with AI modeling.

Cultural Evolution Predictions: By analyzing the cultural shifts and trends through a semiotic lens, AI could anticipate future cultural shifts. Brands could then craft messages that not only resonate today but also align with where society is moving.

Ethical Considerations: With great power comes great responsibility. The depth of personalization and emotional resonance that semiotic learning offers mean brands will need to be more cautious than ever to ensure they're respecting privacy and not manipulating consumers in harmful ways.

Interdisciplinary Collaboration: A resurgence in the importance of humanities in tech. Philosophers, cultural experts, and semioticians collaborating closely with data scientists and AI experts. This interdisciplinary approach will ensure AI models are nuanced, ethical, and effective.

5.3 Closing Thoughts

The future of digital advertising, as informed by this exploration, is poised at an exciting intersection of human understanding and technological advancement. Semiotic Learning could revolutionize how brands communicate, making messages not just personalized but deeply resonant and forward-looking. As we tread into this new territory, it's crucial to approach it with curiosity, collaboration, and a deep sense of responsibility.

The exploration undertaken in this paper is just the beginning. The confluence of semiotics and AI in digital advertising beckons scholars, advertisers, and technologists to venture deeper, unlocking possibilities that we are only beginning to glimpse.

REFERENCES

[1] Saussure, F. (1916). Course in General Linguistics.

[2] Chandler, D. (2002). Semiotics: The Basics. Routledge.

[3] Williamson, J. (1978). Decoding Advertisements. Marion Boyars.

[4] Li, H., & Kannan, P.K. (2014). Attributing conversions in a multichannel online marketing environment: An

empirical model and a field experiment. Journal of Marketing Research, 51(1), 40-56.

[5] Tam, K.Y., & Ho, S.Y. (2006). Understanding the impact of web personalization on user information processing and decision outcomes. MIS Quarterly, 865-890.

[6] LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. Nature, 521(7553), 436-444.

[7] Brown, T.B., et al. (2020). Language Models are Few-Shot Learners. arXiv preprint arXiv:2005.14165.

[8] Smith, A., & Zook, M. (2011). Geographies of Placing and Routing on the Internet. Annual Review of Information Science and Technology, 45(1), 131-161.

[9] Saussure, F. (1916). Course in General Linguistics.

[10] Peirce, C. (1931-1958). Collected Writings (8 Vols.).

[11] Kress, G., & van Leeuwen, T. (2006). Reading Images: The Grammar of Visual Design. Routledge.

[12] Messaris, P. (1997). Visual Persuasion: The Role of Images in Advertising. Sage.

[13] Barthes, R. (1964). Elements of Semiology. Hill and Wang.

[14] Cook, G. (2001). The Discourse of Advertising. Routledge.

[15] Rodgers, S., & Thorson, E. (2000). The Interactive Advertising Model: How Users Perceive and Process Online Ads. Journal of Interactive Advertising.

[16] Li, H., & Kannan, P.K. (2014). Attributing conversions in a multichannel online marketing environment: An empirical model and a field experiment. Journal of Marketing Research, 51(1), 40-56.

[17] Tam, K.Y., & Ho, S.Y. (2006). Understanding the impact of web personalization on user information processing and decision outcomes. MIS Quarterly, 865-890.

[18] Hauser, J., Urban, G., Liberali, G., Braun, M. (2009). Website morphing. Marketing Science.

[19] Russell, S., & Norvig, P. (2016). Artificial Intelligence: A Modern Approach. Pearson.

[20] Provost, F., & Fawcett, T. (2013). Data Science for Business. O'Reilly.

[21] Brown, T.B., et al. (2020). Language Models are Few-Shot Learners. arXiv preprint arXiv:2005.14165.

[22] Szeliski, R. (2010). Computer Vision: Algorithms and Applications. Springer.

[23] Smith, A., & Zook, M. (2011). Geographies of Placing and Routing on the Internet. Annual Review of Information Science and Technology, 45(1), 131-161.

[24] Kaya, N., & Epps, H. H. Relationship between color and emotion: A study of college students. College Student Journal, 38(3), 396-405.

[25] Lundholm, H. The Affective Tone of Lines: Experimental Researches. Psychological Review.

[26] Barthes, R. Elements of Semiology. Hill and Wang.

[27] Schmitt, B., & Simonson, A. Marketing Aesthetics: The Strategic Management of Brands, Identity, and Image. Free Press.

[28] Gardner, B. B., & Levy, S. J. The product and the brand. Harvard Business Review, 33(2), 33-39.

[29] Chandler, D. Semiotics: The Basics. Routledge.

[30] Lakoff, G., & Johnson, M. Metaphors We Live By. University of Chicago Press.

[31] Keller, K. L. Conceptualizing, Measuring, Managing Customer-Based Brand Equity. Journal of Marketing, 57(1), 1-22.

[32] Lannon, J., & Cooper, P. Why the soft-sell sells best. Campaign, 17, 15-19.

[33] Vaswani, A., et al. (2017). Attention is All You Need.

[34] Devlin, J., Chang, M. W., Lee, K., & Toutanova, K. (2019). BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding. In Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies (pp. 4171-4186).

[35] Kumar, V., et al. (2016). From Social to Sale: The Effects of Firm-Generated Content in Social Media on Customer Behavior. Journal of Marketing, 80(1), 7-25.

[36] Saussure, F. (1916). Cours de linguistique générale. Payot.

[37] Peirce, C.S. (1931-58). Collected Papers. Harvard University Press.

[38] Oestreicher-Singer, G., & Sundararajan, A. (2012). The Visible Hand of Social Networks in Electronic Markets. MIS Quarterly, 36(1), 291-313.

[39] Barthes, R. (1972). Mythologies. Hill and Wang.

[40] Li, X., et al. (2010). Context-Aware Recommendation: A Review on Computational Intelligence Techniques and

Applications. IEEE Transactions on Evolutionary Computation, 16(6), 799-817.

[41] Joulin, A., et al. (2017). Bag of Tricks for Efficient Text Classification. arXiv preprint arXiv:1607.01759.

[42] Papoutsaki, A., et al. (2015). Eye tracking for web page analysis. In Proceedings of the 26th International Conference on World Wide Web Companion (pp. 1031-1036).

[43] Levi, G., & Hassner, T. (2015). Age and Gender Classification using Convolutional Neural Networks. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops (pp. 34-42).

[44] Linguistic Theories Supporting This: Eco, U. (1979). The Role of the Reader: Explorations in the Semiotics of Texts. Indiana University Press.

[45] Davenport, T. H. (2018). The AI Advantage: How to Put the Artificial Intelligence Revolution to Work. MIT Press.

[46] Jakobson, R. (1960). Closing Statement: Linguistics and Poetics. In Style in Language, MIT Press.

[47] Rao, J., et al. (2016). Data Fusion for Audience Segmentation in Digital Marketing. In Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (pp. 65-70).

[48] Venkatesan, R., et al. (2006). Multichannel Retailing: A Case Study of Early Experiences. Journal of Interactive Marketing, 20(2), 63-74.

[49] Poole, A., & Ball, L. (2006). Eye tracking in human-computer interaction and usability research. In C. Ghaoui (Ed.), Encyclopedia of Human-Computer Interaction (pp. 211-219). Idea Group Reference.

[50] DoubleVerify. (2021). Creative Analytics for Better Engagement. https://www.doubleverify.com/creative-analytics/

[51] Halliday, M.A.K. (1978). Language as Social Semiotic. Edward Arnold.

[52] Hogarth Worldwide. (2021). Innovating Ad Production through AI. https://www.hogarthww.com/

[53] Hogarth Worldwide. (2021). Leveraging Creative Analytics for Target Audience Alignment. https://www.hogarthww.com/

[54] Saussure, F. (1916). Cours de linguistique générale. Payot