

AI-Generated Cartoon on YouTube Kids: An Analysis on Pacing, Sensory Intensity and Toddler Attention

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Abstract - Since the recent boom in AI, there has been a rapid use and generation of various types of AI content all across different digital platforms. One area where this is seemed to take a majority control over is cartoon. Majority of the audience have seen ai-generated cartoon of cats and ducks similarly, cartoon for toddlers has seen a huge surge of ai-generated cartoon. Compare to traditional cartoons which the previous generation have grew up on, the AI cartoons are fast paced, employ highly-saturated colors, have quick fast cuts and most of them seem to have continuation error or distortion, all to sustain attention. Such a shift in how content for toddlers is created has brought a drastic change in their behavior. Where cartoons used to be something played in the background for a limited time, it's now had the toddler glued to the screen and parents have noticed their toddlers being more aggressive and unsettled once such cartoons are turned off. Despite this drastic shift, limited study has been done on how these ai-cartoons negatively affect the toddler's cognitive development and disrupts and shortens their attention span. This research paper aims to address this issue through a qualitative analysis for which 15 AI-generated cartoon clips have been selected from YouTube Kids to study the characteristics of AI cartoons and examining how such content exceeds a toddler's processing abilities. This research aims to highlight the implications and encourage to being more focus on development appropriate media for children.

Keywords: AI- Generated Cartoon, YouTube Kids, Pacing, Visual intensity, Toddler Attention

I. INTRODUCTION

1.1 Background of the Study

The reason why it becomes crucial to study toddler's attention in the digital space especially on social media platforms is because it's during this time in a child's development that their cognitive systems are the most sensitive to influences. Attention during this phase is the major mechanism through which a child encodes information, regulates their behavior, socially interacts and develops their potential for learning. Developmental psychologists have long

contended that attentional capacities are still evolving throughout early preschool years and thus are particularly susceptible to environment overstimulation. However, it is well known that children are much more sensitive to salient external stimuli including bright colors, movement, loud sounds, novelty events and sudden sensory changes. Thus, media content consumption and its pacing can have huge implications for both attention distribution and cognitive processing.

According to research in developmental psychology, a combination of exogenous and endogenous attentional systems governs attention during infancy age and toddlerhood. Two types of attention are exogenous and endogenous, with the former being an automatic orienting response to salient environmental stimuli and the latter representing more voluntary cognitive control. Since executive control systems are fully immature, toddlers rely more on exogenous attentional mechanisms. Consequently, high-arousal media contexts may compete for and hijack the attention of young children via bottom-up features. Properties of dynamic scenes like sudden motion, rapid scene cuts, loud sound events, color salience and visual novelty can repeatedly engage our attention away from ongoing cognitive goals and redirect it to immediate (and perceptually grounded) sensory stimulation.

Formal Production features have been shown to affect attention behavior in children's television research. One influential line of work led by Anderson and colleagues demonstrated that pacing, action, sound effects and visual changes determine children's viewing behavior pattern and vigilance with TV material. Formal features (i.e. cuts, zooms, edits, movements and audio emphasis) were discovered to direct attention regardless of narrative understanding. This framing would become essential to the children's media studies position, thereby

conceptualizing television form-not-content-as developmentally relevant.

Additional studies have sought to support these concerns surrounding the cognitive effects of exposure to fast-paced media. In one experiment, preschool-aged children who viewed fast-paced animated cartoons for nine minutes exhibited poorer executive functioning skills than those who watched slower-paced educational programs; the authors posited that the rapid pacing and fantastical nature of the cartoons would overtax children's cognitive processing and temporarily disrupt their executive control. Similarly, reviewed a number of studies which suggested that repeated exposure to fast-paced media may promote attentional dysregulation in very young children, particularly when the content includes rapid transition between scenes or heightened sensory stimulation.

Research into the impacts of fantastic events presented in children's entertainment has shown that there is a strong connection between perceptually novel stimuli and attention disruption. found that young viewers' endogenous (internal) attentional control was reduced by viewing highly fantastical content due to the continuous need to process impossible or unexpected events that defy everyday physical expectations. This is especially true for cartoons that are created using artificial intelligence (AI), as these types of CGI animations typically use exaggerated aesthetics of fantasy; rapidly transforming from one form to another; and have movements that are not normally possible due to the workings of algorithm-driven systems.

The rise of AI-generated content for children has had an impact on the social and academic landscape of cartoons and has resulted in new questions about theory and practice. First, AI-produced cartoons typically place a higher priority on meeting the engagement metric of the algorithms used to produce them than on the developmental appropriateness of the content. Recommendation systems reward content that generates the most significant amount of time watched, clicks, repeats and continues to interact with the platform. As a result, content creators may rely more heavily on increasingly exaggerated forms of sensory stimulation to hold the viewer's attention. Secondly, the use of AI-assisted animation tools allows continuous creation of repetitive but highly stimulating content at an

unprecedented rate and scale. Lastly, most AI-generated cartoons have been created and presented through unregulated digital environments where developmental standards and pedagogical monitoring are either inconsistent or nonexistent.

There are important issues concerning how cartoons created by AI will direct attention through pacing and sensory intensity. Current research into media has not adequately explored the structural features of AI animated works. The majority of existing literature has focused either on the duration a viewer sees a given piece of media, or on media exposure in general (and not on the internal structure of audiovisual stimuli). Therefore, the way that children will develop as a result of their viewing experience may depend less on the fact that they saw some form of media at all and more on how the media was built. Therefore, it is imperative to identify the modes of how AI created cartoon's structure time and design sensory intensity to properly assess their impact on development.

Children are made to attract children's attention. The study will use content analysis to analyze these cartoons, rather than measuring the audience's response to these cartoons through behavioral outcomes, such as through experimental methods. The study will use thematic analysis to identify: (1) the common pacing patterns within the animated cartoons (2) how the animated cartoons employ sensory enhancement techniques (e.g. music, sounds, etc.). (3) how the animated cartoons employ novelty techniques (e.g. color, movement, etc.) (4) production techniques to encourage children's attention (e.g. slow-motion). By using these methods of thematic analysis, this study will gain an in-depth interpretation of how AI-generated comics may develop attention-capture techniques within a theoretical framework based on developmental attention.

1.2 Research Problem

There is a growing public concern about the exposure of children to digital media, however, limited research has examined the formal characteristics of AI generated cartoons for toddlers. Most of the research has centered around television programming, educational media or general patterns of screen exposure. Very little is currently known about how pacing, sensory intensity, novelty cues and

audiovisual disruptions are used in AI generated cartoons to maximize viewer engagement.

This represents an important gap in research because the AI media environments differ in a number of ways from traditional children's programming when examining: production logic; algorithmically optimized; and sensory designed. Many contemporary AI cartoons utilize accelerated editing patterns, constant motion; abrupt transitions; repetitive sound layering; and highly saturated visuals which may enhance exogenous attentional capture from a young child.

In addition, few existing developmental media studies systematically examine qualitative media analysis and attention theory. Therefore, less is known about the mechanisms through which AI-generated cartoons shape attentional orientation than should be understood.

There is currently no qualitative study about the pacing and sensory intensity of AI-created animated cartoons. This lack of research creates a gap in research knowledge regarding how algorithmically created media environments can impact young children's attention processes. Researchers, educators, caregivers and policy makers lack an evidence-based framework to assess the developmentally appropriateness of emerging AI-generated children's content. As such, detailed analyzes of these media forms are an important step toward supporting evidence-based pedagogical practices for responsible use of AI-generated children's content.

1.3 Research Objectives

1. To examine how AI-generated cartoons vary in pacing and sensory intensity associated with toddler attention.
2. To identify recurring patterns and sensory cues within AI-generated cartoon.
3. To analyze whether AI-generated cartoon exhibit novelty-based interruption patterns in relation to developmental attention theory.

1.4 Research Questions

1. How does AI-generated cartoon vary in sensory intensity and pacing, and what type of attention cues they use?
2. Which pacing (e.g. motion density, cut

frequency) and sensory features (e.g. hyper-saturated color change, layered sound effects) appear most consistent.

3. Does AI-generated cartoons show pattern of novelty and interruption that resemble 'attention-capture' identified in developmental attention research?

1.5 Significance of the study

This research is significant for theoretical, methodological, and practical reasons.

The research theoretically contributes to interdisciplinary research in developmental psychology, media studies, and research on content generated by artificial intelligence. Past research generally has separated children's media effects and theories of attention into distinct research areas. By connecting these areas, this study has created a conceptual framework for understanding how cartoons made using artificial Intelligence capture children's attention with their pace and sensory intensity.

The research further contributes to contemporary investigations into children's digital culture as a result of algorithmic media environments. Although AI-generated content is an emerging and growing area of study, it has not been well examined in existing media studies; therefore, this study provides foundational conceptual guidance for understanding how automated production systems influence the sensory foundation of children's entertainment.

Methodologically, this study demonstrates the use of qualitative thematic analysis as a method for studying the structure of formal media. The research concentrated not on the behaviors of media users, but on the structure of the audiovisual elements constituting the media. By studying the content of media texts rather than the behavior of the audience, the researchers have gained a clearer understanding of how the structure of media texts is used to manage attention.

In a practical sense, the research provides practical insights to parents, teachers, child health specialists, media producers, and policy makers about how to use sensory stimulation techniques in AI-created cartoons. This will help parents make good decisions about what children should watch during their early development. When creating material, creators need to choose their pacing carefully so it will be appropriate given where a child is at

developmentally.

Additionally, the findings of this study can serve as a reference point in policy discussions around regulating children's digital media use. With the increase in the creation of AI-generated content for children across many online platforms (e.g., YouTube and Netflix), we must give consideration to how we will make certain that all content developed is designed ethically, is developmentally appropriate, and/or that all online platforms hosting the content are held accountable for the material they allow onto their platforms.

II. REVIEW OF LITERATURE

2.1 Introduction

The interdisciplinary relationship of children's media exposure and the development/developmental relationships of children are the current focus within by developmental psychology, cognitive science, communication studies, digital cultural scholarship, and media studies, and it has also received considerable attention across disciplines. Researchers have increasingly explored how the formal features employed in children's media such as the pace of the action/images, the level of intensity in the visuals, the qualities of sound design that accompany them, the way in which images are edited together, and the novelty of sensory stimulation affect cognitive processing and attention to stimuli during early child development for many years. With the recent and rapid increase in volume of AI children's media being made available via algorithmic distribution, researchers are now eagerly addressing how these same features of children's media function yet in ways that may differ from traditional children's programming.

While there is a substantial amount of literature regarding the relationship of television viewing and children's cognitive development (i.e., cognitive outcome), there is comparatively much less research regarding how AI children's cartoons will use pace and sensory stimulation as mechanisms for capturing the attention of young children. Based on what we know about the previous research regarding children's media exposure and cognitive processing, the majority of existing literature has concentrated on the observable or behaviorally measured outcome of using media (i.e., children's cognitive outcomes) while devoting only secondary or limited

consideration to the internal formal structures (i.e., the overall format) of the audiovisual material that is used in creating and delivering media. For this reason, we still do not have an adequate understanding of how children's AI cartoons may use a variety of different salience mechanisms, through novelty cues, or through rapid sensory stimulation to have children remain engaged longer.

This literature review critically analyzes already available research that is relevant to the research questions and objectives of this study. The chapter is organized based on key thematic areas: Media Usage and Attention Development in Children, Timing Requests and Cognitive Load, Sensory Salience and Audiovisual Attention, Attention-Capture Mechanisms for Different Ages (Developmental), Media Contexts for AI-Generated Media (Artificial Intelligence), Novelty Theory and Disruption Theory, Economies of Attention and Algorithmic Engagement Systems, and Methodologies of Media Analysis Regarding Children.

2.1.1 Children's Media and Cognitive Attention

The first prominent research effort linking media exposure, particularly television, to the development of cognitive attentional processes occurred during the rapid expansion of television in the 20th century. In the beginning, there was debate among researchers about the nature of children's television viewing. Some believed it was a form of passive activity while others believed that children were engaged in an active process of attending to and processing the audiovisual content through a process of "selective" attention. The foundations for this research occurred through the work of Anderson and Levin. In their research, Anderson and Levin demonstrated the presence of selective attention in children with television viewing and challenged simplistic assumptions that television is consumed passively. They identified four categories of formal features that children pay attention to when viewing (e.g., movement, audio effects, visual transitions) and were the basis for later research about children and television.

The body of knowledge regarding the relationship of attention and media exposure in children continued to develop with the work of their research demonstrated how formal production features (e.g., cuts, zooms, sound, character movement, visual

change) serve as organizing features of attention and provide a guide for children on how to attend to television programming. As a result of this research, children are reported to be especially attentive to salient audiovisual changes due to the response activated by this feature, which then redirects the focus of their perceptual attention.

Over the last two decades, there has been a parallel growth in the body of literature examining the cognitive implications of how fast-paced and highly stimulating media can affect children's development. Christakis and his colleagues have proposed that through early childhood, children may experience cognitive difficulties as a result of their exposure to rapidly changing entertainment media, and that the developing child's brain becomes accustomed to high-intensity stimulation environments early in life.

An example of a prominent experimental study in this area is the research done by regarding the impact of fast-paced fantastic cartoons on executive functioning. They found that preschool aged children who watched a fast-moving cartoon for 9 minutes performed worse on working memory, delay of gratification, and cognitive flexibility tasks after viewed than students who participated in educational materials with slower pacing.

Research conducted by also provides evidence that children's attentional responses are influenced greatly by their pacing pattern and sensory complexity. Programming that is characterized by fast cuts, exaggerated movement, and constant audiovisual stimulation generally creates greater immediate attention fixation; however, those same programming characteristics also can decrease reflective cognitive engagement.

Barr, et al. (2010) stated that sustained visual fixation on media does not guarantee the child will learn. Attention on screen-based media may be more dependent on perceptual salience than conceptual understanding.

2.1.2 Pacing and Cognitive Load

Pacing is one of the most often researched formal variables in children's media studies. In media terms, pacing refers to how quickly and how frequently audiovisual changes occur within a program, such as scene changes, transitions, motion density (the amount of motion on the screen), sound cues, and changes in the story's pace or flow. In the case of fast-paced programming, there will be many scene

changes (cuts) in a short period of time, as well as many instances of rapid movement, multiple (accelerated) cuts, and only brief (limited) periods of visual stability.

Cognitive Load Theory, which originally developed, states that if the amount of information being processed exceeds the information-processing abilities of a person, a cognitive overload may occur. Fast-paced cartoons could induce cognitive overload by requiring toddlers to continuously process new sensory information as quickly as possible while they have yet to fully process the previous sensory information. Each time a fast-paced cut occurs or a visual interruption occurs (which requires attention to be redirected), it adds to the demands of processing the information being presented. Similarly, Limited Capacity Model of Mediated Message Processing states that humans have a number of cognitive resources that are finite/limited and will be of limited assistance to them when encoding, storing and retrieving media-related information.

This interpretation has been further supported by results showing a significant reduction in children's executive functioning due to exposure to rapidly paced fantasy cartoons. In that study, children had significantly less executive functioning following exposure than they did prior to exposure. Children who had viewed the cartoons had less cognitive resource available for future self-regulation tasks as a result of the substantial amount of cognitive resource used to respond to fast paced scene changes and fantastical continuous events, according to the authors.

2.1.3 Sensory Salience and Bottom-up attention

The sensory salience theory provides an alternative lens to examine a child's exposure to media. Salience describes how prominent an object is when compared against other surrounding environmental objects. A stimulus is salient when it differs significantly from other stimuli in color, brightness, speed, contrast, direction, size or sound.

Bottom-up attention theories contend that perceptually salient characteristics of stimuli automatically capture the attention of observers without regard to their conscious will or intentions. The saliency map model developed by is the most influential model in this tradition, proposing that the

visual system is continuously constructing perceptual maps which identify those areas of the visual field with the highest levels of sensory distinctiveness.

These theories have important implications for the media environment of children; toddlers tend to use exogenous attention to orient themselves toward or attend to stimuli. Therefore, sudden movement, flashing colors, loud sounds, unexpected visual transitions will typically draw the child's attention to them.

Research on the development of vision indicates that infants are very quickly developing sensitivity to color contrast and movement. Therefore, highly contrasting, very bright or colorful, and fast-moving images will have a significant impact on the attention of young children.

AI-generated cartoons amplify these types of strategies because algorithmic systems can rapidly develop highly visually exaggerated content that has been optimized for metrics of engagement. For instance, the majority of AI-generated video for toddlers use neon-like color combinations, overly large facial expressions, very rapid zooms, repetitively bouncing movements, and highly exaggerated audio/visual synchronization

2.1.4 Developmental Attention and Novelty-preferences

Fantz (1964) conducted groundbreaking research on how infants perceive the world, which revealed that infants consistently spend longer looking at new visual information versus previously seen photos. Later research confirmed that habituation is an essential component of attention processes in younger children.

Sokolov's (1963) Orienting Response Theory helps explain the automatic shifting of attention as a result of the unexpected event occurring around them, as when suddenly a visual and auditory stimuli have changed; when something is moving; when the light changes; or when there is a change in what you hear. *Leckey et al. (2024)* also examined how children continue to show their attraction and novelty and found that children frequently switch their focus to new things, even if they were previously told to focus on something else.

In children's media environments, novelty may be defined as rapid changes in locations/setting; sudden

changes in sound; unusually large body movements; unusual behavior by a character; strange physical transformations of the character; or the interruption of the narrative. In many cases, AI-generated cartoons use an overabundance of these novelty features because they engage children and limit their habituation to the repeated content.

2.1.5 AI generated children's media and Algorithmic Content Production

In recent years, there has been a significant shift in the creation of children's entertainment through the introduction of artificial intelligence-generated children's media. Many aspects of AI technology now influence how content is created, including the use of automated animation software, generative image creation, voice synthesis, algorithmic-based content recommendations, automated video editing and predictive engagement analytics.

Unlike traditional animation production methods, AI-generated content can now be created quickly and easily, and in large quantities, with limited amounts of human supervision. Generative systems allow creators to develop an endless supply of animated programming that has been optimized for presentation and discoverability on digital platforms *Scheirer et al. (2025)*.

Academics researching the development of algorithm-based cultures suggest that digital platforms are increasingly searching for ways to encourage more engagement with their audience's content. Within the context of children's entertainment, many of these same motivations exist and reward content that generates a high number of clicks, visits, and repeat views while providing long attention spans. Thus, due to our constant state of high sensory overload, AI-generated cartoons will likely have more sensory stimulation since increased sensory stimulation creates higher engagement metrics *Dionne-Dostie et al. (2015)*.

2.1.6 Engagement design and attention economies

Attention economics describes a broader sociocultural construct for interpreting the children's media environments of the present. The concept of an attention economy posits that among digital platforms there is competition for finite human attention through increasingly complex engagement

paradigms.

For toddlers interacting with digital root in the children's media, these same general dynamics are exceptionally pronounced due to their enhanced perceptual saliency and novelty. As such, content producers will frequently utilize the following tactics to retain a high level of viewer engagement: rapid movement, amplified sound effects (i.e., a child's laugh might be exaggerated), repetitive motion, and extreme visual stimulation (e.g., bright colors).

This industrial model of engagement based on an attention economy is a far cry from the standards of many traditional broadcast child Television programmers when educational criteria and developmental pacing were considered. Conversely, the ecosystems of AI-generated content will operate through an algorithmic feedback-loop where patterns of success at engagement are perpetually reproduced and pruned.

2.2 Theoretical Framework

At the heart of this research is Developmental Attention Theory (*Posner & Rothbart, 2006; Colombo, 2001*), which offers insight into the development of attentional systems during early childhood as well as the ways in which toddlers' attention is attracted to exogenous, stimulus-driven sensory events. This theory provides the basis for investigating whether AI-generated cartoons will attract and maintain toddlers' attention through rapid audiovisual presentations.

Sokolov's Orienting Response Theory (1963) also informs this study, as it explains how novel/unexpected stimuli cause automatic shifts in attention. The application of this theory will aid in better understanding the amount of attention devoted to the sampled clips based on abrupt scene changes, novelty-based interruptions, and sudden audiovisual transitions. Analysis of visual intensity, exaggerated motion, color saturation, and audiovisual synchronization will also be informed by Saliency-Based Attention Theory and the Saliency Map Model (*Koch & Ullman, 1985*). According to these theories, visually salient stimuli will attract visual attention automatically.

Cognitive Load Theory (*Sweller, 1988*) and Lang's Limited Capacity Model of Mediated Message Processing (*2000*) will also be incorporated to assist in interpreting cognitive implications of the use of

high pacing and constant sensory stimulation. These theories purport that excessive sensory stimulation and rapid information presentation may exceed attention-processing ability, particularly in young children who are still developing cognitive processing abilities.

The use of thematic analysis as the primary means of analyzing and interpreting the research was on the basis of *Braun and Clarke's (2006; 2019)* reflexive thematic analysis framework that was used to guide the coding and interpreting processes throughout the study. Choosing to use thematic analysis as the primary means of analysis and interpretation for this study occurred for multiple reasons.

First, thematic analysis provides a methodologically flexible approach to conducting interdisciplinary media research. Because this study is located at the intersection of developmental psychology, media studies, and the emergence of visual cultures generated using artificial intelligence technologies, thematic analysis allowed for multiple theoretical frameworks and perspectives to be integrated together without being limited by rigid methodological assumptions.

It also allows for detailed examinations of observable patterns of meaning in qualitative data across multiple media forms. This study is focused on identifying recurrent attention-related patterns found in audiovisual materials, as opposed to isolated formal characteristics within the materials. Therefore, using thematic analysis enabled identification of the broader sensory structures that are embedded in the audiovisual materials across the various clips.

Thematic analysis is particularly appropriate for the types of audiovisual and multimodal data contained within the AI-generated cartoons because these types of materials contain simultaneous visual, auditory, temporal, and motion-based aspects of the materials that all lend themselves to interpretively synthesized results, rather than to isolated coding categories.

Braun & Clarke (2006) talk about how themes may not just occur by chance, they are created by actively interpreting them. In our case, this is relevant because we needed to intersect theoretical understanding of the structures of the media, with a theoretical understanding of the developmental aspects of attention in order to identify mechanisms

for capturing attention through the use or presence of media.

2.3 Research Gap

The literature reviewed reveals a number of significant conceptual, methodological and empirical gaps that warrant the current study. One such gap is that there is a lack of scholarly research on AI generated cartoon content specifically aimed at toddlers.

Most previous studies have looked solely at conventional television programming/educational media/generalized screens, rather than at algorithmically generated animation. Another gap is that much of the past research has focused primarily on behavioral outcomes instead of conducting an in-depth qualitative examination of media form. There also have been few studies examining how pacing, sensory salience, audiovisual interruption and novelty are structurally embedded within AI generated media.

Finally, developmental attention research and scholarship regarding media aesthetics are generally under integrated with one another. The current study attempts to address these gaps through a qualitative thematic analysis of AI generated toddler cartoons with respect to developmental attention theory, sensory salience literature, and media pacing literature.

III. METHODOLOGY

3.1 Methodology

The qualitative descriptive method of inquiry was selected to explore AI-generated animated shorts using pacing patterns, sensory density, and novel audiovisual mechanisms in order to identify the influence of those elements on toddler attention. The method was designed purposefully to address the research questions, which aim to identify recurring attention-related patterns in the media produced specifically for children near or about age two and/or toddlers, as opposed to examining the relationship between media and behavior (i.e. causal relationship).

The overall methodological framework for this study weaves theoretical perspectives and types of analyzes derived from multiple disciplines, including media

studies, developmental psychology, visual communication, and qualitative content analysis. As it studies specific characteristics of the media used to engage toddlers such as; pacing (i.e. rate of movement in the edited product), motion density (i.e. visual element density within the animated product), audiovisual salience (i.e. level of perceptual interest created by audio/image pairing), sensory interruption (i.e. auditory or visual cues used in animation to keep toddlers focused), and novelty structures (i.e. new audiovisual combinations, textures, and types of animation), a qualitative method allows a more in-depth study of nuanced patterns embedded within audiovisual media. A quantitative methodology would be inadequate for an examination of the interaction of editing rhythms, layering of sensory input, and attention traits present in AI-generated animated shorts.

To achieve this purpose, we will use qualitative methodology that includes qualitative description as an analysis method and Braun and Clarke's thematic process (2006; 2019) as the basis for developing themes through systematic coding procedures. This use of qualitative methods will allow the researcher to go beyond simply describing in detail what happened by effectively describing and interpreting the sensory engagement strategies of AI generated cartoons and how they were employed to successfully attract young children's attention.

This chapter will detail the study's methodological background by providing a thorough description of the study's research design, research philosophy, data collection methods, sampling methods, method of analysis (used), and thematic analysis stages. Additionally, details related to the study's trustworthiness, validity, reflexivity, ethics, and limitations will be provided.

3.2 Data Sources

To achieve a comprehensive level of analysis and verify the theoretical perspective presented, the study used both primary and secondary sources of evidence.

3.2.1 Primary Data Sources

The primary data consisted of 15 animated cartoon clips produced using AI, which were designed specifically as entertainment for young children. The

true range in length of each clip was between 1 and 3 minutes. All clips contained commonly recognized characteristics that characterize children's digital media today, including bright colors, animated characters, rapid movements, repetitive musical patterns, repeated sounds and easy-to-follow story lines.

Each of the clips was created through the use of current AI-assisted animation tools and selected for their differences in pace, aesthetics, density of edits, density of movement and complexity of sensory information. The clips were different in style because they were created using different processes but were all aimed at entertaining young children (early childhood children).

The 15 animated cartoon clips were treated as audio-visual text that could be qualitatively analyzed. Because the purpose of the study was to look at the structure of audiovisual art, as opposed to the impact of the content on the audience, the researchers did not engage in any direct interaction with any of the children who participated in the study.

3.2.2 Secondary Data Sources

The secondary data sources discussed here come from peer-reviewed scientific literature and utilized commonly throughout this study within the following areas of study:

- Developmental Attention Theory
- Sensory Salience
- Media Pacing
- Cognitive Load
- Audiovisual Attention
- Novelty Preference
- Children's Media Effects
- Algorithmic Content Production
- AI-Generated Media Environments
- Methodology for Thematic Analysis

Furthermore, secondary data sources were useful for providing context for finding, supporting theoretical interpretations, and enhancing the analytical rigor of each of the empirical studies conducted.

3.3 Sampling Strategy

Qualitative researchers use purposive sampling as a form of sampling that allows them to access rich sources of data to achieve specific research goals. The use of purposive sampling occurs when researchers

seek to identify particular types of cases for their research. Because purposive sampling is made for such purposes, it was a good fit for this study, as the study included only clips that contained identifiable pacing structures, identifiable sensory intensity patterns, and identifiable audiovisual characteristics associated with toddlers.

Selecting a sample of clips that was random would not have assured that the sample would be sufficiently diverse in editing rhythms, motion density, audiovisual salience, and mechanisms for novelty, and would therefore not have provided the necessary information to conduct a usable study.

Therefore, each of the fifteen clips included in the sample met the following selection criteria:

1. The clip must have been generated using AI-assisted or AI-based animation technologies.
2. The clip's content must be directed toward toddlers or preschooler audiences by the use of some combination of visual style, sound design, character simplicity, use of repetitive dialogue, or the incorporation of educational/play-themed content.
3. The audiovisual complexity of the clip must be sufficient for thematic coding of pacing and sensory attributes.
4. The length of the clip must be manageable for repeated close analysis and must contain multiple editing and sensory sequences.
5. The sample must collectively represent varying degrees of pacing intensity and sensory density.

The sampling strategy resulted in analytic diversity while providing a thematic coherence to the dataset.

3.4 Unit of Analysis

The analysis of cartoon clips occurred through a unit of analysis based on audiovisual sequences from each clip. Instead of viewing the clips strictly as narrative wholes, the study focused on segments that displayed identifiable pacing changes, visual transitions, sound effects, novel events, and sensory intensifying events.

Attention was paid to the following components:

- Scene transitions
- Cut frequency
- Motion density
- Audiovisual synchronicity
- Sound effect layering
- Color contrast change
- Visual exaggeration

- Repetition of sensory loops
- Surprise events
- Interruption structures

Analyzing at the sequence level allowed for an in-depth analysis of how attention capturing mechanisms functioned dynamically throughout each of the clips.

IV. ANALYSIS

4.1 Overview of the Analyzed Clips

Clip	Dominant Pacing Style	Motion Density	Color Intensity	Sound Effect Density	Novelty Interruptions	Overall Sensory Intensity
Clip 1	High	High	High	High	Frequent	Very High
Clip 2	High	High	Very High	High	Frequent	Very High
Clip 3	Moderate-High	Moderate	High	Moderate	Moderate	High
Clip 4	High	High	High	High	Frequent	Very High
Clip 5	Moderate	Moderate	Moderate	Moderate	Occasional	Very High
Clip 6	High	High	Very High	High	Frequent	Very High
Clip 7	High	High	High	Very High	Frequent	Very High
Clip 8	Moderate-High	Moderate	High	Moderate	Moderate	High
Clip 9	High	High	Very High	High	Frequent	Very High
Clip 10	Moderate	Moderate	Moderate	Moderate	Moderate	Medium
Clip 11	High	High	High	High	Very Frequent	Very High
Clip 12	High	Very High	Very High	High	Frequent	Extremely High
Clip 13	Moderate-High	Moderate	High	High	Moderate	High
Clip 14	High	High	Very High	High	Frequent	Very High
Clip 15	High	High	High	High	Frequent	Very High

Table 4.1 Overview of Cartoon Clip features; Out of the total number of clips analyzed in this dataset, there was a strong correlation between being fast-paced, fast-paced audiovisual structures, exhibiting less extreme sensory density or too much sensory density compared to the pace. Only two clips were moderately paced or had moderate-density visuals, demonstrating that the majority of the video clips had high amounts of fast-paced motion, snappy editing, bold color contrasts and/or strong repetitive audio effects.

4.2 Theme one: Pacing Patterns and Temporal Acceleration

6, 7, 9, 11, 12, 14, and 15.

The editing structures exhibited a number of common editing devices including:

4.2.1 Rapid Editing Structures

The editing structure exhibited in most clips created a dominant accelerated pacing structure through rapid editing. Most clips demonstrated an identifiable pattern of constant scene transitions within an extremely abbreviated time frame with corresponding simultaneous motion effects and sound transitions.

- abrupt jump cuts
- rapid zoom transitions
- instantaneous replacement of scenes
- frequent camera movement simulations
- flashing transitions
- looping or motion effects

The clips continually presented new sensory stimuli before allowing the viewer to completely process preceding frames, as demonstrated in Clips 1, 2, 4,

The use of pacing devices therefore generated an ongoing redirection of the viewer's attention line throughout the duration of the clips, in most

instances preventing any sustained visual focus, thereby generating what could be described as a continuously active or constantly activated visual perception.

From a developmental attention perspective, the rapid pacing of the visual images within the clips is congruent with exogenous attentional orienting mechanisms. Repeatedly introducing a new sensory stimulus to the viewer causes the attention systems of the viewer to be reactivated via repeated stimulation on the initial stimulation by means of new sensory stimuli.

4.2.2 Motion Density

The next primary pacing component was motion density. The vast majority of clips featured motion throughout the frame even though scenes had no transitions.

Objects in the background frequently moved independently from the objects in the foreground, and frequently characters would be continuously bouncing, rotating, growing, morphing and changing directions continuously throughout the clips, and there was also simulated camera movement occurring in many of the clips through:

- Panning
- Zooming
- Vibrating effects
- Rapid directional switches

Clip 12 illustrated the highest amount of motion density due to containing simultaneous motion by all characters, movement of all objects, animated background and rapid scene transitions

Developmentally, toddlers tend to pay attention to motion because motion communicates their environment's importance and novelty; therefore, the continual presence of motion serves as an ongoing mechanism for keeping your attention.

4.2.3 Repetitive Rhythm and Looping Structures

Another major form of synchronized pacing involved rhythmic repeats. Various clips featured movement/property cycles with repetitive sound effects or musical beats.

Examples included:

- Bouncing movements

- Looping dance movements
- Repeating gestures made by characters
- Synchronized jumps in rhythm
- Visually transformed properties.

Repeating these forms appeared most strongly in Clips 5, 8, 10, and 13.

There were two important functions of rhythmic repetition for the viewer simultaneously. The first was that the repetitive nature of these moves allowed for greater predictability and therefore created a sense of familiarity, and in turn potentially increasing engagement length. Second, the repetitive cycles often resulted in a sudden and dramatic contrast with the previous action; this generated anticipation and then again resulted in the novelty of seeing something completely new.

The combination of predictability and contrast together is similar to the reward cycles found in most algorithmically driven digital media platforms.

4.2.4 Minimal Cognitive Downtime

No clips included an extended period of visual stillness, any extended period of quietness, or any extended period of narrative silence. Instead, the audiovisual elements of each clip were almost continuously stimulated by means of:

The lack of any downtime from sensory stimulation may have resulted in continuous levels of attentional activation with little opportunity for reflective processing (of the narrative). In this respect, the clips appeared to favor stimulation continuity over narrative pacing balance.

4.3 Theme two: Sensory Intensity and Enhancements

4.3.1 Bright Designs through the use of Highly saturated colors

The second overriding theme is sensory intensity and multimedia enhancements (or intensifiers).

- Saturated neon colors (e.g., blue, orange, yellow)
- Bold contrasts (e.g., from black to white)

In the analysis conducted of the clips, some were

noted to have significant amounts of color saturation (clips 2, 6, 9, 12, and 14).

The *Visual Salience Theory* states that people are naturally attracted to something that is visually distinctive (i.e., highly contrasting color, brightly colored). Thus, within the clips analyzed, color was used not only for decoration but also as an interactive means of engaging one's attention. In addition, several clips used rapid transitions of color at times of high emotion/motion states.

4.3.2 Layering Sound-Effects

Almost all the clips employ layers of sound effects alongside the fast-cut visuals. Importantly, sound effects rarely functioned independently.

The presence of audiovisual synchrony has heightened sensory salience, i.e., increased the salience of [perceivable] events by producing them within multiple sensory [modalities] at the same time. The two clips that produced the most auditory stimulation (sound effects) were Clip 7 and Clip 12, and thus, provided the greatest degree of near-continuous auditory stimulation while watching them.

4.3.3 Continuous Audio/Visual Synchronization

Motion in the clips is very rarely without noise; as sound will almost always accompany motion or visual transition will occur simultaneously. During the action types, the tempo of music will increase, and the sound effect intensity will also rise at the same time as the visual effects or actions occur.

This synchrony creates a highly integrated multisensory (audio/visual) stimulation environment. From an attention perspective, multisensory congruence increases salience because all sensory systems concurrently reinforce the existence of the same event (motivation based on synergy). Therefore, the clips create environments that are very rich in their sensory profile and optimized for immediate attention responses.

4.4 Theme Three: Novelty-Interruptions and Attention Capture

4.4.1 Abrupt Novelty Events

The frequency of novelty in the events directly following repeated pattern sequences indicates that

the creators intended to interrupt the habit-forming process of viewers by using novelty. Examples include that bouncing sequences typically were abruptly interrupted by, sudden colorful explosions, jumping into bringing new characters abruptly, or suddenly zooming in and out of something when the camera is moving.

The development attention theory states that the use of novel stimuli interrupts the process of forming habits by 'reactivating the orientation response' to stimuli. Novelties used in the clips consistently related to this theory to help maintain the viewers perceptual investment.

4.4.2 Surprise Interruptions and Resetting Attentional Focus in Viewers

Several of the video clips contained abrupt breaks, which seemed intentionally designed to redirect attention. These breaks provided a means to undo established sensory rhythm patterns, utilizing:

- Instant silence
- The use of dramatic zooms
- Unpredictable cuts
- Utilization of visual distortions
- Rapid directional changes

The intent behind these breaks was to perform a "Perceptual Reset" to redirect attention prior to enabling the process of habituation from occurring. This type of structure is similar to those found within "attention resetting" techniques employed within short-form algorithmic content ecosystems.

4.4.3 Fantastical Transformations

Fantastical Transformations were another of the main novelty mechanisms in the clips. Examples included:

- Morphing characters
- Impossible changes to environments
- Magical Objects appearing
- Surreal movement
- Extreme distortion of physical characteristics

The presence of fantastical events challenges an individual's typical perceptual expectations and therefore creates, increased unpredictability with respect to attention.

According to research studies from the field of

development psychology, fantastical events will result in individuals requiring additional cognitive processing due to the fact that the fantastical event violated a person's previously formed schema about physical reality.

The frequent presentation of fantastical transformations across the clips may also increase cognitive processing demands for individuals, thus increasing attentional activation.

4.5 Cross Thematic Interpretation

The interaction of the themes was observed during the clips, despite being examined separately. Because rapid pacing resulted in constant movement, the perceptual (or sensory) intensity increased rapidly through the novel effects of the clips' highly exaggerated colors and exaggeratedly audible sounds.

Since the novelty mechanisms increased the pace, those increases delayed habituation and reactivated attentional systems responsible for orienting towards those types of events. Together, these mechanisms produced highly stimulating media environments by having continuous attentional activation, minimal period of perceptual rest, consistent reinforcement of the same sensory information and using multiple strategies to keep the viewer's attention through interruption-based engagement.

Overall, it appears that toddler cartoons produced using AI rely upon systems used to capture exogenous (as opposed to endogenous) attention, rather than a narrative-driven approach to sustaining immersion or reflective processes.

4.6 Major Findings

This chapter analyzes the results of the thematic analysis in relation to the study's research questions, developmental attention theory, sensory salience frameworks, and contemporary scholarship on media for children. Additionally, it contextualizes the structures of pacing, the patterns of sensory intensity, and the mechanisms for novelty within the larger theoretical debates around toddler attention, cognitive overstimulation, algorithmic engagement systems, and AI-generated media design.

The results suggest that AI-generated toddler cartoons have a consistent approach to utilizing fast-paced editing, dense layering of sensory experiences, audiovisual matching, and structurally disruptive moments of novelty, all of which resemble the externally driven attention-capture mechanisms described in developmental psychology literature. The clips that were analyzed demonstrated that sustained engagement was primarily due to continuous perceptual activation and repeated redirection of attention, rather than through narrative continuity or educational progression.

This study provides an important contribution to emerging scholarship regarding how algorithmically generated children's media will affect development. While previous literature has focused mainly on the pacing of television shows and the amount of time spent in front of a screen, this study demonstrates that AI-generated films create a new, intensified sensory environment for toddlers characterized by continuous motion, greater audiovisual attention, less cognitive dead time, and strategically placed novelty mechanisms.

This chapter explores three major categories of themes drawn from our analysis.; Pacing Acceleration, the increased intensity of sensory input, and a break in attention due to novelty. It also provides an overview of how these findings can contribute to theories regarding developmental attention research, media, AI-generated content systems, and cognitive environments for young children.

4.6.1 Accelerated pacing and Toddlers Attention

The study contains one initial conclusion, that most of the AI-generated clips (i.e., toddler aged films) feature the use of accelerated pacing structures. Specifically, most of the video clips examined had rapid pacing due to the continual sequence of scenes changing, continuous motion, the layering of multiple motions in the same or adjacent scenes, and very little perceptual rest between events.

This supports previous research that suggests that children's media is primarily organized by how pacing regulates attention. Additionally, the findings of this research support the foundational hypothesis (Anderson & Levin, 1976) that

children's attention is much more sensitive to prescriptive features of formal media than by units of narrative comprehension.

For example, the structures of pacing that occurred in the videos analyzed appear to be developed to provide repeated orientation to attention due to the continuous onset of sensory stimuli in each of the videoclips. In other words, the rapid cut, movement change, zoom, and/or transition which occur in each video clip provided each of these stimuli as new, perceptually defined events which required children to provide a new allocation of attentional resources to them.

Furthermore, the findings provide an extension to the early findings of television research into the new area of AI-generated children's media, as children's television programs are typically created by including sequences of rapidly paced events in balance with at least several longer paced events in the program, examples of which were recorded in very few of the AI-generated children's cartoons in this study. Children's AI-generated cartoons contained significantly fewer stimuli than children's traditional cartoons, due to the lack of meaningful pauses, reflective pauses, or at least some sustained visual sequences throughout the majority of the clips.

Concerns over overstimulating visual stimuli and interruptions to focused attention (as noted by developmental psychologists) are supported by the pattern discussed herein. Researchers have argued that children's executive function may be temporarily compromised when watching fast-paced, highly stylized (fantasy) cartoons because they need to constantly shift their attention from one rapidly changing stimulus to another (Lillard, & Peterson, 2011). Our current results suggest that the fast-paced style of the AI-generated cartoons reviewed here actually magnifies many of the formal features associated with cognitive overload. The issue is particularly important with regard to toddlers' development. During early childhood, systems that support internal mechanisms of focus, inhibition, and self-regulation are still maturing and remain underdeveloped. Ruff & Rothbart (2001) suggest that young children depend upon the use of exogenous mechanisms of attention due to their ongoing development of executive control mechanisms. Thus, environments that create

continuous interruptions of perceptual experiences may reinforce reflexive patterns of attention rather than promoting sustained cognitive engagement.

The AI-generated cartoon segments that were analyzed in this review produced primarily exogenous attention through rapid changes in sensory information. Therefore, it appears that AI-generated cartoons could train children's developing attentional systems to continue to be oriented towards reorienting attention with little ability to concentrate for an extended period of time, which may lead to the development of fragmented patterns of attention during a critical developmental period for developing executive function.

The motion density associated with pacing was another key feature of pacing identified in the results. The findings indicated that not only did editing transitions facilitate the movement of people from one location to another, but virtually all visual frames of reference (i.e., character movements) and all sets of visual frames of reference (i.e., backgrounds and foregrounds) were also moving continuously. Characters were continually bouncing and backgrounds were continually changing while more than one visual frame of reference (i.e., layers of movement) competed visually to be viewed above all others.

The resulting environment of continuous motion may increase the amount of attentional demand because exogenous visual attention is largely driven by motion. Motion signals to an organism an object's environmental relevance and potential behavioral relevance (i.e., the tendency of organisms to use motion as a recruitment cue). With respect to toddlers' cognition, motion develops as one of the most salient features because attention is preferentially directed to the dynamic than to the static stimulus when children are developing their attention systems.

These findings appear to suggest that AI-generated animated cartoons create a perceptual ecosystem that is physically saturated with movement and focus on retaining the viewer's attention as the viewer moves through the perceptual space of the visual frame. Instead of directing the viewer's attention toward a singular focal point, the animated clips built a perceptual space that includes multiple sensory modalities competing for the same attentional capacity. This may increase the viewer's

perceptual engagement and decrease the viewer's opportunity to reflect on or direct their attention back internally.

The almost complete absence of cognitive downtime in the animated clips has significant developmental implications. Prior to this study, commercial children's programming often incorporated breaks, slower transitions, and conversational pauses between segments to provide children with time to process material as well as to consolidate the narrative of the segment. In contrast, the animated clips created by the AI were virtually non-stop sound and visual activity.

The results of this study support larger critiques of today's digital attention economy from many scholars (*e.g.*, Wu, 2016; Hari, 2022) who argue that digital systems today value engaged metrics much more than they do thoughtful cognitive experiences. The cartoons examined in this study support these larger platform logics by providing a constant amount of stimulation to keep viewership engaged over a long period of time.

For young children in toddler-friendly media environments, this way of structuring media can be particularly problematic; toddlers have a limited ability to self-regulate their sensory input and, as a result, could be vulnerable to having their attentional systems overloaded with ongoing sensory stimulation, without any opportunity for endogenous recovery time or for developing their own pace of cognitive processing.

4.6.2 Sensory Salience and Multisensory Enhancement

The second major finding revealed the highly systematic use of sensory salience across the clips. Bright color contrasts, exaggerated visual elements, repetitively-utilized sound cues, synchronized audio/visual transitions and enhanced perceptual amplification appeared consistently throughout the data set.

This data strongly supports a salience-based theory of visual attention by Koch & Ullman (1985) and later computationally operationalized by Itti, Koch, and Niebur (1998). In the salience theory, stimuli that are very different from other stimuli in the immediate perceptual environment automatically

attract attention. The clips that were analyzed utilized predominantly saturated colors, exaggerated motion, and synchronized sounds to enhance the perceptual salience of the features contained within the image.

Additionally, evidence of perceptual salience in AI-generated cartoons is not coincidental — it is structurally embedded in the design of the content. The sensory intensity was systematically organized to maximize the perceptual visibility and duration of attention. The repeated use of flashing colors, exaggerated facial expressions, rhythmic sound effects, and synchronized audio/visual elements resulted in settings of ongoing sensory amplification.

This finding builds upon the previous body of literature regarding the use of multisensory salience in children's media by indicating that the systems developed through AI-generated content were able to achieve a greater degree of multisensory engagement than were typically possible with most traditional television broadcasts. Traditional animation has certainly utilized bright colors and sound cues; however, the clips that were analyzed in the study exhibited a very high-density layering of sensation across multiple layers of perception with minimal perceptual moderation.

Audiovisual synchronization played a significant role in the media clips used. Almost every visual change had an accompanying sound effect or musical transition. Sound effects occurred when a visual change took place, zooms matched increasing sound volumes, and there was often an exaggerated sound burst to match the visual transformation.

Research on multisensory integration has demonstrated that when sensory stimuli are experienced in synchrony, they will simultaneously provide the same input to multiple perceptual systems to aid in future attention-drawing events. Therefore, during the clips studied, the role of synchronization was as an attitudinal amplification strategy. Visual and auditory stimuli were able to relate cooperatively, serving to enhance their ability to draw attention to the same event.

This is an important finding for toddler-directed media, as early attention systems respond well to multisensory events that occur in synchrony.

Children at this age are attracted to visual/audio congruency over finding unrelated sensory stimuli. Dense sensory enhancement strategies have been used to take advantage of this developmental characteristic in the AI-generated cartoons viewed. The vast number of exaggerated visual images in the data was another significant finding. For example, exaggerated facial expressions were found on characters in the media clips compared to a character's body shape, exaggerated body appearance was shown on characters compared to their proportions, glowing outlines around characters, and exaggerated emotional responses shown by the character. These features create an increased perceptual immediacy and simplify the emotional meaning of the original image.

From a development-based approach, extreme visuals could have originally aided in attentional orientation as well as emotional identification. However, closely related to exaggerated visuals was not just the facilitation of communication through clarity in a visual field, but the provision of continuous sensory stimulation. The edits of the examples provided a continuous and not selective amplified perceptual experience.

These observations suggest an additional analysis in regards to concerns around sensory overload within the digital child population as scholars' research is indicating that today's children's media systems are using extreme perceptual measures to maximize attention. These examples support this claim with their continual use of magnification and increasing levels of perceptual intention.

Another important consideration relates to the process of habituation. Developmental research focused on attention shows that repeated exposure to the same type of sensory input over time leads to a diminishing of novelty and the need for greater levels of sensory input to maintain attention. The edits illustrated increased sensory effects, such as brighter colors, louder sounds, faster movement, and more extreme variations with each edit.

This escalation related to attentional systems is somewhat like engagement models that are based on use of artificial intelligence-generated graphics to produce increasing levels of novelty to maintain or prevent an associate from attending. Thus, AI-generated animated films may be part of the overall

trend of increasing levels and frequencies of digital stimulation generated by technology.

4.6.3 Novelty and Interruptions as Attention Capture Mechanisms

The third significant theme in the Analysis of all video clips was the pervasive use of structure with novelty and interruption. Important characteristics of the clips were the presence of abrupt sensory changes, surprise transformations, fantastic events, rapid interruptions, and attentional reset mechanisms.

Additionally, these findings match well with past developmental research; such as in the foundational studies of preference for novelty and orienting responses. Fantz (1964) provided evidence from experiments conducted with infants that infants orient toward novel stimuli preferentially once they have habituated to stimuli. Mather (2013) added to this notion when he stated that novelty serves as an early stage primary source of attention for infants, as the presence of an unfamiliar stimulus serves to indicate that this stimulus is of informational importance.

The video clips analyzed contained frequent attempts by the creators to take advantage of this attentional tendency in their design of the video clips. Repetitive sensory sequences were routinely disrupted by illegible sensory changes (e.g. zooms, explosions of color, large and unexpected characters) used to stimulate attention before habituation was achieved.

The importance of these findings comes from the fact that the majority of interruption events created from the clips analyzed did not have the opportunity to develop according to the natural progression of the narrative. In fact, there were often groups of rhythmic sensory events frequently broken up by rest periods, and at those points in time where there would usually be rhythmic sensory events were replaced with large discontinuous sensory events such as; an explosion of color, the introduction of large existing and or non-existent characters, new and unrelated music, etc.

This design appears to be an example of what might be termed an attentional re-set design. Each interruption was used as an opportunity to attempt

to change the viewer's perceptual focus before that viewer's attention would tend to wane. These types of attention mechanisms have been strongly associated with the exogenous attentional capture mechanisms identified in developmental psychology.

Another noteworthy characteristic of all of the clips was the prevalence of fantastical transformations. Characters underwent unexpected transformations, environments changed abruptly, and species had their physical laws violated. All of these fantastical events brought an increased amount of perceptual unpredictability and increased disruption to attention.

Vasilev et al. (2020) conducted a previous study that demonstrated how fantastical content might impair executive function in children who are continuously processing violations of the typical physical laws. In this set of analyzed clips, the fantastical transformations were used frequently as tools for drawing the viewer's attention back on an ongoing basis, instead of only serving as stand-alone imaginative moments.

Overall, the results indicate that cartoons created through artificial intelligence may provide an instance of the boundaries between imagination-driven storytelling and interruption-driven sensory engineering becoming blurred. Fantasticality, then, became less a characteristic of narrative and more of a tool for managing attention.

Further, the results offer support for the orientation response mechanism theory proposed by *Sokolov (1963)*, where sudden changes in sound, motion, or visual structure, when presented suddenly, used to provide perceptual reorientations throughout all of the clips. Each sudden change, then, represented an interruption of the continuity of the viewer's attention.

Toddlers are unable to maintain their endogenous attentional control. As a consequence, these types of environments may result in habitual attentional shifting instead of maintaining prolonged attention. Continued interruptions will condition viewers to expect constant new experiences and high amounts of rapid sensory turnover.

This phenomenon can also be seen on modern-day platforms. Many current short-form digital content

ecosystems use interruption-based engagement strategies to keep viewers watching. The AI-generated cartoons that were examined in this study were found to be conceptually aligned with the larger patterns of algorithmically directed attention retention.

It should be noted that the authors of this study are not contending that novelty is negatively impactful, because novelty is essential for a child's ability to learn, explore and develop cognitively. Still, the findings suggest that AI-generated cartoons utilize novelty at an extremely high rate and with a degree of intensity creating an experience of fragmented exploration instead of exploratory/perceptual use of attention.

The overall findings from this research point to many broader implications for the relationships formed by uses of AI-generated children's media within the digital attention economy. With the characteristics observed in the analyzed segments relating strongly to characteristics typically associated with an algorithmically engaged optimization of content for audience engagement (e.g., rapid pacing; endless, perpetual motion; multi-sensory synchrony; escalation in novelty; repetitive reward loops; and constant resetting of attentional focus) there is reason to believe AI-generated toddler-appropriate animated content may increasingly value retention metrics of engagement over the appropriateness of their pace for developmental growth.

In contrast to a traditional animation pipeline that generally relies upon utilizing an extensive amount of time with human editors doing work on the content, an AI-assisted content creation system can quickly produce a significant amount of visually stimulating media that has been algorithmically optimized for placement in front of audience members by virtue of an analysis of audience retention metrics associated with platform visibility of the material previously produced from those systems. High levels of stimulation also tend to be rewarded under algorithmic recommendation models, thereby potentially driving an excessive delivery of sensory stimulation in regards to toddlers.

Thus, the results of this study provide further evidence suggesting AI-generated children's media

may further exacerbate the existing commercial attention-capturing dynamics, which already exist within digital culture. The toddler-targeted media does not only function as entertainment; it is also the area through which algorithmically-optimized attentional engineering occurs.

This presents a critical ethical dilemma with respect to developmentally vulnerable populations. Because toddlers cannot act in a critical manner when faced with sensory environments that are specifically designed to maximize their attention focus, AI-generated content creation systems may too greatly influence the developing attention tendencies of toddlers at highly sensitive times of development.

Based on the study's results, it's clear that there needs to be a reassessment in how we define "engagement" in the context of children's digital media experiences. The finding that there was high attentional fixation did not mean that the engagement exhibited was positive developmental engagement. The attention maintained to the clips that were analyzed was maintained through sensory interruption/perceptually increased stimulation rather than through any reflective cognitive engagement.

This distinction between forms of engagement is important as many contemporary platforming systems use watch time and duration to measure success or "engagement level" with any piece of content. The data findings indicate that the metrics used to track watch time and duration may ignore other important developmental aspects of engagement such as attentional quality, cognitive pacing, and sensory regulation.

4.6.4 Contributions to the Theory

This study makes three major theoretical contributions by integrating developmental attention theory, sensory salience research and AI-based media.

The study expands research on traditional television pacing to examine how the fast-paced nature of traditional television will be exaggerated in AI-based media through heightened layering of sensory input and optimized stimulus structure due to the use of AI systems.

It enhances salience theory by providing a new example of multisensory amplification at work in AI-based media targeted to infants/toddlers. The results indicate that the mechanisms used to capture attention in cartoons generated through AI do not rely on isolated visual or auditory stimuli, but rather on the functioning of a coordinated audiovisual network of stimuli (e.g., synchronized color, movement, sound, rhythm and interruptions).

Third, the study expands developmental novelty theory by showing how digital-based media create strategies for establishing habituation interruption. In the case of AI-generated cartoons, novelty serves as a systematic (rather than incidental) means of managing attention.

Finally, the study extends intellectual inquiry into the phenomenon of algorithmic childhoods and the influence of digital platforms on early childhood development. The presence and behavior of toddlers in AI-Generated cartoons are interwoven into a much larger network of digital attention economies, which are characterized by the promotion of continuous engagement using optimized sensory inputs.

This summarizes that toddler cartoons produced by AIs are consistently fast-paced, amplify sensory experience, and utilize interruption techniques because they exemplify the developmental systems that capture attention. In other words, toddler cartoon media environments arrange to continuously stimulate perception with rapid changes in sensation, audiovisual synchronization, and by resetting one's attention from one distraction to another. From the integration of developmental psychology, salience theory, and the analysis of AI-generated media, the study shows how the amount of toddler-directed content being created with algorithmically increased levels of engagement. Although this type of engagement may be effective for holding attention, it brings up major issues regarding attention fragmentations, overstimulation, and the effects that perpetual exposure to these types of new things has on development during early childhood.

4.7 Implications

The outcomes of this research have implications for theories and practices of children's media

development as well as policy-making processes that operate across four major domains: theoretical implications, practical/industry implications, developmental/educational implications, and policy/ethical implications. The research provides new and vital information about how toddlers interact with AI-generated toddler cartoons, including learning about: pacing structure; sensory intensity; and novelty-based attention mechanisms. Therefore, this work gives rise to broader discussion related to children's digital media environments; early cognition; and algorithmically optimized engagement systems.

The results of the research show that: toddlers are exposed to AI-generated cartoons that employ rapid pacing, dense, multisensory stimulation, repetitive audiovisual reinforcement, and novel interruption strategies. In addition, there are many exogenous (external) attention-capturing mechanisms used in developmental psychology that are consistent with the ways in which attention is captured in AI-generated toddler cartoons. Taken together, these findings have implications that exceed typical descriptions of media and raise significant questions about how new AI-generated toddler content will shape attentional experiences during children's early cognitive development.

Findings and implications of the study should not be construed as a blanket dismissal of digital media or of the application of AI-based animation technologies in digital media production. Rather, the findings indicate a need for content designers/developers, platform governance organizations/media literacy educators, and ethical AI practitioners to take developmentally conscious approaches in creating media, using existing technology and implementing new technology in children's media ecosystems. The chapter discusses the broad implications of the research in four key areas:

1. Implications for Theory
2. Implications for Practice and Industry
3. Implications for Development and Education
4. Implications for Policy and Ethics

4.7.1 Developing the Developmental Attention Theory Model of AI Media

A major theoretical contribution of this research is to develop the developmental attention theory

model for current AI-generated children's media. Much of the existing scholarly research on developmental attention has been conducted with traditional television, educational television, or screen time in general. There has, however, been little research conducted related to AI-generated audiovisual systems as they relate to structuring sensory engagement.

The findings of this research indicate that AI-generated toddler cartoons/cartoons systematically utilize the mechanisms of exogenous attentional capture such as rapid onset stimuli, perceptual novelty, motion-amplified events, audiovisual synchrony, and interruption-based escalation of sensory events. These patterns support theoretical models of attention suggesting that early attention systems will respond to all stimuli related to their salience.

Ultimately, this study contributes to developmental psychology by demonstrating how contemporary AI Generated media environments instantiate the attentional activation triggers already identified in the fundamental novelty-preference and orienting-response theories of attention. Based on these findings; AI-generated media will operate as highly exaggerated perceptual ecosystems that are organized around the principles of attentional retention.

This study supports the partition of attention in toddlerhood to that which is driven by an external source ('exogenous') and that which is internally sustained ('endogenous'). In this study, the majority of the clips were geared toward exogenous, or externally stimulating, sources of attention stimulation compared to internally sustained sources of cognitive engagement; therefore, this supports the theoretical argument that excessive dependence upon external sources of stimulation could potentially have an effect on the patterns of emerging attentional regulation in early childhood. Additionally, this study contributes to the broader framework of developmental attention theory by incorporating toddler cognitive function into sensory environments created with algorithms and characterized by a level of continuous perceptual activation.

4.7.2 Extending Salience Theory to Digital Childhood Studies (Research on Digital Child Development)

Research findings on visual/audiovisual attention theorizing as salience theory is an important avenue of research for future digital childhood scholarship. The classic salience frameworks of *Koch and Ullman (1985)* theorized on attention as influenced by visually and/or aurally distinctive stimuli, such as differences in color; movement; brightness; and orientation. Research findings in this study also extend the above theories to include that salience as it relates to the use of technology to create children's digital media, can be considered to operate not only through visual stimuli, but through a combination of multiple sensory and temporal stimuli within algorithmically generated/cartoons. As such, the attention capturing events of the analyzed video clips were correlated with the simultaneous or synchronized combinations of the following (aspects of their structure/elements):

- Amount of movement
- Audio or sound-effects employed in layering
- Rhythmical repetition
- Amount of color intensity
- Animation and exaggeration of characters
- Unusual and novelty attributes of interruptions

These findings provide evidence that children's digital media (i.e., AI-generated cartoons) utilize a theoretical framework called multisensory salience structure, in which there is a persistent, multisensory perception of similar characteristics amongst the different sensory modalities at the same time. In addition, this is an important consideration when examining or theorizing salience and attention due to traditional models of salience that focus on attentional stimuli in static or simplified environments have been considered to be relatively constant over time.

In comparison, AI-generated cartoons demonstrate that there is dynamic, changing salience mechanisms involved within an evolving, dynamic audiovisual/visual environment. Furthermore, this research contributes to the development of a new theoretical construct for scholarship/conceptualization of digital-sensory environments by demonstrating how digitally generated environments create and combine attributes that enhance and combine sensations in

time and location through the use of salience to allow for maximum duration of attention.

4.7.3 Redefining Media Engagement in Early Childhood

A key theoretical implication of this research is how engagement is understood in children's media studies. For most of today's digital platforms, engagement can be assessed by how long a child watched an item and how often they attended to it. However, this study found that children attending to AI created cartoons, do so for the majority of time due to either an interruption in sensory input or an increase in newness (from stimulation), rather than reflective thought.

This is a significant theoretical distinction as it creates a theoretical challenge to the assumption that if a child is exhibiting attention towards something, it must necessarily indicate that they are engaging in a meaningful developmental interaction. Rather than immersion in narrative, or depth of thought, or scaffolding for educational benefit, the clips analyzed in this study retained the child's focus, largely, through mechanisms of continued activation of perception.

The findings in this study also support the development of emerging critiques of the digital attention economy (i.e., with respect to children in the context of media). Therefore, engagement with regard to the digital attention economy should not just be defined in terms of the retention of behavior, but rather as an experience (level of intensity) experience that will be qualitatively different from other experiences when a child engages in it.

This reframing of engagement will encourage researchers to begin distinguishing between:

- Attentional fixation
- Sensory capture
- Cognitive processing
- Emotional engagement
- Reflective learning.

These distinctions developed through this study and add further clarity to the theoretical understanding surrounding the way that children engage with media produced in an algorithmic context.

4.7.4 Implications faced by Parents and guardians

There is a rise with the use of digital forms of media in their day-to-day parenting routines. Some parents might think that even though (while using) colorful and/or engaging cartoons (which are generated by using artificial intelligence) keep toddlers' interest - they are simply being entertained (in a good way).

The findings from this research show that just because toddlers exhibit attention to a media item - does not mean that they were engaged with that media item in a meaningful way. The media clips examined in this research kept toddlers' attention due to continuous sensory interruption rather than through meaningful cognitive interaction.

Therefore, caregivers must evaluate children's media for meaningful engagement based not only on educational descriptions of the media and/or popularity of the media, but also based on the pace and sensory structure of the media. Several practical implications for caregivers who provide media to their children were identified during this research:

- Select slower-paced media
- Limit the amount of exposure to highly stimulating media
- Provide opportunities for co-viewing with children and discussing the media
- Provide a balance between screen-time and playtime
- Choose media with a coherent narrative structure

In addition, there is a significant need for all parents to become media literate so they will be able to make informed choices of how they will navigate the changing of new AI-generated media.

4.7.5 Implications for Early Childhood Education (ECE)

There is an increasingly growing trend among education's practitioners using digital media in ECE learning environments. This study's findings will inform educators to critically analyze the sensory design of children's media before they integrate them into the education setting.

Due to their rapid pacing and continuous novelty, AI-generated content may ultimately hinder

engagement in reflective thinking and prolonged attention. In order to foster attentional development, educational media must do more than just capture the user's attention.

Therefore, this study encourages Early Childhood Educators to prioritize the use of media that consists of:

- Manageable pace
- Continued narrative structure
- Moderate sensory input
- Reflective activity
- Developmentally appropriate cognitive interaction

Educational institutions may also want to include a media-awareness curriculum that will allow educators and caregivers to better understand the ways that sensory design impacts attention tendencies.

The findings of this study have far-reaching implications for many fields including developmental psychology, media studies, AI ethics, platform governance, education, and digital policy for children. The results indicate that AI-created toddler cartoons are characterized by rapid pacing, multi-sensory amplification, and frequent interruption systems based on the principles of novelty, all of which activate exogenous mechanisms for capturing attention.

The research demonstrates the urgent need to critically analyze not only how much media children watch, but also the structural design of modern, AI-produced media systems that organize kids' attention. As algorithm-based content creation becomes increasingly prevalent in the digital experiences of children, understanding how sensory optimization and attentional engineering impact development will be an urgent, interdisciplinary concern.

V. CONCLUSION

There are many areas of potential future research on AI-generated media for toddlers, and they all require an interdisciplinary approach as well as increasingly urgent attention from researchers.

Both the AI-generated cartoons in this study exhibited cognitive capture techniques for infants

and toddlers (e.g., accelerated pacing or rapid time-rate), sensory increase (e.g., visual and auditory), audio-visual synchrony and novelty-driven attentional interruption; all patterns of effective cognitive capture correspond closely with attention capture systems that develop through early childhood development.

Future scholarship regarding child-generated media technologies must continue moving beyond simply descriptive studies, and must include longitudinal studies, experimental studies, neurocognitive studies, computational studies, education-focused studies as well as policy-focused studies; this includes highlighting some of the complex developmental consequences that algorithmically optimizing sensory environments for children results in.

For AI-generated children's media research to be successful in the long run, all participants (academics, developers, parents, educators, etc) must work collaboratively across disciplines and work toward the common goal of appropriately balancing the technological innovations of the future on cognitive healthy development and to design media for children.

5.1 Limitations

In addition, the authors wish to emphasize that while this study produces valuable knowledge regarding the timing of event structures, patterns of sensory overload, and attentional processes within toddler cartoons produced by A.I., there are many methodological, conceptual, and analytical limitations that constitute potential issues that are important to note because the findings still apply. These limitations do not detract from the results of this research, but will assist in providing the necessary context of each finding for future research in order to provide a wider understanding of A.I. produced toddler cartoons from a multidisciplinary approach to this emerging field.

A.I. produced media are constantly changing; thus, this research is exploratory in nature and is occurring within an emerging, interdisciplinary research area. This research attempts to produce deeper understanding of the ways in which the structural organization of toddler cartoons created by A.I. can organize the way in which children pay

attention to cartoons and their attentional process, or the ways in which they process sensory design within cartoons.

This study does not intend to identify a causal relationship between the number of media used and developmental outcomes resulting from said media exposure. This chapter outlines limitations related to the study's sample, methodological strategy, interpretive framework, data arrangement, theoretical design, and context of this study, and presents a number of options for future research to expand and improve upon the current study findings.

5.1.1 Qualitative Interpretive Limits

The most important drawback to this study is its qualitative interpretive method. Although the thematic analysis provided a rich examination of the audiovisual structure of the works studied (and provided an examination of the sensory systems oriented to visual attention), it is important to note that qualitative interpretations are inherently biased by the researcher's viewpoint and the analytical frame used to evaluate the material. For example, although identifying the pacing intensity, degree of sensory salience, and novelty structures of the materials being studied required interpreting them rather than measuring them objectively, the use of coding, inter-coder discussion, and theoretical triangulation increased the validity of the data to some extent but did not completely eliminate the possibility of a completely objective interpretation of the data.

Thematic analysis focuses on the use of meaning to create an understanding of some phenomenon, not on making a statistical representation of that meaning. Therefore, the findings of this study do not suggest that the results of this study can be applied to every AI-generated media product designed for children ages 0 to 12; rather, they provide interpretive evidence based on theory of the recurring themes found in this sample.

It may be beneficial for future studies to use a combination of qualitative interpretations with computational media analyzes, biometric measurements of visual attention, or cognitive assessments using experimental designs. The combination of qualitative and quantitative data

would provide more detailed knowledge about the relationship between sensory structures and actual visual attention of children viewing media being used by AI.

5.1.2 Absence of Direct Child Participants

The fact that toddlers or child participants were not included in any direct observations is a significant limitation of this study. The media items that were evaluated as a part of this research were treated as objects (i.e., the actual media themselves) but did not have viewer responses measured experimentally. Because of this limitation, the study could not provide conclusive evidence regarding how toddlers behave, feel and think in response to these noted pacing and sensory mechanisms. Established theories of developmental attention were used to interpret the results of the study; however, the attention implications were inferred from the study rather than being observed by the researcher.

This is a very important distinction to make, because just because rapid pacing, audiovisual prominence and novelty interruptions were observed in media items does not mean that all children will necessarily respond to the same in the same ways, as individual differences (e.g., temperament, developmental level, parental mediation, etc.) can greatly affect how attention is received by each child. Therefore, child-centered empirical processes must be applied to future research such as:

- Eye tracking studies
- Observational viewing studies
- Physiological measures of attention
- Cognitive assessments
- Parent/child interaction analyzes These types of studies will yield better insight regarding how toddlers perceive and understand AI-generated sensory places when viewed in real- world settings.

5.1.3 Limited Sample Size

A limited size of sample has made it impossible to generalize or accurately identify trends or themes within the data. Instead of having an equal representation of the overall number of children's shows, there were variations across the three dimensions of pacing, density, and AV structure, but they were all captured through a single dataset.

In addition, because the number of AI-generated children's media is continually increasing, there is a great deal of additional variation and diversity in that media than exists within this study.

The dataset analyzed in this study is likely to demonstrate certain stylistic tendencies related to:

- Specific systems for generating AI
- Specific cultural characteristics associated with platforms on which they are displayed
- Content optimization strategies which may include: optimization of the use of AI-generated elements in the production process.

Research into cross-platform and/or cross-cultural datasets would enhance our understanding of how toddler media generated using AI technology continues to evolve across various technological and cultural contexts.

5.1.4 Future Research Directions

The limitations expressed in the current study provide many possibilities for future research.

AI-Generated Cartoon on YouTube Kids: An Analysis on Pacing, Sensory Intensity and Toddler Attention

A first set of studies to be done should have longitudinal approaches to determine how long-term repeated exposure to very stimulating cognitive-digital environments impacts a child's developing ability to attend and concentrate.

Much of the current research has only considered the short-term effects of increased levels of stimulation. How long the impact of algorithmically produced increased levels of sensory environment remains unknown.

Experimental research with toddlers to examine how different pacing variables relate to developmental outcomes of attention, memory, emotional regulation and executive functioning is warranted. In particular, comparing toddler responses to different stimulus rates from two types of AI-influenced cartoons would be beneficial.

Another opportunity for research lies in teamwork with developmental psychologists, media studies professors, AI researchers, and computer science researchers in how generation systems define and develop child-engagement through their process of

developing media for the child.

Another area for future research is identifying ethical AI standards for designing child-focused media.

This includes studying how AI systems may intentionally encourage a child's ability to maintain attention balance, regulate their emotions, maintain focus and to reflect cognitively.

The last area to explore through research would be comparative styles of AI-generated child-oriented media across culture, media portals and socio-economic considerations to assist in strengthening our understanding of how digital collaborations shape today's childhood sensory environments on a global level.

This research is an important first step toward understanding the new field of AI-generated children's programming. The current study identifies an increasing trend toward continuous perceptual activation and attention optimization of toddler-directed cartoons, as well as an emerging pattern of finding features of pacing structure, sensory intensity, and novel types of attention mechanisms associated with these types of media.

The limitations noted throughout this chapter reflect the numerous challenges associated with studying the digital environments of children that result from rapidly changing technologies, algorithms, and developmentally vulnerable populations; however, the limitations also provide considerable opportunity for future interdisciplinary research on AI-generated media and early developmental processes.

5.2 Future Scope of Study

The rise of AI-created media directed at children has presented many new possibilities and difficulties for scholars working in the fields of education, developmental psychology, communication studies, ethics of artificial intelligence, digital governance, and media studies. This study shows that toddler cartoons generated by AI generally appear to use quick pacing, more than average sensory stimulation, synchronized audiovisual information, and interruptions based solely on the novelty of the content being presented. There is much to learn

about the long-term impact of sensory exhibits produced by AI on the child's cognitive development, emotional regulation, creation of media habits, and experience over time.

While this study presents a qualitative examination of these findings, it is clear from this study that there is an urgent need for a great deal of additional research aimed at understanding the impact of digitally produced environments on young children through their cognitive development, emotional regulation, media habits, and overall development over extended periods of time. Current research needs to shift from descriptive content analysis of AI-generated child's content to longitudinal, interdisciplinary, experimental, computational and policy-oriented methods of research in order to keep pace with the ever-increasing pace of change in the AI-generated media ecosystem.

Therefore, the future of this specific area of research is vast and likely to grow with new technologies such as generative AI, adaptive recommendation systems, personalized children's content using computer algorithms, immersive media technologies, and algorithmic engagement with children during their early development will continue to enhance the relevance of research related to the digital attention environment of young children. This chapter discusses a number of future research directions to be developed based on the current research results.

5.2.1 How Long-Term Exposure to AI-Powered Media Affects Attention Development

There is lots of potential future research focusing on long-term developmental effects of children's continual exposure to AI sensory media environments.

Most existing studies on children's media use (e.g., studies that deal with pacing and fantasy in children's media) have only examined the short-term behavioral and cognitive effects of the children immediately after they viewed the media. Although short-term studies are valuable, they do not provide an adequate understanding of how a child's continual exposure to heavily stimulating AI-generated content might affect their attentional development over months and years.

The current research contains evidence of ongoing patterns of rapid pacing; increasing levels of stimulation; multisensory experiences and lack of attention; throughout the entire clip set. Long-Term Studies can assess whether long-term use of these types of media environments will affect the ability to maintain attention over extended periods of time, plan and execute tasks till the end, shift resources of attention, manage one's emotional state, tolerate frustration when challenges persist and delay gratification until an appropriate moment to redeem has occurred.

Comparisons can be made between children who primarily experienced AI produced materials that were developed with high levels of stimulation with those who primarily experienced slower paced educational content. This would allow further research into how these experiences affect the development of the child's attention systems and their overall development across time.

Longitudinal research will be important due to the fact that being a toddler represents a stage of life when attention regulation systems are being developed. Understanding how the use of algorithmically intensified forms of media development will be crucial as AI continues to develop children's content.

5.2.2 Experimental Studies on Cognitive Processing and Sensory Intensity

The objective of this paper is to investigate how changes in sensory input affect toddler cognitive and attentional processes, and to provide direction for future research investigating this topic. The present study contributes to a framework of empirical research on this topic by identifying specific challenges that remain unresolved regarding the nature of toddler cognition and attention, as well as general implications for researching the relationship between sensory input and toddler cognition and attention.

The findings of the present study demonstrate the need for controlled experimental research examining how specific sensory inputs affect toddler cognition and attention. Future research should strive to identify and manipulate individual media features, including cut frequency, motion density, color saturation, sound-effect intensity,

audiovisual synchrony, and frequency of novelty. Experimental designs that incorporate strict measures of eye movement, physiological arousal, duration of gaze, and behavioral measures of attention would provide valuable empirical data regarding how toddlers respond differently to different configurations of sensory input.

Other studies could explore whether or not continuous exposure to novelty-rich content affects toddlers' ability to engage in cognitively demanding tasks such as reading, imaginative play, classroom engagement, or problem solving that require sustained attention.

The present study provides a conceptual foundation for future empirical research in this area by outlining the common sensory characteristics that are likely to warrant further empirical research.

5.2.3 Eye tracking and neuroscientific methods

In the future, combining neuroscientific and biometric methods with AI-produced children's media research may be a promising way to advance research on this area.

Data from thematic analysis suggest that the use of visual "hotspots" in AI-generated cartoons appears to be characterized by sudden movement, color enhancement, synchronization of audio and video, and sudden interruption. Future studies that employ eye tracking may determine how toddlers visually explore their sensory environment through AI-generated cartoons.

Some of the potential insights from using eye tracking include:

- Which visual characteristics maintain a toddler's gaze for the longest duration?
- How quickly do toddlers shift their attention from one stimulus to another?
- Does increased sensory density result in fragmentation of attentional focus?
- Does the degree of novelty result in longer periods of attention paid to stimuli?

Similarly, other neuroscientific methods (for example, EEG or functional neuroimaging) can be used to investigate how AI-generated media with high levels of stimulation impact the neural systems

of attention in young childhood.

While these types of studies introduce methodological and ethical challenges in studying toddlers, they may provide researchers with valuable insight into attentional arousal, sensory processing load, habituation and mechanisms of cognitive overstimulation.

Interdisciplinary collaborations between developmental neuroscientists and scholars of media may foster the increased development of knowledge about the sensory environment of AI-generated media in early childhood.

5.2.4 Comparative Analysis between Traditional and AI-Generated Animation

A study comparing the AI-created cartoons created for toddlers versus traditional techniques used for creating those same cartoons should be performed to determine if there are any differences in how fast they are created (i.e., time to make); how much they interrupt (i.e. the number of times an animated cartoon stops to have new information injected); how intense the layering of sensory stimulation is for children watching the animation; or if any engagement techniques applied by an animator to keep children engaged are stronger in one versus another technique of animation creation.

There may be differences between AI-created cartoons for toddlers and those created using traditional methods, such as: emotional coherence; instructional technique to support learning or education; continuity of a story; imagination; or character development.

Doing this type of comparison study will provide clarity as to whether the above characteristics that result in kids focusing their attention on an item of media have broader implications to digital media as whole or that the differences reflect only between how children consume media in general (i.e., beyond just animation) and how children consume animation specifically created using an artificial intelligence production system.

Lastly, future scholars may want explore in greater detail how various animation creation techniques, such as traditional and artificial intelligence production systems, differ from a conceptual

standpoint with regard to audience engagement relative to toddlers.

5.2.5 Cultural Comparisons of Children's AI Media

Another key area for future development in children's media is examining how AI produced media aesthetics and attention structures cross-culturally. Currently, this research reflects global styles of digital media that circulate through the filtered output of platform cultures optimized by algorithms. However, children's media traditions can differ greatly between cultures, including differences in pacing practices, priorities of education, types of sensory stimuli, and conventions of storytelling.

Future research could look at cross-cultural variations in children's AI generated media based on region (cultural region), language or context used, education system and parental expectation of media. For example, while some cultures prefer to tell stories in a manner that allows for slower-paced educational delivery; many will generally choose dynamic modes of delivery designed to maximize stimulating sensory experiences. Comparing cultures in this regard could demonstrate significant variation regarding how AI-produced systems create childhood media experiences.

Additionally, examining cross-cultural relationships between the sensory-sensory patterns observed in this study and others across the globe can assist in identifying whether those patterns exist universally or culturally relative to each nation.

Cross-cultural research in this regard is critically important since AI-produced content is reaching transnational audiences via digital platforms; thereby influencing how childhood media will be established in vastly different societies.

5.2.6 Education Will Be Enhanced by the Use of AI-Generated Media.

This study concentrated on attention-drawing techniques and the strength of stimulation. But there are many more educational uses for AI-generated cartoons! Researchers should examine how we can design AI-generated animation around: language acquisition; emotional development; attention training; problem-solving; and imaginative play.

Instead of constantly increasing the stimulation of children's senses, educational AI-generated cartoons could minimize sensory stimulation through: slower pacing; guided interactivity; narrative reflection; and added cognitive-engagement value. Researchers could evaluate if this way of designing AI-generated/animated educational content improves learning outcomes and reduces over-stimulation.

The future of AI-generated children's media should therefore be viewed beyond just risks, as there is an opportunity to create generative technologies that are aligned with child developmental objectives relative to the current maximization of engagement systems.

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