# Haptic Cues May Enhance Affective Priming in Multimedia Experience

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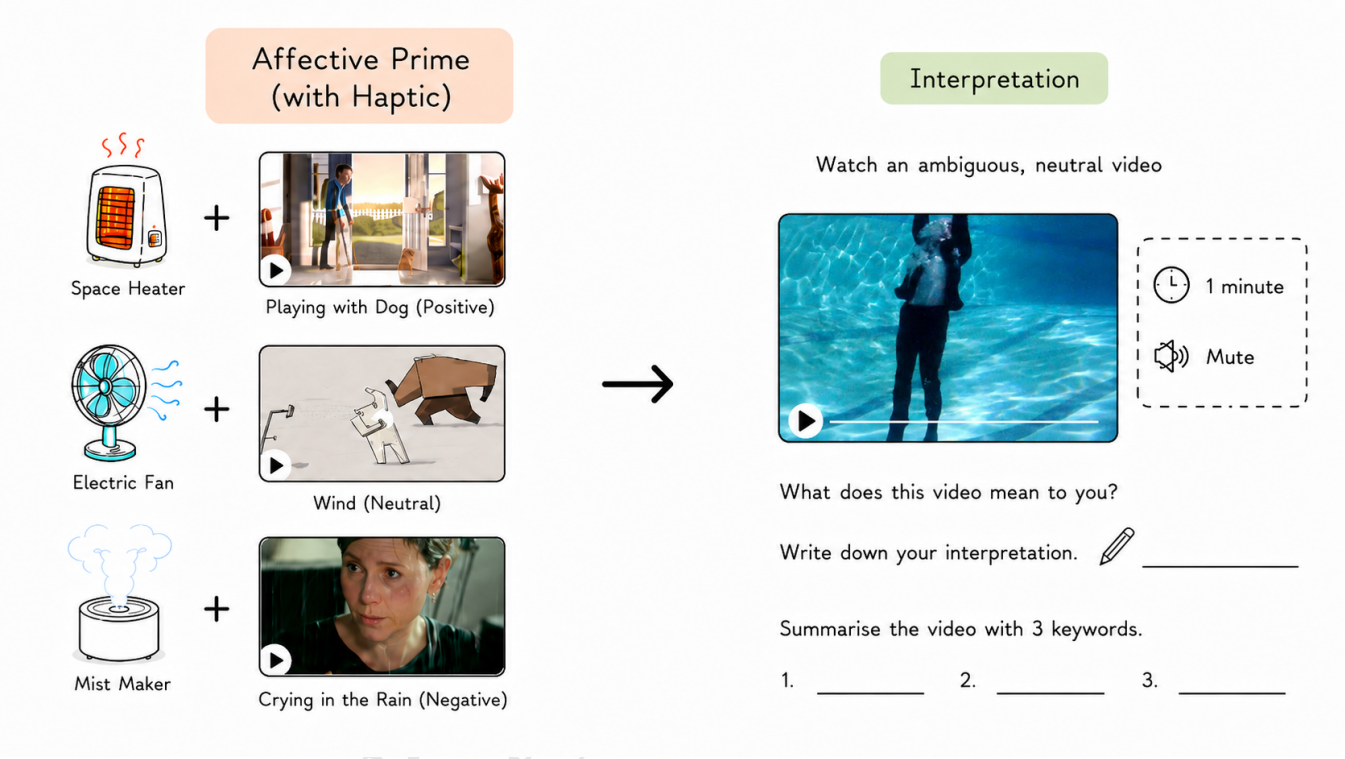



**Figure 1: Overview of the study workflow. Affective prime videos are paired with warmth, airflow, or mist to examine whether haptic cues shape participants' interpretations of ambiguous neutral videos.**

## Abstract

This paper explores whether haptic cues shape the interpretation of ambiguous multimedia content. In a within-subject study with 12 participants, affective prime videos were paired with warmth, airflow, or mist before participants viewed muted neutral clips. While haptic cues did not clearly shift valence ratings, norm-based keyword analysis showed slightly higher affective loading in the haptic condition (0.13) than in the no-haptics condition (−0.07). In contrast, no-haptics responses showed higher perceptual concreteness (0.53) than haptic responses (−0.08), suggesting that participants without haptic cues described more directly observable content. These findings suggest that touch may not simply change emotional valence, but may encourage more affectively loaded and less purely visual interpretations of ambiguous media.

## CCS Concepts

• **Human-centered computing** → **Haptic devices**; **Empirical studies in HCI**; **User studies**.

## Keywords

Haptic Feedback, Multisensory, Affective Computing

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# 1 Introduction

Multisensory cinema formats such as 4DX use effects including motion, vibration, light, wind, and scent to intensify the viewing experience. While these effects are often associated with action-oriented spectacle, their potential role in more narrative or emotion driven films remains less clear. This raises a broader question: can sensory stimulation shape not only immersion, but also how viewers interpret cinematic meaning?

Prior work suggests that memory and interpretation are influenced by sensory context. Godden and Baddeley's study of context-dependent memory showed that recall improves when the retrieval environment matches the encoding context [10], and theories of grounded cognition argue that cognition is closely tied to perception, bodily states, and situated action [2]. Touch may be especially relevant, as incidental haptic sensations such as weight, texture, and hardness can influence judgments in unrelated tasks [1].

In this exploratory study, we examine whether haptic stimulation can influence the interpretation of ambiguous film content. Because subjective feelings are difficult to quantify and compare across viewers, we focus on interpretation as an observable proxy for affective influence. Participants watched affective prime videos either with or without corresponding haptic stimulation, then interpreted an ambiguous and affectively neutral video segment. This design allows us to examine whether a brief, affectively congruent haptic cue can carry over into subsequent media interpretation while reducing the influence of other cinematic variables.

We ask: *Can affectively congruent haptic stimulation paired with prime videos influence participants' later interpretation of an ambiguous neutral video?*

Our preliminary results did not show a clear difference in valence classifications between the haptic and no-haptics conditions. However, open-ended responses showed a slight tendency toward more affective descriptions following haptic stimulation. Although the limited sample size prevents statistical generalization, these findings suggest a possible role for touch in shaping cinematic interpretation and motivate further study of multisensory stimulation in narrative and emotion-centered media.

# 2 Related Work

## 2.1 Context-Dependent Memory and Encoding Specificity

The relationship between sensory context and memory has been widely studied in cognitive psychology. The encoding specificity principle proposes that memory retrieval is more effective when cues available during retrieval overlap with cues present during encoding [17]. This principle suggests that contextual information is not merely background noise, but may become part of how an event is encoded and later retrieved. A classic demonstration of this effect is Godden and Baddeley's study of context-dependent memory, in which participants who learned material either on land or underwater showed better recall when tested in the same environment in which learning occurred [10]. These findings provide an important theoretical basis for the idea that sensory cues can later reactivate associated experiences.

## 2.2 Emotion, Mood, and Affective Priming

Emotion also plays a central role in memory and interpretation. Bower's associative network theory of mood and memory argues that emotional states can become linked with events, thoughts, and memories, making mood-congruent information more accessible later [4]. In related work, affective priming studies have shown that exposure to emotionally valenced stimuli can influence subsequent judgments and evaluations. Fazio et al. demonstrated that attitudes can be automatically activated and can affect responses to later stimuli [8]. Murphy and Zajonc further showed that affective responses may occur rapidly and even with limited conscious awareness, influencing how subsequent stimuli are evaluated [13]. Together, these studies suggest that prior affective experience can bias the interpretation of later stimuli, particularly when those stimuli are ambiguous or open to multiple meanings.

## 2.3 Embodied Cognition and Haptic Experience

The present study is also informed by theories of embodied and grounded cognition. Rather than treating cognition as purely symbolic or detached from the body, grounded cognition argues that mental processes are deeply connected to perceptual, motor, and bodily systems [2]. From this perspective, tactile experience may play a role in shaping affective and cognitive interpretation. Touch is not only a physical sensation, but can also carry emotional and social meaning. Research in affective haptics has shown that tactile feedback can be designed to communicate or modulate affective states [7]. In human-computer interaction, multisensory design has similarly emphasized that touch, sound, and visual information can work together to create richer and more meaningful user experiences [15].

# 3 User Study

## 3.1 Participants

Twelve participants were recruited for the study. Participants had a mean age of 22.92 years ($SD = 0.67$); eight identified as male (66.7%) and four as female (33.3%).

## 3.2 Prime Stimuli

Three prime videos were used to induce affective and environmental associations. Each video was associated with a corresponding sensory theme: sunlight, wind, or rain. The videos were chosen because they contain clear environmental or atmospheric cues that could be mapped onto physical stimulation.

The sunlight prime used *The Present*, a short animated film about a boy who spends time indoors playing video games before being encouraged to go outside [9]. The wind prime used *Wind*, an animated short portraying people living in a windy environment and adapting their everyday behavior to strong weather conditions [12]. The rain prime used *Rain / Regn*, a short film in which rain follows the protagonist through daily life, creating a strong association between rainfall and emotional burden [14].

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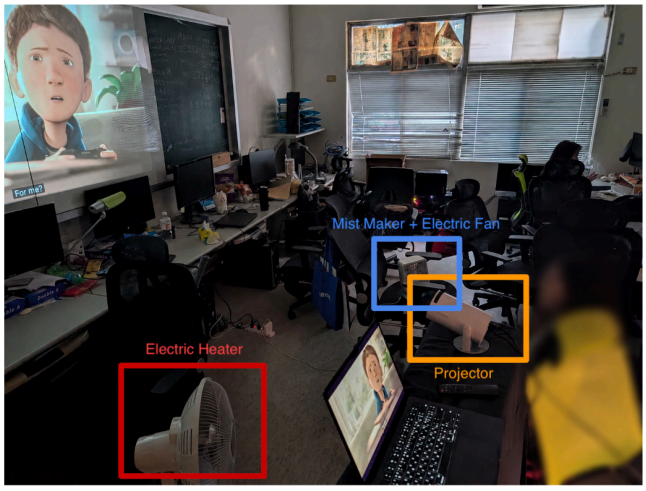



**Figure 2: Experimental environment.**

### 3.3 Neutral Target Stimuli

Four neutral target videos were selected as ambiguous interpretation materials. The purpose of these videos was not to convey a single explicit emotional meaning, but to provide visually rich and open-ended content that participants could interpret in different ways. To reduce the influence of soundtrack, dialogue, rhythm, or music, all neutral videos were muted. Each neutral video was edited into a one-minute clip. The one-minute duration was selected to make the viewing experience comparable across stimuli while keeping the overall experiment short.

N1, *The Others*, depicts the Shibuya intersection in Tokyo and focuses on crowd movement, urban energy, and the feeling of being alone within a large city [11]. N2, *Deep End Dance*, is a short dance film involving a mother and son above and below the surface of water [3]. N3, *Crack Shot*, centers on a young squash player and includes themes of sport, tension, discipline, and psychological pressure [6]. N4, *Kindred Bodies*, is a one-take dance film exploring vulnerability, empathy, and shared emotional experience through bodily movement [18].

### 3.4 Apparatus

The experiment was conducted in a darkened room. Videos were displayed using a projector to create an immersive viewing environment and to reduce participants' awareness of the physical stimulation apparatus. The haptic and environmental stimuli were delivered using automated electronic devices placed outside the participant's direct attention. These devices included a electric heater and an electric fan then have a mist generator capability. The devices were triggered manually during the corresponding prime video condition. Figure 2 shows the experimental setup. Participants were not explicitly informed about the timing or purpose of the haptic and environmental stimulation before the experimental trials.

### 3.5 Procedure

The experiment consisted of two experimental blocks. Each experimental block included a prime video, a distractor task, a neutral video, and a post-viewing questionnaire. The two blocks differed in whether a haptic cue was presented during the prime video. The basic task components were as follows:

(1) **S1: Prime video with a haptic cue.** Participants watched a prime video paired with its corresponding haptic or environmental cue. Depending on the prime video, the cue consisted of warmth, airflow, or mist. This step lasted approximately five minutes.
(2) **S2: Prime video without a haptic cue.** Participants watched a prime video without any additional haptic or environmental cue. This step lasted approximately five minutes.
(3) **S3: Distractor task.** After each prime video, participants completed an unrelated game-based distractor task for approximately three minutes. The task was included to reduce immediate carryover effects and to separate the priming phase from the subsequent interpretation task.
(4) **S4: Neutral video viewing and post-viewing questionnaire.** Participants watched a one-minute muted neutral video clip. After viewing the clip, they completed a short questionnaire about the video's visual content, the feelings it evoked, its overall emotional valence, and three keywords that summarized their interpretation. This step took approximately three minutes.

Each participant completed both the haptic-cue and no-haptics blocks. The order of the two conditions (S2 and S4), as well as the assigned prime and neutral videos, followed a predetermined counterbalanced schedule.

### 3.6 Post-Viewing Questionnaire and Analysis

After each neutral video, participants completed a short questionnaire in Chinese to support natural and accurate responses:

(1) **Q1: Visual description.** Visually describe the video you just watched.
(2) **Q2: Subjective impression.** What feelings did this video evoke for you?
(3) **Q3: Overall emotional valence.** How would you characterize the emotional tone of the video: positive, neutral, or negative?
(4) **Q4: Keyword summary.** Summarize the video using three keywords.

Q3 and Q4 were designated as the primary outcome measures. Responses to Q3 were used to compare the distribution of positive, neutral, and negative interpretations between the haptic and no-haptics conditions. Responses to Q4 were used to examine the semantic characteristics of participants' keyword descriptions across conditions. The detailed procedure for this keyword analysis is described in Section 4.3.

Q1 and Q2 were used as supporting prompts rather than primary outcomes. They helped participants articulate their observations and provided context when Q3 ratings or Q4 keywords were ambiguous. Because earlier questions may influence later responses [16], future studies could counterbalance the questionnaire order.

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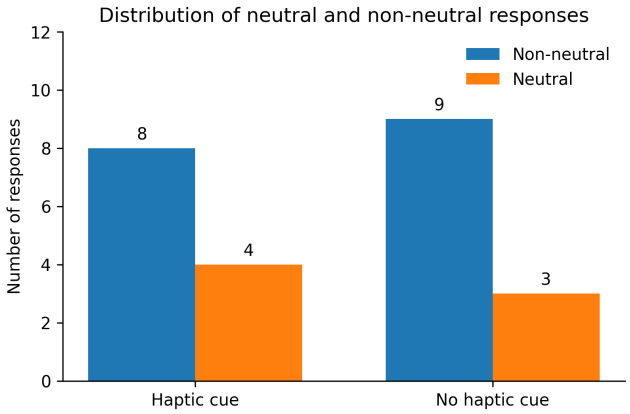



**Figure 3: Number of neutral and non-neutral responses in the haptic-cue and no-haptics conditions.**

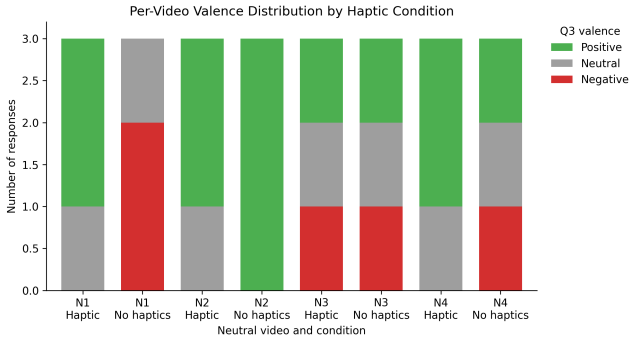



**Figure 4: Distribution of Q3 valence ratings for each neutral video, separated by haptic condition. Each bar represents three responses.**

# 4 Results

## 4.1 Neutral and Non-Neutral Interpretations

We first examined whether the presence of a haptic cue affected the likelihood that participants would interpret a neutral video as having a non-neutral emotional valence. Responses to Q3 were grouped into two categories: *neutral* and *non-neutral*. The non-neutral category included positive, strongly positive, and negative responses.

As shown in Figure 3, 8 of the 12 responses (66.7%) in the haptic-cue condition were non-neutral, whereas 9 of the 12 responses (75.0%) in the no-haptics condition were non-neutral. The number of neutral responses was therefore 4 in the haptic-cue condition and 3 in the no-haptics condition.

Because each participant completed both conditions, we additionally examined the paired differences between conditions. Two participants provided a non-neutral interpretation only in the haptic-cue condition, whereas three participants provided a non-neutral interpretation only in the no-haptics condition. An exact McNemar test did not indicate a difference between the two conditions ($p = 1.000$).

These descriptive results do not suggest that the presence of a haptic cue increased the overall likelihood of a non-neutral interpretation. However, this binary comparison does not capture whether haptic cues affected the direction of the perceived valence or the specific affective keywords used by participants. These differences are examined in the following analyses.

## 4.2 Per-Video Valence Distributions

The previous analysis grouped responses into neutral and non-neutral interpretations. To examine whether these responses were related to haptic cues or to differences among the neutral videos themselves, we compared Q3 valence ratings separately for each video. Each neutral video was presented three times in the haptic-cue condition and three times in the no-haptics condition.

As shown in Figure 4, N1 showed the clearest descriptive difference between conditions: the haptic-cue condition included two positive responses and one neutral response, whereas the no-haptics condition included two negative responses and one neutral response. N2 showed a different pattern, with five of the six responses across both conditions rated as positive and none rated as negative, suggesting that it may have carried an implicitly positive affective tone even without haptic cues. For N3, the distribution was identical across conditions, with one positive, one neutral, and one negative response in each condition. For N4, the haptic-cue condition included two positive responses and one neutral response, while the no-haptics condition included one positive, one neutral, and one negative response.

Overall, these results suggest that participants' interpretations were shaped not only by the presence of haptic cues, but also by the inherent affective ambiguity of each neutral video. However, because each video was presented only three times per condition, these patterns should be interpreted as exploratory observations rather than conclusive evidence.

## 4.3 Keyword Distributions Analysis

To characterize participants' keyword responses in a more systematic and reproducible way, we conducted a norm-based lexical analysis using the traditional Chinese word norm database by Chan and Tse [5]. The database provides normed ratings for valence, arousal, familiarity, concreteness, and imageability. Each keyword token provided in response to Q4 was normalized and matched to the database. Two-character keywords were matched directly, whereas longer phrases were segmented into two-character lexical units when possible. Units that did not appear in the database were treated as out-of-vocabulary and excluded from the aggregate norm-based analysis.

For each matched lexical unit, we computed two derived measures. First, affective loading was estimated by combining valence extremity and arousal. Valence extremity was defined as $D_v = |V - 5|$, where $V$ is the normed valence score and 5 is the neutral midpoint of the scale. Affective loading was then calculated as $L_a = (z(D_v) + z(A))/2$, where $A$ is the normed arousal score. Second, perceptual concreteness was calculated as $L_c = (z(C) + z(I))/2$, where $C$ and $I$ denote normed concreteness and imageability. All z-scores were calculated relative to the full norm database. For each neutral video and condition, the reported score was computed as

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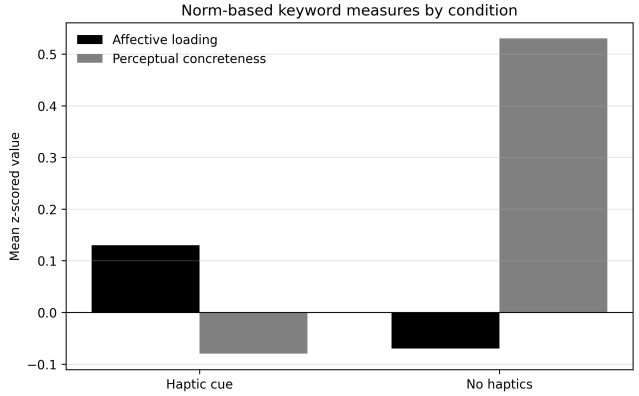



**Figure 5: Norm-based keyword measures by condition.**

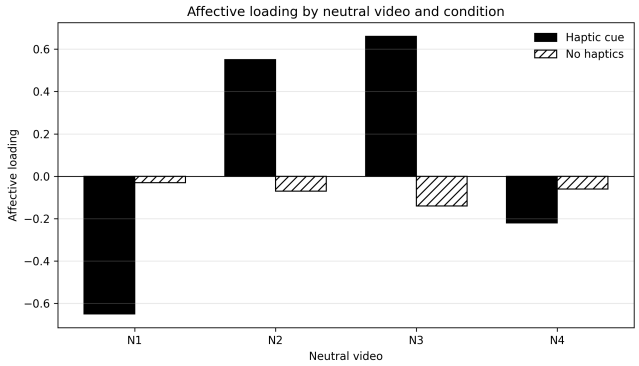



**Figure 6: Affective loading by neutral video and haptic condition.**

the mean of all matched keyword units associated with that video-condition pair.

As shown in Figure 5, the haptic-cue condition produced slightly higher affective loading than the no-haptics condition. The average affective loading score was (0.13) in the haptic-cue condition and (-0.07) in the no-haptics condition. This suggests that, among matched lexical units, participants used words with somewhat stronger emotional extremity or arousal after haptic stimulation. In contrast, perceptual concreteness was lower in the haptic-cue condition. The average perceptual concreteness score was (-0.08) in the haptic-cue condition and (0.53) in the no-haptics condition, suggesting that no-haptics responses were more visually grounded, concrete, or imageable.

The per-video results further clarify this pattern. As shown in Figure 6, the increase in affective loading was most visible for N2 and N3. For N2, affective loading increased from (-0.07) in the no-haptics condition to (0.55) in the haptic-cue condition. For N3, it increased from (-0.14) to (0.66). These results suggest that haptic cues may have encouraged more affectively loaded interpretations for some neutral videos, although the pattern was not consistent across all stimuli.

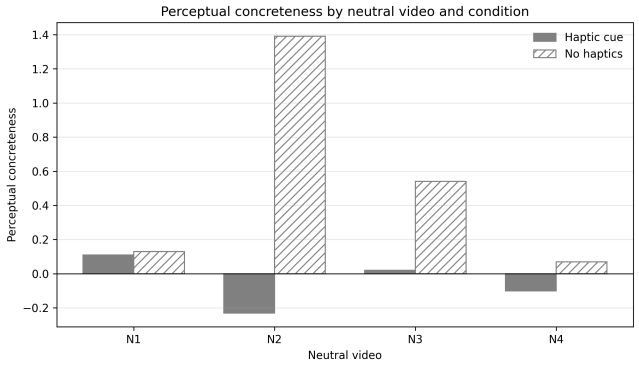



**Figure 7: Perceptual concreteness by neutral video and haptic condition.**

Figure 7 shows the corresponding pattern for perceptual concreteness. No-haptics responses were generally more concrete and imageable, especially for N2, where perceptual concreteness was (1.39) in the no-haptics condition but (-0.23) in the haptic-cue condition. This suggests that, without haptic stimulation, participants tended to describe more directly observable visual content, whereas haptic stimulation may have shifted responses toward more subjective or affectively mediated descriptions.

These results should be interpreted cautiously. As lexical coverage differed across conditions. In the haptic-cue condition, (25/36) keyword tokens were matched to the database, corresponding to (69.4%) coverage. In the no-haptics condition, (30/36) keyword tokens were matched, corresponding to (83.3%) coverage. Several unmatched responses were colloquial or domain-specific expressions, such as '在幹嘛', '匹克球', '壁球', and "律動". Therefore, the norm-based analysis provides a more structured complement to qualitative interpretation, but should not be treated as a complete account of all participant responses.

Taken together, the norm-based keyword distributions suggest that haptic cues did not simply shift participants' responses toward more positive or negative interpretations. Instead, the haptic-cue condition showed slightly higher affective loading, while the no-haptics condition produced more concrete and imageable descriptions. This pattern supports the interpretation that haptic cues may encourage participants to describe ambiguous media in more subjective, affectively loaded, and less purely visual terms.

## 5 Limitations and Future Work

This study was exploratory and involved a small sample size, so the findings should be interpreted as preliminary rather than conclusive. In addition, some target videos appeared to contain latent affective characteristics despite being selected as ambiguous stimuli, which may have influenced participants' interpretations independently of the haptic condition. The norm-based keyword analysis also depended on lexical coverage in the Chinese word norm database; therefore, colloquial, one-character, or domain-specific responses could not always be included in the aggregate analysis.

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Future studies should validate the neutrality of target videos through a separate pre-study, and examine each haptic cue independently. More controlled cue–prime pairings would also help clarify whether specific sensory cues, such as warmth, airflow, or mist, produce different interpretive effects. Beyond these methodological refinements, future systems could incorporate additional modalities, such as smell, taste, temperature, airflow, vibration, and spatialized environmental effects, to better understand the potential of multisensory interaction for shaping affective media interpretation and meaning-making.

## 6 Conclusion

This paper explores whether haptic cues shape the interpretation of ambiguous multimedia content. In a within-subject study with 12 participants, affective prime videos were paired with warmth, airflow, or mist before participants viewed muted neutral clips. While haptic cues did not clearly shift valence ratings, norm-based keyword analysis showed slightly higher affective loading in the haptic condition (0.13) than in the no-haptics condition (−0.07). In contrast, no-haptics responses showed higher perceptual concreteness (0.53) than haptic responses (−0.08), suggesting that participants without haptic cues described more directly observable content. These findings suggest that touch may not simply change emotional valence, but may encourage more affectively loaded and less purely visual interpretations of ambiguous media.

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