

Making Sense: Juxtaposing Visual, Auditory, and Kinesthetic Design Elements to Create Meaning, Reinforce Emotions, and Strengthen Player Memory Formation and Retrieval

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Abstract

In this paper, visual, auditory, and kinesthetic design elements are introduced with regard to their sense-specific narrative qualities or properties. Discussing perceived hierarchies of different sensory stimuli and their reciprocal effects through contrast and agreement, the paper shows how different forms of juxtaposition create meaning, reinforce player emotions, strengthen memory formation and retrieval, and support various dramatic functions within individual beats through incongruity and ambiguity and through clarification and intensification.

Keywords: *game design, sensory design, narrativity*

1. INTRODUCTION

Visual, auditory, and kinesthetic design elements in video games both inform the player and elicit emotions. To establish a memorable gameplay moment in an individual beat as the smallest element of structure [1], information and emotion design need to go hand in hand. Moreover, memory retrieval is strengthened when the moment of memory formation—i.e., the learning event—is attached to a specific context or space that can then be recreated for easier retrieval [2][3][4]—which, as a caveat, works better with recall than with recognition [5][6]. In turn, the specificity of a given context or space is strengthened when it is attached to distinct emotions with the just-right level of intensity [7].

In dramatically complete games with story and character arcs, emotions are primarily created through narrative content, or story. But emotions can also be created through narrativity. Narrativity, a term adapted from film theory [8]—which, in this particular context, is closer in use to visual arts theory [9] than textual semiotics [10]—refers to narrative qualities or properties that works of art often possess, in any medium, despite lacking identifiable plot or story elements. Conveyed through visual, auditory, and kinesthetic design elements, these narrative qualities or properties can support narrative content, aid memory formation and retrieval, and create memorable gameplay moments beyond and without story or plot.

This paper discusses the game design–specific characteristics of visual, auditory, and kinesthetic design elements with regard to narrativity; how these experiences relate to each other hierarchically; and how they can be combined to create ambiguity and uncertainty on the one hand or work toward clarification and intensification on the other to establish distinctly different meanings.

2. SENSORY DESIGN ELEMENTS

Despite occasional attempts to add olfactory stimuli to media experiences [11][12][13], smell and taste can be excluded as sensory design elements for video games at this point in time. Visual and auditory design elements, in contrast, are both universally applied and extensively researched, psychologically, neurologically, and aesthetically, for audiovisual media and interactive media as well. Somatosensory design elements for the last of the five traditional senses, the sense less formally known as touch, needs a more thorough introduction.

In the context of video game design, somatosensory design elements have been studied and applied substantially less than visual or auditory ones. Moreover, the input and output characteristics of video games work in ways that are not easily captured by the term somatosensory, or somatosensory alone. Certain somatosensory categories are not productive, such as nociception [14] for the reception of harmful stimuli, attached to pain responses [15], or haptic stimuli as the active exploration of surfaces and objects [16]. Categories that are productive, on the other hand, work together with the somatosensory system but are not necessarily an integral part of it, notably equilibrioception [17] as the sense of balance. As a nontraditional sense, equilibrioception combines visual and auditory information with proprioception [18], the sense of position and movement—which, in turn, is part of the somatosensory palette.

Thus, equilibrioception and proprioception appear to provide the most productive stimuli for game design purposes: equilibrioception on the one hand as the sense of balance, acceleration (which includes both a sense of weight and effort), and direction of movement, and proprioception on the other as the sense of self-movement and the relative positions and movements of body parts with respect to each other. As a shorthand, and for the purposes of this paper, this combination will be referred to as *kinesthetic*, an alternative term for proprioception that, especially in game design literature, often includes equilibrioceptive elements [19][20][21][22].

2.1 Visual design elements

For visual content, narrative qualities or properties can be established through the choice of color, color range, tint, shade, tone, surface texture, brightness, contrast, exposure, hue, saturation, luminance, temperature, fluorescence, sharpness, haze, blur, noise/grain, depth, resolution, size/dimensions, lighting, lenses, filters, camera angles, subjective/objective view, and many more.

2.2 Auditory design elements

For auditory content, primarily from music and Foley but from speech elements as well, narrative qualities or properties can be established through duration, loudness, timbre, pitch, intonation, modulation, inflection, rhythm, tempo, voice quality, modulation effects like distortion, reverb, echo, and many others, as well as positional audio in three-dimensional space and temporary silence.

2.3 Kinesthetic design elements

For kinesthetic content, which strongly depends on a game's control scheme and this control scheme's level of abstraction, narrative qualities or properties can be delivered through combinations of player movement, avatar movement, and camera movement. With regard to abstraction, three basic types can be differentiated: traditional device-specific controller setups like keyboard and mouse, gamepad, or touchscreen commands; controller setups that mimic real-world tools like guns, steering wheels, musical instruments, rudder pedals, and similar; and motion sensor controller setups like dance pads, the Wii Remote, or VR controllers. Sometimes these classes overlap, as in the case of sensor-controlled clubs for screen-based and VR golf simulators, respectively. But in terms of input abstraction, these classes structure the field sufficiently well with regard to principal design decisions. Thus, while each type has its own toolbox, narrative qualities or properties can be established through speed, acceleration, force, angle, momentum, fluidity, sureness, smoothness, rhythm, balance, economy, consistency, variety, predictability, unpredictability, and similar.

2.4 Sensory design elements and emotions

While the open question of how these sensory design elements' qualities or properties evoke emotions in the player cannot be discussed at any depth in this paper, it needs at least to be touched upon. Music can be highlighted as a representative example. Despite its well-established research history, the question of how exactly musical elements—i.e., its qualities or properties—evoke emotions in listeners is far from solved, let alone the question of how these emotions give rise to perceptions of narrativity [23][24][25]. Equally unresolved is the related question why many people are drawn to pieces of music that evoke specific emotions like sadness, again attached to perceptions of narrativity [26]. These questions around emotions and narrativity for music and, in extension, all other sensory stimuli as enumerated above, is a complex one, owing to its broad range of implications. They span numerous fields from psychology and neuropsychology to philosophy and art, the latter particularly through artistic processes of abstraction in any medium that are able to encode creative intentions, at least to a certain degree, and communicate an artistic vision

3. USE CASES FOR SENSORY DESIGN ELEMENTS

In most games, not counting certain types of experimental, serious, or art games, at least two sensory design elements are present in any given beat, namely visual and auditory ones. This presence also includes their absence in the form of temporary silence or a temporary blank screen. This section will discuss how visual, auditory, and kinesthetic design elements relate to each other hierarchically, as perceived by the player, and how different sensory design elements can work together or against each other to create specific effects and create different meanings.

3.1 *Juxtaposing sensory design elements for contrast*

According to research, visual information dominates spatial processing while auditory information dominates in other areas, notably temporal processing [27], emotion/mood [28][29], and even empathic emotion [30]. Particularly with respect to emotions, sound almost always overrides even strong visual expressions. Thus, creative and imaginative design effects can be achieved in any given beat by juxtaposing and contrasting auditory and visual design elements for effects of incongruity, ambiguity, and uncertainty. Strong kinesthetic design elements related to balance and movement can certainly drown out both visual and auditory ones, but not necessarily in all three classes as discussed above, and not across all dimensions of valence and arousal in dimensional models of emotion [31]. The likelihood that kinesthetic design elements can dominate visual and auditory ones decreases rapidly from motion sensor controller setups to controller setups that mimic real-world tools to traditional device-specific controller setups like keyboard and mouse, gamepad, or touchscreen commands. First and foremost, this is an effect of increasing abstraction, but the different types of movement also play a role. During interactive sequences with traditional controller setups, the avatar movement dominates all other movements. Player movement is substantially reduced and camera movement, outside of cutscenes, is severely limited—kinesthetic design elements that rely on camera positioning and camera movement work well in audiovisual media like movies, but do not work well together with player agency in interactive environments like video games. Nevertheless, kinesthetic design elements can also be juxtaposed in contrasting ways with visual or auditory ones, or both, to create interesting and unexpected effects around incongruence, ambiguity, and uncertainty.

3.2 *Juxtaposing sensory design elements for agreement*

Barring certain forms of movement design in kinesthetic setups, auditory design elements are again the strongest factor in most cases when visual, auditory, and kinesthetic design elements work together in agreement. The two most notable effects that can be achieved through the agreement of sensory design elements is clarification and intensification. To exemplify their creative potential for game design, they will be

discussed in this section in association with the Kuleshov montage effect and the misattribution of arousal effect, respectively.

Compared to defined narratives and story beats, narrative qualities or properties of sensory design elements leave substantially more room for interpretation, and there will always remain uncertainty with regard to this interpretation. To support a preferred interpretation through design, one sensory design element can clarify another sensory design element by, e.g., utilizing the Kuleshov montage effect [32][33]. As Kuleshov showed, people take cues for the interpretation of a picture from a second picture that is juxtaposed with it; and when that second picture is different, the first picture will be interpreted differently. That way, the second picture defines or clarifies the meaning of the first picture by providing cues for interpretation, which can then resolve ambiguities and create specific meaning. As a more recent study on a potential auditory Kuleshov effect showed [34], juxtaposing a visual design element with different auditory design elements yields similar results—depending on the nature of the juxtaposed auditory design element, the visual one will be interpreted differently, its ambiguities will be resolved in different ways, and the meaning that is created will also be different. Thus, juxtaposing different sensory design elements in agreement with each other can help the player understand a situation, e.g., assessing the trustworthiness of a non-player character or estimating the relative importance of an item, without resorting to explanation or exposition.

In contrast to clarification, intensification seems a more obvious choice, and it is perhaps the most frequently applied effect in this context. Yet, narrative qualities or properties from different sensory design elements working in agreement can intensify player emotions very precisely and very effectively in less obvious ways. The misattribution of arousal effect has been attested to by several studies, the most widely known of which is the “bridge” experiment [35]. In this setup, an attractive “interviewer” meets the test subjects on a suspension bridge with “many arousal-inducing features,” while the subjects from the control group meet the same interviewer on a solid wood bridge much closer to the ground. As a reproducible effect, the test subjects from the suspension bridge are significantly more attracted to the interviewer than the subjects from the control group. This result was reinforced by other, methodically more rigorous (but less spectacular) tests within the same study. Moreover, other studies showed that this effect of misattributed arousal works not only with emotions from the fear spectrum, as in the bridge experiment, but also with emotions like euphoria and anger [36][37] or confidence [38], and the emotional transfer even works with physical exertion [39][40] and high-arousal music [41]. Dependent on the setup, these transfer effects can intensify both positive attraction and its opposite, negative attraction. That way, narrative qualities or properties from visual, auditory, and kinesthetic design elements that work in agreement can intensify an intended player emotion and thereby strengthen the player’s relationship with non-player characters, places, or items in positive as well as in negative ways.

3.3 *Misleading sensory design elements*

A question that arises, specifically with clarification in mind, is whether narrative qualities or properties from sensory design elements should be used to mislead the player. Except, again, for certain kinds of experimental, serious, or art games, the general answer is that diegetic sensory design elements are allowed to mislead but non-diegetic ones are not. From the design perspective, a cheerful sing-along within the game world is certainly allowed to deceive the player as to its participants' intentions. But the same tune introducing a dangerous situation as non-diegetic music from outside the game world, that would be difficult to justify.

4. CONCLUSION

With respect to the player, the perceived hierarchies and the use of contrast and agreement strategies for narrative qualities or properties attached to visual, auditory, and kinesthetic design elements can be used to create disorienting experiences like incongruity, ambiguity, or uncertainty; create meaning and understanding through clarification; reinforce emotional bonds through intensification; and strengthen memory formation and retrieval. While narrative qualities or properties cannot be used to advance the plot, as they have no identifiable story elements by definition, they can still be used to enrich plot points with specific emotional values. Beyond that, these narrative qualities or properties are also able to support many other dramatic functions within individual beats, e.g., portray a character, communicate an insight into the game world, or advance player proficiency with regard to knowledge and understanding.

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