Intersensory Redundancy

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How does redundancy in the input affect the child's attention? Consider, for example, a scenario in which the child is listening to a parent's utterances, as well as watching the parent's lips moving in synchrony with the speech. Intuitively, one might assume that there is an inherent advantage in such informational coherence. The match between sounds and visual input might help constrain attention in productive ways. Alternatively, a mismatch in intersensory information might affects attention negatively. The reality of how intersensory redundancy affects a child's attention is more surprising than what intuition might suggest, as we discuss in this essay.

Bahrick, Lickliter, and colleagues discovered that intersensory redundancy primes attention to a specific aspect of the information—rather than improving overall attention. Specifically, when the surrounding contains redundant information across senses, a child's attention focuses on *amodal* content—abstract information that is available across senses in a coordinated fashion. Examples include the tempo or rhythm of a sound, as well as the intensity of an event. In contrast, when there is a mismatch among different aspects of the input, a child's attention focuses on information that is *modality-specific*—information that is only accessible via one modality (e.g., color for vision; pitch for acoustics).

Two presentation conditions are typically contrasted to demonstrate the effect of intersensory redundancy experimentally: Information is presented either in one modality (e.g., visual input) or in more than one modality (e.g., audio-visual input). For example, a toy hammer is tapped against a surface, either with the tapping sound (multimodal presentation: vision and acoustics) or without it (unimodal presentation: vision only). A crucial test is whether children can attend to a change in information (e.g., a change in the hammer's orientation; a change in tempo). Findings show that even 3-month-old infants can attend to such changes. Specifically, (1) they were more likely to detect changes in orientation in the unimodal than the multimodal condition; and (2) they were more likely to attend to changes in tempo in the multimodal than the unimodal condition.

The difference in attention to amodal versus modality-specific information was confirmed with 2-month-old infants' face perception. The task was to discriminate a target face from other faces (all female). The target face was shown as talking either with accompanying audio (multimodal presentation: vision and acoustics) or without (unimodal presentation: vision only). Results confirm an effect of presentation mode: Infants presented with the unimodal clip could successfully discriminated the woman's face against other women. In contrast, infants presented with the multimodal clip had difficulty with face discrimination. It appears that the unimodal presentation highlighted the modality-specific (visual) content. Interestingly, 3-month-olds can successfully discriminate the woman's face in both the unimodal and the multimodal conditions.

On the basis of these findings, the so-called *intersensory redundancy hypothesis* (IRH) was proposed. It states that redundant information primes a child's perceptual system to selectively attend to and learn about amodal properties. Vice versa, unimodal information primes the perceptual system to selectively attend to and learn about modality-specific properties. These principles are said to be most evident when attentional resources are limited (e.g., early in development). As children grow older and gain more experience, their attentional abilities mature enough to attend to both amodal and modality-specific information, independent of presentation mode. And as task difficulty increases, the dissociation between presentation modes re-appears.

The link between intersensory redundancy and children's attention offers important insights about the developing mind. First, it highlights the fluidity of attention: Intersensory redundancy guides children's attention differently than unimodal information. Such fluidity is present early on in infancy, allowing the baby to learn from her surrounding, whether information is synchronized across different senses or whether it is unique to a specific modality. Thus, babies benefit from input in complex ways, affected by the degree to which different aspects of information are synchronized.

Second, the effect of intersensory redundancy shows that even young children can attend to abstract content. This content becomes available automatically under the right circumstances, without requiring a laborious mental integration. This puts to rest the controversy about whether multisensory integration is (1) a protracted matching process that builds upon unimodal

perception, or (2) an automatic process that precedes the differentiation into unimodal perception. The answer lies in whether the different modalities are redundant or not.

Ultimately, the effect of intersensory redundancy highlights the resourcefulness of the developing mind, namely to assign more than one meaning to the exact same input. It can make sense of the multiple layers of information merely through the interplay of mental biases and how information is structured.

Further Readings

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