

Visualize for People with Visual Impairments: How do Node-Link Diagrams Sound and Feel?

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BACKGROUND

Node-link diagrams are a common visualization technique to illustrate graph data showcasing the relationships among entities, but they are not effectively accessible to people with visual impairments. Typically, to help the visually impaired understand a visual diagram, an image description of it is manually constructed, but the descriptions can give overwhelming information through only words without utilizing the other senses of human. Moreover, such a description needs to be achieved by someone else who is sighted, and people with visual impairments are not able to perceive a diagram independently as a result.

OBJECTIVE

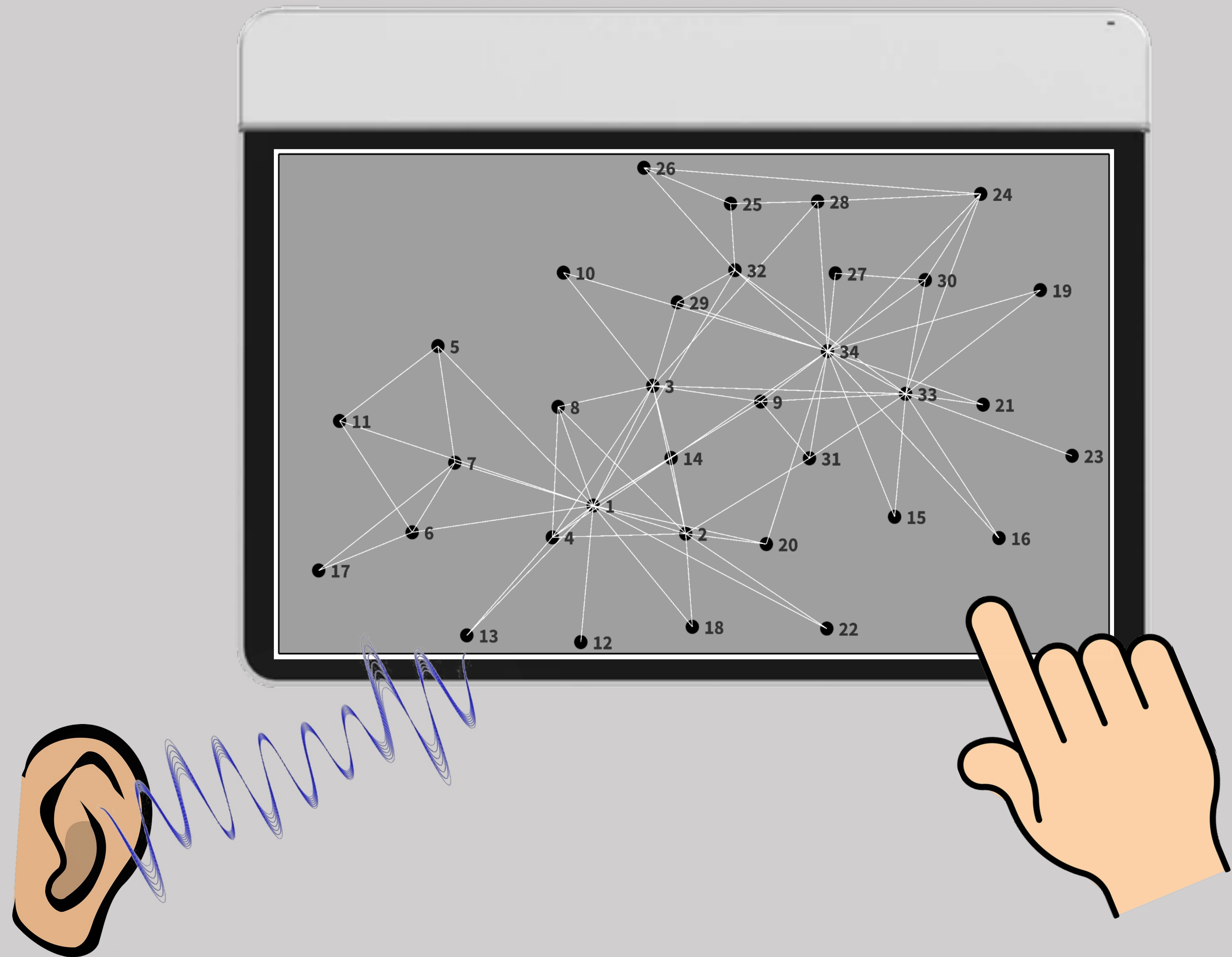
Different senses other than vision, and interaction techniques are being explored to convey visual information of a node-link diagram to people with visual impairments.

METHODS AND DESIGN

Particularly, audio and texture information could be developed to replace visual information of a node-link diagram. The current stage of research involves:

- 1. ideation of information mappings between the visual information and audio and / or texture information
- 2. ideation of primitive interaction techniques
- 3. rapid prototyping of information mappings and interaction techniques by using the game engine Unity to construct a 2-dimensional visual graph structure allowing physics interactions, and the Sensel Morph controller device for pressure touch inputs

Custom User Interface Allows People with Visual Impairments to Perceive and Interact with Node-Link Diagrams



The current set of user tasks, primitive interactions, and information mappings includes:

Tasks	Interactions	Info Mappings
Graph overview	Finger/hand sweeps	Graph density -> Pitch
Node perception	Finger sweeps	Connectivity -> Pitch
Link perception	Finger sweeps	Length of link -> Pitch
Node search	One finger's movements	Distance -> Volume
Navigation	Two fingers' movements	Distance -> Volume
Annotation	Finger sweeps & pressures on plasticine layer	Graph layout -> Perception audio & Tactile feedback
Diagram creation	Finger sweeps & pressures on plasticine layer	Graph layout <-> Tactile feedback

After the ideas are prototyped, more mappings and interactions could be ideated, and the research methods follow an iterative approach. Eventually, targeted users would be recruited and involved in the research to undergo user testing and evaluation of the final prototype for specific use cases to receive feedback and improve the design.

SIGNIFICANCE

If such a design could be achieved to allow effective conversion of visual information of a node-link diagram into audio and / or texture information, it is extremely hopeful that the design will indeed make such a diagram more accessible to and benefit the people with visual impairments.

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