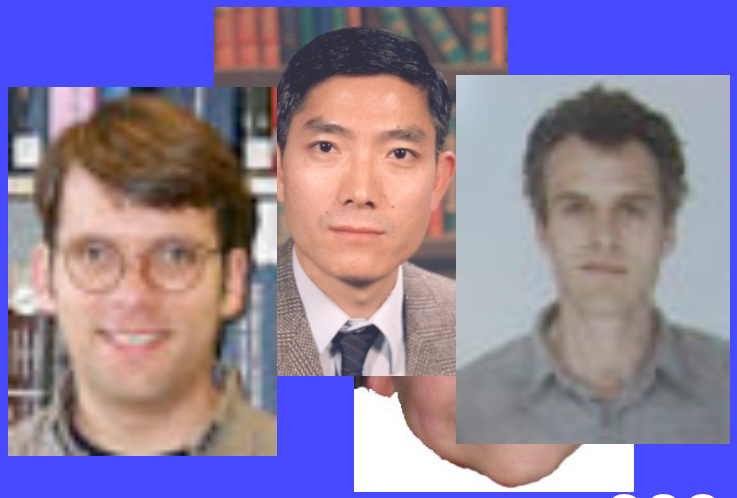
Spatial Differences

Problem posed by Nat:

Assume that "clean" sources are available.

What is the best way to use spatial cues if the user must monitor and attend competing, simultaneous sources?

Source locations influence ability to detect, segregate, and understand



???

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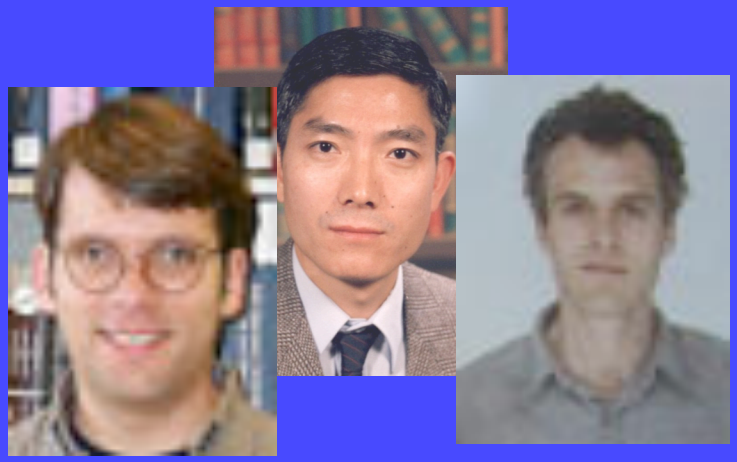

Will

If spatial cues are good, why not make them bigger?

Is bigger always better? How does spatial separation actually help the listener?

1. For each source, there is an acoustic "better ear" with better audibility

2. Processing of interaural differences improves audibility just at or below detection threshold

3. Confusion / competition between "similar" sources is reduced by spatial attention

Changes in energy at ears probably do not require adaptation by listener…

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What is the best way to utilize the acoustic better ear advantage?

For TWO sources, the limit is dichotic presentation

What is the best way to utilize the acoustic better ear advantage?

… but what if there are more than two sources?

(see Brungart?)

What is the best way to utilize the acoustic better ear advantage?

Enlarging the head would provide larger differences in relative energy at the two ears, and at lower frequencies than normal… so….?

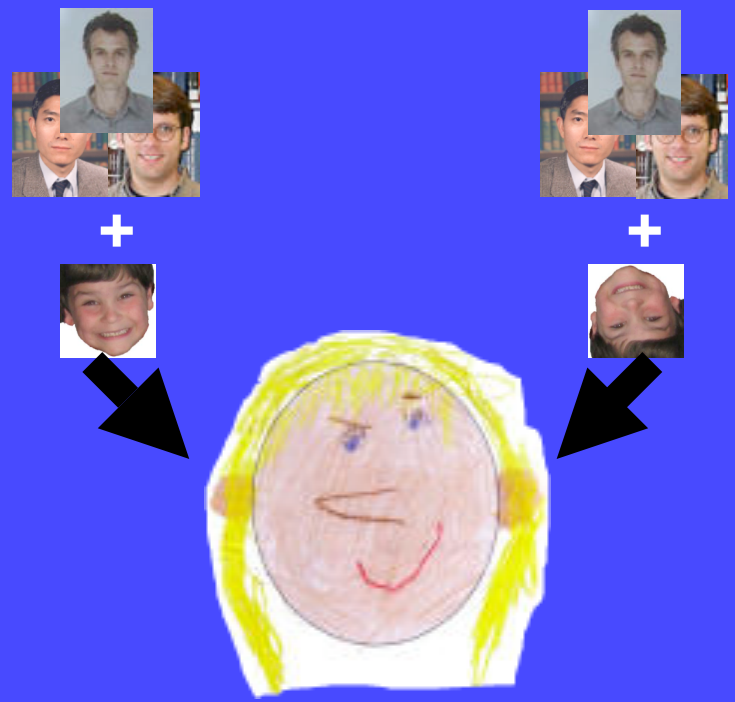
What is the best way to utilize interaural time differences?

Thought 1:

Differences in ITD help near threshold, and only if the rest of the signal is interaurally coherent

Thought 2:

The best thing to do is to present the nearly-masked signal so that its interaural phase *at every frequency* is π out of phase with the rest of the signal



What is the best way to utilize differences in perceived location?

For an unadapted listener hearing "big head" cues, sources are heard farther from midline.

This definitely should help!

normal

unadapted percept

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Listeners rapidly adapt so that there is no *mean* error in perceived location…

But once they "adapt," what happens to resolution?

Are the sources perceptually separated …

or is resolution reduced?

We observe that we rapidly achieve "supernormal" resolution…

… if the transformation is simple

… and we limit the range of spatial cues to the "normal" range (only magnifying sources out to "normal" cues for 90˚)

But not all expansive transformations produce supernormal resolution

A nonlinear warping of azimuth) confused subjects…

As they adapted and heard sources at the correct location, their resolution decreased.

Hmmm….

Enhancing spatial separation will probably help, but there there is a lot to think through…

More questions than answers

Can listeners learn to make use of extra large time delays and level differences?

(Is this fundamentally more difficult than altering how spatial cues map to exocentric space?)

What is the optimal spatial encoding, and at what cost of training?

What happens with longer adaptation times?

Genetically, 1/4 correct