# Solutions to the assignment problem balance tradeoffs between local and catastrophic errors





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### Conclusions

The assignment problem can only be solved if distributed representations have some overlapping information. However, overlapping information is inefficient. The brain must navigate a tradeoff between **redundancy for solving the assignment** problem and efficiency for representing stimulus information.

- More overlapping features increase redundancy at the cost of efficiency.
- Asymmetric feature representations increase efficiency at the cost of redundancy.
- Human behavior is consistent with our solution.

## Predictions for experimental data



### How is total distortion minimized?

In many cases, the optimal solution leverages both tradeoffs between redundancy and efficiency.



### References and acknowledgments

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- [1] Treisman (1996) *Curr. Op. in Neurobiol.*
- [2] Cover & Thomas (2012)
- [3] Weisstein. "Square Line Picking." MathWorld
- [4] Weisstein. "Cube Line Picking." *MathWorld*

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