# Effective Explanations: How to make difficult material seem easier

One of the skills that a good teacher needs is the ability to explain complex, difficult material in simple ways. When you are presenting your research at an international conference, you are acting as a teacher and must also be able to give explanations suitable for your audience.

Since a significant proportion of your audience at a conference will be experts in your area, you should not simplify things too much. Nevertheless, for complex material that is new to them it is vital that you guide them to understanding, and for those new to your research topic you do need to help them get basic concepts in your Introduction. Here are three good ways to help your audience understand the “hard stuff”.

**1. Use intuitive functional definitions. What does it DO?**

 Example: A *shoe* protects your foot as you walk

 Example: A *catalyst* helps a chemical reaction go faster

Comments:

* *Intuitive* means it seems expected and fits with what they already know.
* *Functional* means it does not focus on what it *is*, but rather on what it *does*.
* Notice that a functional definition leaves out a lot of information (e.g. material, color, style, cost) but what is there captures the most important reason why shoes exist.
* The key is for the audience to have an idea that is at least *mostly* right. Later you can refine the idea, such as to point out that catalysts are not used up in the reaction.

**2. Use analogies.**

Example: 3-D sound wave propagation in air is like water waves traveling from rock dropped into pool

Example: “On-line computer algorithm” – you don’t know the future (questions). “Off-line computer algorithm” – you know the future, can guess all future questions.

Example: Cool, dense air moving into a warm mass of air at ground level acts like a chisel or paint scraper forcing the warm air to rise.

Comments:

* There are significant differences between the reality and the analogy! Water waves travel 2-dimensionally rather than 3-dimensionally, and they are waves of displacement rather than compression. Nevertheless, there are many vital similarities that give good intuitive understanding.
* The analogy should be to a simple, real-world situation that everybody knows.

**3. Use pictures/illustrations** (visual analogies)**.**

Example: atom is like sun with planets in orbit around it.

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Comments:

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| * The “solar system” idea and the Rutherford/Bohr models are still useful, even though a “cloud” idea is more accurate: 🡪
* Be sure you know your audience so your illustrations are not *too* simplistic.
* As with the other techniques, the idea the user gets is useful but not totally accurate! Correcting the details can come later.
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