

FSE (RARE, TSE,...)

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My career in MRI started 1984 when I was hired by Freiburg University to take care of their soon-to-be coming Bruker scanner. I took my first steps at Bruker factory under the guidance of B. Ströbel and D. Ratzel working on a multiecho-CPMG sequence with radial encoding. We had many discussions on how to make the painstakingly slow data acquisition faster. Mansfields EPI-paper already told, that acceleration could be done using spatial encoding along the echotrain, but how? Known solutions (ie. by L.Hall) required perfect 180° -pulses. At that time Bruker decided to switch to Fourier encoding, while maintaining a multiecho-CPMG-sequence as basic acquisition module. B.Ströbel using the development system was responsible to make this transition for the standard spin echo sequence, I was allowed to play around on the 'Freiburg' system with a fast multiecho encoding implementation. The first task was to adapt the various gradients to follow the CPMG-conditions and over the course of this work we frequently met to discuss our progress. As it turned out, the key issue was how to deal with the phase encoding gradient. I would love to report, that the insight to use a phase encoding rewinder came as a great 'Eureka'-moment, but this is not the case. We rather used what we had learned about the CPMG-conditions and translated this knowledge to gradient encoding. If anything the main credit probably should go to B. Ströbel, I was lucky to work on what turned out to be the much more useful fast imaging sequence, which we called RARE in our papers and for which other manufacturers have meanwhile found other labels (TSE, FSE, ...).

The first field test of RARE on real patients outside of our own scanner was actually performed in China, where I was sent by Bruker to install a system at Nan Fang Hosital and made the very first MR images of a human volunteer (one of the nightwatches at the hospital) on Dec. 25, 1985, 1 a.m.

Later on in my career I did have some 'Eureka' moments, when some unexpected solution sprang into my mind apparently out of nowhere. Just for the record, this didn't happen to me ever while sitting in a bathtub, moments I remember are while jumping into a pool during vacation or walking in the woods or riding my bike –rarely while sitting at my desk and working.

While this precious and special inventive moment cannot be planned, over the years I found some recipes, which at least for me seem to work well to facilitate new ideas. It doesn't make life necessarily more easy, but definitely more fun, that many of these are in some respect self-contradicting:

- Think hard about the task at hand – and then forget it. The solution will eventually surface. To achieve this (the equivalent of consciously not thinking about an elephant) it can be helpful to be tied up in some menial task like grant writing.
- Be open that the answer coming back may not solve your original question, but could solve another and much more important one.. So stay focused but keep an open mind.
- We take a lot of things for granted in our way of problem solving without actually spelling out the underlying assumptions. Try to identify these and negate them - this may lead to something genuinely new (think non-Euklidean geometry).
- last but not least: don't forget to take a walk (or some other kind of relaxation) every once in a while.

and just as a reminder: the practical (and economic) value of a new idea has nothing to do with the intellectual and creative leap necessary to achieve it.

Being creative means to break out of the well-trodden path of established thinking. So – lucky for me – it takes more courage than intelligence or knowledge, although the latter helps in sorting out, which of the whacky ideas running through one's mind have some merit and are worthwhile pursuing.