A Short Course on Generation of New Ideas for PhD Research in Engineering

Authors:

Veljko Milutinovic
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Mendeleyevization: Catalyst versus Accelerator

If one of the classification classes includes no examples, it first has to be checked why is that so. If it is so because it makes no sense, an appropriate explanation is in place. If it is so because the technology or the applications are not yet ready for such an approach, one can act in the same way as the famous chemists Mendeleyev: empty positions in any classification are potential avenues leading to new inventions. As indicated in Figure 6A, these inventions sometimes need a catalyst (a resource that makes an invention happen) or an accelerator (a resource that turns a known invention without potentials into an invention with potentials). We refer to such an approach as: Mendeleyevization.

Hybridization: Symbiosis versus Synergy

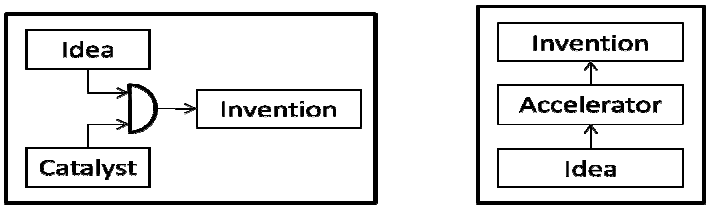
Sometimes two classification classes can be combined, in order to obtain a hybrid solution (hybridization). Hybrid solutions can be symbiotic (measuring the conditions in the environment and switching from one approach to the other, so that each approach is active all the time while the conditions are such that it provides better performance compared to the other approach) or synergistic (creating a new approach, which, for each particular solution element takes the better solution element of two different approaches). This is shown in Figure 6B. The assumption here is that one solution is better under one set of conditions, and the other solution is better under another set of conditions. Another assumption is that solution elements of one solution are better in one domain and that solution elements of another solution are better in another domain.

Transdisciplinarization: Modifications versus Mutations

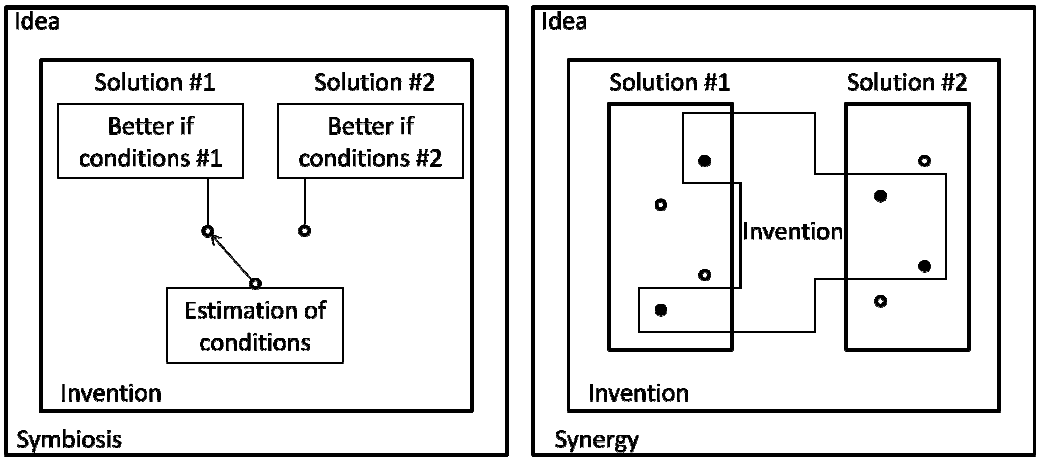
Often times, good new ideas get generated if algorithms, procedures, ways of thinking, or philosophies of thinking can be ported from one field to another field, along the lines of transdisciplinary research methodologies (transdisciplinarization). As indicated in Figure 6C, for an idea to work better in the new field, either smaller modifications or larger mutations have to be introduced. Larger mutations means that analogy is used.

Retrajectorization: Reparametrization versus Regranularization

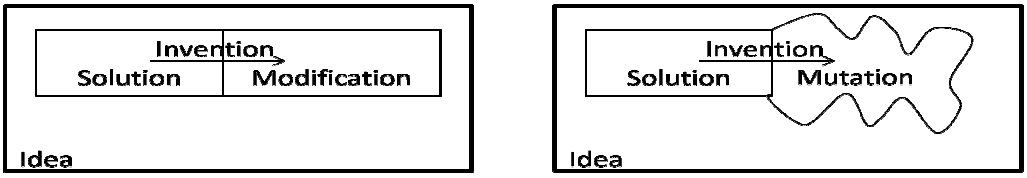
Sometimes it is simply the best to take a research trajectory different (even opposite) compared to what others take (retrajectorization). The different (opposite) research trajectory makes sense either if a more detailed set of parameters is in place (due to technology changes), or because parameters of the environment have changed permanently (due to application changes), as indicated in Figure 6D. The two alternatives are referred to as a reparametrization and regranularization.



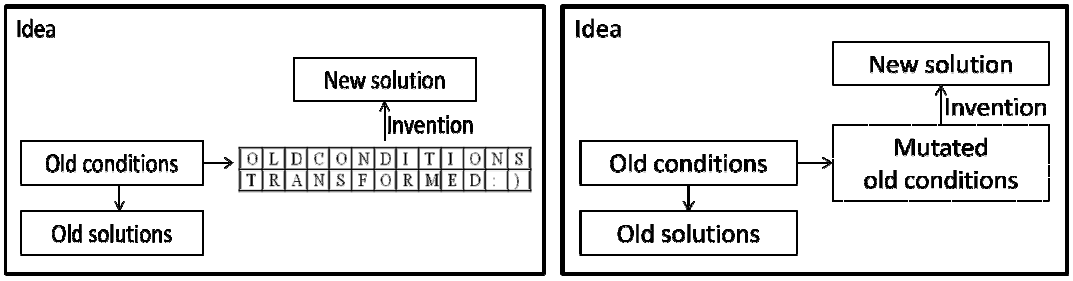
A: Catalyst versus Accelerator (Mendeleyevization)



B: Symbiosis versus Synergy (Hybridization)



C: Modification versus Mutation (Transdisciplinarization)



D: Reparametrization versus Regranularization (Retrajectorization)

Figure 1: Symbolic Representations of Four Idea Generation Methods.
The symbolic explanations are meant to be intuitive.

Mendeleyevization/Catalyst

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Hybridization/Symbiosis

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Hybridization/Synergy

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Retrajectorization/Rep

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Retrajectorization/Ret

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"How to ruin the career of a PhD student,"
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