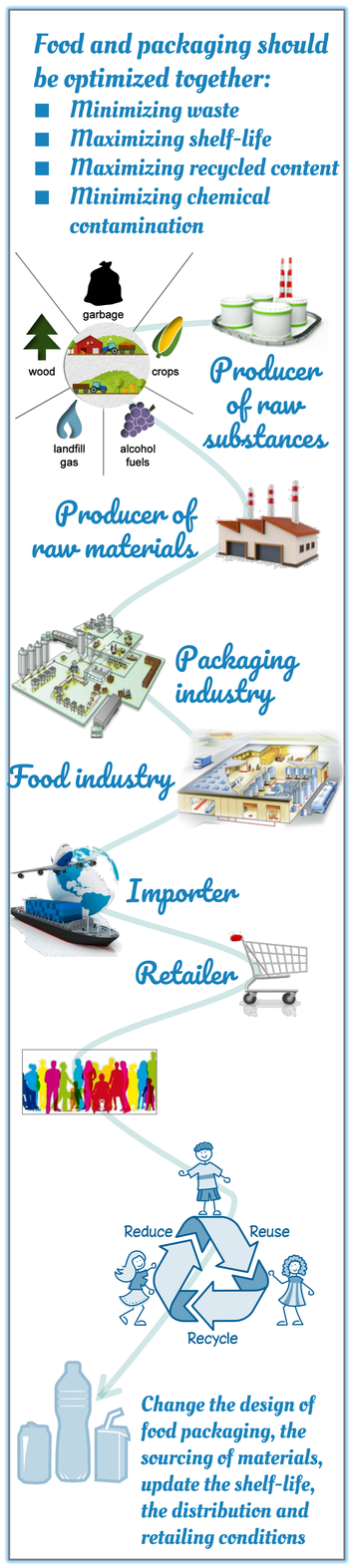
# COMPUTER-AIDED DESIGN OF RESPONSIBLE PACKAGING

responsible packaging use & design


## Summary

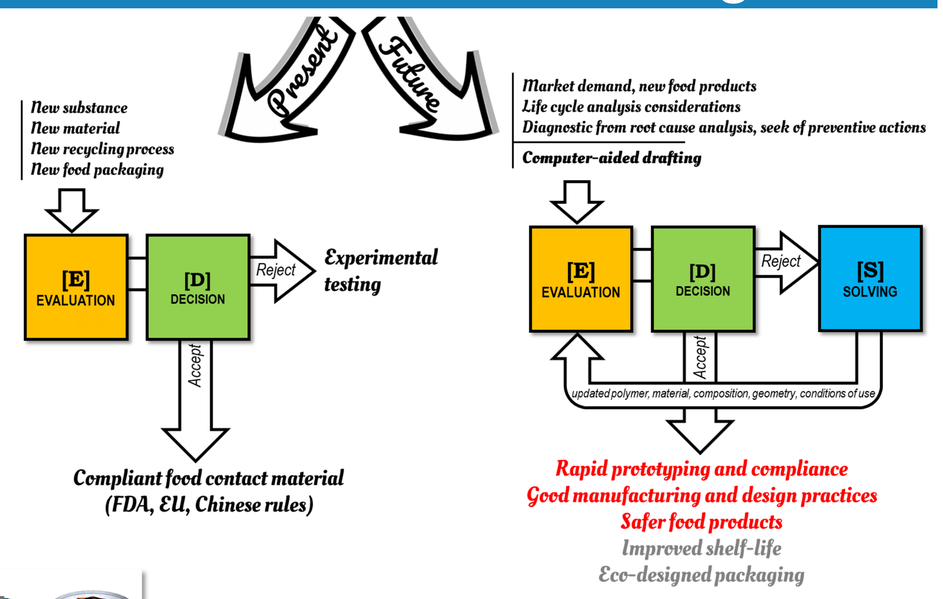
Plastic packaging is accused of all the evils: it has no final value, is a source of endocrine disruptors, microplastics and marine litter. On the other hand, packaging is essential for the preservation and distribution of food. Inspired by risk-benefit methodologies, a 3D rapid prototyping methodology was developed to design packaging that would verify complex and contradictory constraints: maximized food shelf life, minimization of packaging mass, maximization of recycled content, minimal chemical risk, minimal mechanical resistance. The whole methodology has been successfully tested for the redesign of polyethylene terephthalate (PET) bottles used for alcoholic beverage packaging. The gain in mass reduction can reach up to 50%, but above all it opens the exploration of new strategies: new geometries, new formats, adaptation of capacity and lifetimes to the consumption profile. In the same day, the acceptance of new packaging can be tested after integration in augmented reality or after 3D printing. The software is being integrated into an open-source project (https://github.com/ovitrac/FMECAengine).



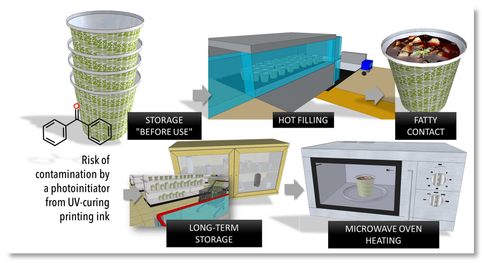


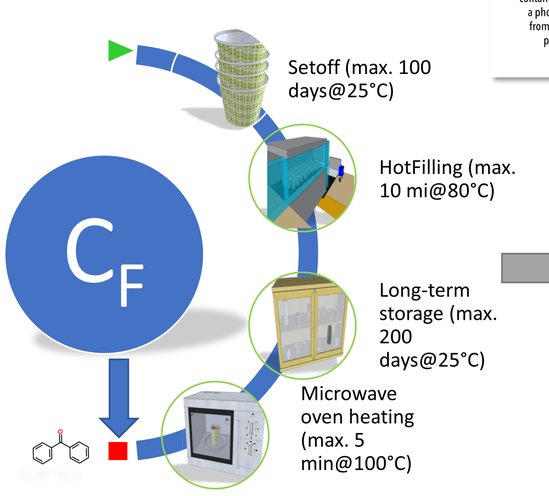

## Tailored [E]valuation and [D]ecision

a. The new framefork [E][D][S] to solve food-packaging challenges

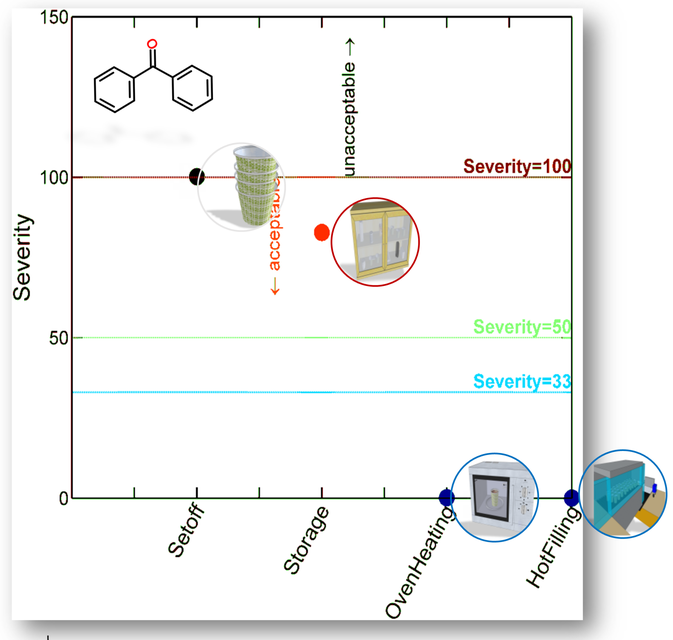




b. Principle of the evaluation of severity along the supply chain (ready-to-eat Chinese soup contaminated by printing-ink constituents)




c. Pareto chart of step severities (ready-to-eat Chinese soup)



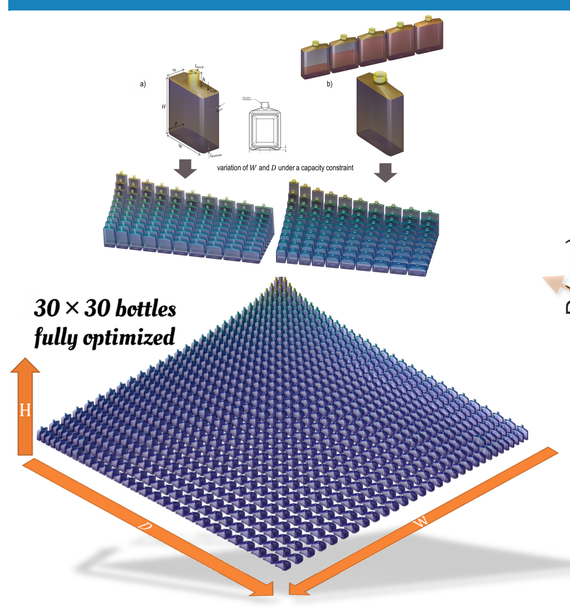

Tailored [E]valuation, [D]ecision can be applied to parts or the entire food packaging up to the entire supply chain.

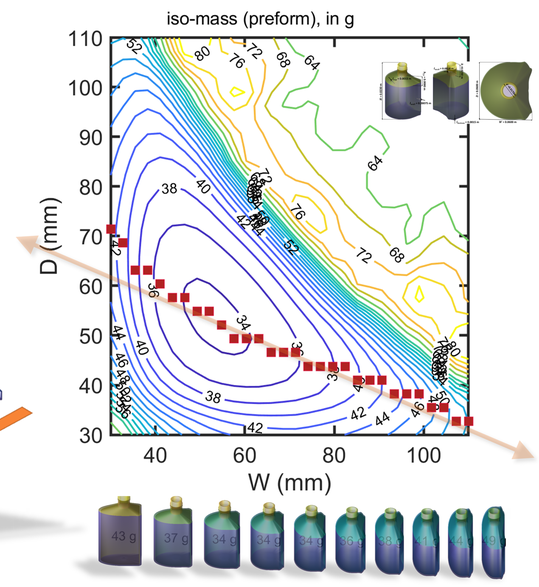
comparison with step $i$ alone

$$\text{Severity}\left(\hat{C}_F(step\,i)\right) = f\left(\max\left(C_{F_M}|_{1\to2\to\cdots\to M} - C_{F_M}|_{1\to2\to\cdots\to M/i}, C_{F_i}|_i\right)\right)$$

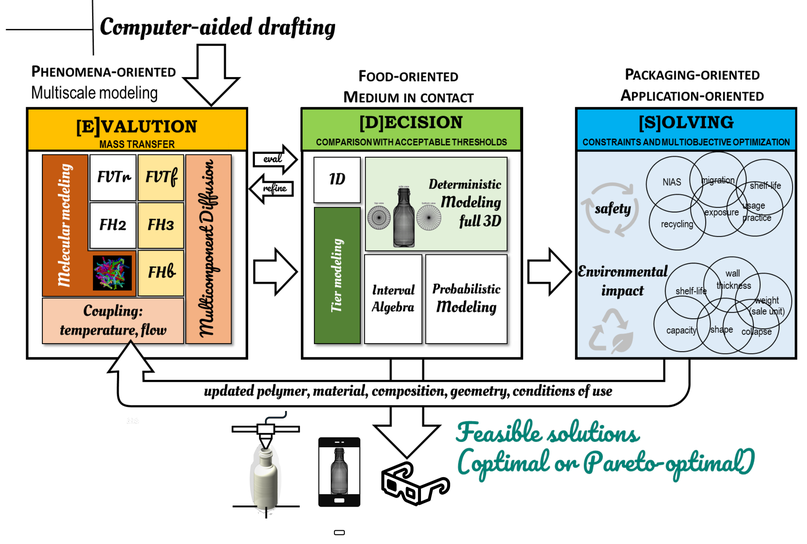
comparison with step $i$ removed

## The new framework [E][D] [S]olving




The [S]olving step changes iteratively the parameters to match strict constraints and optimize simultaneously several criteria.

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## References


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OPEN-SOURCE FMECAengine and FMECAengine 3D
10 years of development - >40 Klines of code


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