COMPUTATIONAL DESIGN IN INDUSTRIAL DESIGN: AN INITIAL INVESTIGATION

Project objective
The project aims to understand the relationship between **computational design (CD)** and **industrial design (ID)** and to investigate future scenarios for **CD adoption**.

Computational Design
With CD, **machines become active participants in the design process,** producing design content in collaboration with the designer. (Mountstephens & Teo, 2020).
CD allows designers to approach design problems from a different angle. Instead of focusing on a single artifact, they can define a process or **system** able to **generate a series of outputs exploring the design pace**.
The boundary conditions of this system can be associated with project **requirements**, environmental factors, user preferences, and the personal sensitivity of the designer.

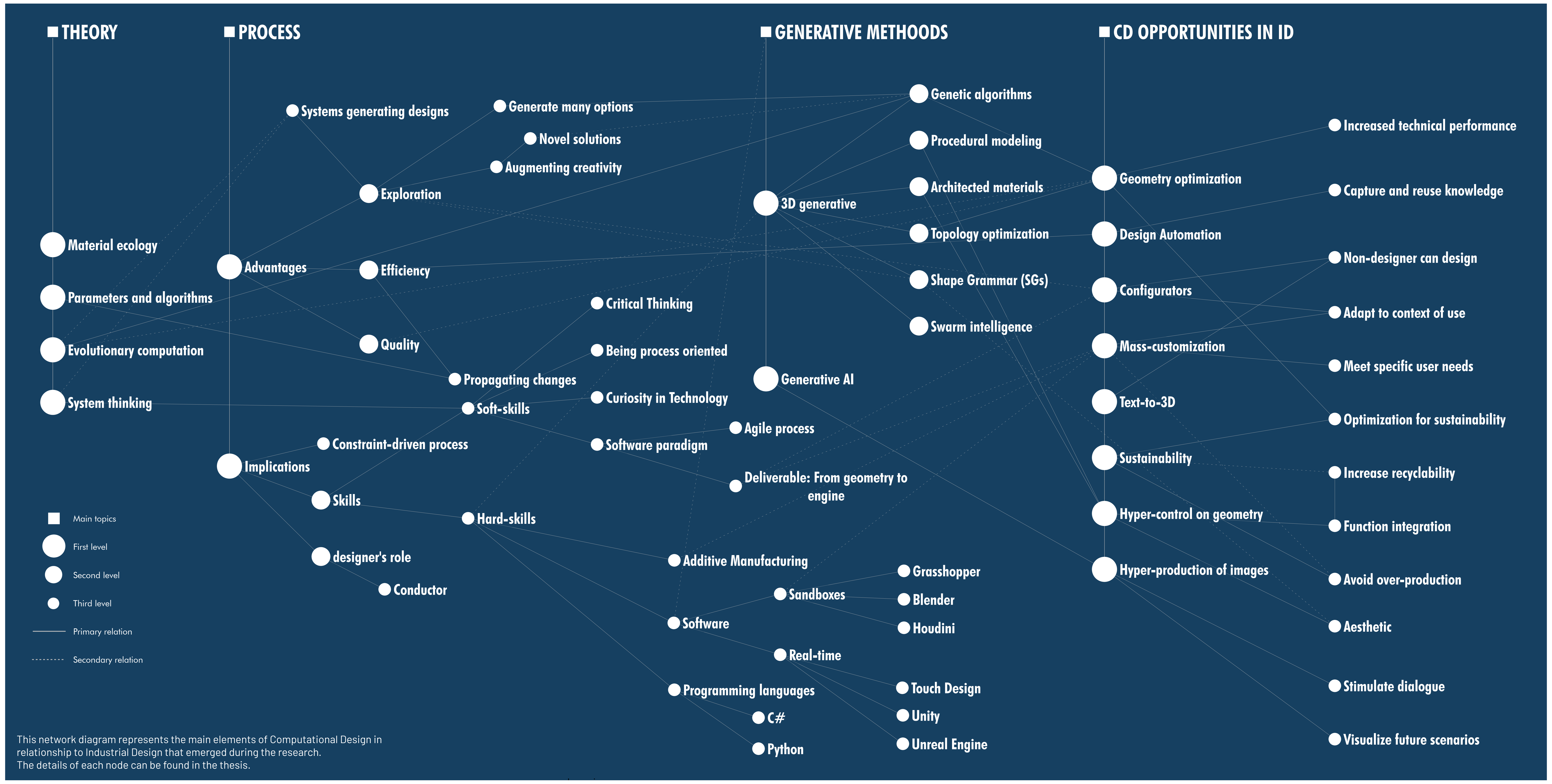
CD can increase **efficiency** during the design process by automating design tasks. Furthermore, CD also stimulates **creativity** by encouraging designers to frame design problems differently and by exposing them to a large number of solutions that are sometimes beyond human imagination. The exploration of the design space depends on the generative capabilities of the algorithm used and is often unrelated to past products. Therefore, the solutions created through CD can go beyond typology, resulting in unexpected outcomes such as those typical of topology optimization.

The research
The project is a research about the role of CD in ID at 360 degrees. The thesis covers CD origins and **theoretical aspects**, such as those linked to applying evolutionary processes inspired by nature to design. Comprehending these concepts is fundamental to understanding the thinking behind CD and its relevance in ID. Furthermore, these theoretical notions can help in applying CD beyond the opportunities or cases presented in this thesis.

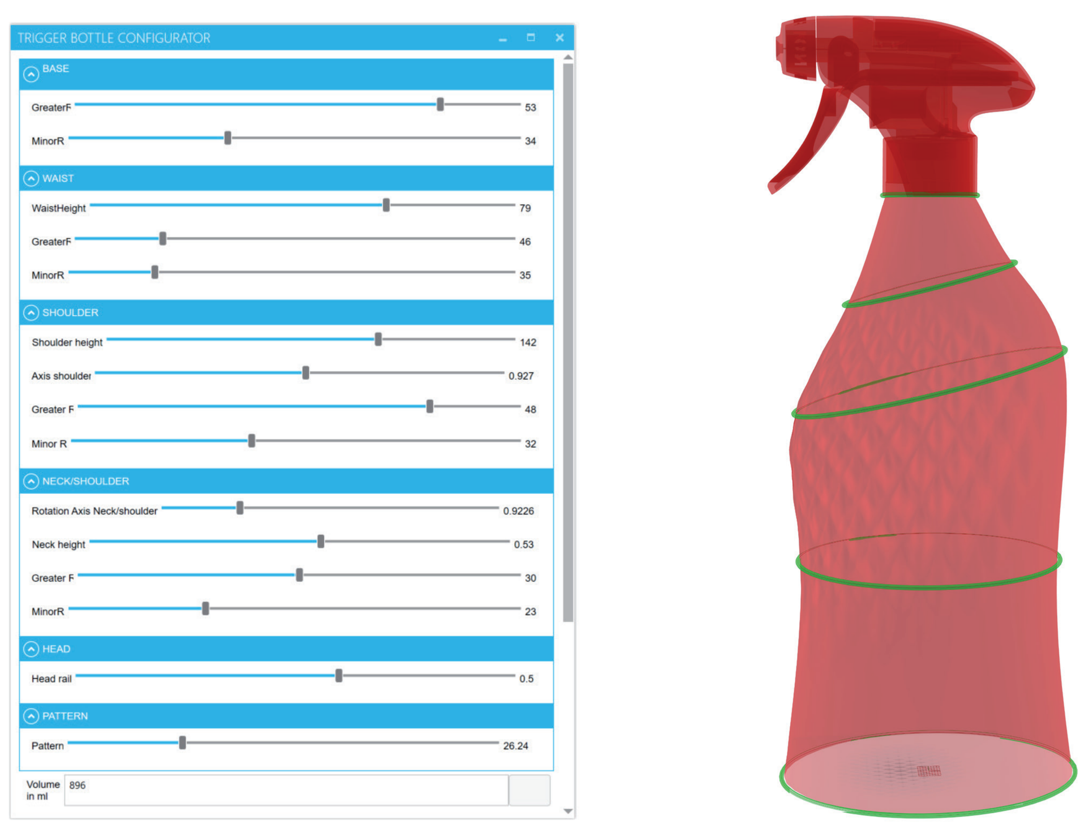
The project also investigates **CD methodologies**. Among these, genetic algorithms stand out for optimization and design space exploration, while architected materials enable higher levels of control over geometry.

The potential of CD in ID is outlined through a series of opportunities, such as the ability to:

Explore a vast solution space, which can lead to new and innovative designs, augmenting creativity.
Optimize technical requirements, from mechanical performances to those related to sustainability.
Achieve **hyper-control over geometry,** which can lead to structures that can enable different mechanical properties and functions using a single material.
Automate parts of the design process, which can increase efficiency and scalability.
Create **mass-customized products** and **configurators** meeting the specific needs of individual users.



This network diagram represents the main elements of Computational Design in relationship to Industrial Design that emerged during the research.
The details of each node can be found in the thesis.



Trigger bottle configurator created using Grasshopper and Human UI.
On the left is the configurator UI. On the right the 3D model with the main parameters in green. Configurators allow for mass customization and enable users to express their ideas during user research.

Trigger bottle 3D geometries generated using Grasshopper and Biomorpher. CD enable designers to explore a wider solution space by generating many solutions in a short amount of time, while stimulating creativity with unexpected outputs. Spray trigger head 3D model from VanBerlo part of Accenture.

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