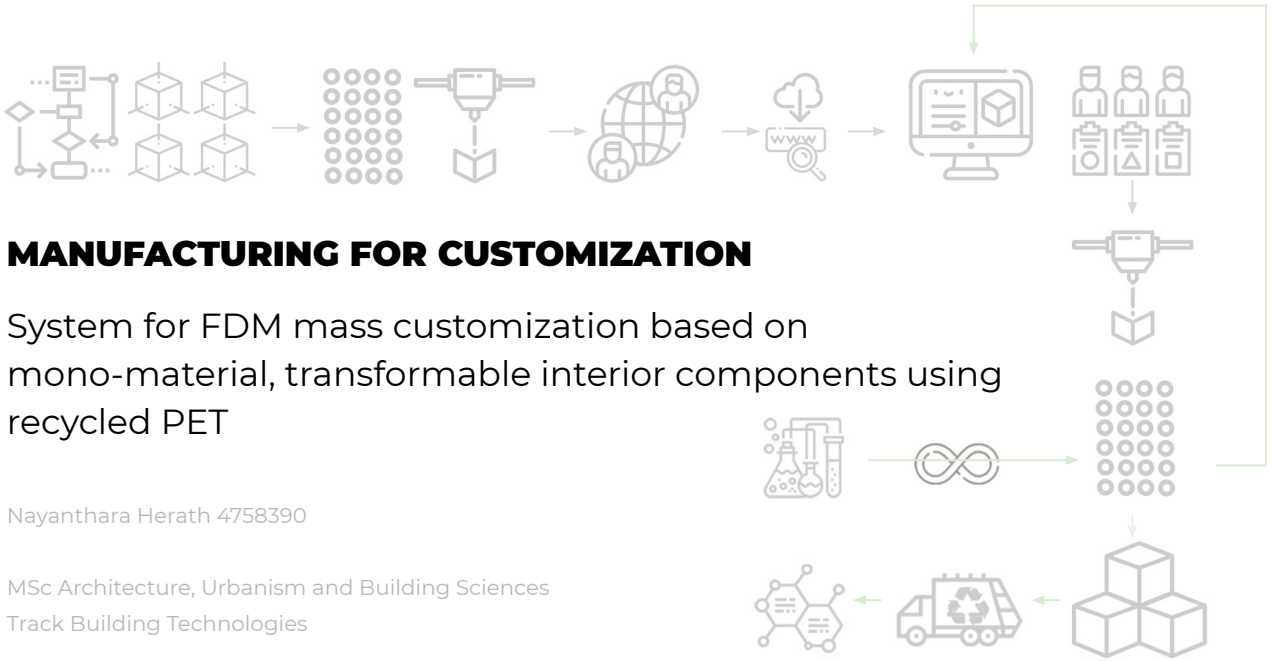


MANUFACTURING FOR CUSTOMIZATION

System for FDM mass customization based on mono-material, transformable interior components using recycled PET

Nayanthara Herath 4758390

MSc Architecture, Urbanism and Building Sciences
Track Building Technologies

Mentors
Ir. P. de Ruiter (AE+T: Computational Design)
Ir. PMM Stoutjesdijk (AE+T Building product innovation)

BACKGROUND **RESEARCH OBJECTIVE** **ORGANIZATION** DESIGN TOOLS **METHODOLOGY** **DESIGN BY RESEARCH** **RESEARCH BY DESIGN** EXEMPLARY DESIGN

Material

Manufacturing method

Design task

Material

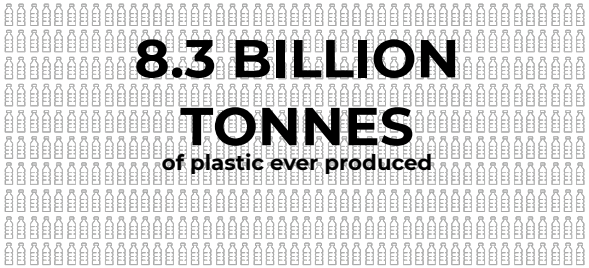
Manufacturing method

Design task

Material

Manufacturing method

Design task



Material

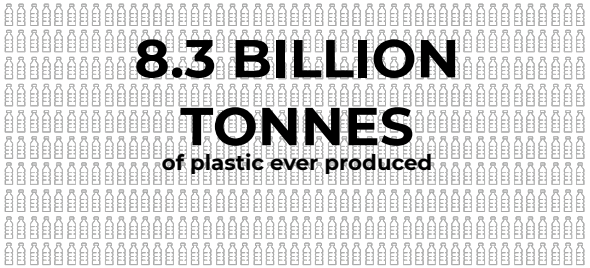
Manufacturing method

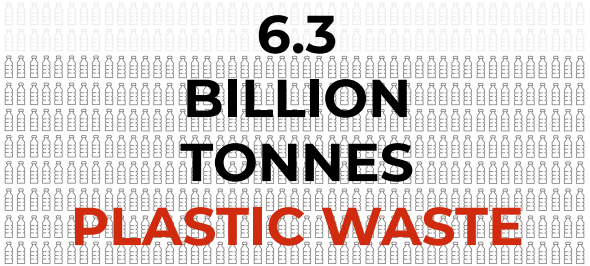
Design task

Material

Manufacturing method

Design task

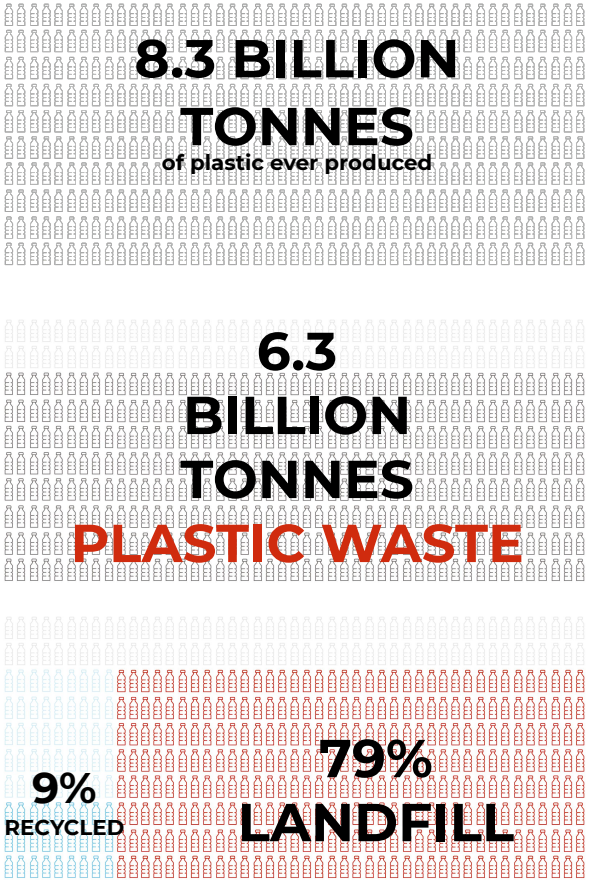




Material

Manufacturing method

Design task



Material

Manufacturing method

Design task

8.3 BILLION TONNES
of plastic ever produced

6.3 BILLION TONNES
PLASTIC WASTE

9%
RECYCLED

79%
LANDFILL

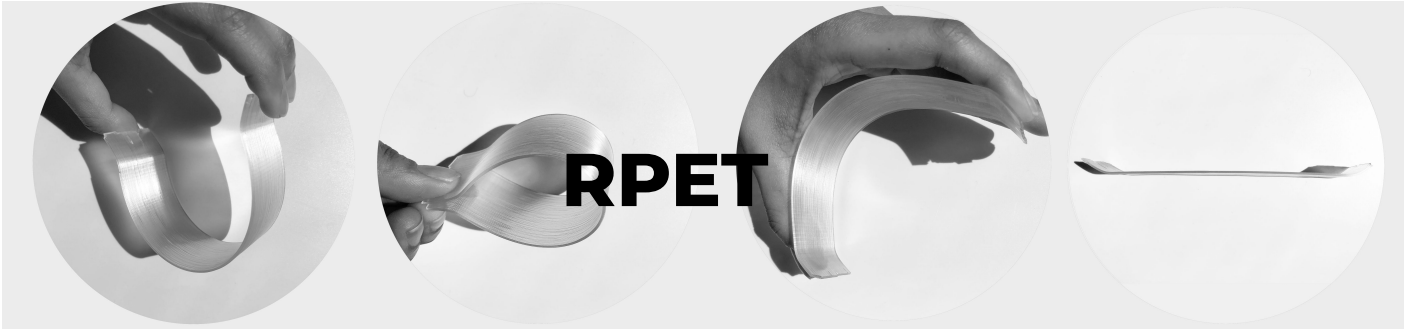
95%

Value reduction after 1st use

Material

Manufacturing method

Design task



Material

Manufacturing method

Design task

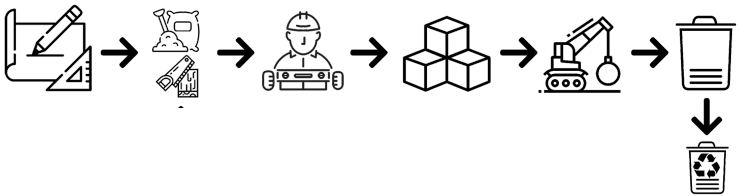
- Very good tensile strength
- Very good impact strength
- Excellent process-ability
- Clarity

Material

Manufacturing method

Design task

Life cycle of traditionally built spaces



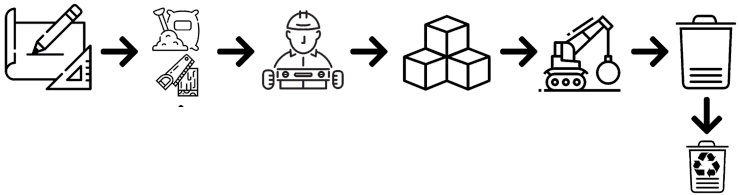
Linear system with only a small percentage of demolished material is reused or recycled.

Material

Manufacturing method

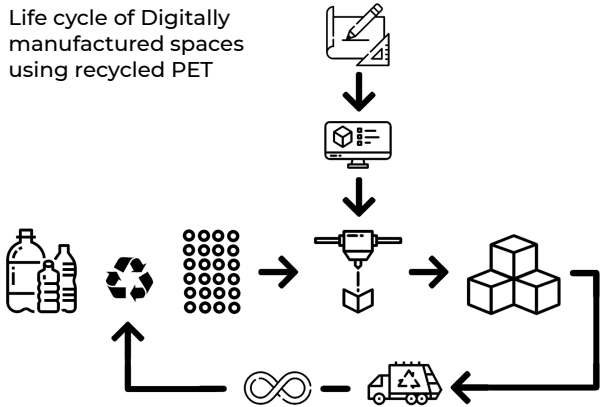
Design task

Life cycle of traditionally built spaces



Linear system with only a small percentage of demolished material is reused or recycled.

Life cycle of Digitally manufactured spaces using recycled PET



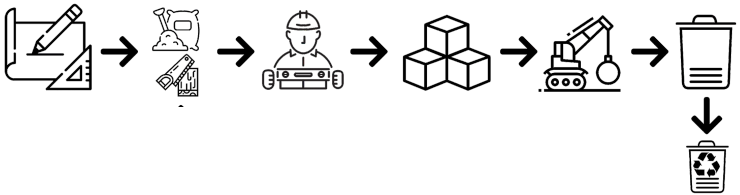
Circular system where PET is a beyond end of life material. Owning the base material with an infinite recyclability.

Material

Manufacturing method

Design task

Life cycle of traditionally built spaces



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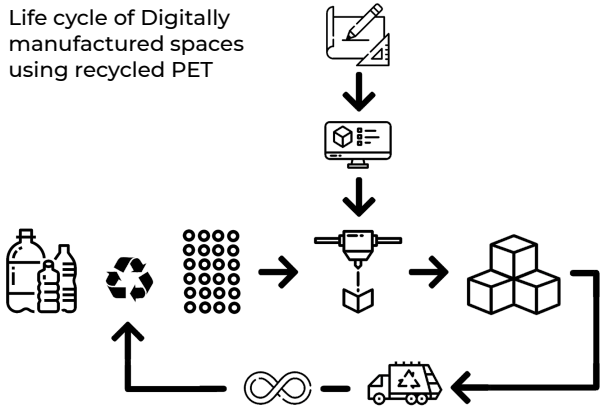


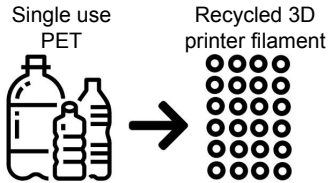
Circular system where PET is a beyond end of life material. Owning the base material with an infinite recyclability.

Material

Single use
PET

Manufacturing method

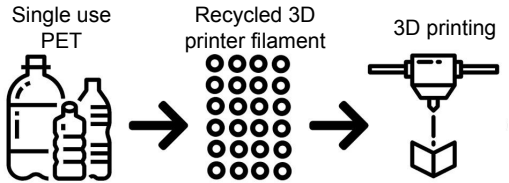
Design task



Material

Manufacturing method

Design task



Material

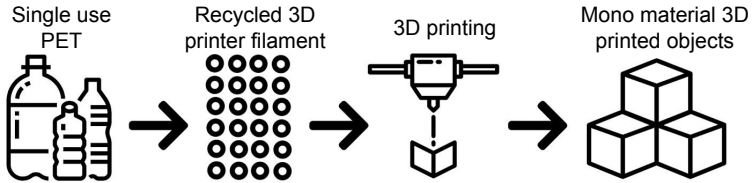
Manufacturing method

Design task

Material

Manufacturing method

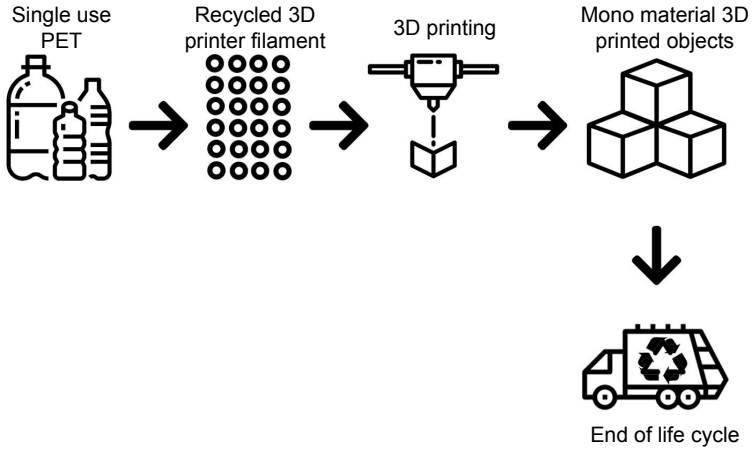
Design task



Material

Manufacturing method

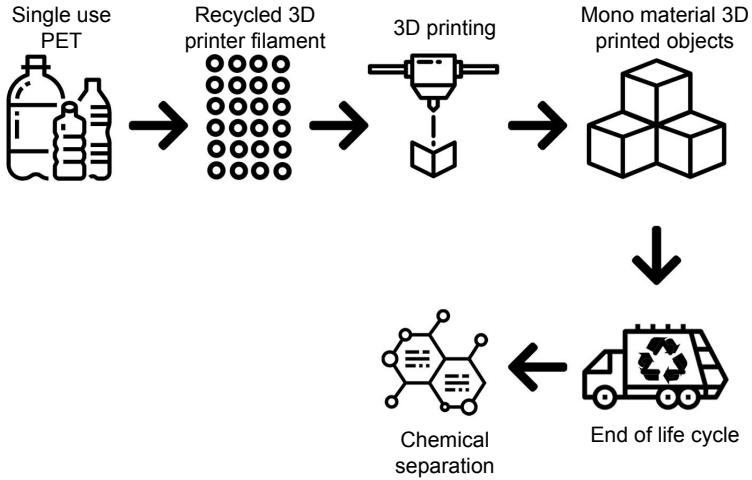
Design task

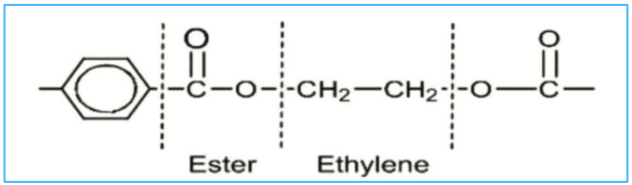


Material

Manufacturing method

Design task



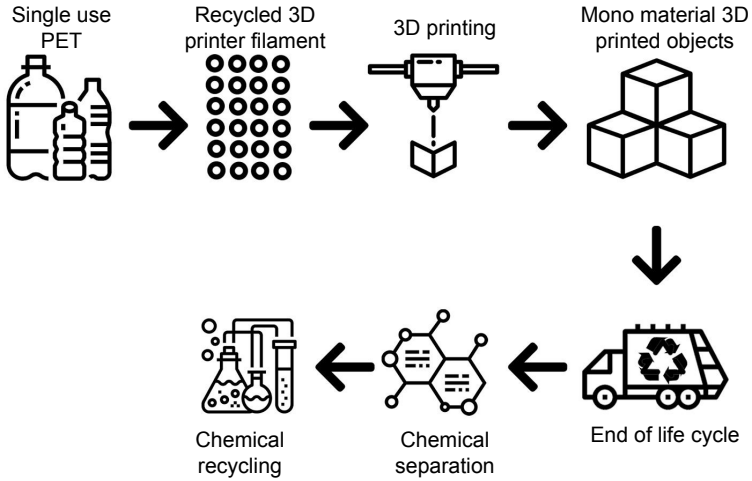


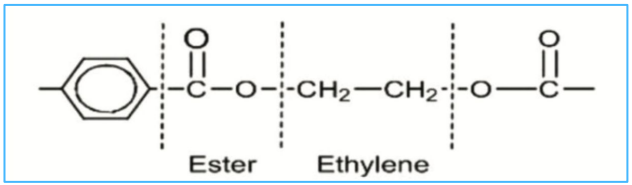
Chemical separation of PET during the recycling process

Material

Manufacturing method

Design task



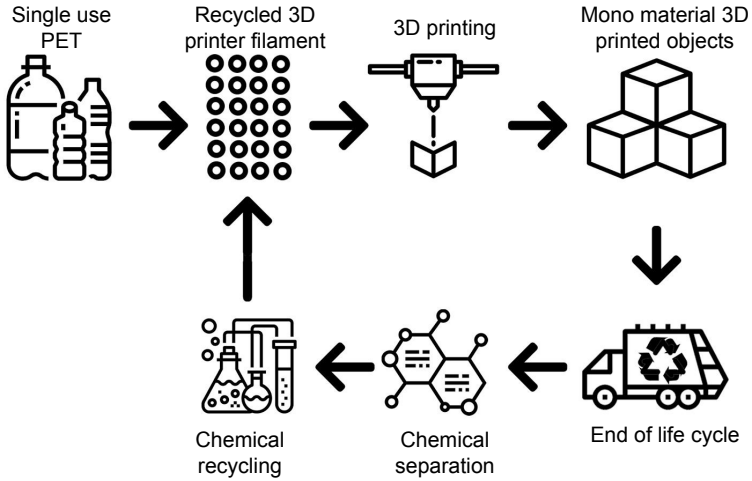


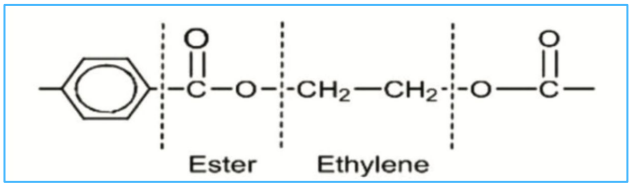
Chemical separation of PET during the recycling process

Material

Manufacturing method

Design task





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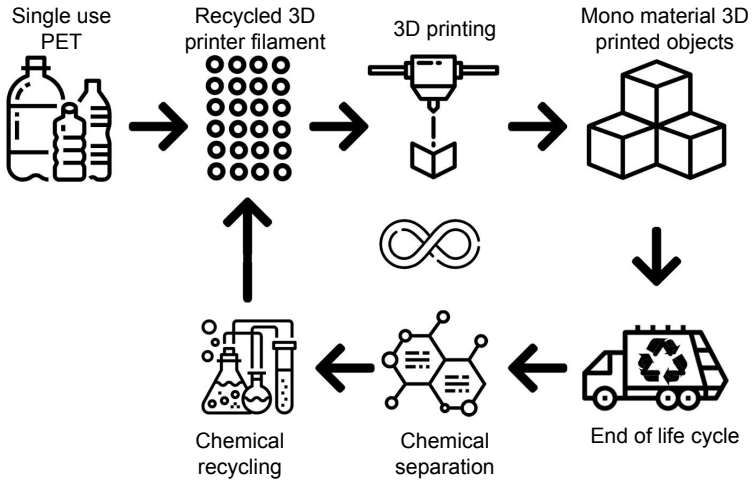
Material

Manufacturing method

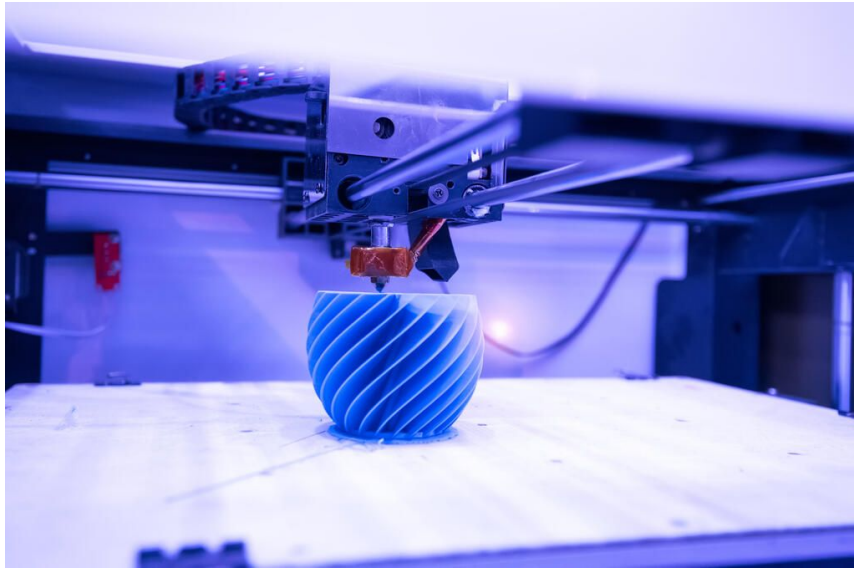
Design task



Material

Manufacturing method

Design task



Fused deposition modeling

Also known as,

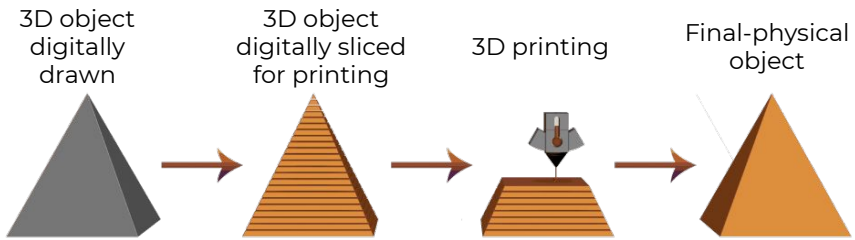
3D printing

Deposit material, layer upon layer, in precise geometric shapes.

Material

Manufacturing method

Design task



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Material

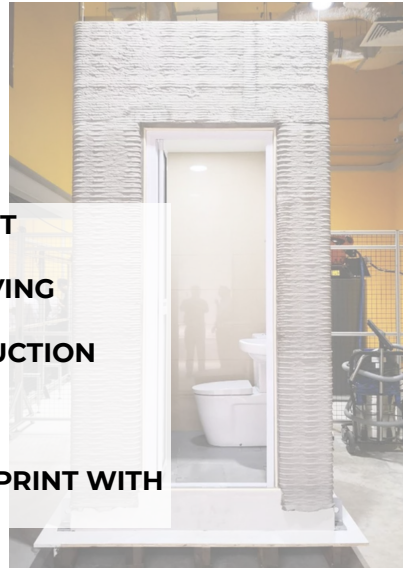
Manufacturing method

Design task

Material

Manufacturing method

Design task



9- 12 HOUR PRINT

30% MATERIAL SAVING

30% FASTER CONSTRUCTION

30% LIGHTER

RANGE OF MATERIALS TO PRINT WITH

Material

Manufacturing method

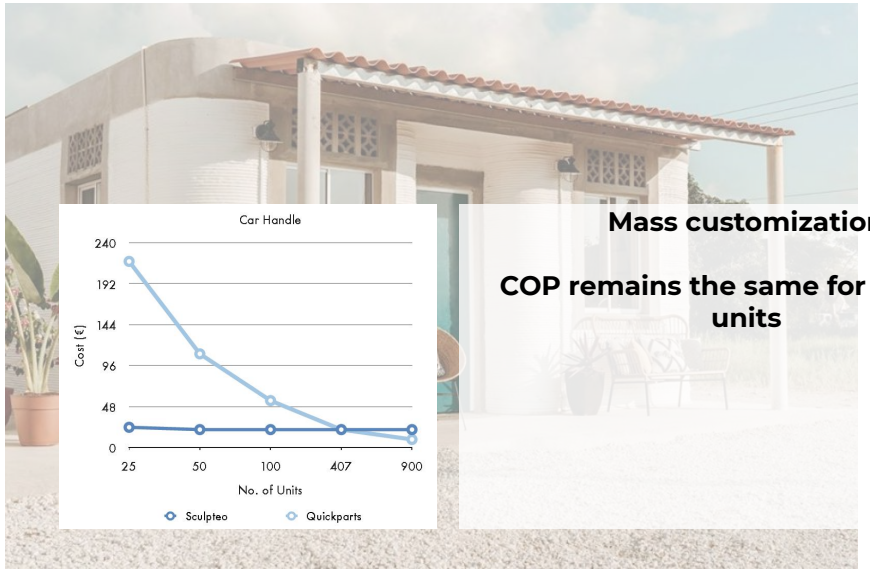
Design task

Mass customization

Material

Manufacturing method

Design task



Mass customization

COP remains the same for 1 or 1000 units

Material

Manufacturing method

Design task

Mass customization

COP remains the same for 1 or 1000 units

Accessibility for smaller businesses and individuals

Material

Manufacturing method

Design task

Mass customization

COP remains the same for 1 or 1000 units

Accessibility for smaller businesses and individuals

Not needing large scale industrial manufacturing

Material

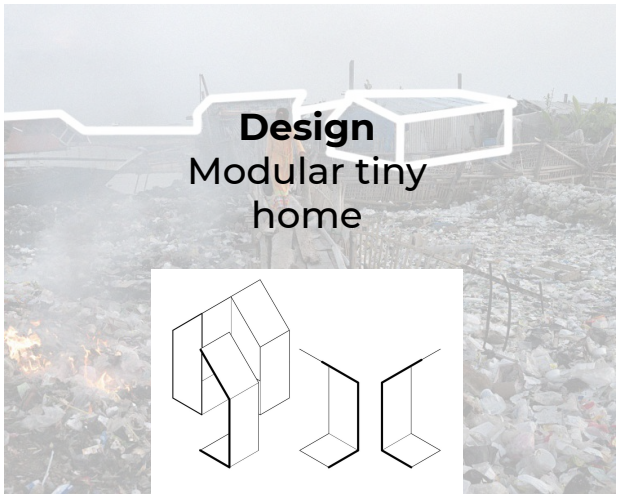
Manufacturing method

Design task

Material

Manufacturing method

Design task



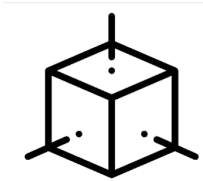
Material

Manufacturing method

Design task

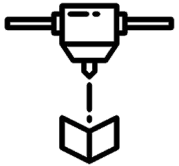
WITH

Material
Recycled PET



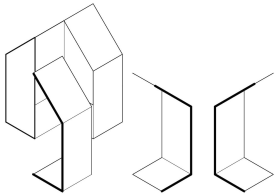
HOW

Method
Additive manufacturing



WHAT

Design
Modular tiny home



How to design **multifunctional interiors** based on **transformable connections** with **mono material PET** using **Fused Deposition Modeling**?

Customizability

Components made combining transformable connections and surfaces

Main focus on transformable connections

How to design **multifunctional interiors** based on **transformable connections** with **mono material PET** using **Fused Deposition Modeling**?

100% recyclability

↓

Prototyping for validation

Design to be influenced by FDM constraints

↓

Efficient manufacturing technique due to customizability and for material

1

Transformable connections

2

Prototyping as a design tool

3

Design for manufacturing and assembly

4

Validating results of testing

1

Transformable connections:

What transformable connections can be designed to extend the use of a surface and how can they be designed in order to allow for redesign and adaptability according to different needs of different users/designers?

What is the most suitable combination of transformable connections with surfaces for the different functions?

2

Prototyping as a design tool:

To what extent can prototyping be incorporated into the research-by-design process and how can it be most effectively used for testing transformability of interior furniture?

How is the design output affected by the prototyping process and machine limitations? Can they be used as strengths when designing?

3

Design for manufacture:

What effect does FDM process have on the design process and how can the design be optimised according to FDM?

What impact does making the designs, methodology and system available to the masses though the maker movement?

4

Validating results of testing:

What methodologies can be used to most accurately validate the results of prototyping and testing according to the different criteria set per design component?

standardized flexible connection system

With

customizable interior components

based on

transformable connections

What is a transformable connection?

Connection

standardized flexible connection system

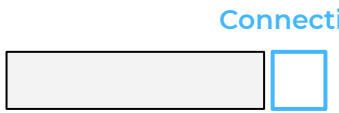
With

customizable interior components

based on

transformable connections

What is a transformable connection?



Adaptable Surface 1

standardized flexible connection system

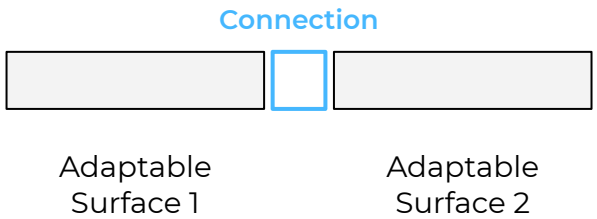
With

customizable interior components

based on

transformable connections

What is a transformable connection?



standardized flexible connection system

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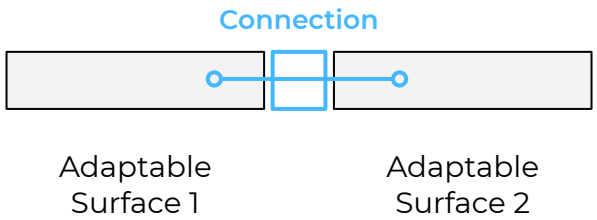

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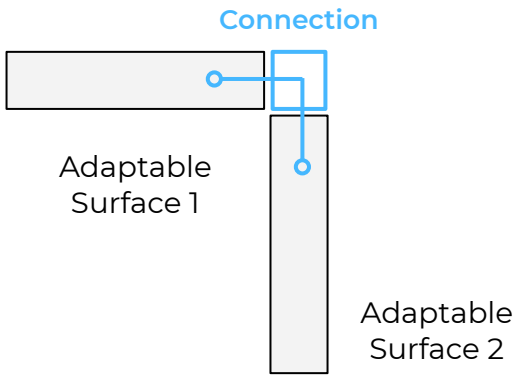


Module

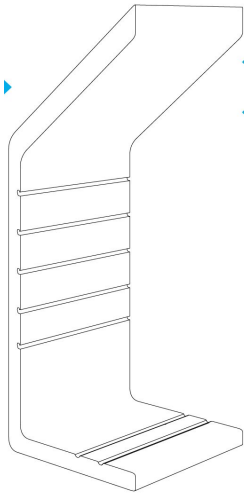
standardized flexible connection system

With

customizable interior components

based on

transformable connections



LIVING MODULE

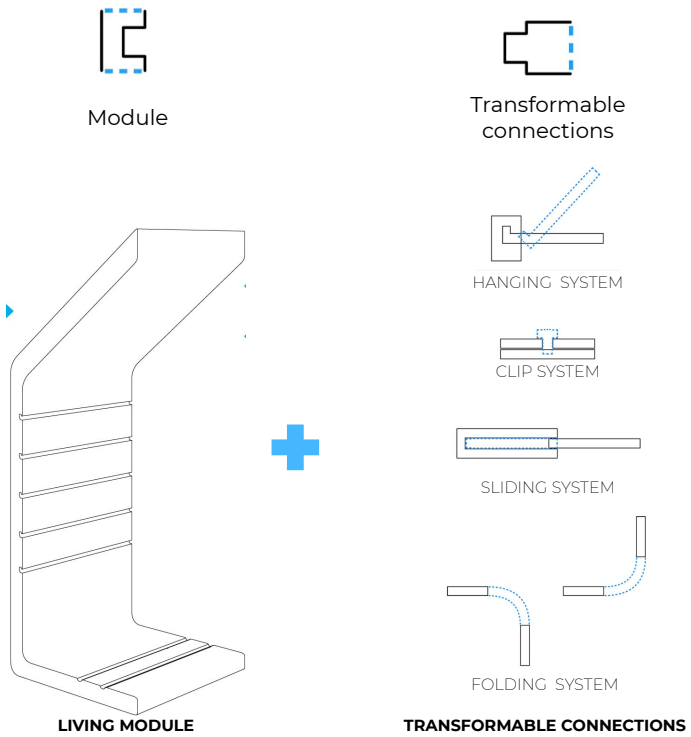
standardized flexible connection system

With

customizable interior components

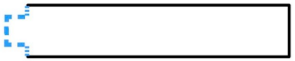
based on

transformable connections



Module

Transformable connections



Customisable interior components

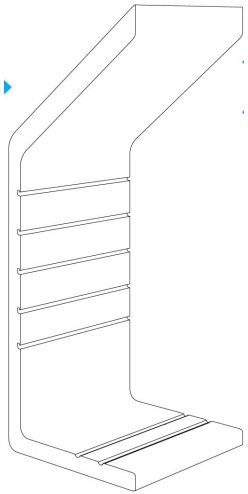
standardized flexible connection system

With

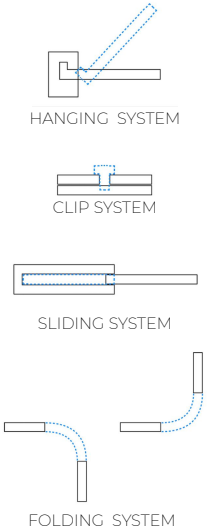
customizable interior components

based on

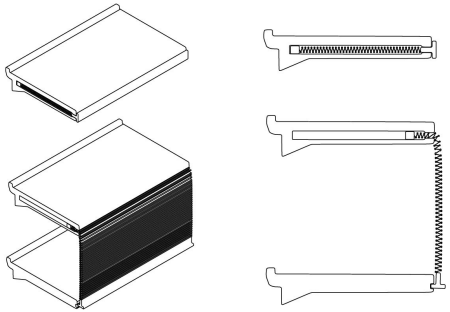
transformable connections



LIVING MODULE

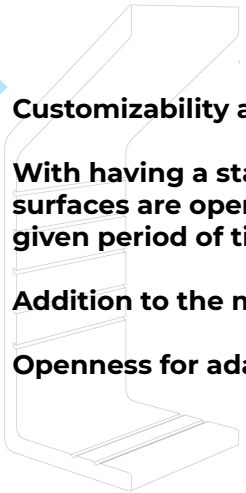


TRANSFORMABLE CONNECTIONS

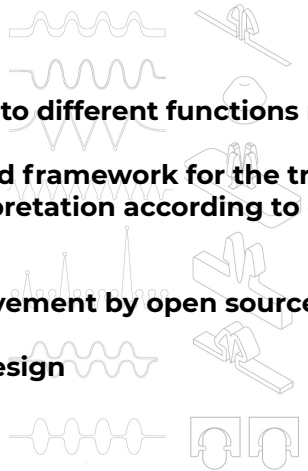


COMPONENT

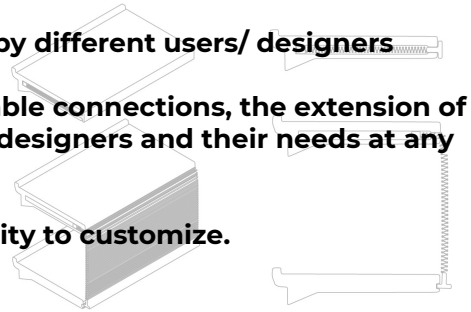
- **Customizability according to different functions required by different users/ designers**
- **With having a standardised framework for the transformable connections, the extension of surfaces are open to interpretation according to different designers and their needs at any given period of time.**
- **Addition to the maker movement by open source availability to customize.**
- **Openness for adaptable design**



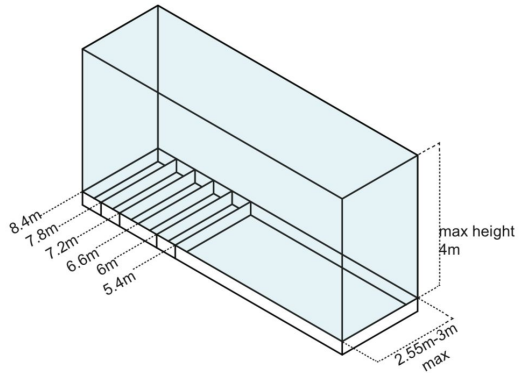
LIVING MODULE



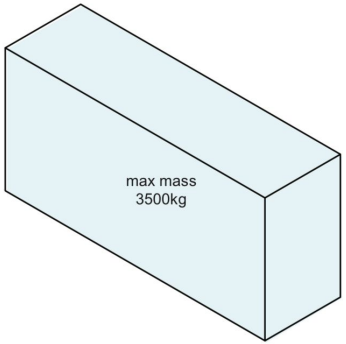
TRANSFORMABLE CONNECTIONS



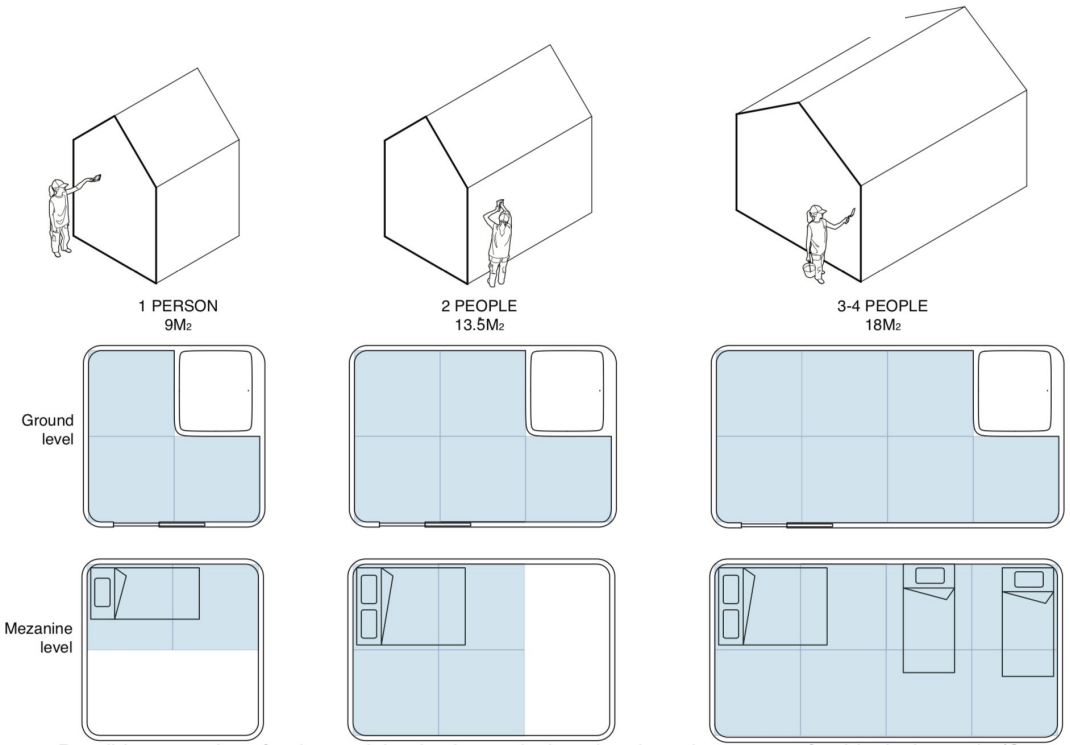
COMPONENT



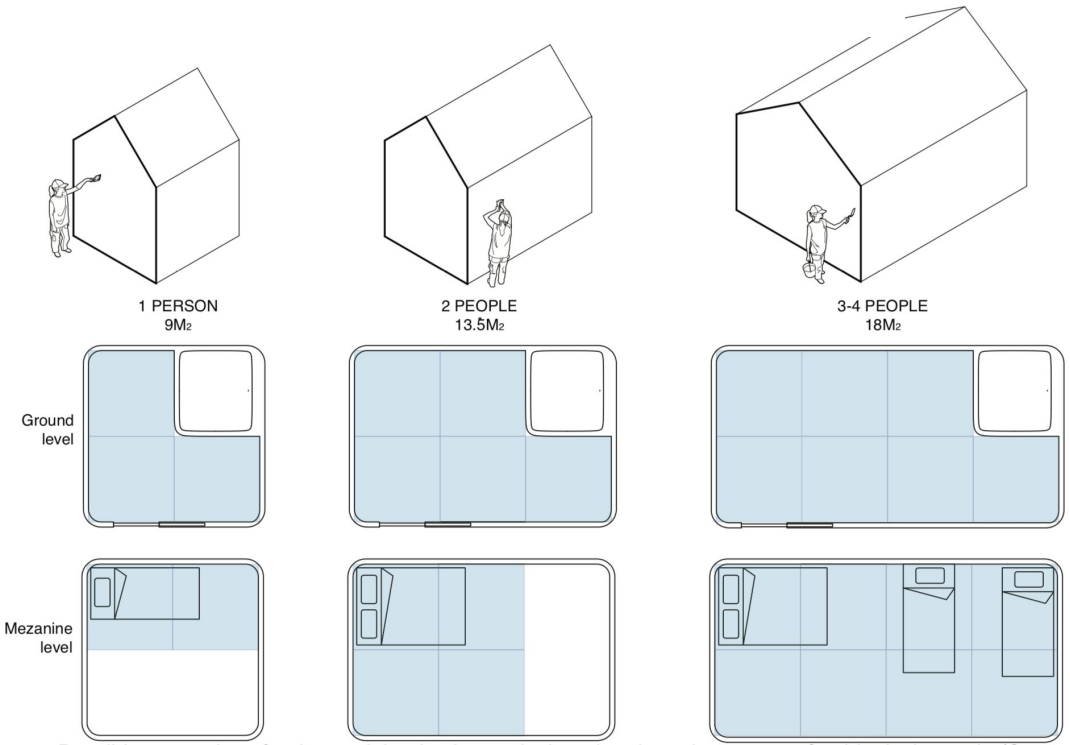
Maximum dimensions



Maximum massing



Basic design for a modular tiny house as context for design task



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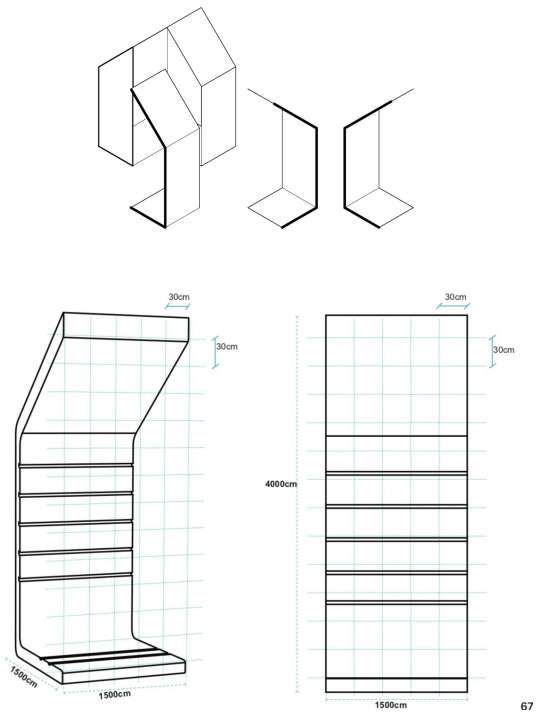
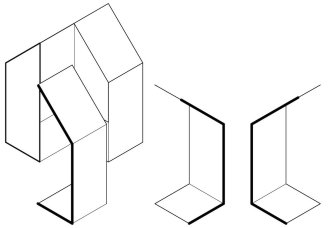
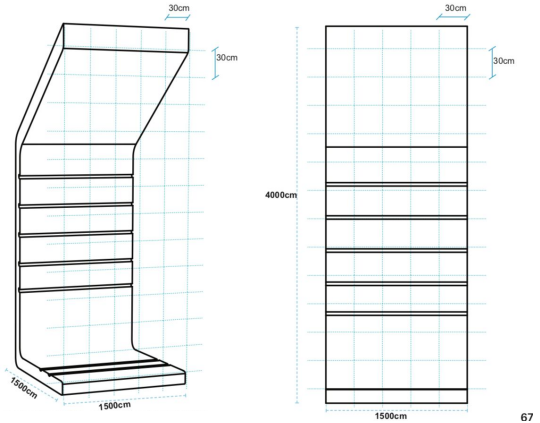


Single module of the modular tiny house





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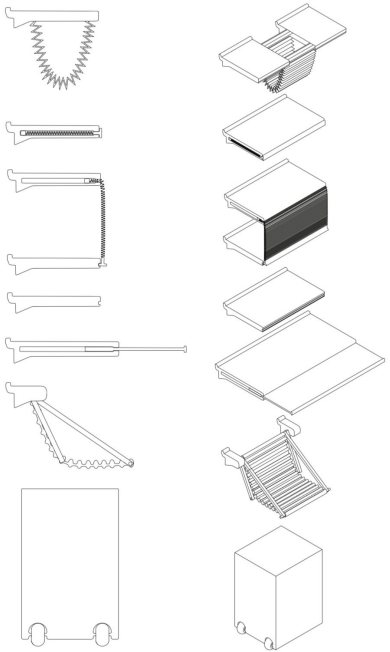
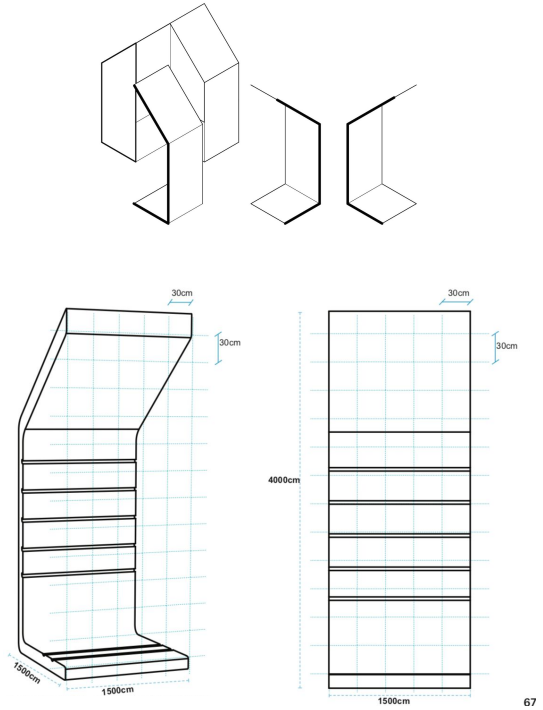


Transformable furniture to connect to the module



Single module of the modular tiny house

1. Literature research

1. Literature research
2. Research by design (Using prototyping as proof of concept)

1. Literature research
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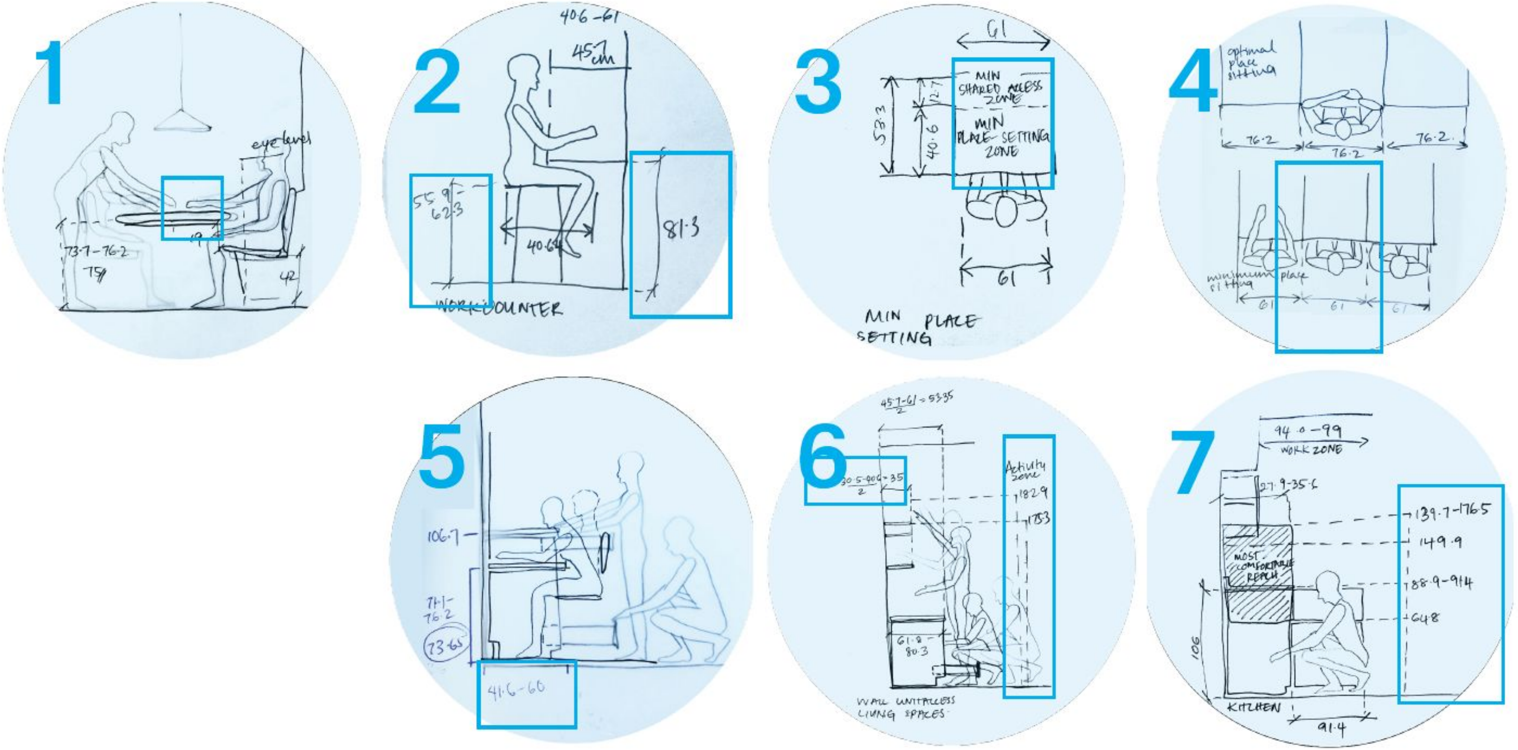
3. Validation matrix using prototyping (Designing, prototyping, Testing, Validating and iterating)

1. Literature research
2. Research by design (Using prototyping as proof of concept)
3. Validation matrix using prototyping (Designing, prototyping, Testing, Validating and iterating)
4. The final combination designs chosen and combined in on exemplary design

LITERATURE RESEARCH

AS A DESIGN TOOL

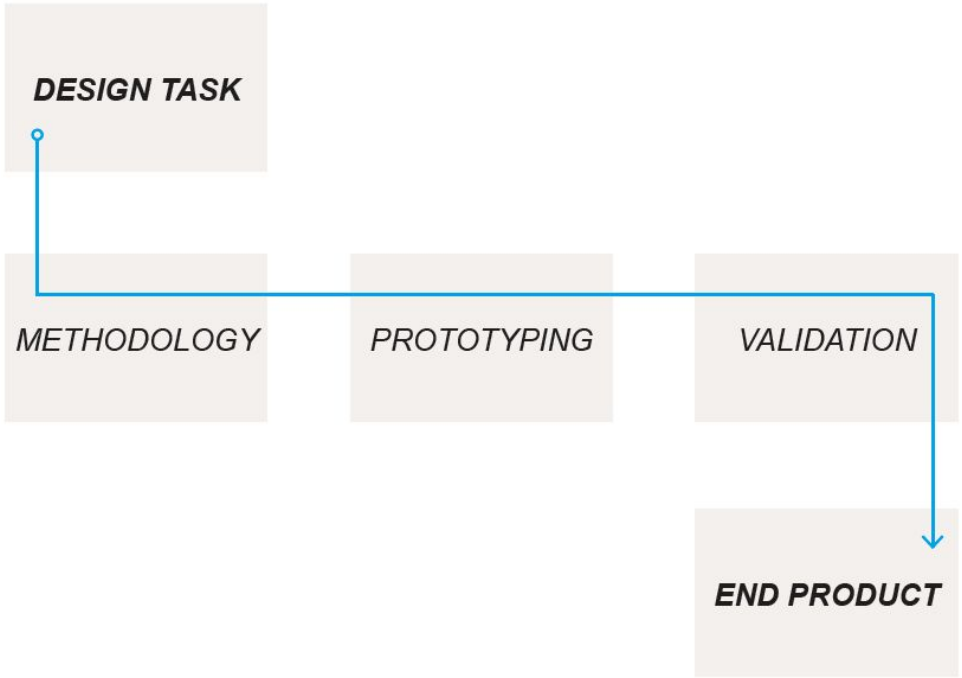
1. Fused deposition modelling (FDM) and criteria
2. Case studies for additive manufacturing of similar projects
3. Design manufacturing
4. Methodologies
5. Prototyping in theory
6. Ergonomics
7. Anthropometric measurements


1
eye level
2
WORK COUNTER
81·3
3
MIN SHARED ACCESS ZONE
MIN PLACE SETTING ZONE
MIN PLACE SETTING
4
optimal place sitting
5
6
Activity zone
7
WORK ZONE
MOST COMFORTABLE REACH
KITCHEN

DESIGN RULES FOR 3D PRINTING

3D HUBS

	Supported Walls	Unsupported Walls	Support	Embossed & Engraved Details	Horizontal Bridges	Holes	Connecting & Moving Parts	Escape Holes	Minimum Features	Pin Diameter
	Walls that are connected to other structures on at least two sides.	Walls that are connected to the rest of the print on only one side.	The maximum angle a wall can be printed out without requiring support.	Features on the model that are raised or recessed below the model surface	The span a technology can print without the need for support.	The minimum diameter a technology can successfully print a hole.	The recommended clearance between 2 moving or connecting parts.	The minimum diameter of escape holes to allow for the removal of build material.	The recommended minimum size of a feature to ensure it will not fail to print.	The minimum diameter a pin can be printed at.
										
Fused Filament Fabrication	0.8mm	0.8mm	45°	0.6mm wide & 2mm high	10mm	Ø2mm	0.5mm		2mm	3mm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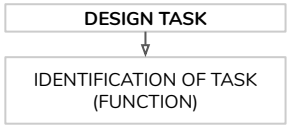
METHODOLOGY
PROTOTYPING
VALIDATION
END PRODUCT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IDENTIFICATION OF TASK
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DESIGN TASK

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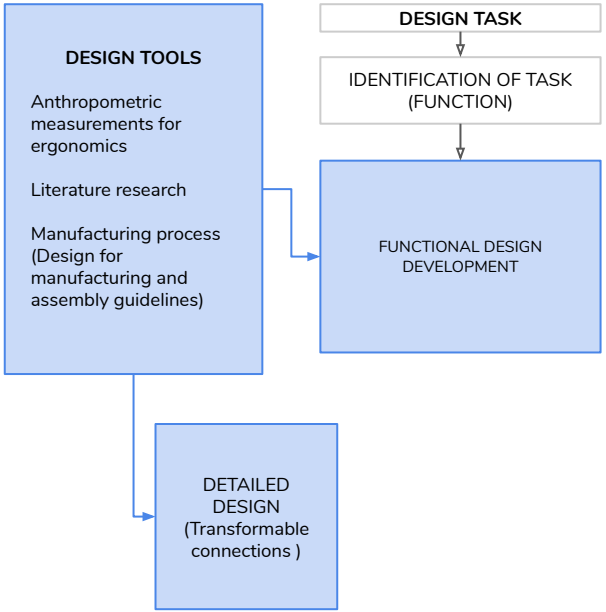
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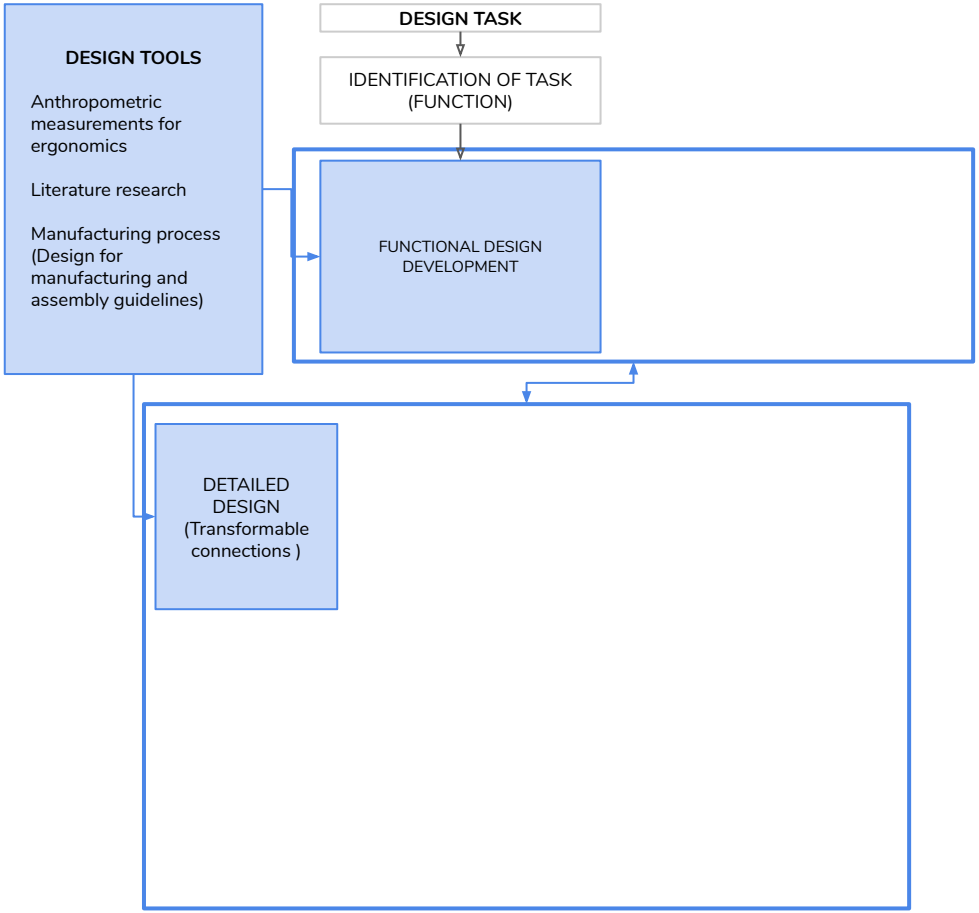
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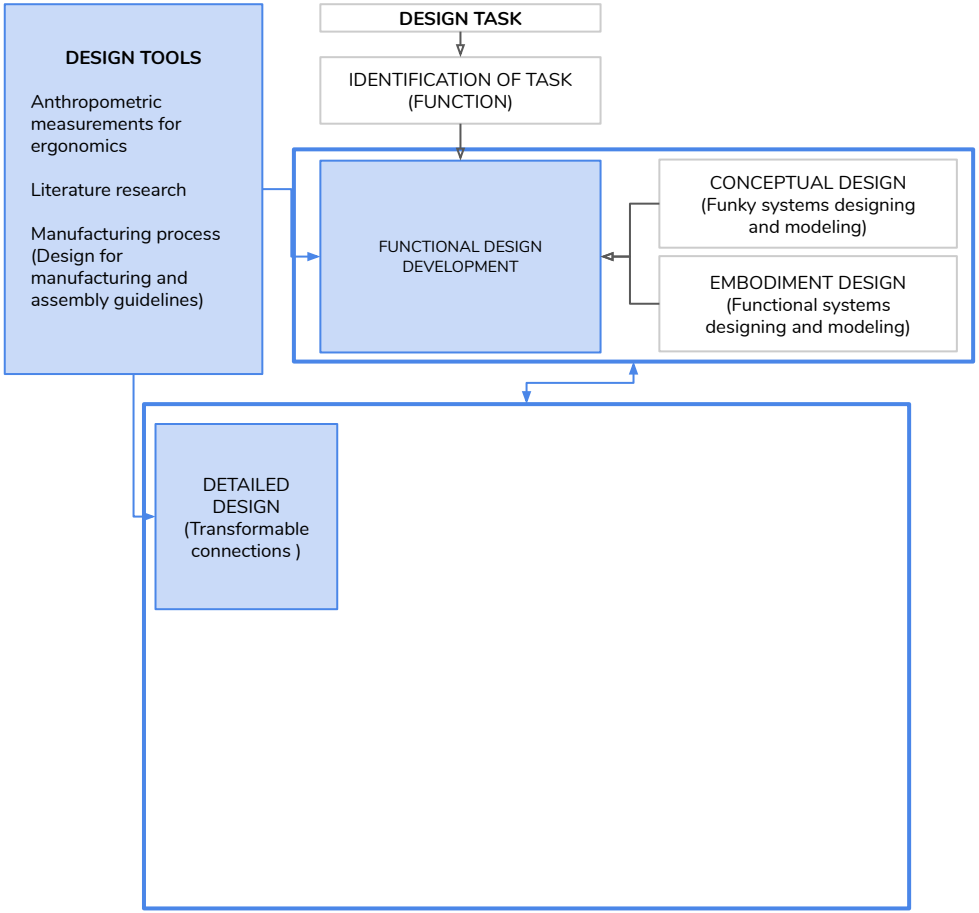
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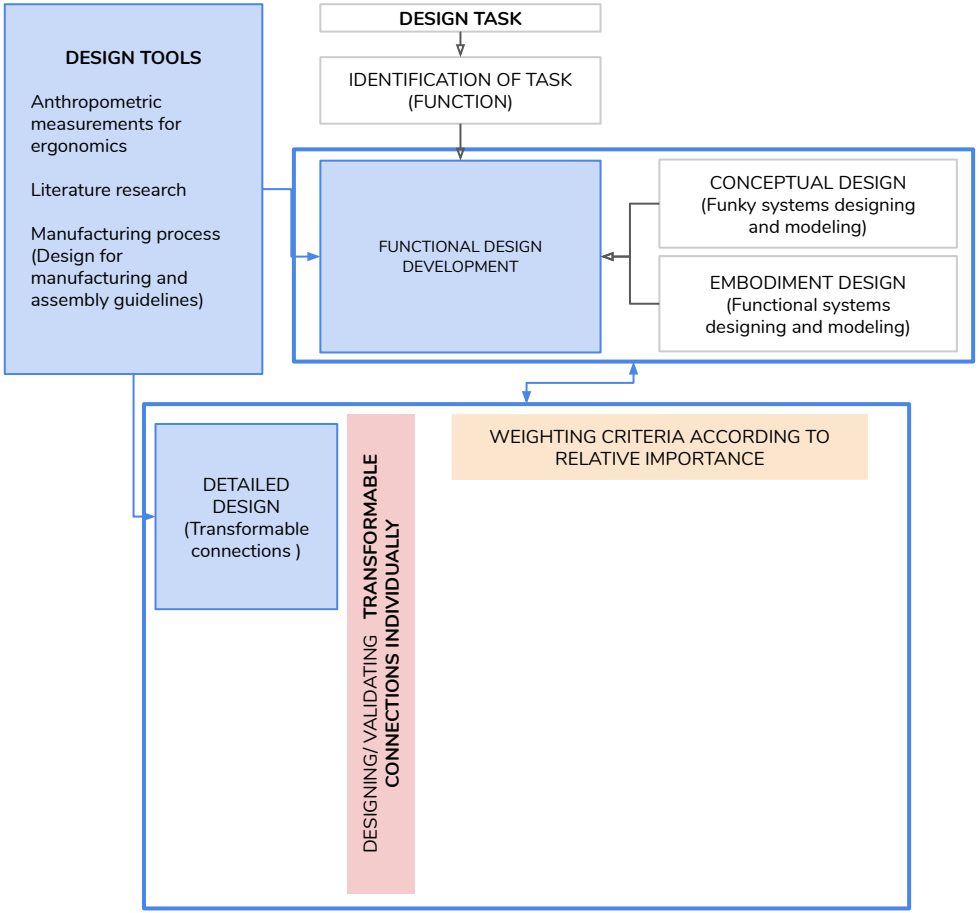
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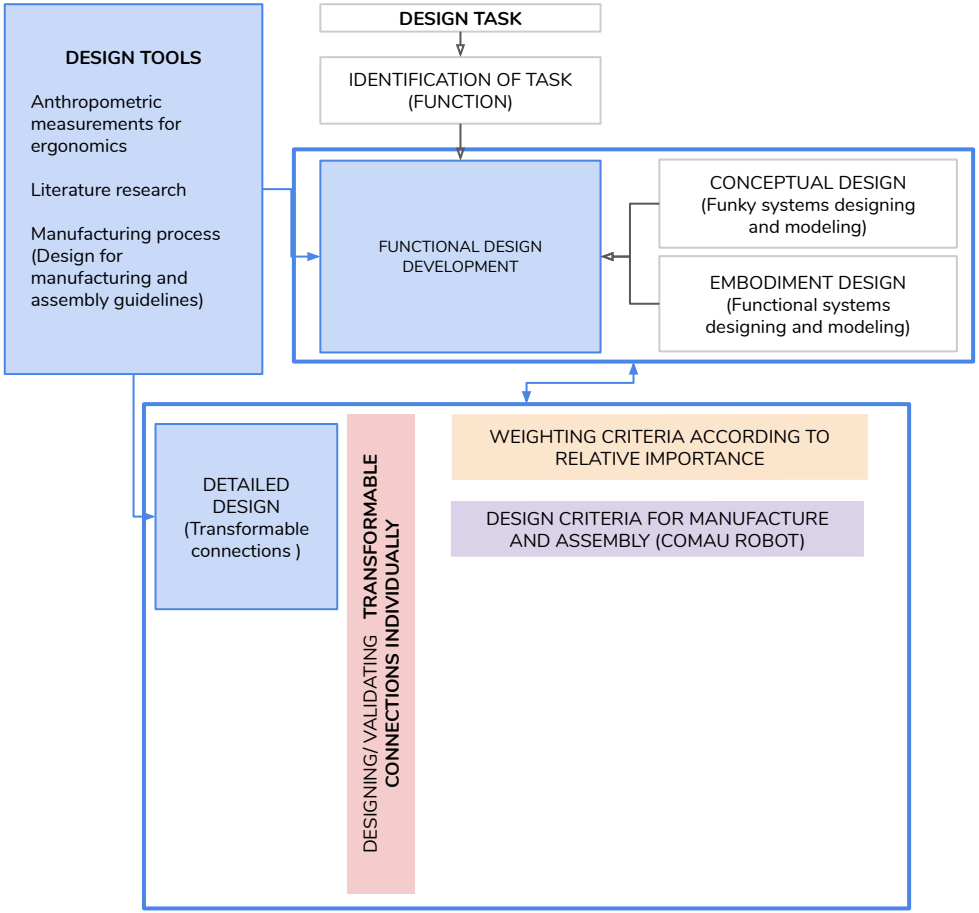
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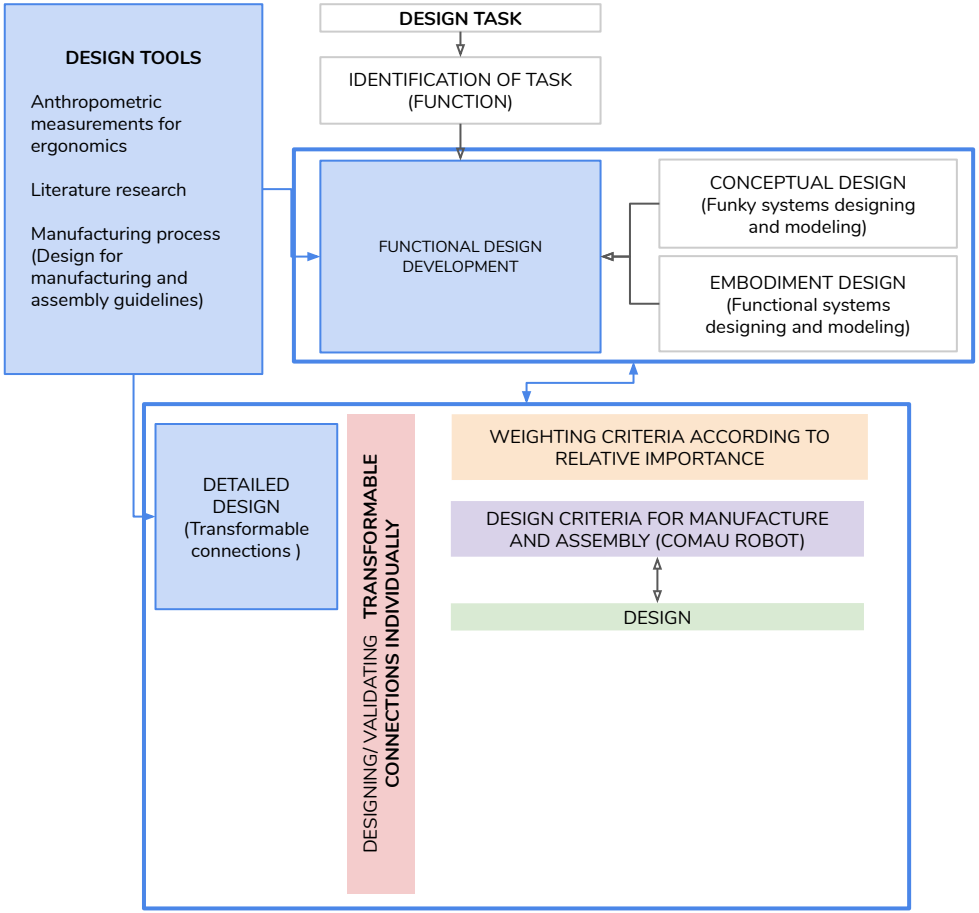
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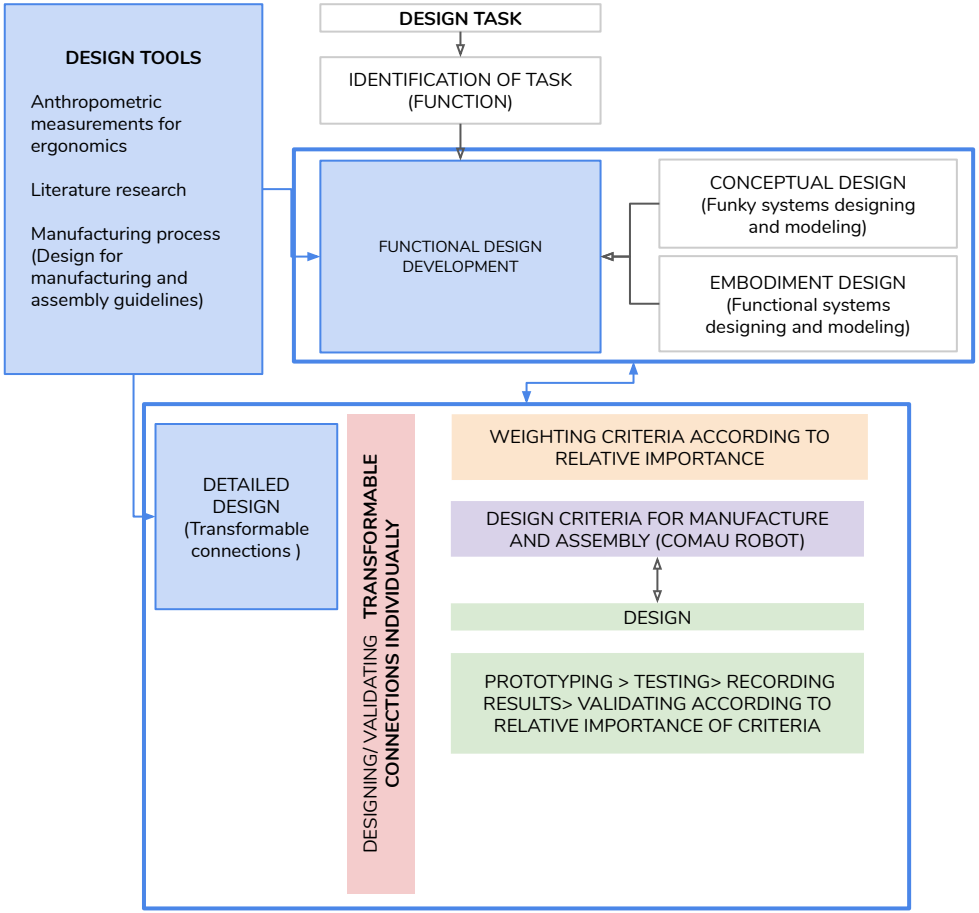
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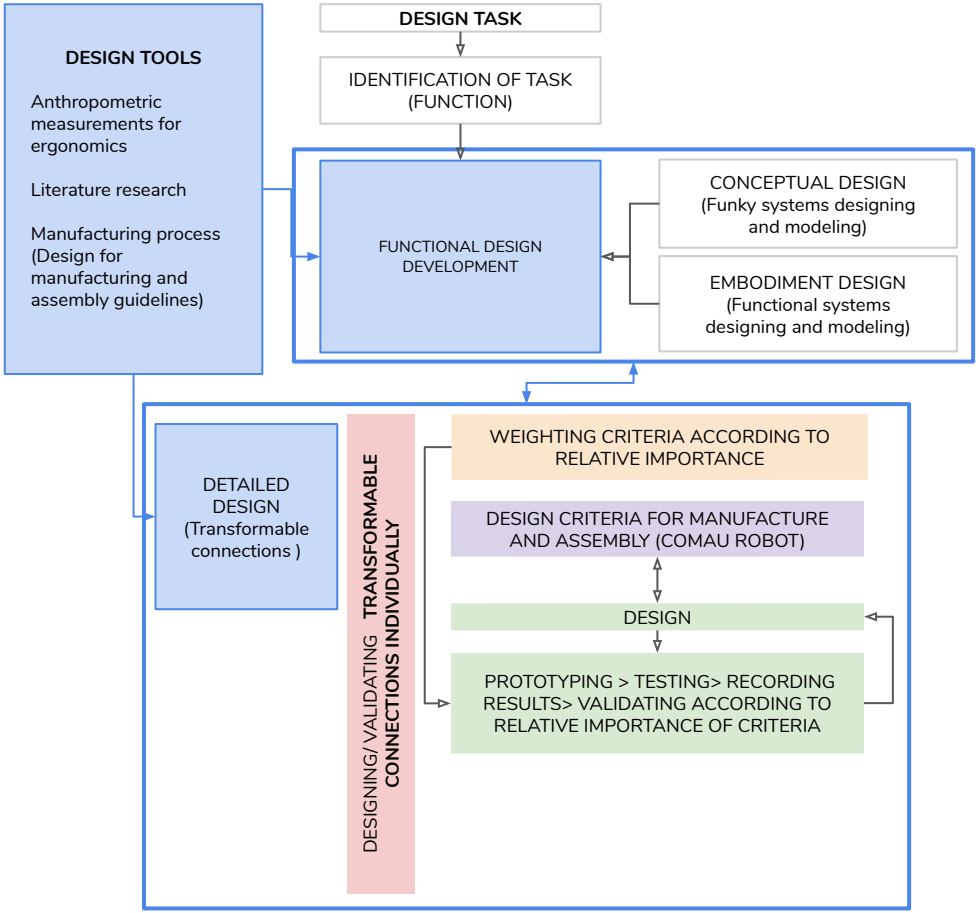
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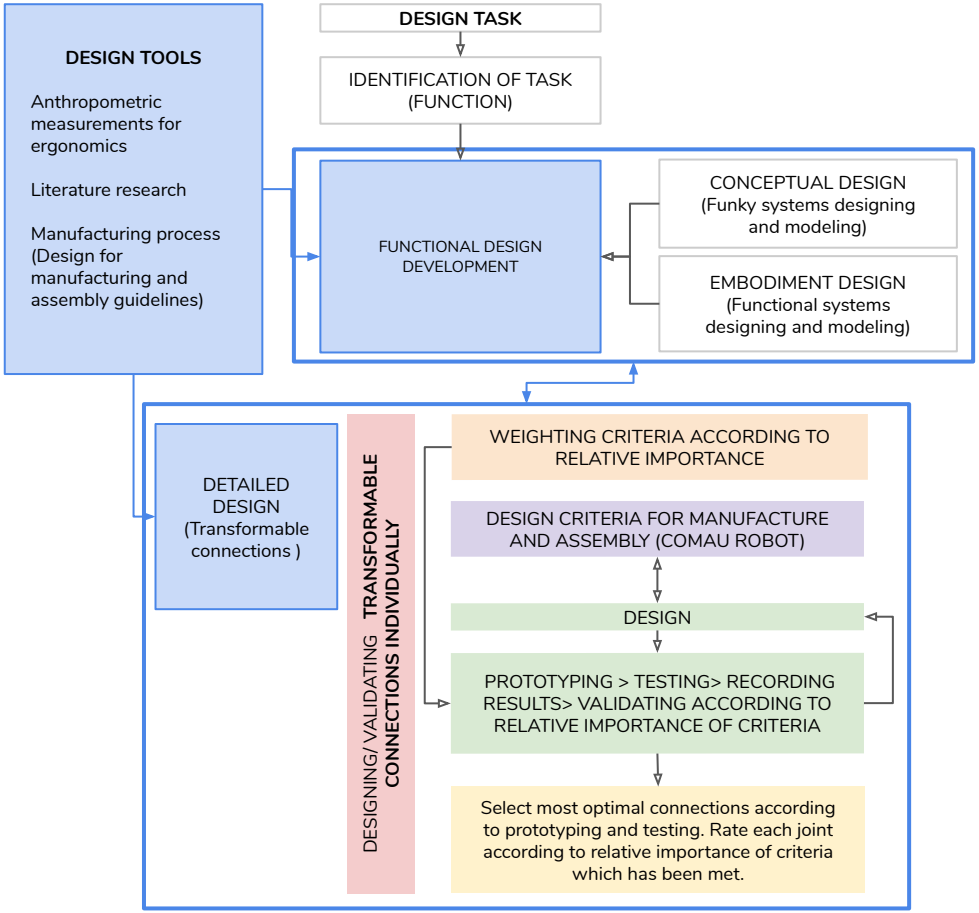
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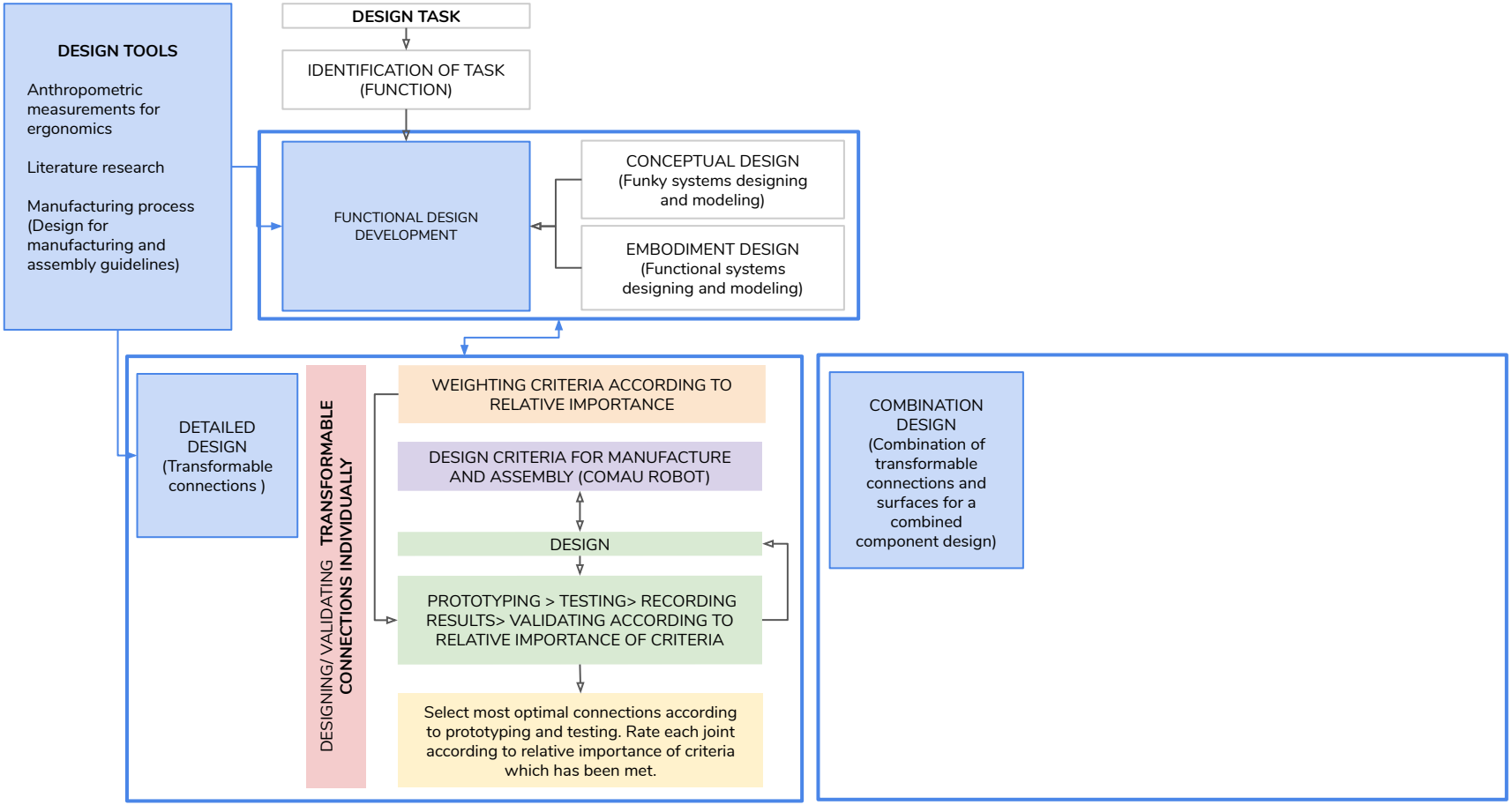
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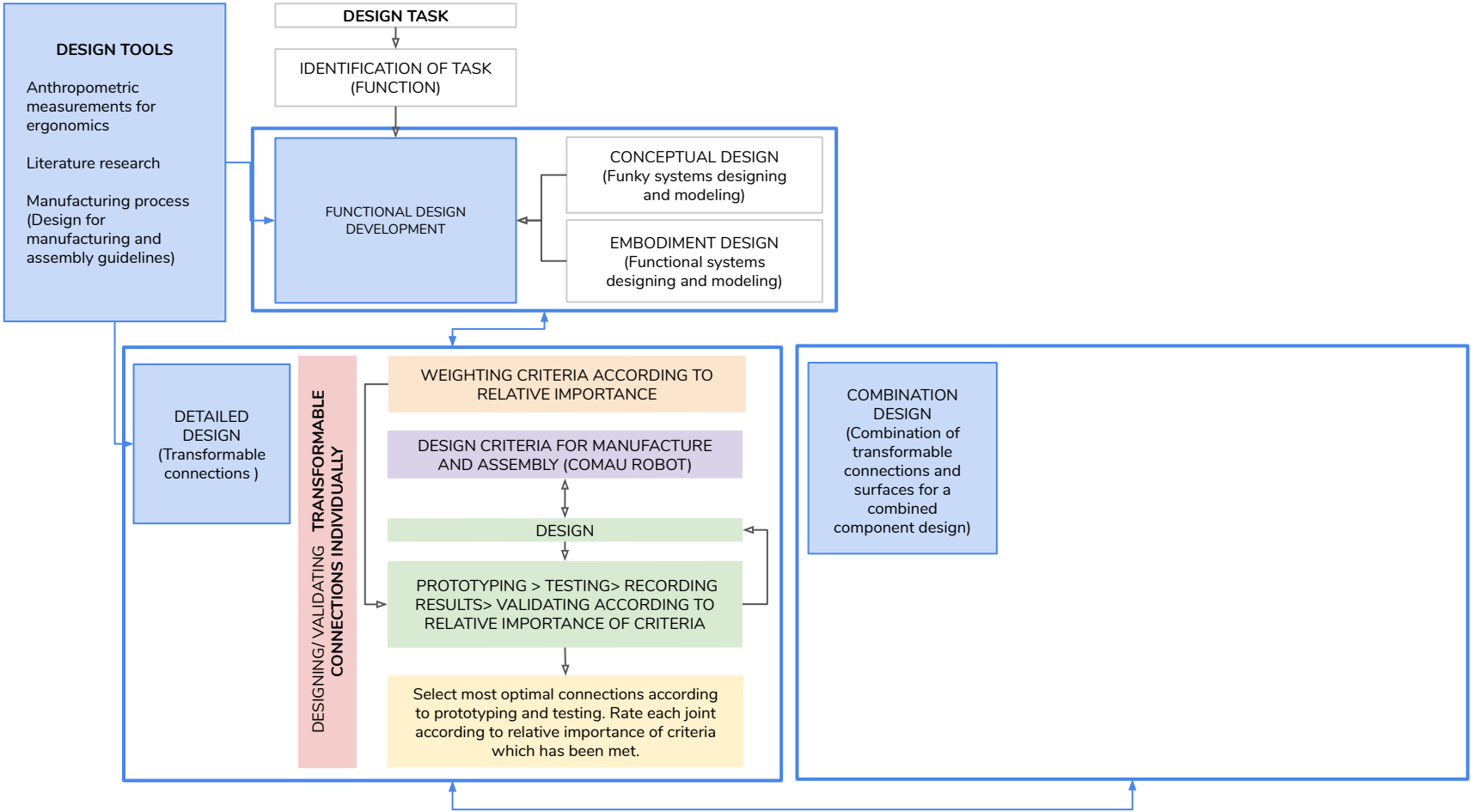
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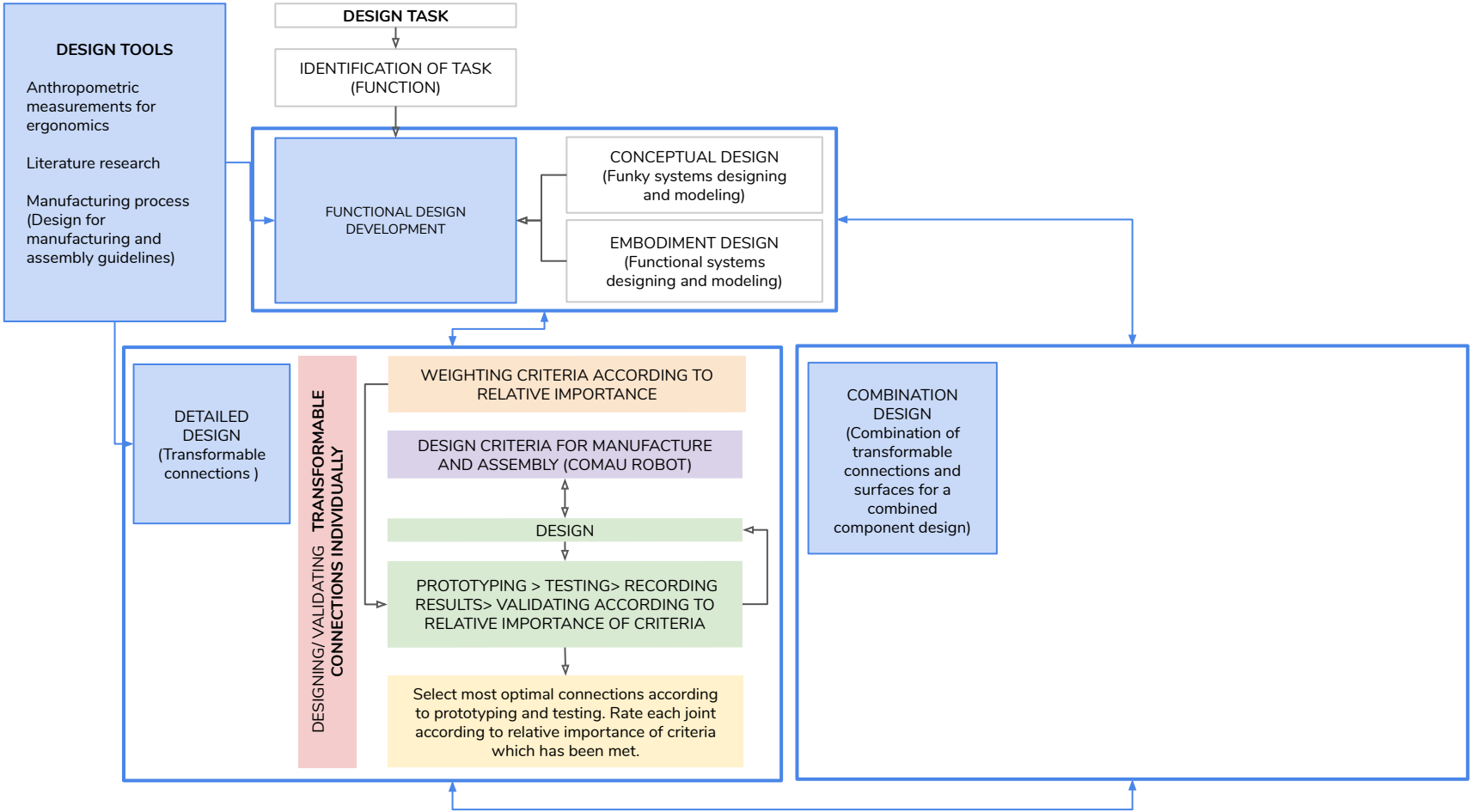
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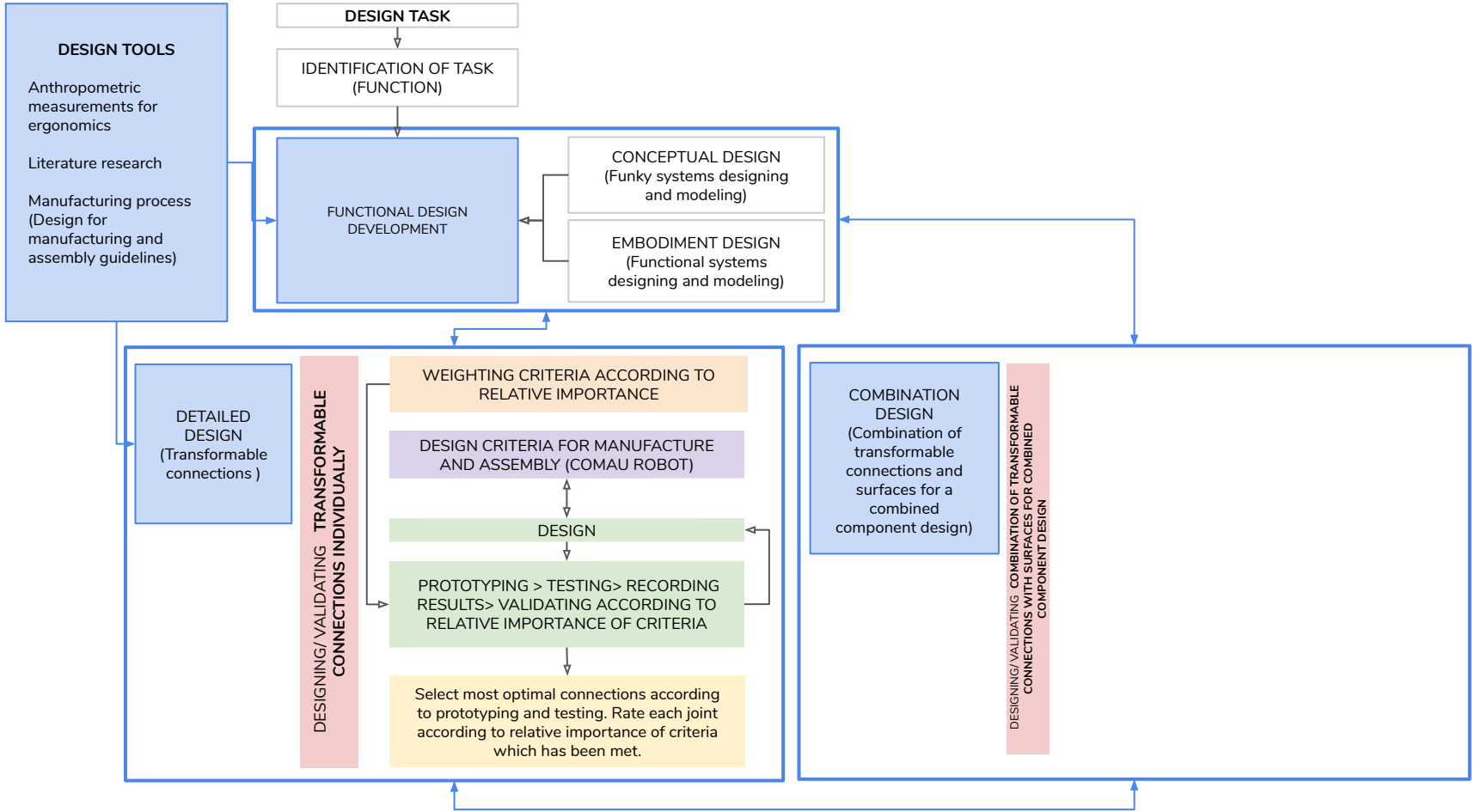
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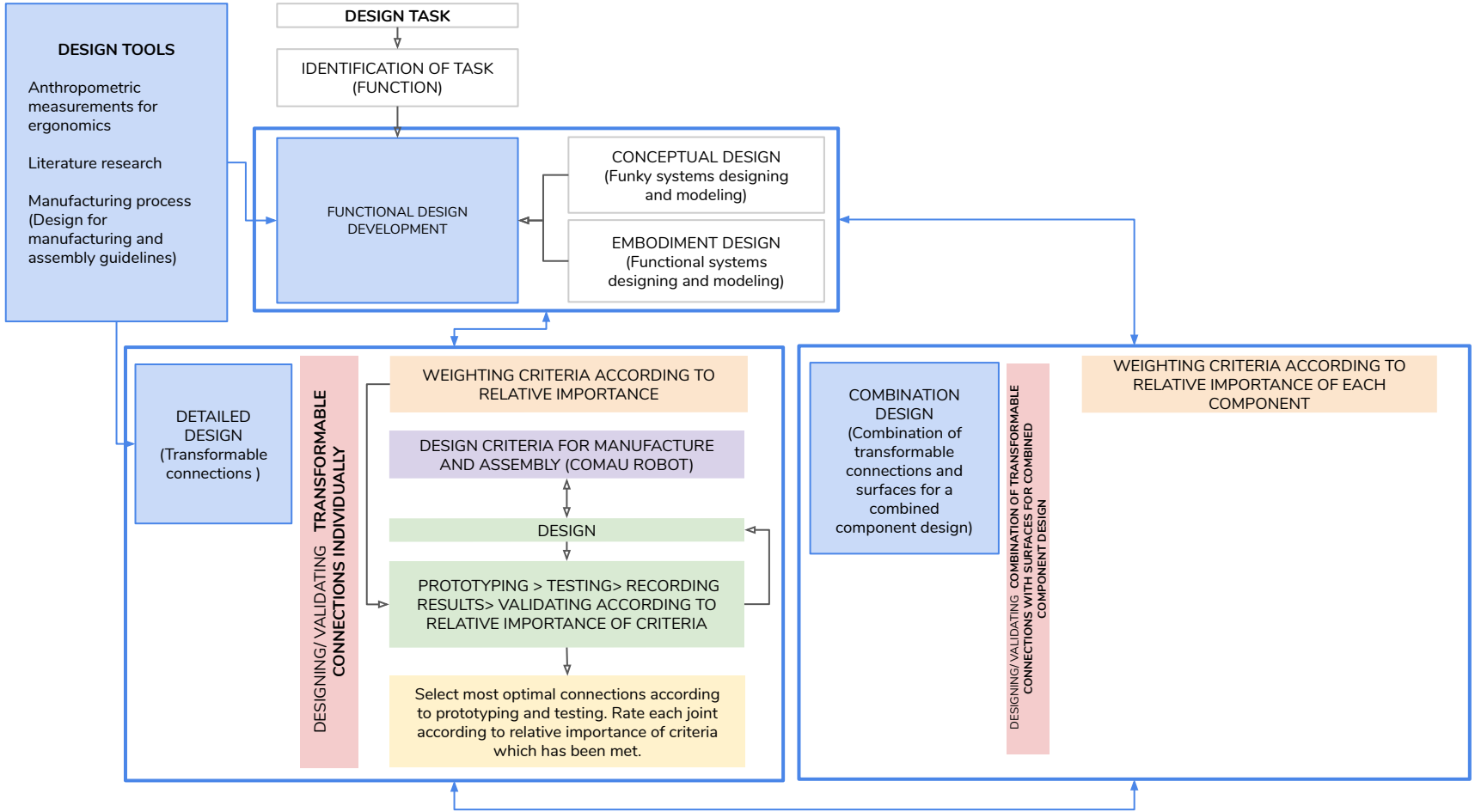
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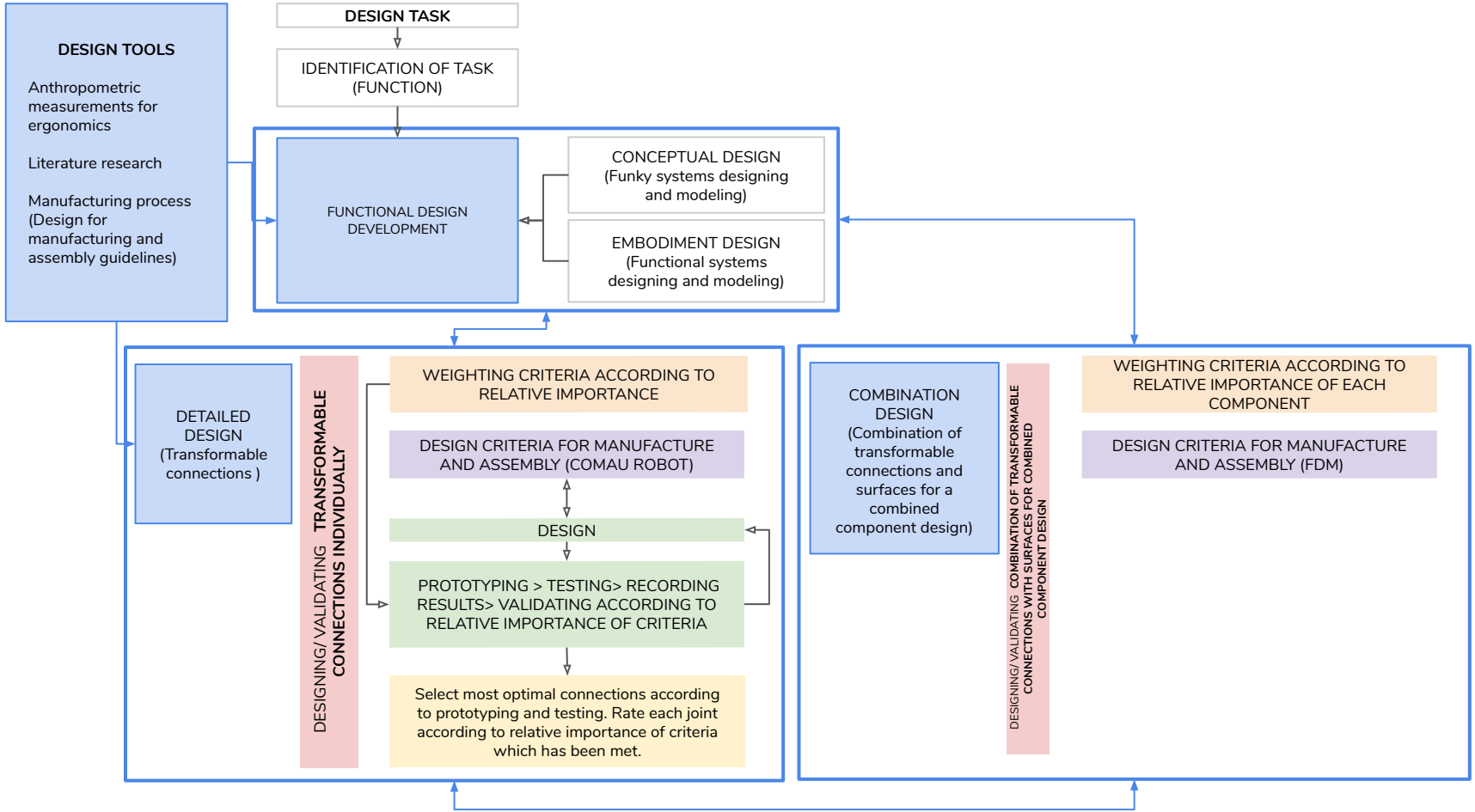
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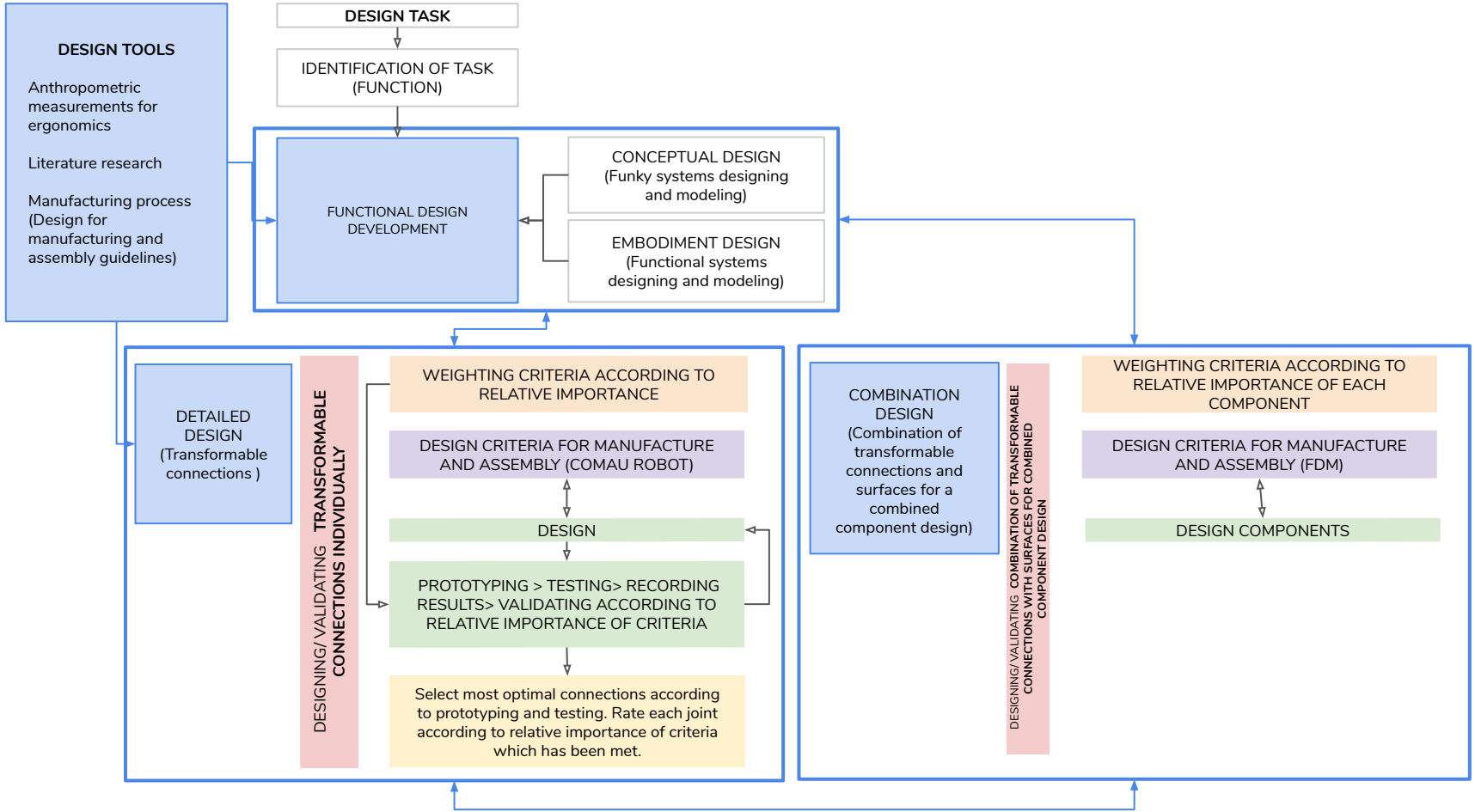
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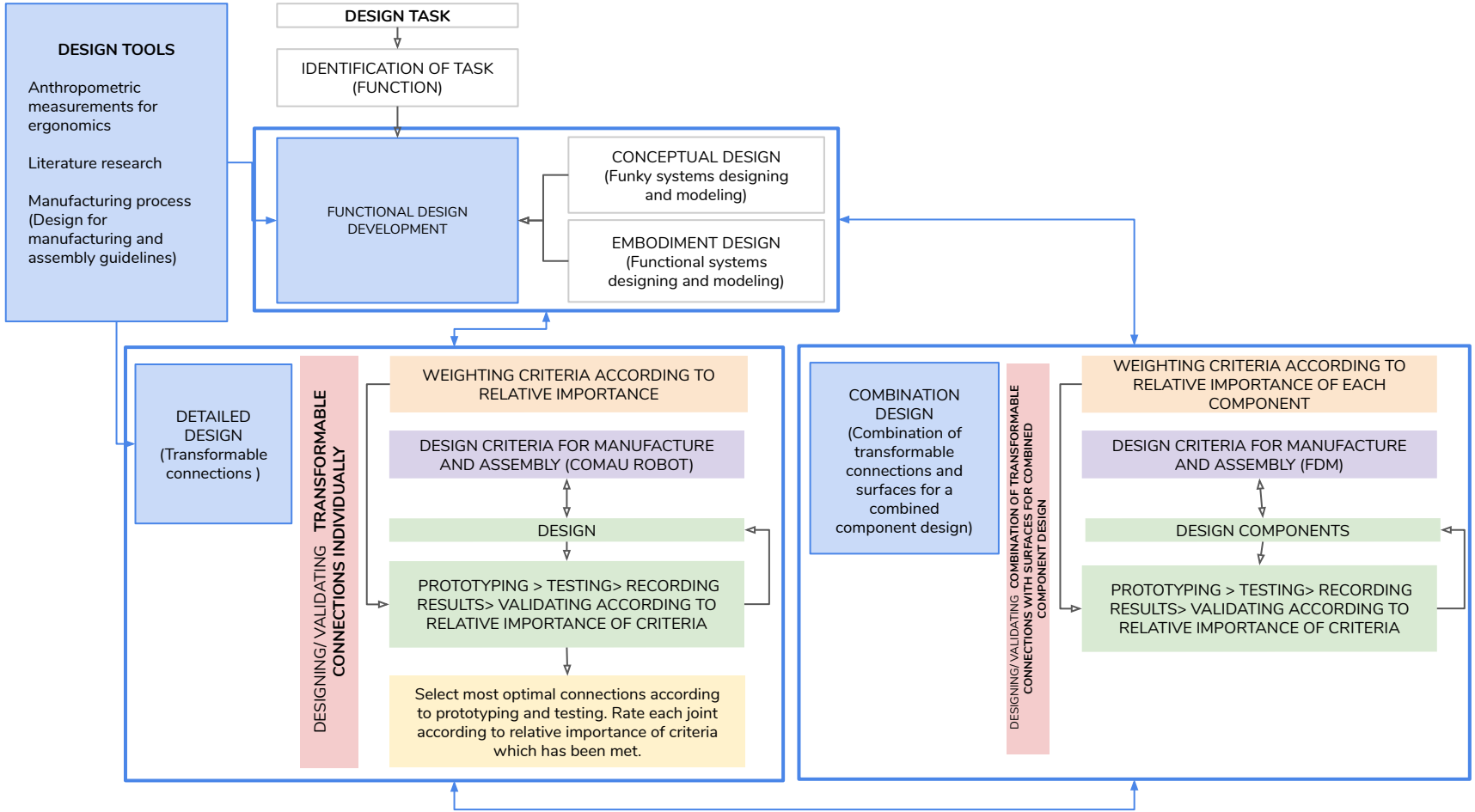
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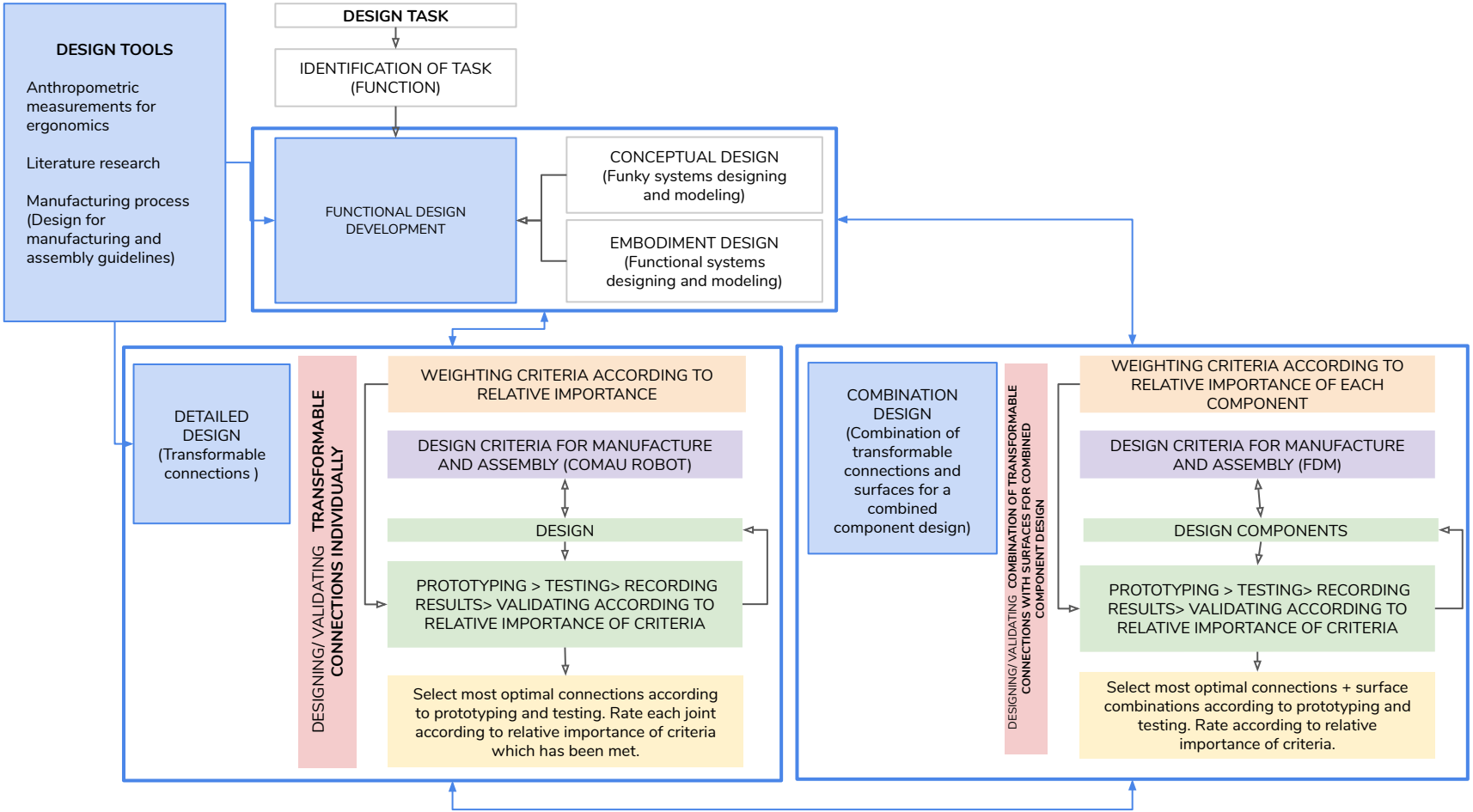
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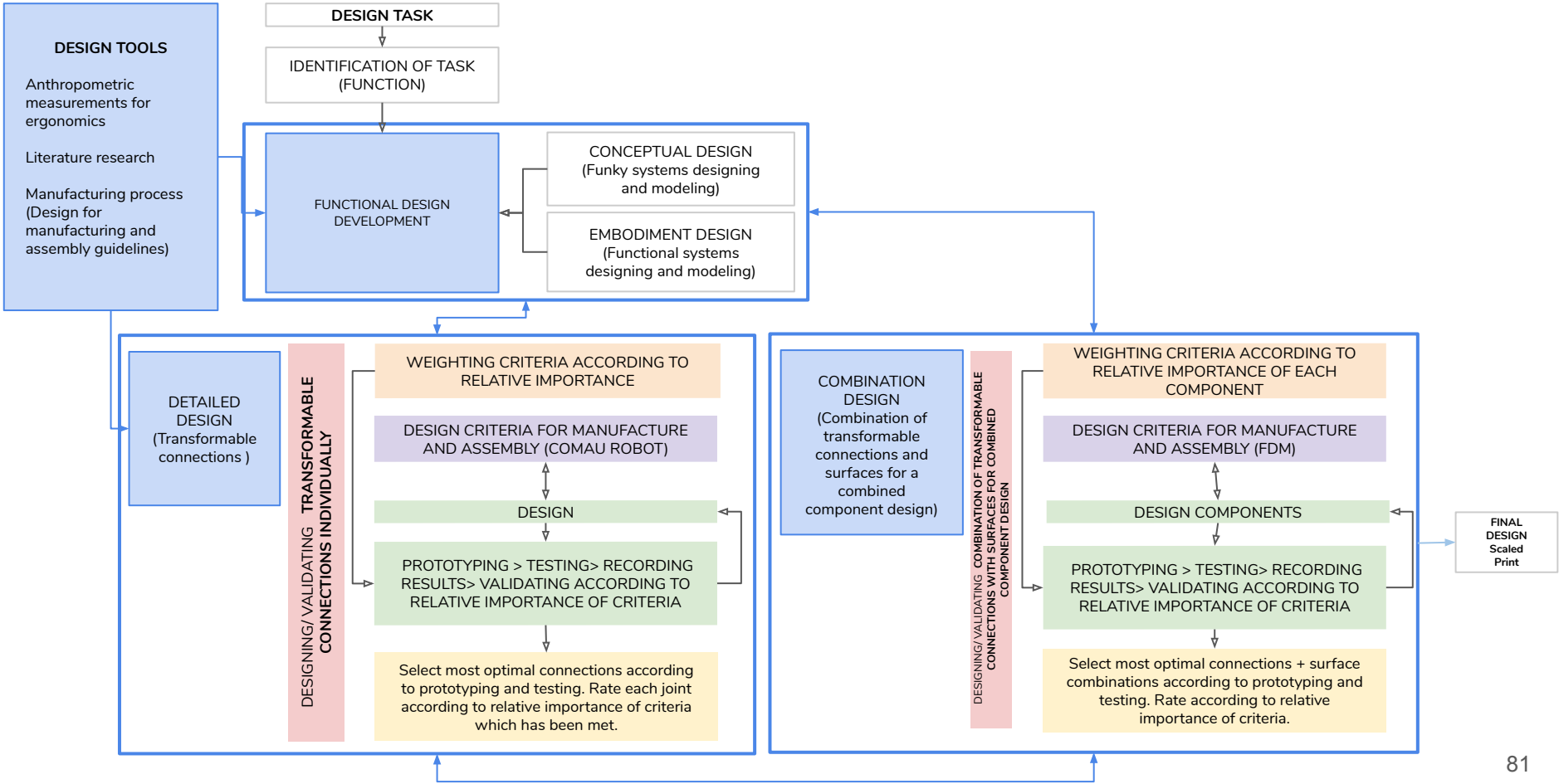
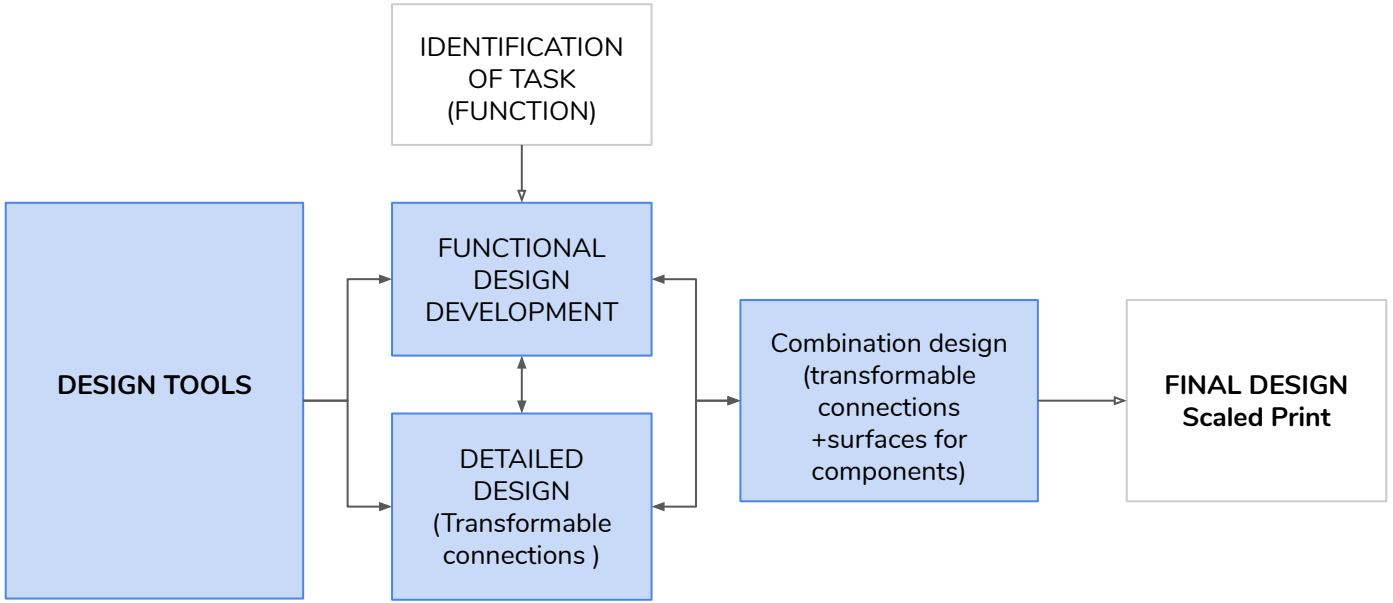
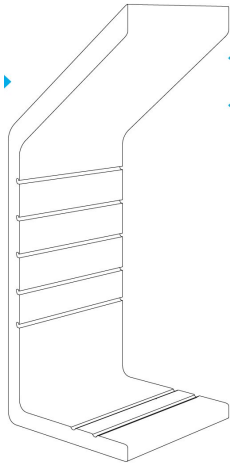
PROTOTYPING > TESTING> RECORDING RESULTS> VALIDATING ACCORDING TO RELATIVE IMPORTANCE OF CRITERIA
Select most optimal connections + surface combinations according to prototyping and testing. Rate according to relative importance of criteria.

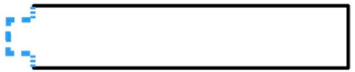

DESIGN TOOLS
Anthropometric measurements for ergonomics
Literature research
Manufacturing process (Design for manufacturing and assembly guidelines)
DESIGN TASK
IDENTIFICATION OF TASK (FUNCTION)
FUNCTIONAL DESIGN DEVELOPMENT
CONCEPTUAL DESIGN (Funky systems designing and modeling)
EMBODIMENT DESIGN (Functional systems designing and modeling)
DETAILED DESIGN (Transformable connections)
DESIGNING/ VALIDATING TRANSFORMABLE CONNECTIONS INDIVIDUALLY
WEIGHTING CRITERIA ACCORDING TO RELATIVE IMPORTANCE
DESIGN CRITERIA FOR MANUFACTURE AND ASSEMBLY (COMAU ROBOT)
DESIGN
PROTOTYPING > TESTING> RECORDING RESULTS> VALIDATING ACCORDING TO RELATIVE IMPORTANCE OF CRITERIA
Select most optimal connections according to prototyping and testing. Rate each joint according to relative importance of criteria which has been met.
COMBINATION DESIGN (Combination of transformable connections and surfaces for a combined component design)
DESIGNING/ VALIDATING COMBINATION OF TRANSFORMABLE CONNECTIONS WITH SURFACES FOR COMBINED COMPONENT DESIGN
WEIGHTING CRITERIA ACCORDING TO RELATIVE IMPORTANCE OF EACH COMPONENT
DESIGN CRITERIA FOR MANUFACTURE AND ASSEMBLY (FDM)
DESIGN COMPONENTS
PROTOTYPING > TESTING> RECORDING RESULTS> VALIDATING ACCORDING TO RELATIVE IMPORTANCE OF CRITERIA
Select most optimal connections + surface combinations according to prototyping and testing. Rate according to relative importance of criteria.
FINAL DESIGN Scaled Print


IDENTIFICATION OF TASK (FUNCTION)
DESIGN TOOLS
FUNCTIONAL DESIGN DEVELOPMENT
DETAILED DESIGN (Transformable connections)
Combination design (transformable connections +surfaces for components)
FINAL DESIGN
Scaled Print

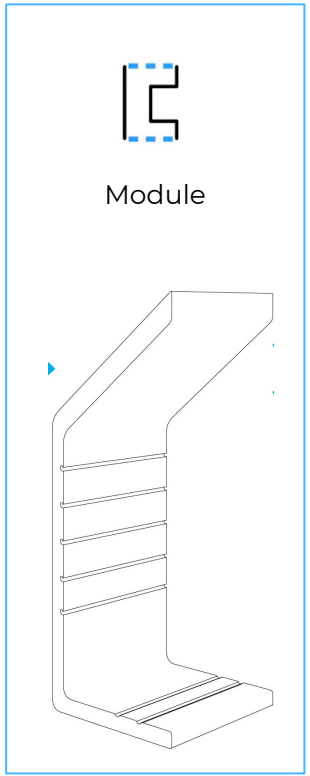
Module

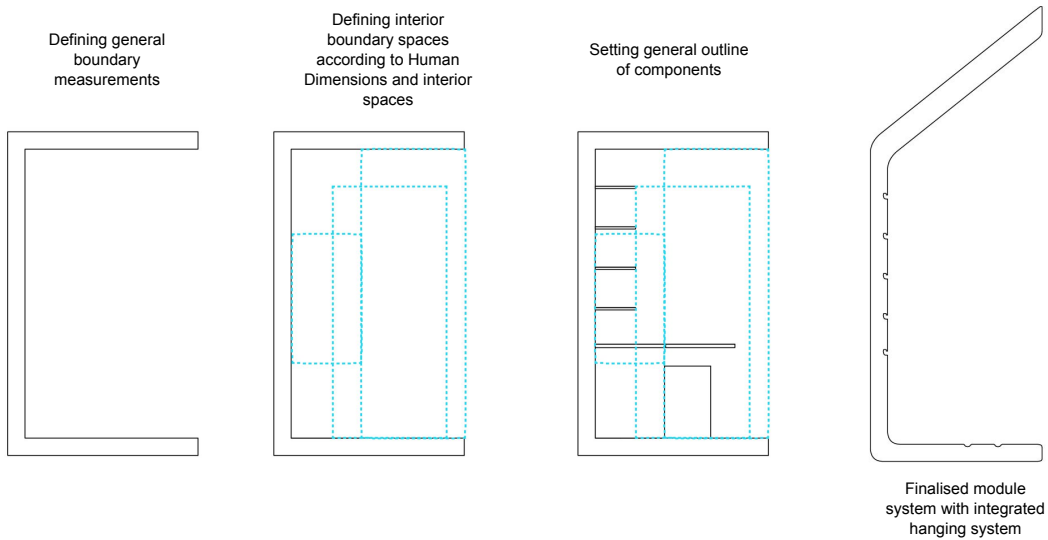


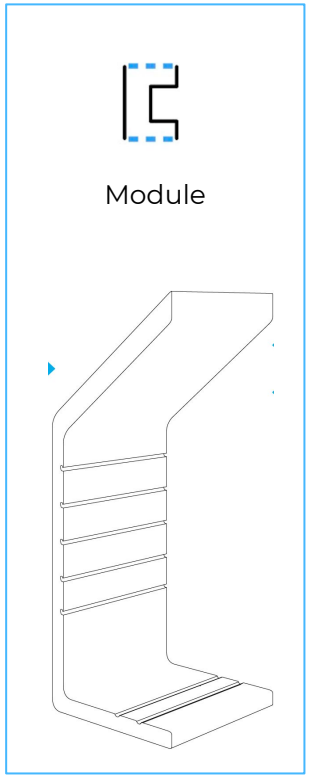
Transformable connections



Customisable interior components

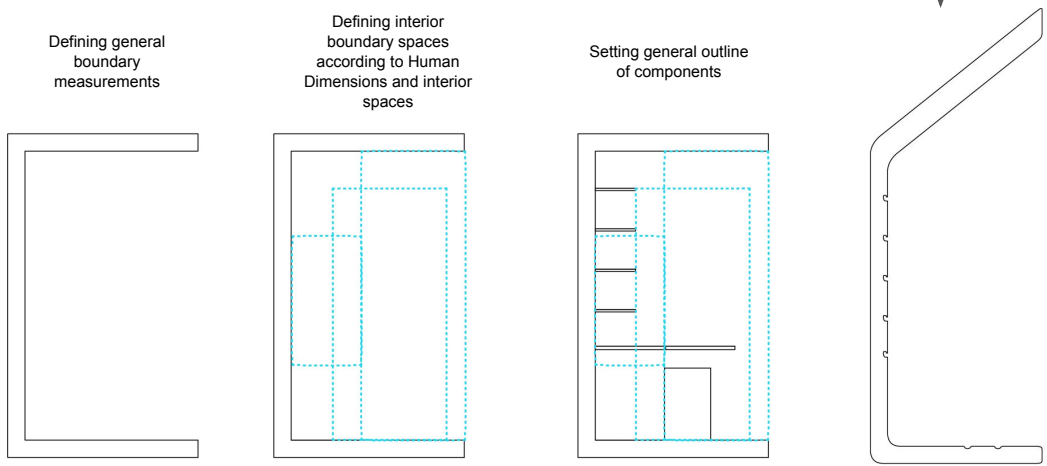

Module

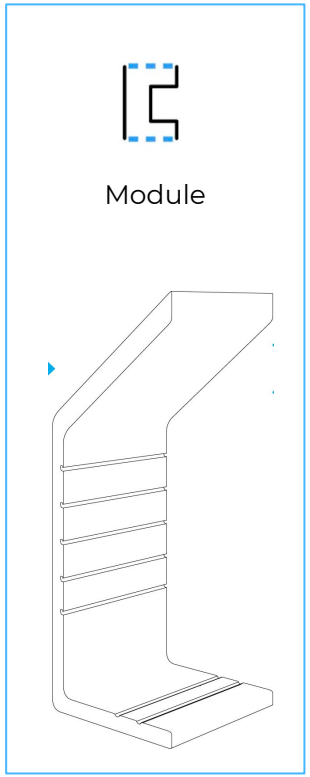

Defining general boundary measurements
Defining interior boundary spaces according to Human Dimensions and interior spaces
Setting general outline of components
Finalised module system with integrated hanging system



DESIGN RULES FOR 3D PRINTING

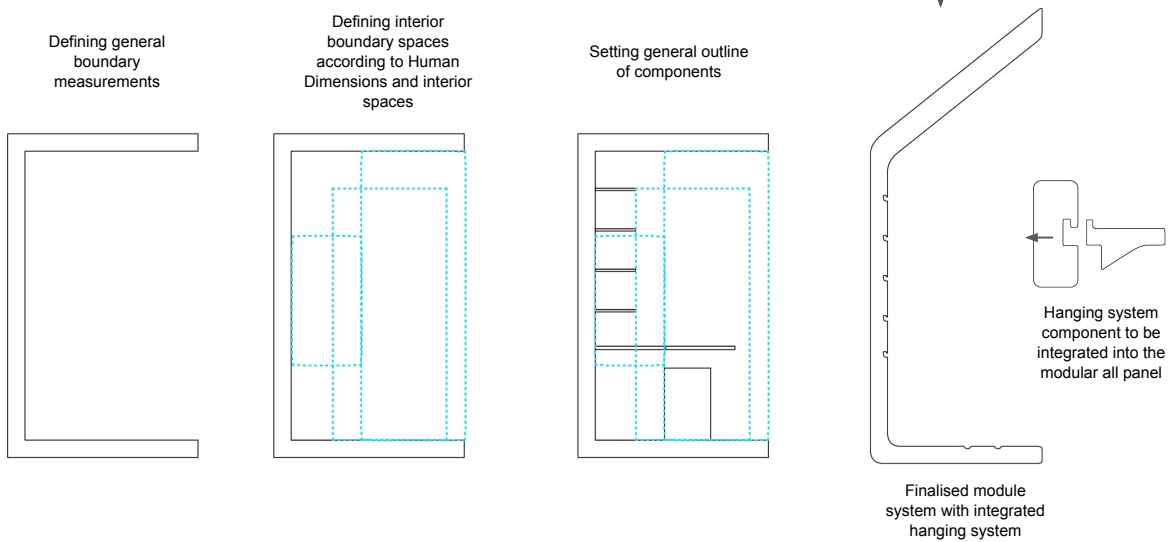
Design for manufacturing and Assembly criteria





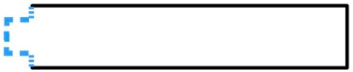
DESIGN RULES FOR 3D PRINTING

Design for manufacturing and Assembly criteria



Module

Transformable connections

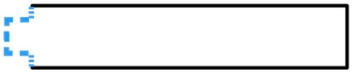


Customisable interior components

Designing/ Validating transformable connections individually

Module

Transformable connections



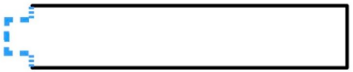
Customisable interior components

Wall

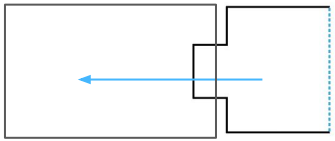
section

Module

Transformable connections



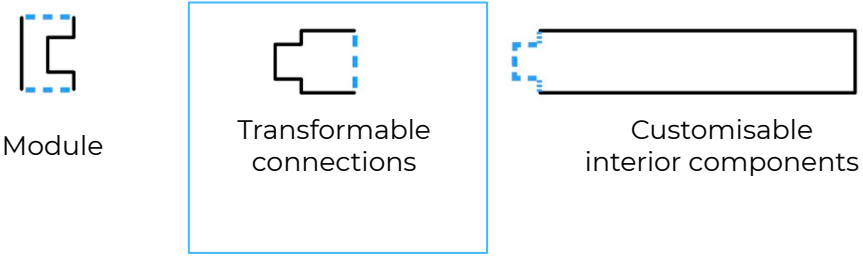
Customisable interior components

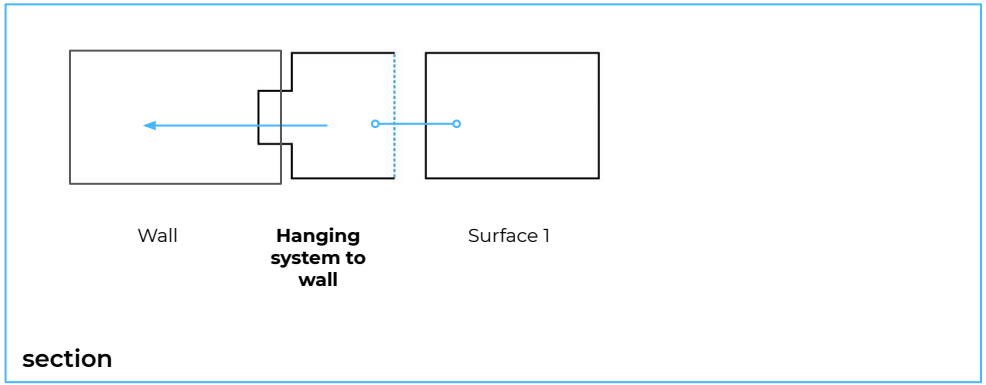


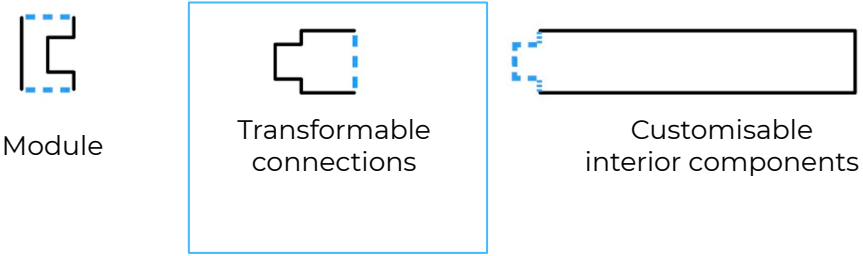
Wall

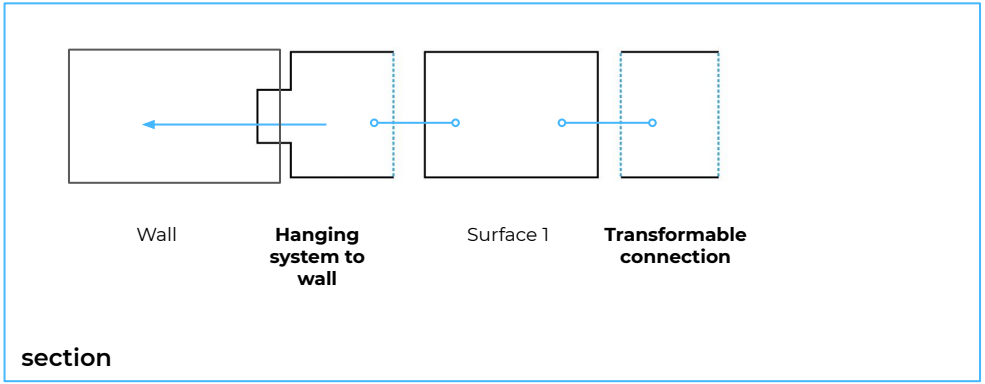
Hanging system to wall

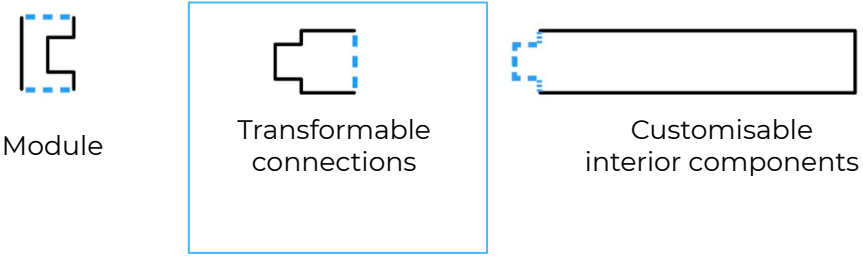
section

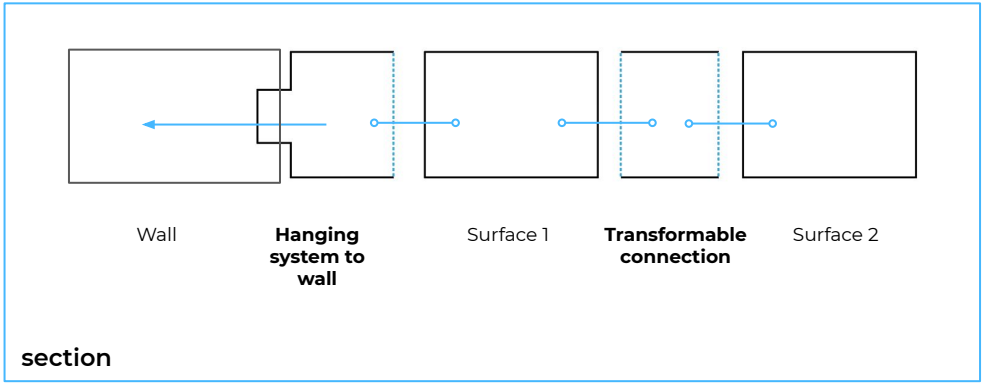

Module
Transformable connections
Customisable interior components

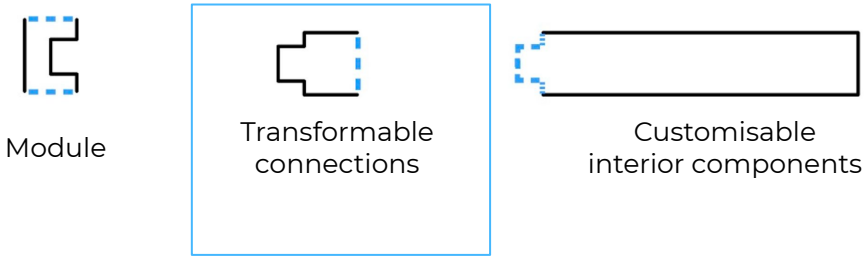

Wall
Hanging system to wall
Surface 1
section

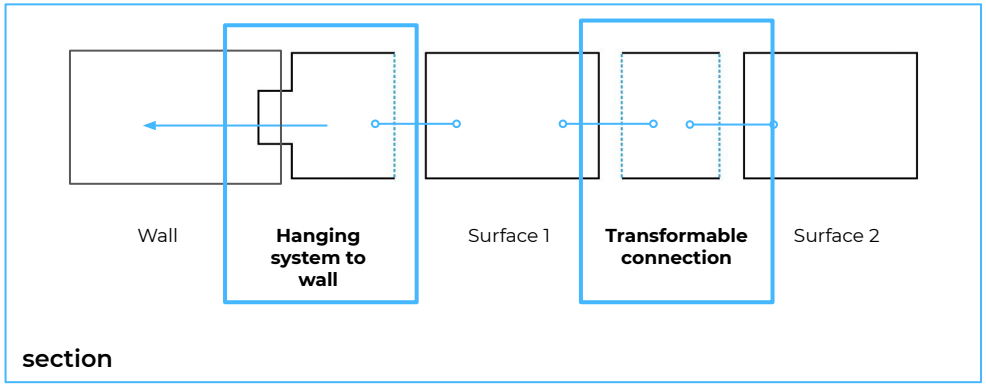

Module
Transformable connections
Customisable interior components


Wall
Hanging system to wall
Surface 1
Transformable connection
section


Module
Transformable connections
Customisable interior components


Wall
Hanging system to wall
Surface 1
Transformable connection
Surface 2
section


Module
Transformable connections
Customisable interior components


Wall
Hanging system to wall
Surface 1
Transformable connection
Surface 2
section

Module

Transformable connections

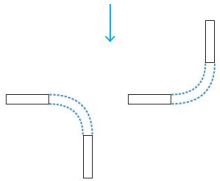


Illustration: Scheme for folding system (own illustration)

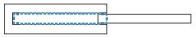


Illustration: Scheme for Sliding system (own illustration)

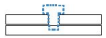


Illustration: Scheme for clip system (own illustration)

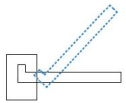
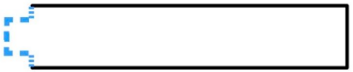


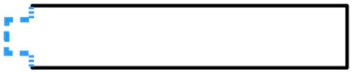
Illustration: Scheme for main hanging system (own illustration)



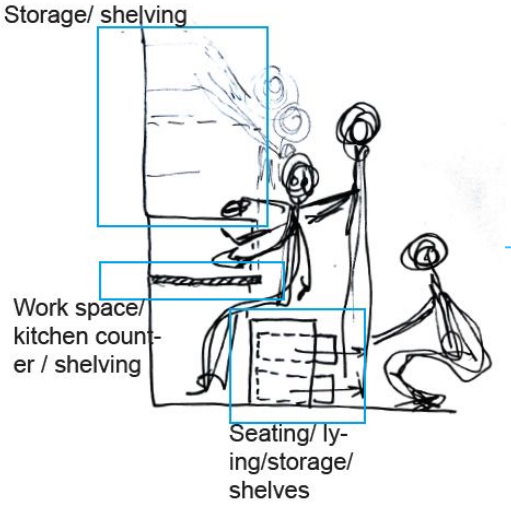
Customisable interior components

Module

Transformable connections



Customisable interior components



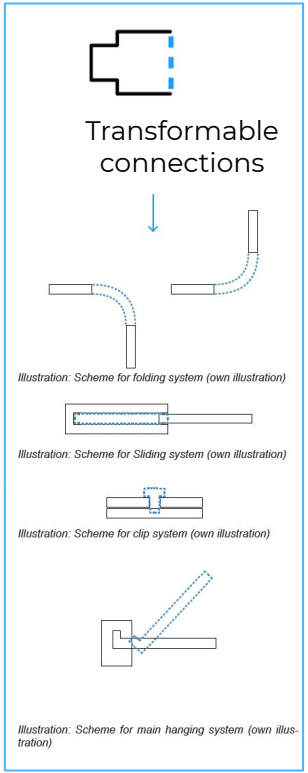


Illustration: Scheme for folding system (own illustration)

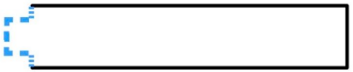
Illustration: Scheme for Sliding system (own illustration)

Illustration: Scheme for clip system (own illustration)

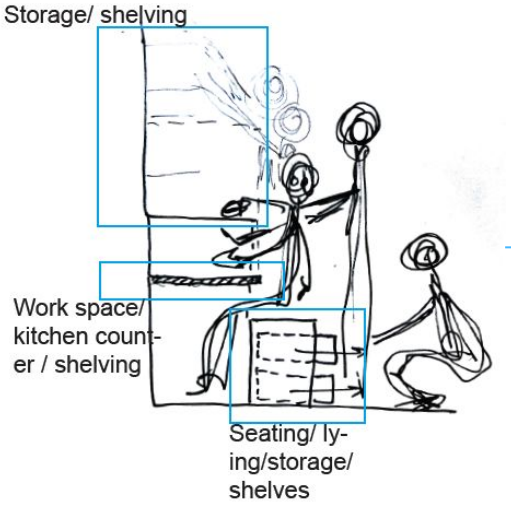
Illustration: Scheme for main hanging system (own illustration)

Module

Transformable connections



Customisable interior components



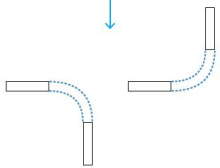


Illustration: Scheme for folding system (own illustration)

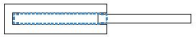


Illustration: Scheme for Sliding system (own illustration)

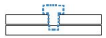


Illustration: Scheme for clip system (own illustration)

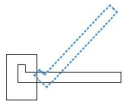
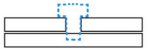


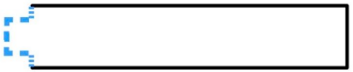
Illustration: Scheme for main hanging system (own illustration)



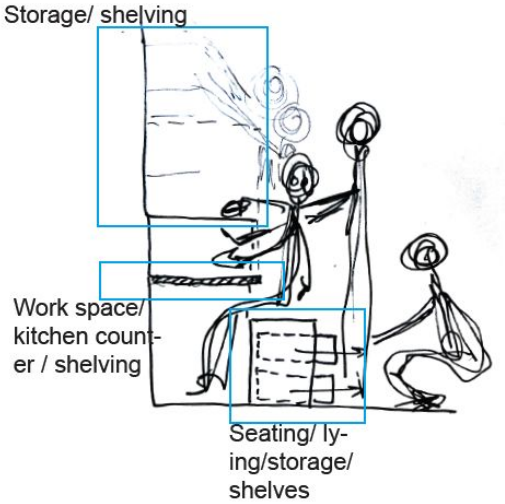
CLIP SYSTEM

Module

Transformable connections



Customisable interior components



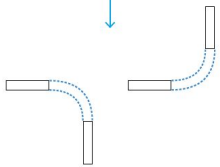


Illustration: Scheme for folding system (own illustration)

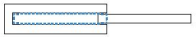


Illustration: Scheme for Sliding system (own illustration)

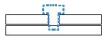


Illustration: Scheme for clip system (own illustration)

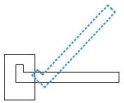
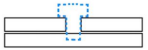


Illustration: Scheme for main hanging system (own illustration)

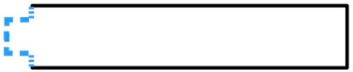


CLIP SYSTEM

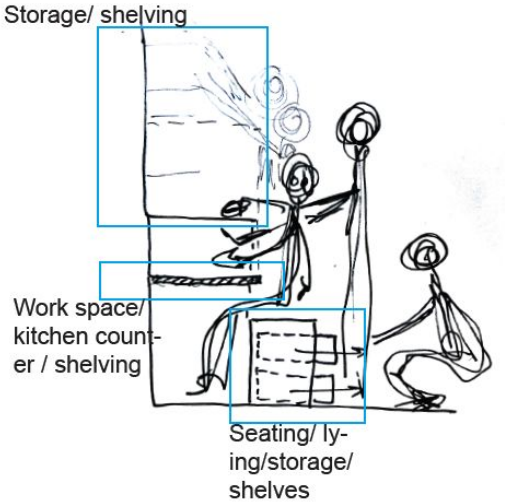
SLIDING SYSTEM

Module

Transformable connections



Customisable interior components



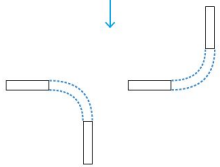


Illustration: Scheme for folding system (own illustration)

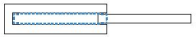


Illustration: Scheme for Sliding system (own illustration)

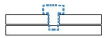


Illustration: Scheme for clip system (own illustration)

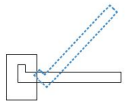
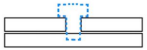
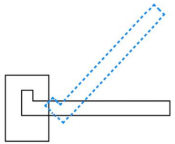


Illustration: Scheme for main hanging system (own illustration)



CLIP SYSTEM

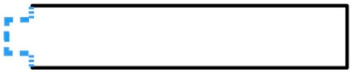
SLIDING SYSTEM



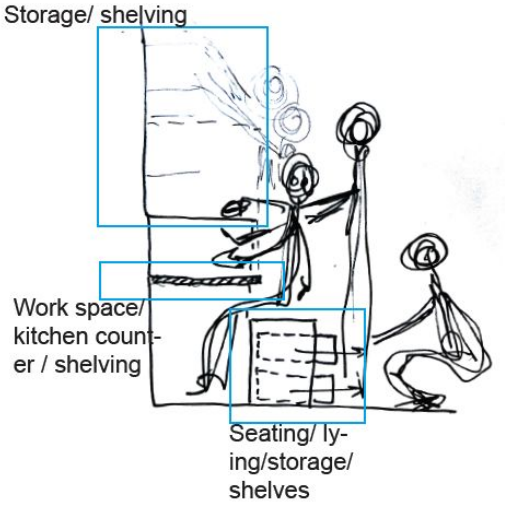
HANGING SYSTEM

Module

Transformable connections



Customisable interior components



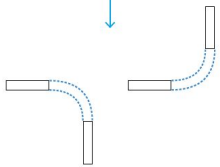


Illustration: Scheme for folding system (own illustration)

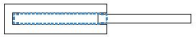


Illustration: Scheme for Sliding system (own illustration)

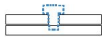


Illustration: Scheme for clip system (own illustration)

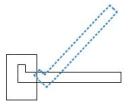
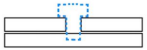
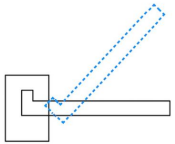


Illustration: Scheme for main hanging system (own illustration)

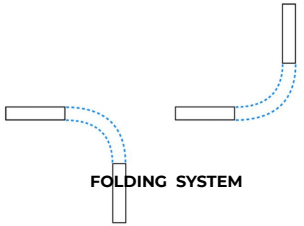


CLIP SYSTEM

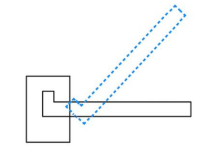
SLIDING SYSTEM



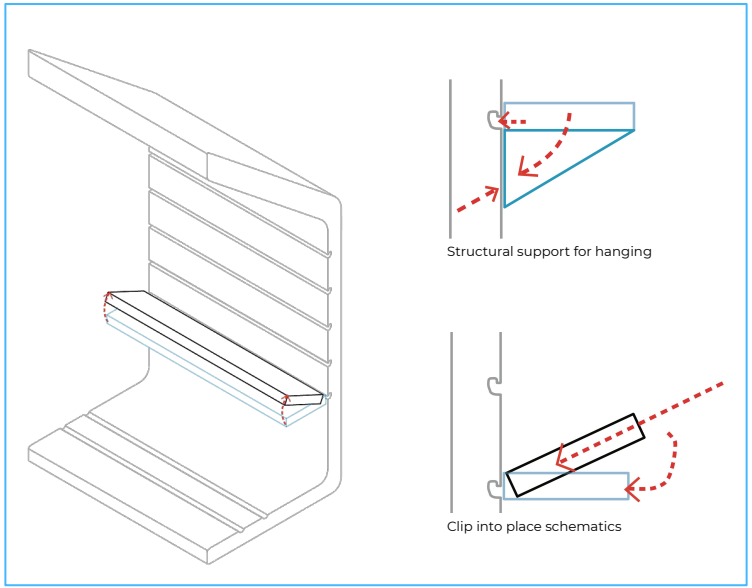
HANGING SYSTEM



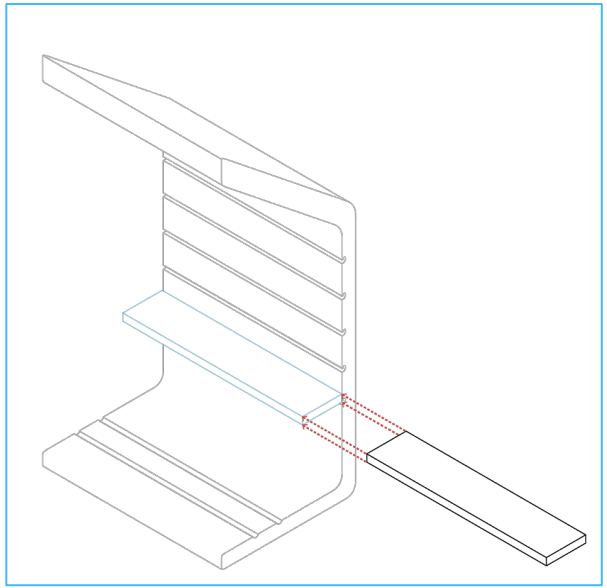
FOLDING SYSTEM



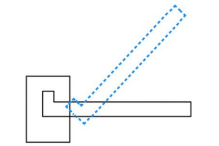
HANGING SYSTEM



Clip into place system



Slide into place system



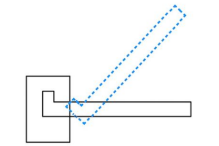
HANGING SYSTEM

1. Possibility to bear the load of any extensions designed beyond the transformable connection
2. Single person handling when transforming as a connection
3. Maximum possible movements during life span (In the case of the hanging system, this will be a minimum due to most components suspended from this hanging transformable system will be more permanent components. What will happen past the extension of this transformable connection will require to transform much more itself than the hanging system)
4. Possibility to allow movement in one direction if transformation requires such movement for 'installation purposes'.
5. Maximum possible movement or maximum possible holding of the movement in place until failure of the connection.

RELATIVE IMPORTANCE OF DETAILED DESIGN CRITERIA FOR TRANSFORMABLE CONNECTIONS

Primary criteria considered	Possibility to move in direction when transforming	Load bearing of transformable connections	Maximum movement until faliure	max number of movements per lifespan	Bending radius	Expandability	Transformation distance	Single person handling	TOTAL SCORE
	To be considered against								
Possibility to move in direction when transforming		0	1	1	2	2	2	0	8
Load bearing of transformable connections	2		2	2	2	2	2	1	13
Maximum movement until faliure	1	0		1	2	2	2	0	8
max number of movements per lifespan	1	0	1		2	2	2	1	9
Bending radius	0	0	0	0		0	0	0	0
Expandability	0	0	0	0	0		0	0	0
Transformation distance	0	0	0	0	0	0		0	0
Single person handling	2	1	2	2	2	2	2		13

0- less important
1- equally important
2- More important



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	To be considered against								
Possibility to move in direction when transforming		0	1	1	2	2	2	0	8
Load bearing of transformable connections	2		2	2	2	2	2	1	13
Maximum movement until faliure	1	0		1	2	2	2	0	8
max number of movements per lifespan	1	0	1		2	2	2	1	9
Bending radius	0	0	0	0		0	0	0	0
Expandability	0	0	0	0	0		0	0	0
Transformation distance	0	0	0	0	0	0		0	0
Single person handling	2	1	2	2	2	2	2		13

0- less important
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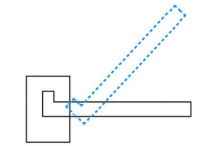

HANGING SYSTEM

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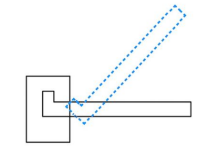
RELATIVE IMPORTANCE OF DETAILED DESIGN CRITERIA

FOR TRANSFORMABLE CONNECTIONS

Primary criteria considered	To be considered against: Possibility to move in one direction when transforming	Load bearing of transformable connections	Maximum movement until failure	max number of movement per lifespan	Bending radius	Expandability	Transformation distance	Single person handling	TOTAL SCORE
Possibility to move in direction when transforming		0	1	1	2	2	2	0	8
Load bearing of transformable connections	2		2	2	2	2	2	1	13
Maximum movement until faliure	1	0		1	2	2	2	0	8
max number of movements per lifespan	1	0	1		2	2	2	1	9
Bending radius	0	0	0	0		0	0	0	0
Expandability	0	0	0	0	0		0	0	0
Transformation distance	0	0	0	0	0	0		0	0
Single person handling	2	1	2	2	2	2	2		13

0- less important
1- equally important
2- More important



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Possibility to move in direction when transforming		0	1	1	2	2	2	0	8
Load bearing of transformable connections	2		2	2	2	2	2	1	13
Maximum movement until faliure	1	0		1	2	2	2	0	8
max number of movements per lifespan	1	0	1		2	2	2	1	9
Bending radius	0	0	0	0		0	0	0	0
Expandability	0	0	0	0	0		0	0	0
Transformation distance	0	0	0	0	0	0		0	0
Single person handling	2	1	2	2	2	2	2		13

0- less important
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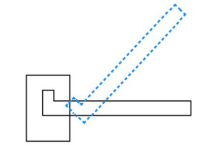

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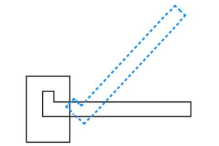
RELATIVE IMPORTANCE OF DETAILED DESIGN CRITERIA

FOR TRANSFORMABLE CONNECTIONS

Primary criteria considered	To be considered against: Possibility to move in one direction when transforming	Load bearing of transformable connections	Maximum movement until failure	max number of movement per lifespan	Bending radius	Expandability	Transformation distance	Single person handling	TOTAL SCORE
Possibility to move in direction when transforming		0	1	1	2	2	2	0	8
Load bearing of transformable connections	2		2	2	2	2	2	1	13
Maximum movement until faliure	1	0		1	2	2	2	0	8
max number of movements per lifespan	1	0	1		2	2	2	1	9
Bending radius	0	0	0	0		0	0	0	0
Expandability	0	0	0	0	0		0	0	0
Transformation distance	0	0	0	0	0	0		0	0
Single person handling	2	1	2	2	2	2	2		13

0- less important
1- equally important
2- More important



HANGING SYSTEM

1. Possibility to bear the load of any extensions designed beyond the transformable connection
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4. Possibility to allow movement in one direction if transformation requires such movement for 'installation purposes'.
5. Maximum possible movement or maximum possible holding of the movement in place until failure of the connection.

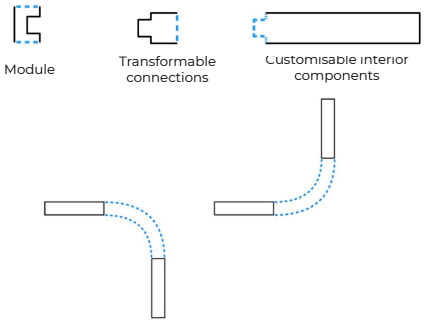
RELATIVE IMPORTANCE OF DETAILED DESIGN CRITERIA

FOR TRANSFORMABLE CONNECTIONS

Primary criteria considered	To be considered against								
	Possibility to move in direction when transforming		0	1	1	2	2	2	0	8
	Load bearing of transformable connections	2		2	2	2	2	2	1	13
	Maximum movement until faliure	1	0		1	2	2	2	0	8
	max number of movements per lifespan	1	0	1		2	2	2	1	9
	Bending radius	0	0	0	0		0	0	0	0
	Expandability	0	0	0	0	0		0	0	0
	Transformation distance	0	0	0	0	0	0		0	0
	Single person handling	2	1	2	2	2	2	2		13

Possibility to move in one direction when transforming
Load bearing of transformable connections
Maximum movement until failure
max number of movements per lifespan
Bending radius
Expandability
Transformation distance
Single person handling
TOTAL SCORE

0- less important
1- equally important
2- More important



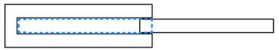
FOLDING SYSTEM

1. Possibility to move in a single direction when transforming
2. Have a bending radius of 45 < in order to successfully transform
3. Possibility to expand as a result of transforming
4. Ability for a single person to handle the transformation
5. Be able to transform to a maximum degree (2) without failure
6. Have the ability to transform to a maximum amount of its life span (maximum amount of movements per life span depends on the extended function adapted by the designer.)

RELATIVE IMPORTANCE OF DETAILED DESIGN CRITERIA
FOR TRANSFORMABLE CONNECTIONS

Primary criteria considered	Possibility to move in direction when transforming	Load bearing of transformable connections	Maximum movement until faliure	max number of movements per lifespan	Bending radius	Expandability	Transformation distance	Single person handling	TOTAL
	To be considered against								
Possibility to move in direction when transforming		2	2	1	1	1	2	1	10
Load bearing of transformable connections	0		0	1	0	0	0	1	2
Maximum movement until faliure	0	2		1	1	0	1	0	5
max number of movements per lifespan	0	2	1		0	0	1	1	5
Bending radius	1	2	1	1		2	2	1	10
Expandability	1	2	2	1	1		2	1	10
Transformation distance	1	2	1	1	0	0		1	6
Single person handling	1	2	1	1	1	1	1		8

0- less important
1- equally important
2- More important



SLIDING SYSTEM

1. Possibility to move in a parallel direction when transforming as a connection
2. Ease of handling for a single person when transforming
3. Possibility to bear load pre and post-transformation
4. Possibility to extend a maximum amount of times necessary before failure**
5. Have the ability to transform to a maximum amount of its life span (maximum amount of movements per life span depends on the extended function adapted by the designer.)

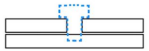
According to the above requirements and functional requirements, the sliding movement could be divided into two main categories;
1. Purely for the purpose of extension and load-bearing after transforming as a connection
2. As an extension that can fold and 'cover' the objects below or above after transforming as a connection

RELATIVE IMPORTANCE OF DETAILED DESIGN CRITERIA

FOR TRANSFORMABLE CONNECTIONS

Primary criteria considered	Possibility to move in single direction when transforming	Load bearing of transformable connections	Maximum movement until faliure	max number of movements per lifespan	Bending radius	Expandability (for the hinge itself to expand as per design)	Transformation distance	Single person handling	TOTAL SCORE
	To be considered against								
Possibility to move in single direction when transforming		2	2	2	2	2	1	1	12
Load bearing of transformable connections	0		1	2	2	2	1	1	9
Maximum movement until faliure	0	1		2	2	2	1	0	8
max number of movements per lifespan	1	1	1		2	2	1	0	8
Bending radius	0	0	0	0		0	0	0	0
Expandability (for the hinge itself to expand as per design)	0	0	0	0	1		0	0	1
Transformation distance	0	0	0	0	0	2		0	2
Single person handling	1	1	2	2	2	2	2		12

0- less important
1- equally important
2- More important



CLIP SYSTEM

1. Single person handling when transforming as a connection
2. Possibility to transform to a necessary amount of times as needed in its life span
3. Maximum Number of movements as required before failure
4. Have a substantial bending radius for the connection to transform
5. Possibility to bare load before and after transforming as a connection

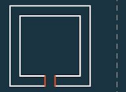
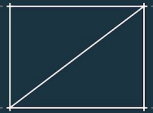
RELATIVE IMPORTANCE OF DETAILED DESIGN CRITERIA FOR TRANSFORMABLE CONNECTIONS

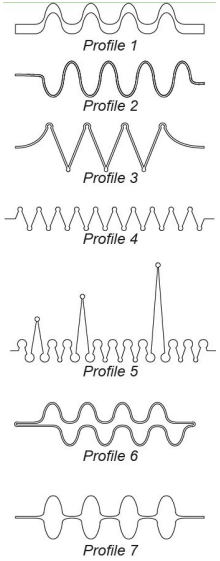
Primary criteria considered	Possibility to move in one direction when transforming	Load bearing of transformable connections	Maximum movement until faliure	max number of movement per lifespan	Bending radius	Expandability	Transformation distance	Single person handling	TOTAL SCORE
	To be considered against								
Possibility to move in direction when transforming		0	0	0	0	0	0	0	0
Load bearing of transformable connections	0		1	1	1	2	0	1	6
Maximum movement until faliure	2	1		1	2	2	2	1	11
max number of movements per lifespan	2	1	2		2	2	2	1	12
Bending radius	2	1	1	1		2	2	1	10
Expandability	0	0	0	0	0		0	0	0
Transformation distance	0	0	0	0	0	0		0	0
Single person handling	2	2	1	1	2	2	2		12

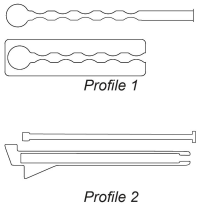
0- less important
1- equally important
2- More important

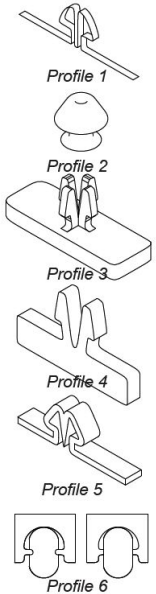
DESIGN RULES FOR 3D PRINTING

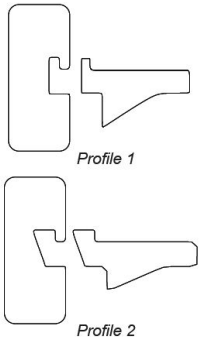
3D HUBS

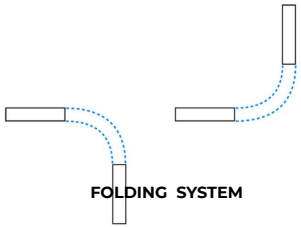
	Supported Walls	Unsupported Walls	Support	Embossed & Engraved Details	Horizontal Bridges	Holes	Connecting & Moving Parts	Escape Holes	Minimum Features	Pin Diameter
	Walls that are connected to other structures on at least two sides.	Walls that are connected to the rest of the print on only one side.	The maximum angle a wall can be printed out without requiring support.	Features on the model that are raised or recessed below the model surface	The span a technology can print without the need for support.	The minimum diameter a technology can successfully print a hole.	The recommended clearance between 2 moving or connecting parts.	The minimum diameter of escape holes to allow for the removal of build material.	The recommended minimum size of a feature to ensure it will not fail to print.	The minimum diameter a pin can be printed at.
										
Fused Filament Fabrication	0.8mm	0.8mm	45°	0.6mm wide & 2mm high	10mm	Ø2mm	0.5mm		2mm	3mm



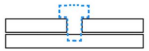


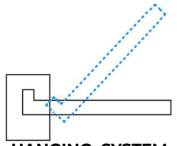


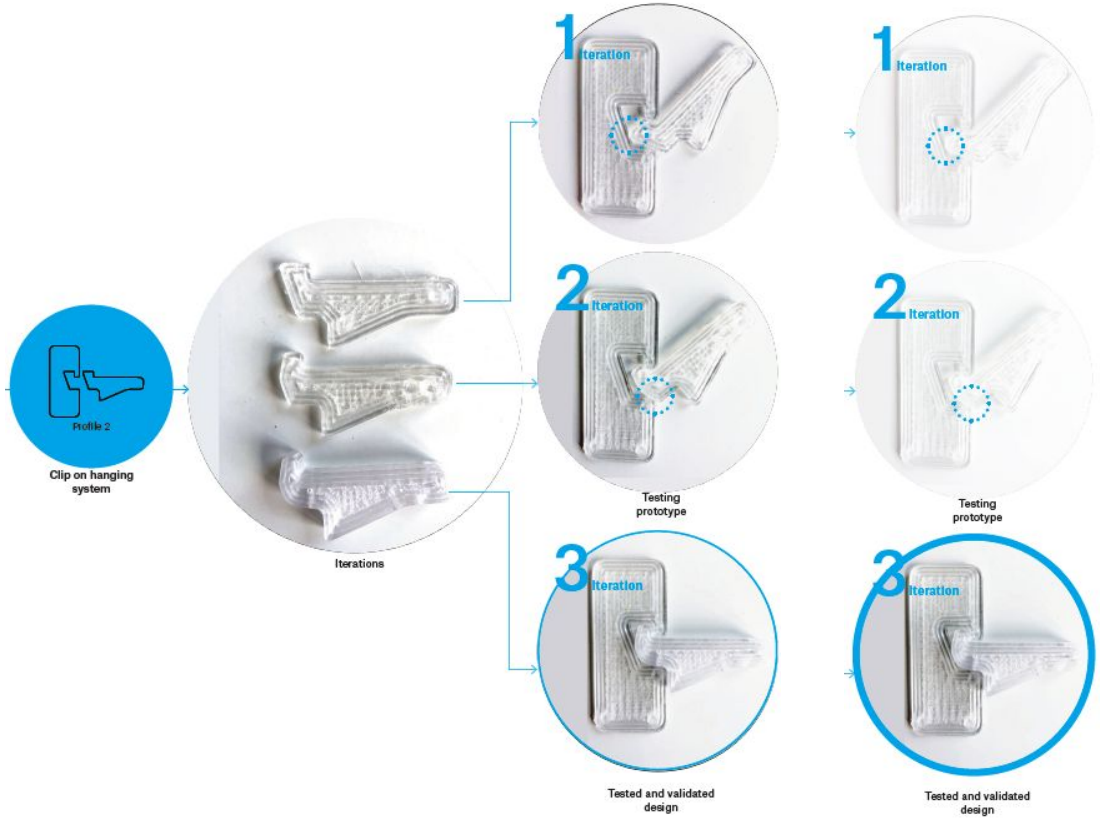



FOLDING SYSTEM


SLIDING SYSTEM


CLIP SYSTEM

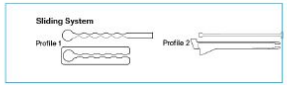

HANGING SYSTEM

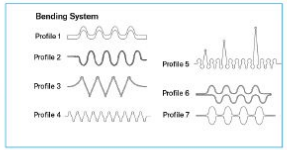

Profile 2
Clip on hanging system
Iterations
1 Iteration
2 Iteration
3 Iteration
Testing prototype
Tested and validated design
1 Iteration
2 Iteration
3 Iteration
Testing prototype
Tested and validated design

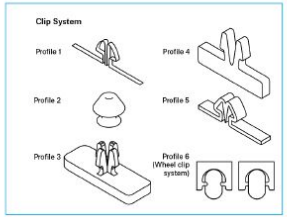
Validation of physical functionality after prototyping

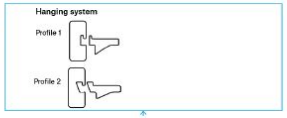
	Type/name	Possibility to move in a direction	Load bearing capacity	Bending capacity (degree)	Possibility to expand	Single person handling	Possibility of duplicating as a surface	Ease of handling	Success after prototyping	Success after testing	Total
	Sliding system										
	Profile 1	2	0	2	2	2	0	-	2	2	12
1	Profile 2	2	2	2	2	2	2	-	2	2	16
	Folding system										
	Profile 1	0	-	0	0	2	2	1	2	1	7
	Profile 2	2	-	0	2	2	2	1	2	1	11
	Profile 3	2	-	2	2	2	2	2	2	2	14
	Profile 4	2	-	2	2	2	2	2	2	2	14
	Profile 5	2	-	2	0	2	0	2	2	2	10
	Profile 6	0	-	0	2	2	2	1	2	1	9
2	Profile 7	0	-	0	2	2	2	1	2	1	9
	Clip system										
	Profile 1	-	0	0	-	2	-	-	2	0	4
	Profile 2	-	2	2	-	2	-	-	0	0	6
	Profile 3	-	2	2	-	2	-	-	0	0	6
	Profile 4	-	2	2	-	2	-	-	2	2	10
	Profile 5	-	2	2	-	2	-	-	2	0	8
3	Profile 6	-	2	2	-	2	-		2	2	10
	Hanging system										
	Profile 1	-	0	2	-	2	-	2	2	0	8
4	Profile 2	-	2	2	-	2	-	2	2	2	10

PROTOTYPE JOINTS TEST JOINTS ACCORDING TO RELATIVE IMPORTANCE OF DESIGN CRITERIA









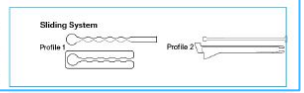
GRADING SYSTEM		Sliding	Folding	Clip	Hanging
	Single	0	2	-	-
	Double	0	2	-	-
	Multiple	0	1	-	-
Direction	None	2	0	-	-
	Yes	2	-	2	2
Load bearing Capacity	No	1	-	0	0
	>90° - no	0	0	2	0
	<90 - yes	0	2	0	0
Minimum bending degree	none	2	0	2	2
	Yes	0	2	-	-
Expandability	No	2	0	-	-
	Yes	2	2	2	2
Single person handling	No	0	0	0	0
	Yes	2	2	-	-
Duplicate as surface	No	0	0	-	-
	Easy	-	2	-	2
Ease of handling	Medium	-	1	-	0
	Yes	2	2	2	2
Sucess after prototyping	No	0	0	0	0
	Yes	2	2	2	2
Success after testing	No	0	0	0	0
	Partially	1	1	1	1

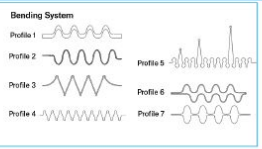
Validation of physical functionality after prototyping

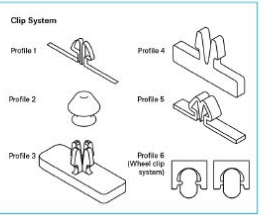
TEST JOINTS ACCORDING TO RELATIVE IMPORTANCE OF DESIGN CRITERIA

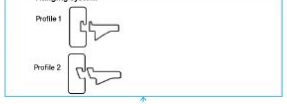
PROTOTYPE JOINTS

	Type/name	Possibility to move in a direction	Load bearing capacity	Bending capacity (degree)	Possibility to expand	Single person handling	Possibility of duplicating as a surface	Ease of handling	Sucess after prototyping	Success after testing	Total
	Sliding system										
	Profile 1	2	0	2	2	2	0	-	2	2	12
1	Profile 2	2	2	2	2	2	2	-	2	2	16
	Folding system										
	Profile 1	0	-	0	0	2	2	1	2	1	7
	Profile 2	2	-	0	2	2	2	1	2	1	11
	Profile 3	2	-	2	2	2	2	2	2	2	14
	Profile 4	2	-	2	2	2	2	2	2	2	14
	Profile 5	2	-	2	0	2	0	2	2	2	10
	Profile 6	0	-	0	2	2	2	1	2	1	9
2	Profile 7	0	-	0	2	2	2	1	2	1	9
	Clip system										
	Profile 1	-	0	0	-	2	-	-	2	0	4
	Profile 2	-	2	2	-	2	-	-	0	0	6
	Profile 3	-	2	2	-	2	-	-	0	0	6
	Profile 4	-	2	2	-	2	-	-	2	2	10
	Profile 5	-	2	2	-	2	-	-	2	0	8
3	Profile 6	-	2	2	-	2	-		2	2	10
	Hanging system										
	Profile 1	-	0	2	-	2	-	2	2	0	8
4	Profile 2	-	2	2	-	2	-	2	2	2	10







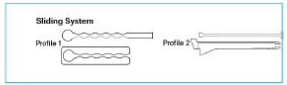


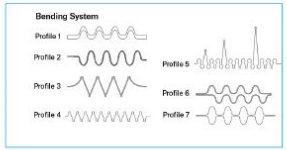
GRADING SYSTEM		Sliding	Folding	Clip	Hanging
	Single	0	2	-	-
	Double	0	2	-	-
	Multiple	0	1	-	-
Direction	None	2	0	-	-
	Yes	2	-	2	2
Load bearing Capacity	No	1	-	0	0
	>90° - no	0	0	2	0
	<90 - yes	0	2	0	0
Minimum bending degree	none	2	0	2	2
	Yes	0	2	-	-
Expandability	No	2	0	-	-
	Yes	2	2	2	2
Single person handling	No	0	0	0	0
	Yes	2	2	-	-
Duplicate as surface	No	0	0	-	-
	Easy	-	2	-	2
Ease of handling	Medium	-	1	-	0
	Yes	2	2	2	2
Sucess after prototyping	No	0	0	0	0
	Yes	2	2	2	2
Success after testing	No	0	0	0	0
	Partially	1	1	1	1

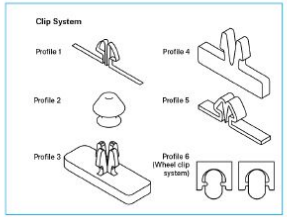
Validation of physical functionality after prototyping

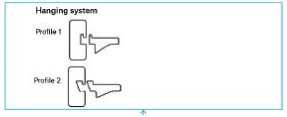
PROTOTYPE JOINTS TEST JOINTS ACCORDING TO RELATIVE IMPORTANCE OF DESIGN CRITERIA

	Type/name	Possibility to move in a direction	Load bearing capacity	Bending capacity (degree)	Possibility to expand	Single person handling	Possibility of duplicating as a surface	Ease of handling	Success after prototyping	Success after testing	Total
	Sliding system										
	Profile 1	2	0	2	2	2	0	-	2	2	12
1	Profile 2	2	2	2	2	2	2	-	2	2	16
	Folding system										
	Profile 1	0	-	0	0	2	2	1	2	1	7
	Profile 2	2	-	0	2	2	2	1	2	1	11
	Profile 3	2	-	2	2	2	2	2	2	2	14
	Profile 4	2	-	2	2	2	2	2	2	2	14
	Profile 5	2	-	2	0	2	0	2	2	2	10
	Profile 6	0	-	0	2	2	2	1	2	1	9
2	Profile 7	0	-	0	2	2	2	1	2	1	9
	Clip system										
	Profile 1	-	0	0	-	2	-	-	2	0	4
	Profile 2	-	2	2	-	2	-	-	0	0	6
	Profile 3	-	2	2	-	2	-	-	0	0	6
	Profile 4	-	2	2	-	2	-	-	2	2	10
	Profile 5	-	2	2	-	2	-	-	2	0	8
3	Profile 6	-	2	2	-	2	-		2	2	10
	Hanging system										
	Profile 1	-	0	2	-	2	-	2	2	0	8
4	Profile 2	-	2	2	-	2	-	2	2	2	10









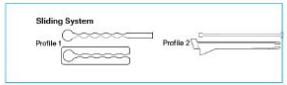
GRADING SYSTEM		Sliding	Folding	Clip	Hanging
	Single	0	2	-	-
	Double	0	2	-	-
	Multiple	0	1	-	-
Direction	None	2	0	-	-
	Yes	2	-	2	2
Load bearing Capacity	No	1	-	0	0
	>90° - no	0	0	2	0
	<90 - yes	0	2	0	0
Minimum bending degree	none	2	0	2	2
	Yes	0	2	-	-
Expandability	No	2	0	-	-
	Yes	2	2	2	2
Single person handling	No	0	0	0	0
	Yes	2	2	-	-
Duplicate as surface	No	0	0	-	-
	Easy	-	2	-	2
Ease of handling	Medium	-	1	-	0
	Yes	2	2	2	2
Sucess after prototyping	No	0	0	0	0
	Yes	2	2	2	2
Success after testing	No	0	0	0	0
	Partially	1	1	1	1

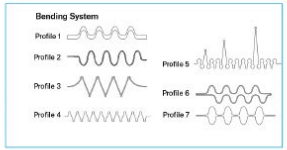
Validation of physical functionality after prototyping

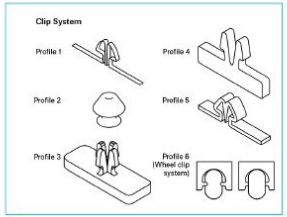
TEST JOINTS ACCORDING TO RELATIVE IMPORTANCE OF DESIGN CRITERIA

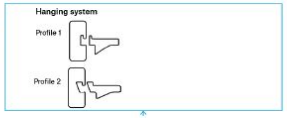
PROTOTYPE JOINTS

	Type/name	Possibility to move in a direction	Load bearing capacity	Bending capacity (degree)	Possibility to expand	Single person handling	Possibility of duplicating as a surface	Ease of handling	Success after prototyping	Success after testing	Total
	Sliding system										
	Profile 1	2	0	2	2	2	0	-	2	2	12
1	Profile 2	2	2	2	2	2	2	-	2	2	16
	Folding system										
	Profile 1	0	-	0	0	2	2	1	2	1	7
	Profile 2	2	-	0	2	2	2	1	2	1	11
	Profile 3	2	-	2	2	2	2	2	2	2	14
	Profile 4	2	-	2	2	2	2	2	2	2	14
	Profile 5	2	-	2	0	2	0	2	2	2	10
	Profile 6	0	-	0	2	2	2	1	2	1	9
2	Profile 7	0	-	0	2	2	2	1	2	1	9
	Clip system										
	Profile 1	-	0	0	-	2	-	-	2	0	4
	Profile 2	-	2	2	-	2	-	-	0	0	6
	Profile 3	-	2	2	-	2	-	-	0	0	6
	Profile 4	-	2	2	-	2	-	-	2	2	10
	Profile 5	-	2	2	-	2	-	-	2	0	8
3	Profile 6	-	2	2	-	2	-		2	2	10
	Hanging system										
	Profile 1	-	0	2	-	2	-	2	2	0	8
4	Profile 2	-	2	2	-	2	-	2	2	2	10







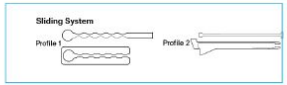


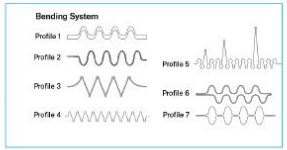
GRADING SYSTEM		Sliding	Folding	Clip	Hanging
	Single	0	2	-	-
	Double	0	2	-	-
	Multiple	0	1	-	-
Direction	None	2	0	-	-
	Yes	2	-	2	2
Load bearing Capacity	No	1	-	0	0
	>90° - no	0	0	2	0
	<90 - yes	0	2	0	0
Minimum bending degree	none	2	0	2	2
	Yes	0	2	-	-
Expandability	No	2	0	-	-
	Yes	2	2	2	2
Single person handling	No	0	0	0	0
	Yes	2	2	-	-
Duplicate as surface	No	0	0	-	-
	Easy	-	2	-	2
Ease of handling	Medium	-	1	-	0
	Yes	2	2	2	2
Sucess after prototyping	No	0	0	0	0
	Yes	2	2	2	2
Success after testing	No	0	0	0	0
	Partially	1	1	1	1

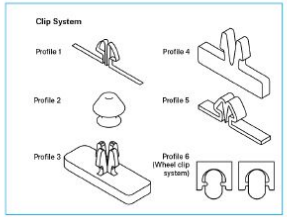
Validation of physical functionality after prototyping

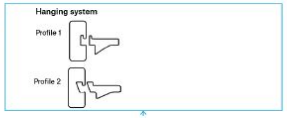
PROTOTYPE JOINTS TEST JOINTS ACCORDING TO RELATIVE IMPORTANCE OF DESIGN CRITERIA

	Type/name	Possibility to move in a direction	Load bearing capacity	Bending capacity (degree)	Possibility to expand	Single person handling	Possibility of duplicating as a surface	Ease of handling	Success after prototyping	Success after testing	Total
	Sliding system										
	Profile 1	2	0	2	2	2	0	-	2	2	12
1	Profile 2	2	2	2	2	2	2	-	2	2	16
	Folding system										
	Profile 1	0	-	0	0	2	2	1	2	1	7
	Profile 2	2	-	0	2	2	2	1	2	1	11
	Profile 3	2	-	2	2	2	2	2	2	2	14
	Profile 4	2	-	2	2	2	2	2	2	2	14
	Profile 5	2	-	2	0	2	0	2	2	2	10
	Profile 6	0	-	0	2	2	2	1	2	1	9
2	Profile 7	0	-	0	2	2	2	1	2	1	9
	Clip system										
	Profile 1	-	0	0	-	2	-	-	2	0	4
	Profile 2	-	2	2	-	2	-	-	0	0	6
	Profile 3	-	2	2	-	2	-	-	0	0	6
	Profile 4	-	2	2	-	2	-	-	2	2	10
	Profile 5	-	2	2	-	2	-	-	2	0	8
3	Profile 6	-	2	2	-	2	-		2	2	10
	Hanging system										
	Profile 1	-	0	2	-	2	-	2	2	0	8
4	Profile 2	-	2	2	-	2	-	2	2	2	10





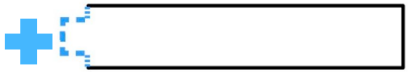




GRADING SYSTEM		Sliding	Folding	Clip	Hanging
	Single	0	2	-	-
	Double	0	2	-	-
	Multiple	0	1	-	-
Direction	None	2	0	-	-
	Yes	2	-	2	2
Load bearing Capacity	No	1	-	0	0
	>90° - no	0	0	2	0
	<90 - yes	0	2	0	0
Minimum bending degree	none	2	0	2	2
	Yes	0	2	-	-
Expandability	No	2	0	-	-
	Yes	2	2	2	2
Single person handling	No	0	0	0	0
	Yes	2	2	-	-
Duplicate as surface	No	0	0	-	-
	Easy	-	2	-	2
Ease of handling	Medium	-	1	-	0
	Yes	2	2	2	2
Sucess after prototyping	No	0	0	0	0
	Yes	2	2	2	2
Success after testing	No	0	0	0	0
	Partially	1	1	1	1

Module

Transformable connections



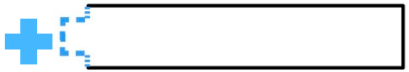
Customisable interior components

DESIGNING/ VALIDATING COMBINATION OF TRANSFORMABLE CONNECTIONS WITH SURFACES FOR COMBINED COMPONENT DESIGN

EXEMPLARY DESIGN

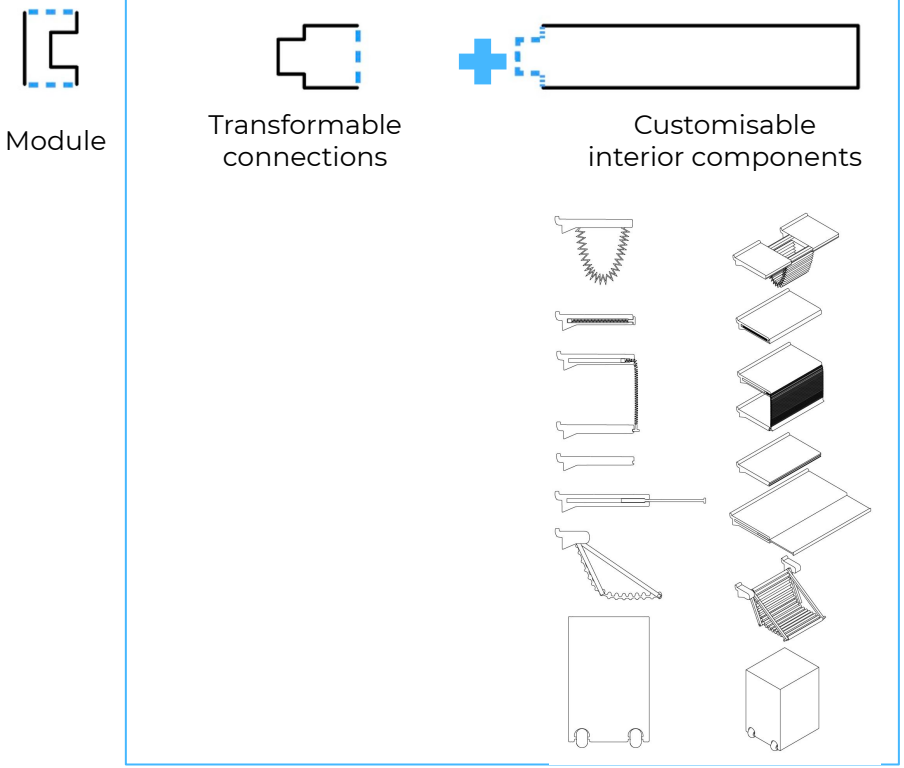
Module

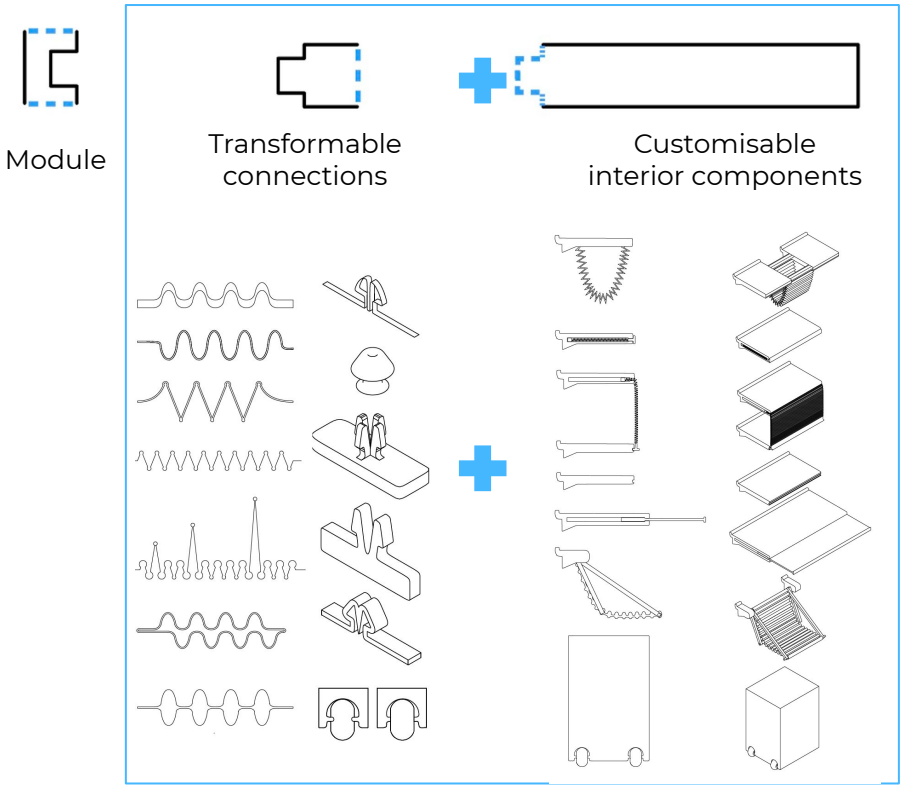
Transformable connections

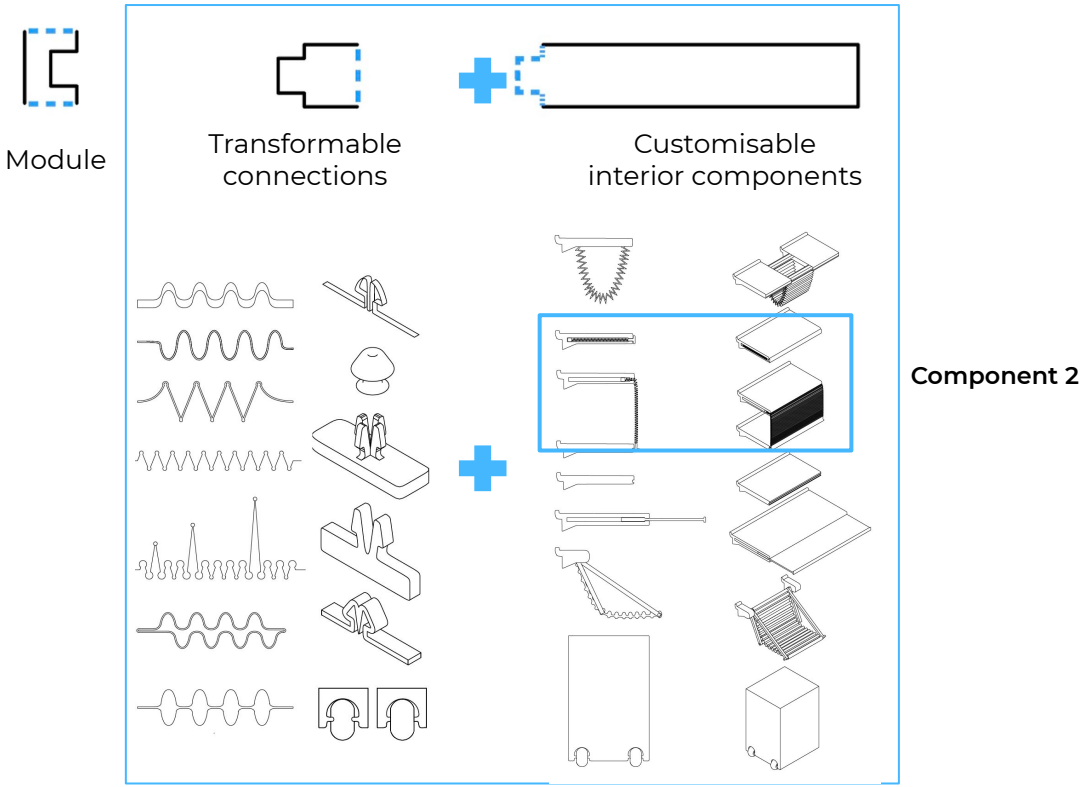


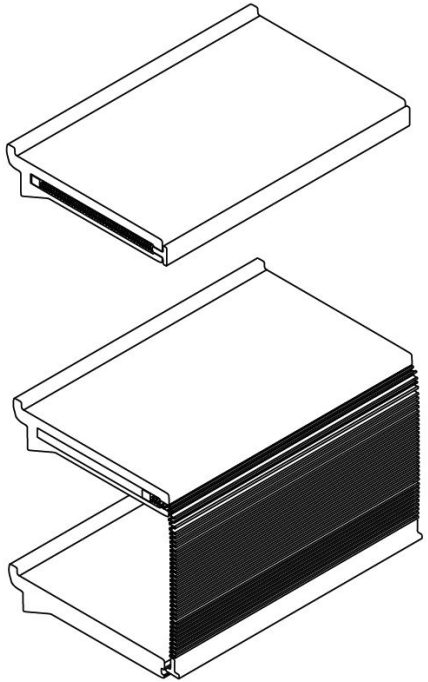
Customisable interior components

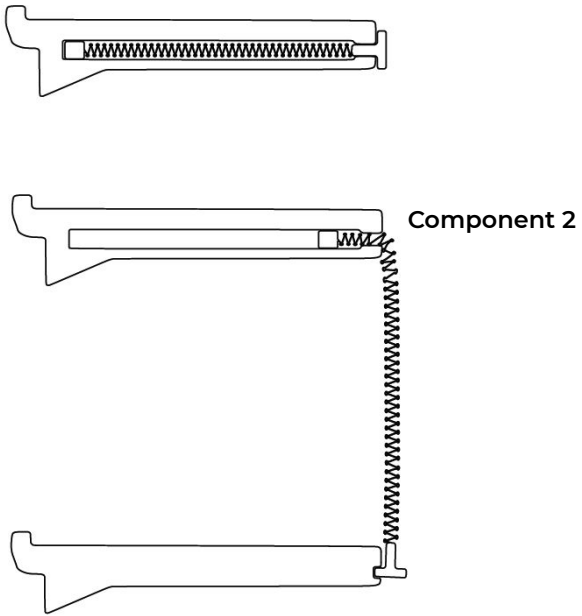
1. **ANYONE WITH ACCESS TO ONLINE PLATFORMS**
2. **ANYONE WITH ACCESS TO AN ADDITIVE MANUFACTURING MACHINE**
3. **ACCESSIBLE**


Module
Transformable connections
Customisable interior components


Module
Transformable connections
Customisable interior components


Module
Transformable connections
Customisable interior components
Component 2




Component 2

RELATIVE IMPORTANCE OF COMBINATION DESIGN CRITER

FOR TRANSFORMABLE CONNECTIONS

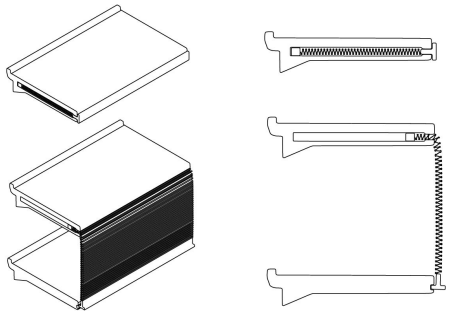
Primary criteria considered	Load bearing >50kg (weight of one person)	Load bearing <50kg (weight of regular goods)	Design for optimal print and material use.	Can be duplicated as a surface	Possibility to adapt to more than one function	Can be detached from wall	Ease of handling	Single person handling	
	To be considered against								
Load bearing >50kg (weight of one person)		0	0	0	0	0	0	0	0
Load bearing <50kg (weight of regular goods)	2		1	1	1	1	1	1	8
Design for optimal print and material use.	2	1		2	2	2	1	1	11
Can be duplicated as a surface	2	1	1		1	1	1	1	8
Possibility to adapt to more than one function	2	0	1	1		1	1	1	7
Can be detached from wall	2	0	0	1	1		1	1	6
Ease of handling	2	1	1	1	1	1		1	8
Single person handling	2	2	1	2	2	2	1		12

0- less important
1- equally important
2- More important

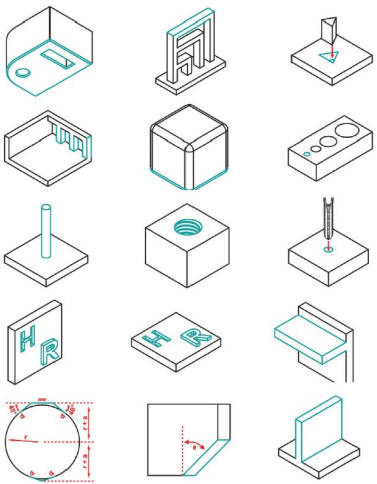
Anything below 5 not taken into consideration as the other criteria outweigh necessity

Design criteria in asscending relative importance for Sliding system

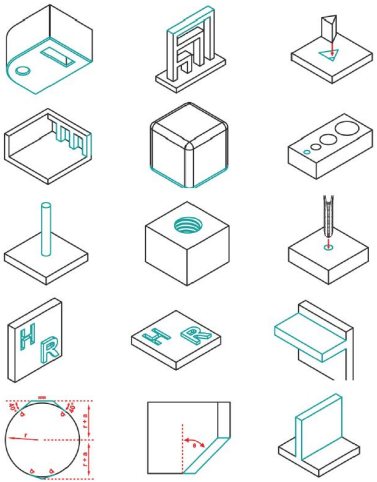
1 Single person handling
2 Design for optimal print and material use.
3 Load bearing <50kg (weight of regular goods)
3 Can be duplicated as a surface
3 Ease of handling
4 Possibility to adapt to more than one function
5 Can be detached from wall



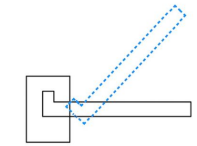
Component 2



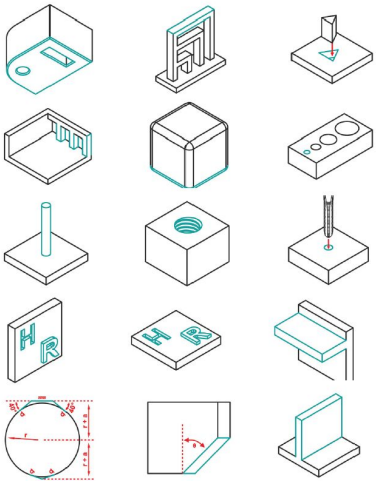
ADDITIVE MANUFACTURING CRITERIA



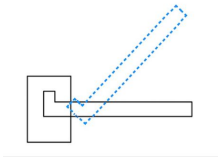
ADDITIVE MANUFACTURING CRITERIA



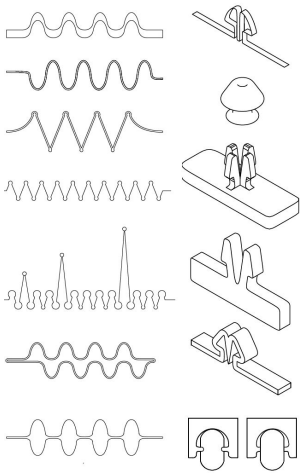
HANGING SYSTEM



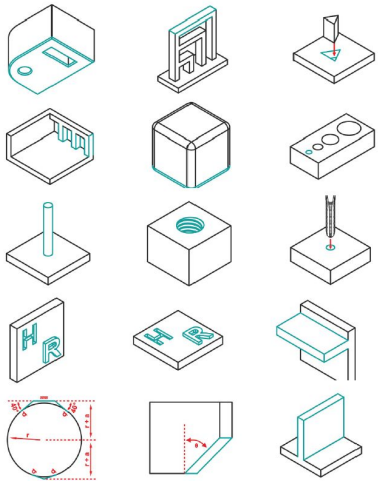
ADDITIVE MANUFACTURING CRITERIA



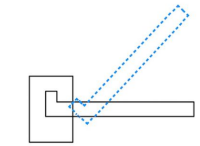
HANGING SYSTEM



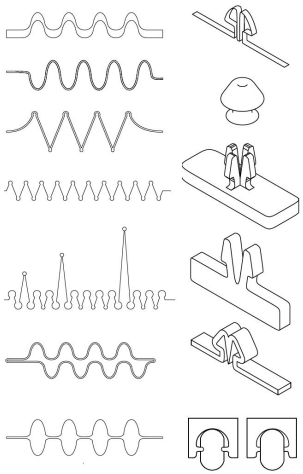
TRANSFORMABLE CONNECTIONS



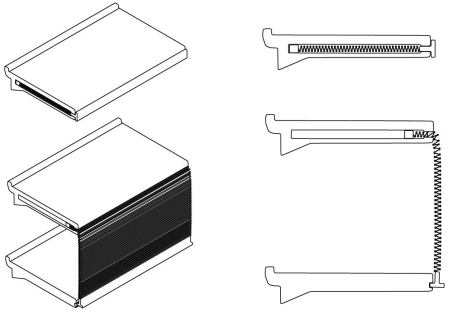
ADDITIVE MANUFACTURING CRITERIA



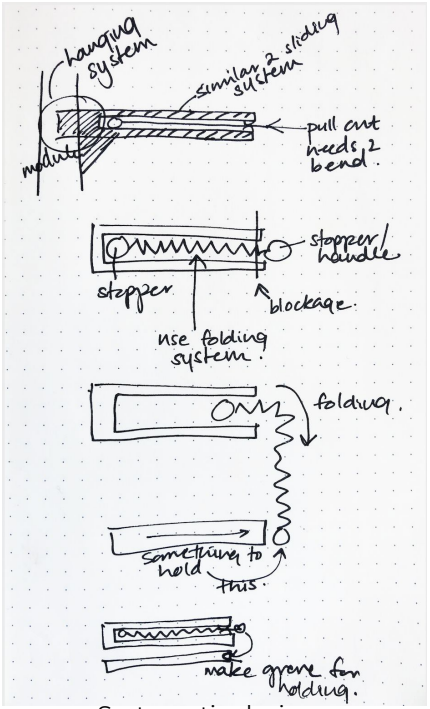
HANGING SYSTEM



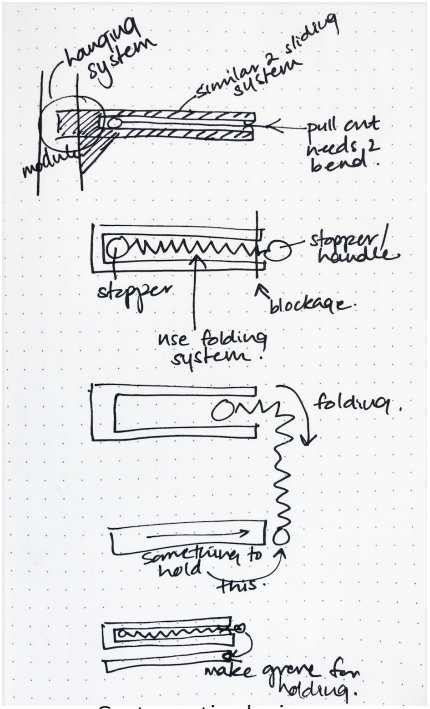
TRANSFORMABLE CONNECTIONS



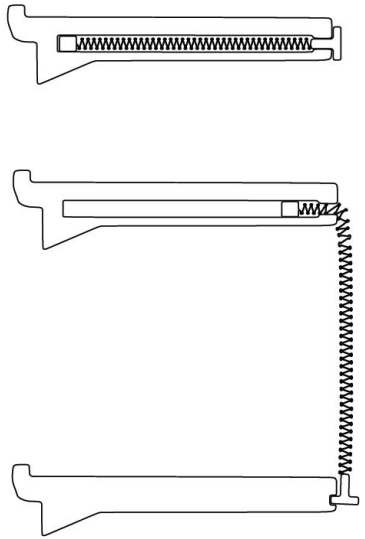
COMPONENT



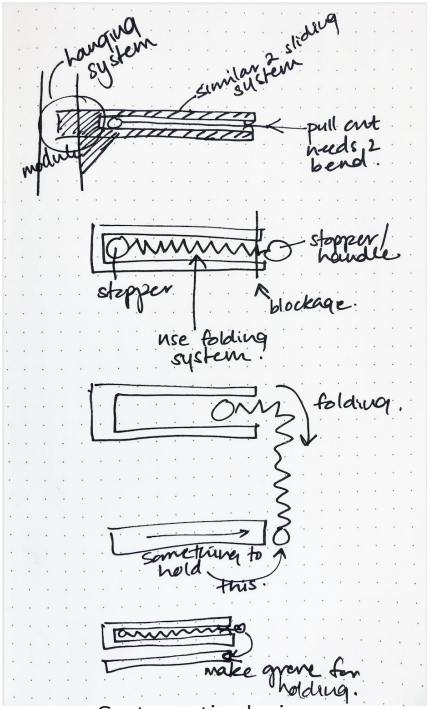
Systematic design



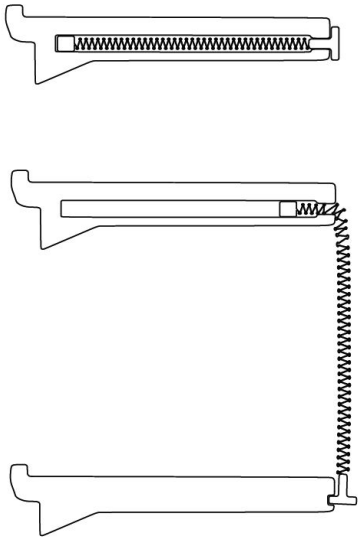
Systematic design



Digitally drawn



Systematic design



Digitally drawn

Rapid prototyped for validation

Type/name	Discription	Combination of transformable connections used
Component 1	Flat surface in combination with folding expandable surface	Hanging System + Folding System +Clip system
Component 2	Flat surface with hidden extendable surface	Hanging System + Sliding System + Folding system
Component 3	Flat surface with depression at the end for attachment	Hanging system + Clip System
Component 4	Falt surface with integrated extendable surface	Hanging system + Sliding System
Component 5	Grooved surface with expandability	Hanging system +Clip System + Folding System
Component 6	Rectangular component with attached wheels	Clip System + (other systems according to function)

TC = transformable connection
TBP = To be protptyped
TBT= To be tested

PROTOTYPE JOINTS	Do the TC's complement the possible fucntion	Can the component perform more than one function	Can the componnt bare weight	Is it possible to adapt the component for a different function	Ease of handling	Single person handling	**Success after prototyping**	**Success after testing**	**Total**
	2	2	2	2	2	2	tbp	tbt	12
	2	2	2	2	2	2	2	2	16
	2	0	2	2	2	2	2	2	14
	2	2	2	2	2	2	2	2	16
	2	0	2	2	2	2	tbp	tbt	10
	2	2	2	2	2	2	tbp	tbt	12

VALIDATION TABLE

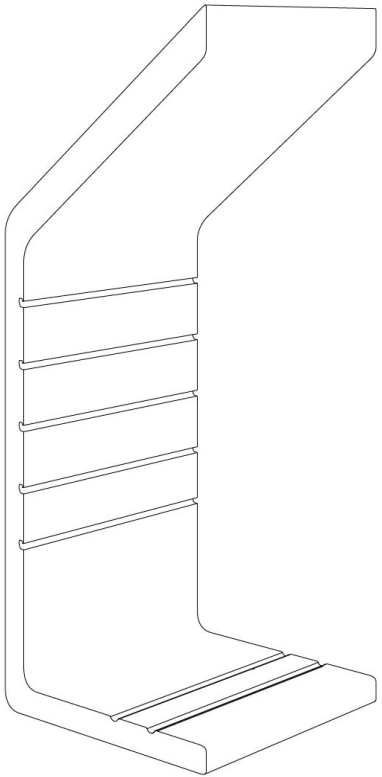
	Yes	To a certain extent	No
Do the TC's complement the possible fucntion	2	1	0

	Yes	No
Can the component perform more than one function	2	0

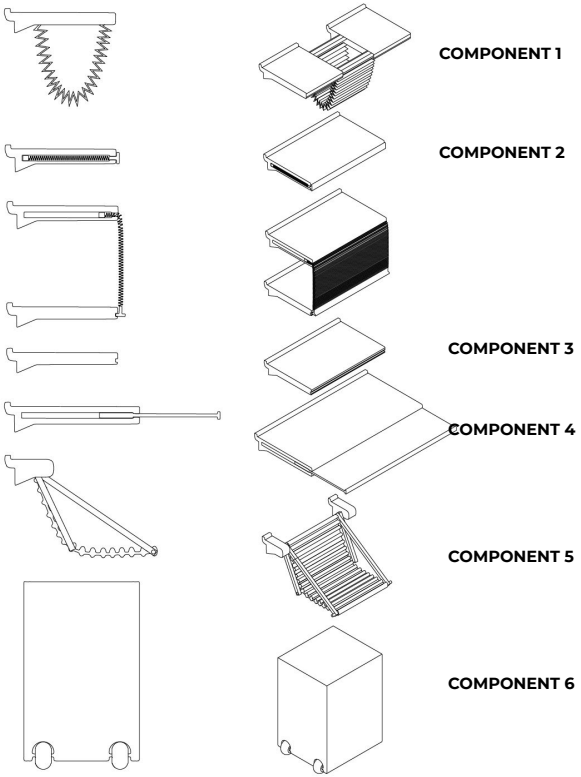
	Yes	Not needed by design	No
Can the componnt bare weight	2	2	0

	Yes	Not needed by design	No
Is it possible to adapt the component for a different function	2	2	0

NUMERICAL VALIDATION FOR COMPONENT 2



MODULE



EXEMPLARY COMPONENTS

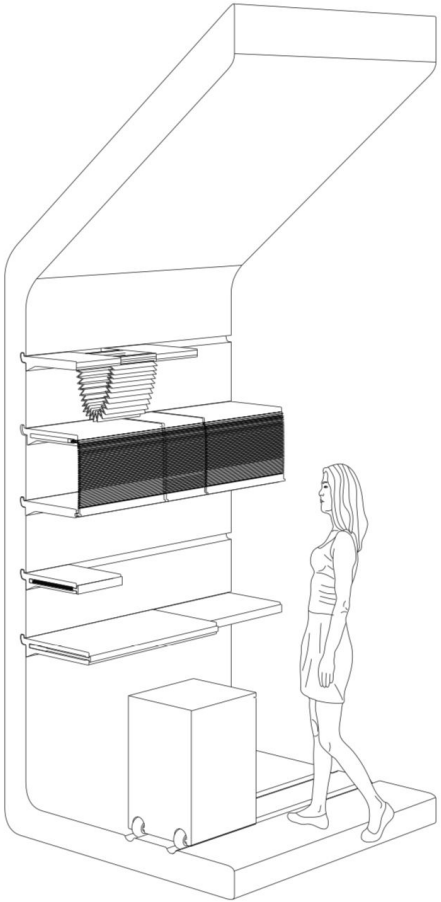


Illustration: Scheme of three sections of the design (Own Illustration)

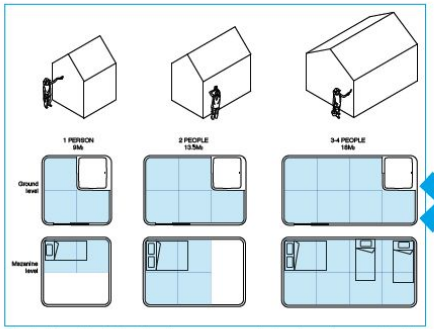


Illustration: Modular tiny house concept developed as context for this design task (Own Illustration)

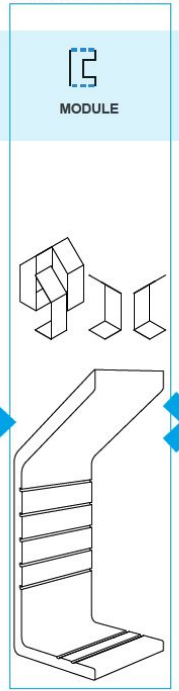


Illustration: Single module of tiny home designed as context for this design task and detail isometric of hanging system integrated to the wall of a single module (Own Illustration)

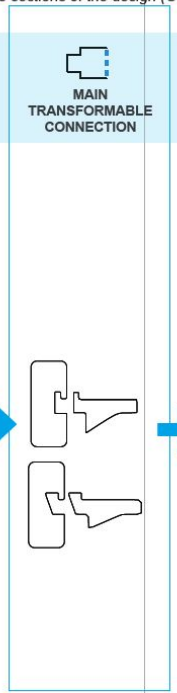


Illustration: Main hanging system for connecting the module with other transformable connections (Own Illustration)

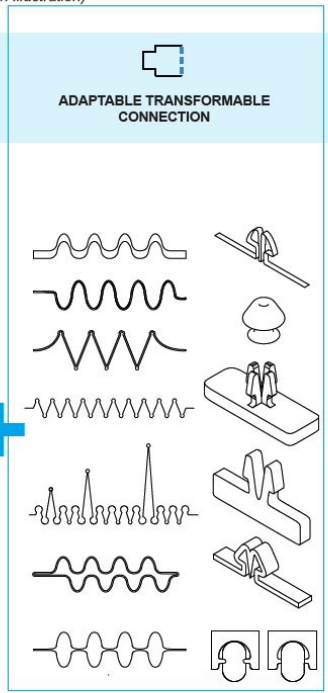


Illustration: Transformbale connections to be combined with the main hanging system for the design of a component (Own Illustration)

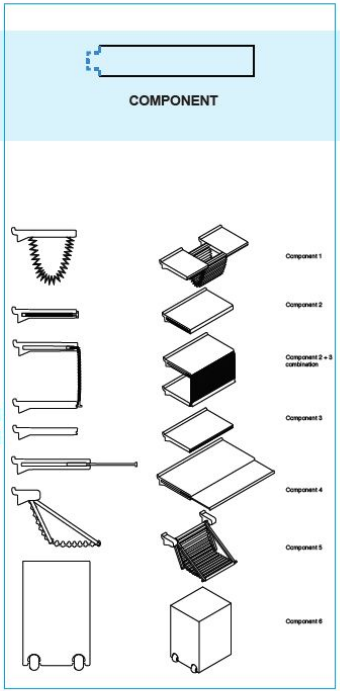


Illustration: Components designed in combination with transformable connections and the main hanging system. More combinations could be according to the need of a certain function by any designer having access to an additive manufacturing machine. (Own Illustration)

OWN YOUR

BASE MATERIAL

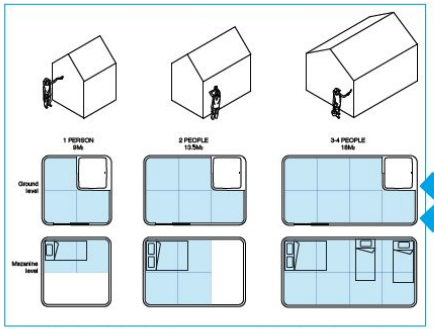


Illustration: Modular tiny house concept developed as context for this design task (Own Illustration)

Illustration: Scheme of three sections of the design (Own Illustration)

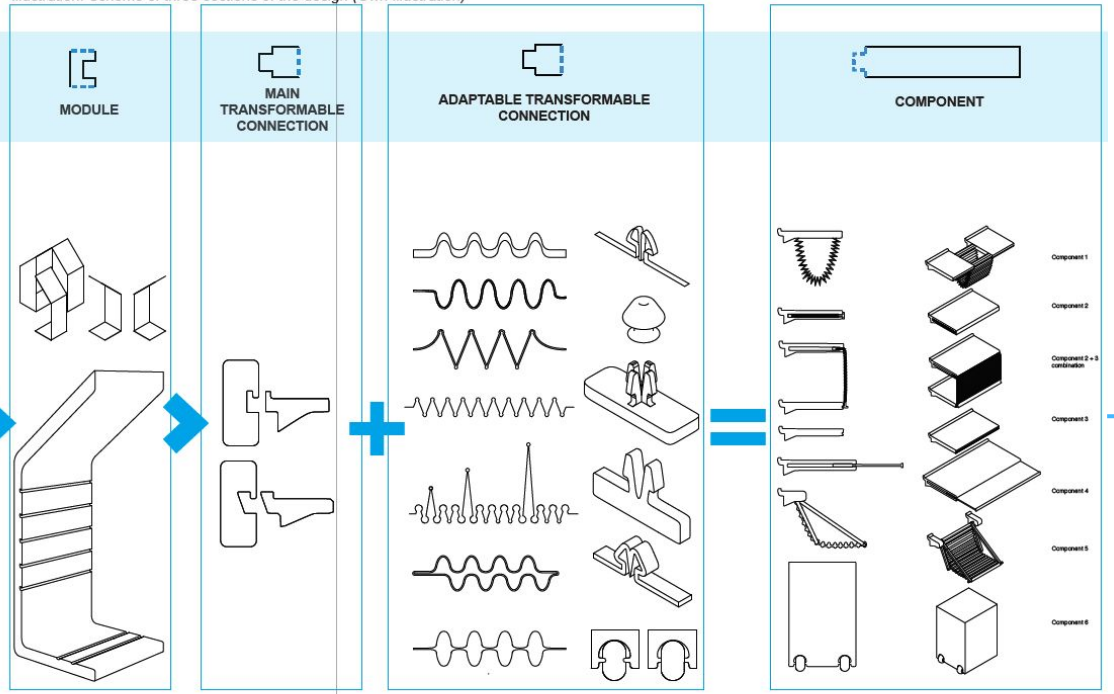


Illustration: Single module of tiny home designed as context for this design task and detail isometric of hanging system integrated to the wall of a single module (Own Illustration)

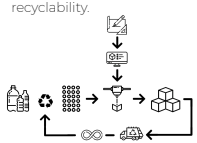
Illustration: Main hanging system for connecting the module with other transformable connections (Own Illustration)

Illustration: Transformbale connections to be combined with the main hanging system for the design of a component (Own Illustration)

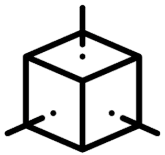
Illustration: Components designed in combination with transformable connections and the main hanging system. More combinations could be according to the need of a certain function by any designer having access to an additive manufacturing machine. (Own Illustration)

Life cycle of Digitally manufactured spaces using recycled PET

Circular system where PET is a beyond end of life material. Owning the base material with an infinite recyclability.



OWN YOUR



BASE MATERIAL

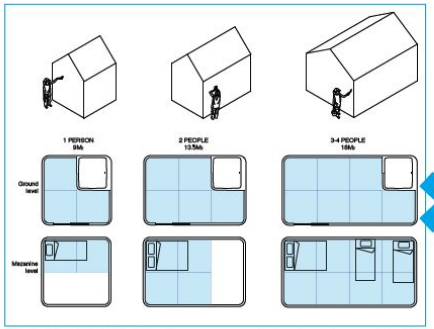


Illustration: Modular tiny house concept developed as context for this design task (Own Illustration)

Illustration: Scheme of three sections of the design (Own Illustration)

MODULE

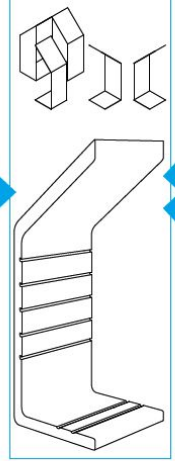


Illustration: Single module of tiny home designed as context for this design task and detail isometric of hanging system integrated to the wall of a single module (Own Illustration)

MAIN TRANSFORMABLE CONNECTION

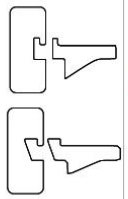


Illustration: Main hanging system for connecting the module with other transformable connections (Own Illustration)

ADAPTABLE TRANSFORMABLE CONNECTION

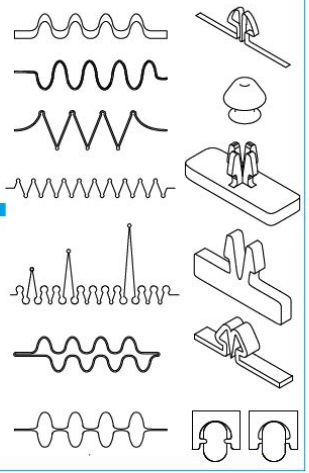


Illustration: Transformbale connections to be combined with the main hanging system for the design of a component (Own Illustration)

COMPONENT

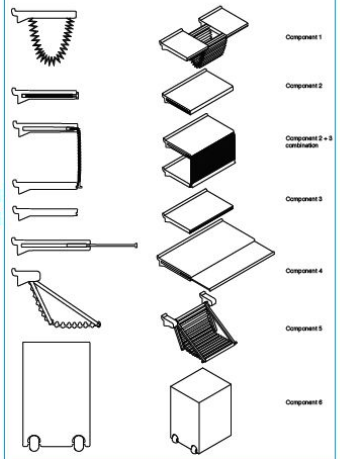
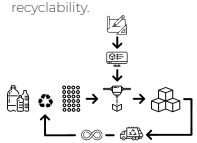


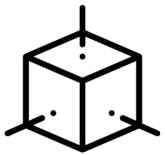
Illustration: Components designed in combination with transformable connections and the main hanging system. More combinations could be according to the need of a certain function by any designer having access to an additive manufacturing machine. (Own Illustration)

Life cycle of Digitally manufactured spaces using recycled PET

Circular system where PET is a beyond end of life material. Owning the base material with an infinite recyclability.



OWN YOUR



BASE MATERIAL

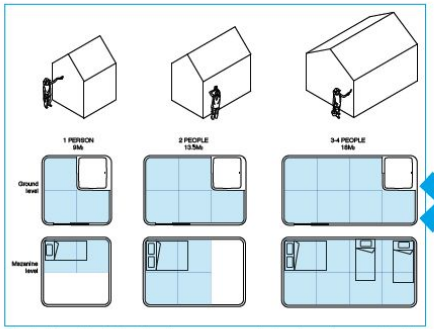


Illustration: Modular tiny house concept developed as context for this design task (Own Illustration)

Illustration: Scheme of three sections of the design (Own Illustration)

MODULE

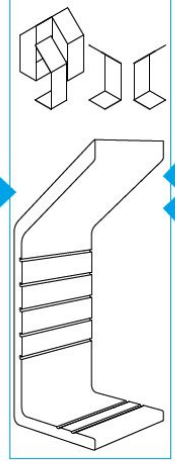


Illustration: Single module of tiny home designed as context for this design task and detail isometric of hanging system integrated to the wall of a single module (Own Illustration)

MAIN TRANSFORMABLE CONNECTION

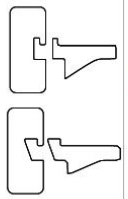


Illustration: Main hanging system for connecting the module with other transformable connections (Own Illustration)

ADAPTABLE TRANSFORMABLE CONNECTION

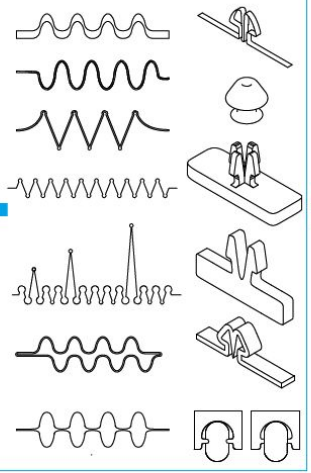
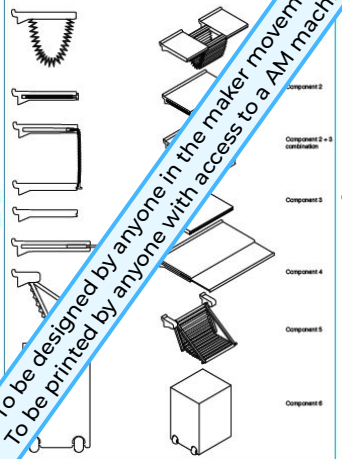


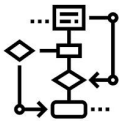
Illustration: Transformbale connections to be combined with the main hanging system for the design of a component (Own Illustration)

COMPONENT

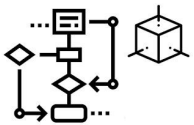


To be designed by anyone in the maker movement
To be printed by anyone with access to a AM machine

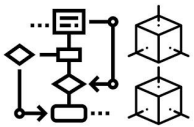
Illustration: Components designed in combination with transformable connections and the main hanging system. More combinations could be according to the need of a certain function by any designer having access to an additive manufacturing machine. (Own Illustration)



Methodology and
standardised system of
transformable connections



Methodology and
standardised system of
transformable connections



Methodology and
standardised system of
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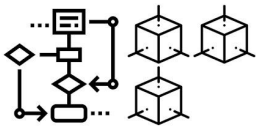
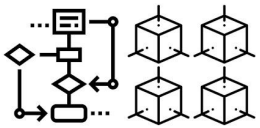
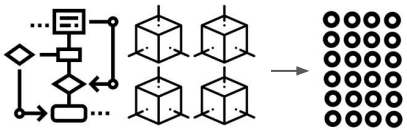


Methodology and
standardised system of
transformable connections

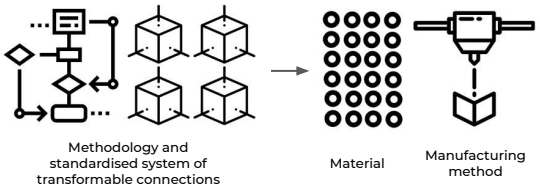


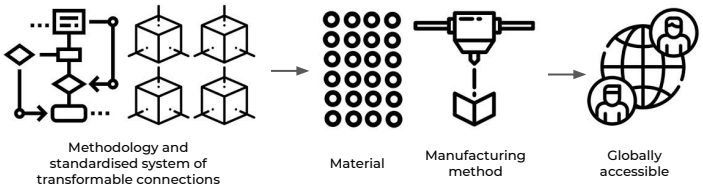
Methodology and
standardised system of
transformable connections

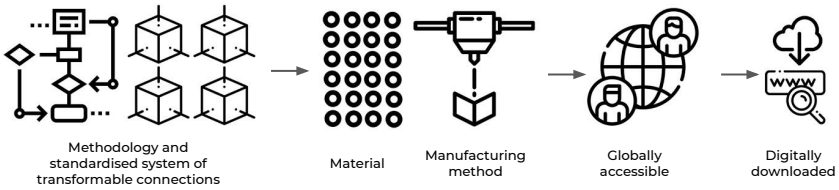


Methodology and
standardised system of
transformable connections

Material


Methodology and
standardised system of
transformable connections
Material
Manufacturing
method


Methodology and
standardised system of
transformable connections
Material
Manufacturing
method
Globally
accessible


Methodology and standardised system of transformable connections
Material
Manufacturing method
Globally accessible
Digitally downloaded
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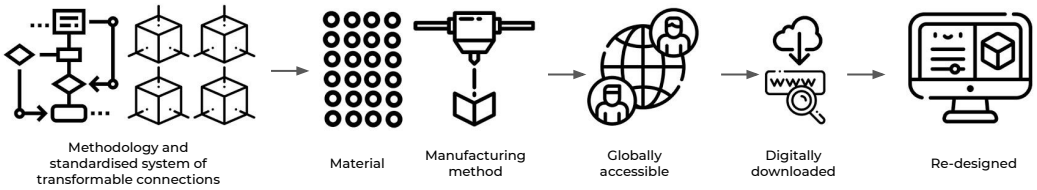
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Manufacturing method
Globally accessible
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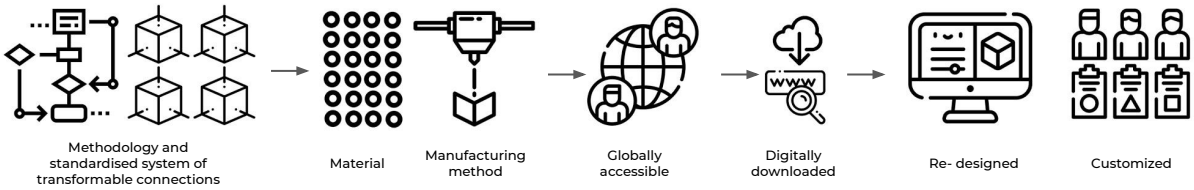
Re-designed


Methodology and standardised system of transformable connections
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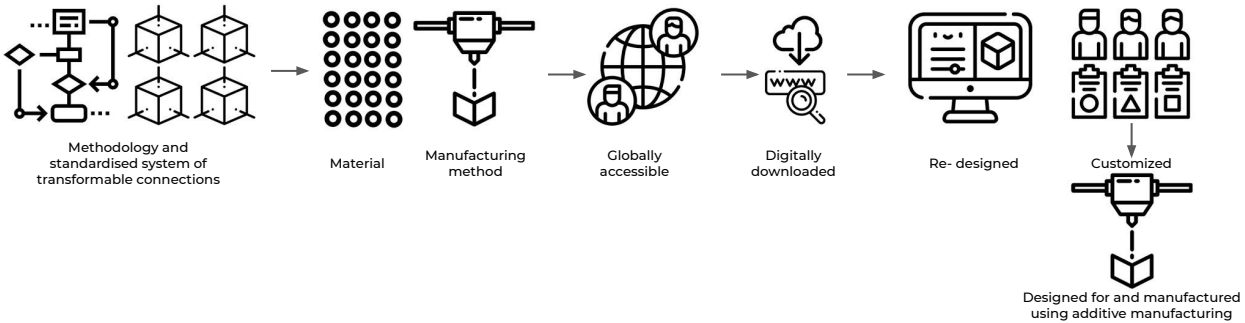
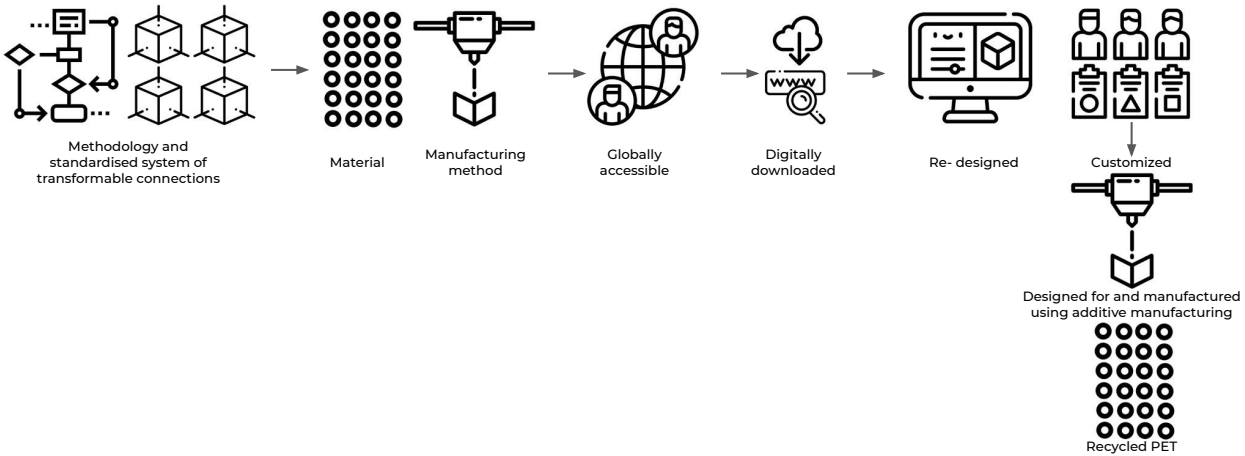
Manufacturing method
Globally accessible
Digitally downloaded
Re- designed
Customized


Methodology and standardised system of transformable connections
Material
Manufacturing method
Globally accessible
Digitally downloaded
Re- designed
Customized
Designed for and manufactured using additive manufacturing


Methodology and standardised system of transformable connections
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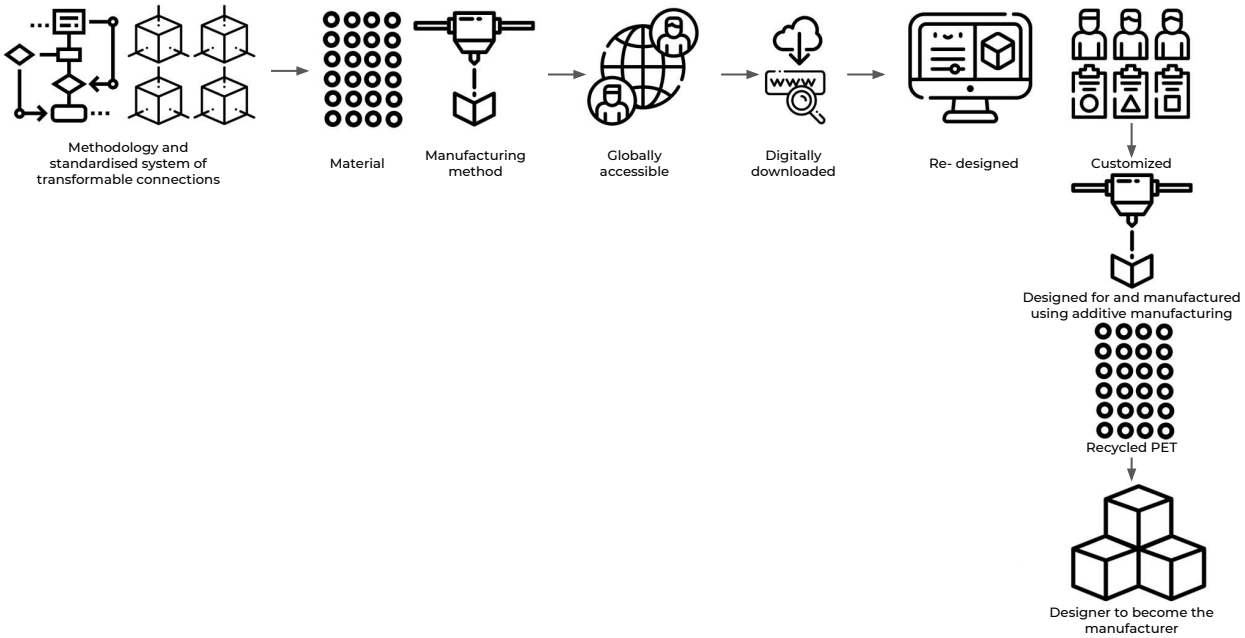
Manufacturing method
Globally accessible
Digitally downloaded
Re- designed
Customized
Designed for and manufactured using additive manufacturing
Recycled PET


Methodology and standardised system of transformable connections
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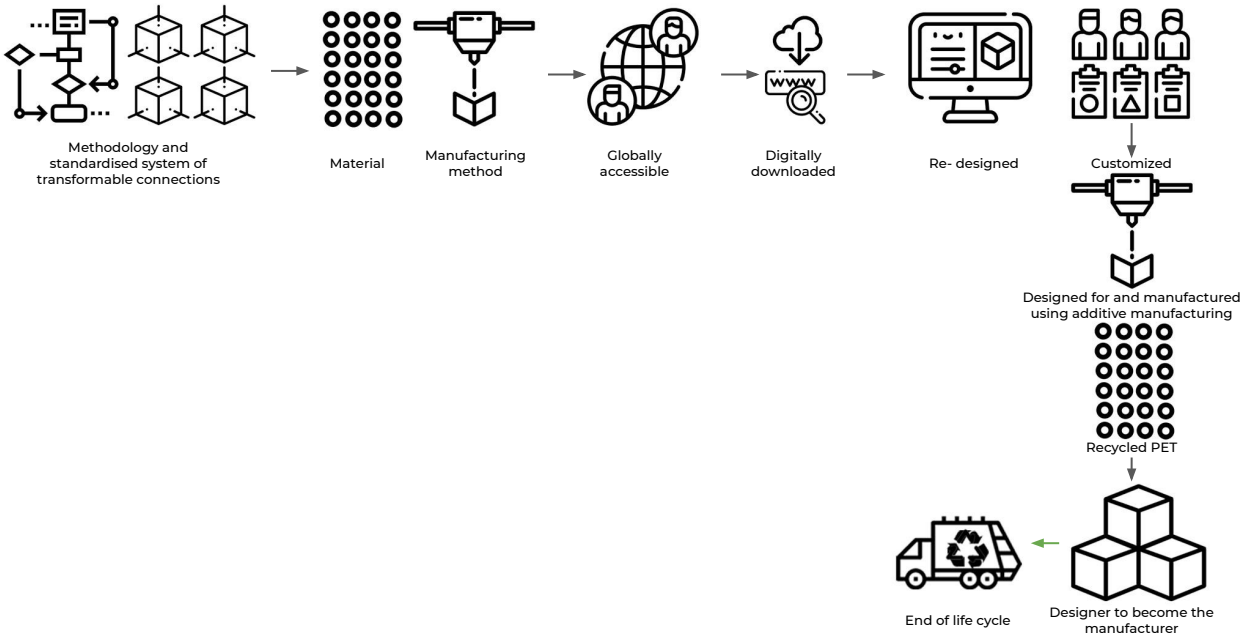
Manufacturing method
Globally accessible
Digitally downloaded
Re- designed
Customized
Designed for and manufactured using additive manufacturing
Recycled PET
Designer to become the manufacturer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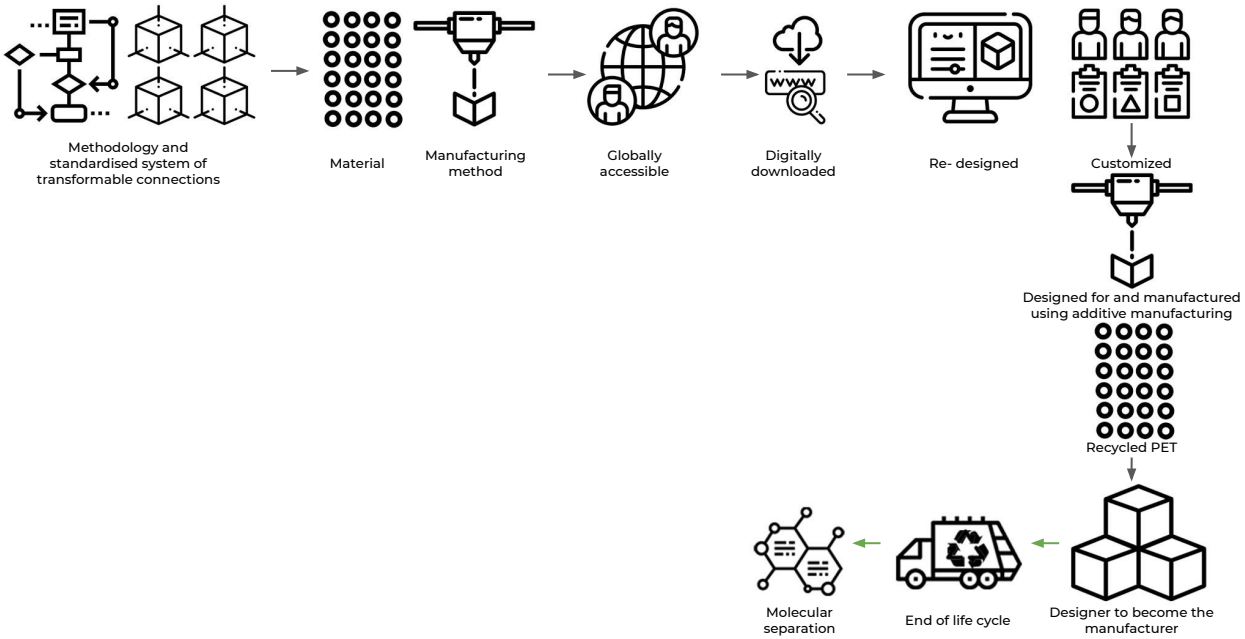
Digitally downloaded
Re- designed
Customized
Designed for and manufactured using additive manufacturing
Recycled PET
Designer to become the manufacturer
End of life cycle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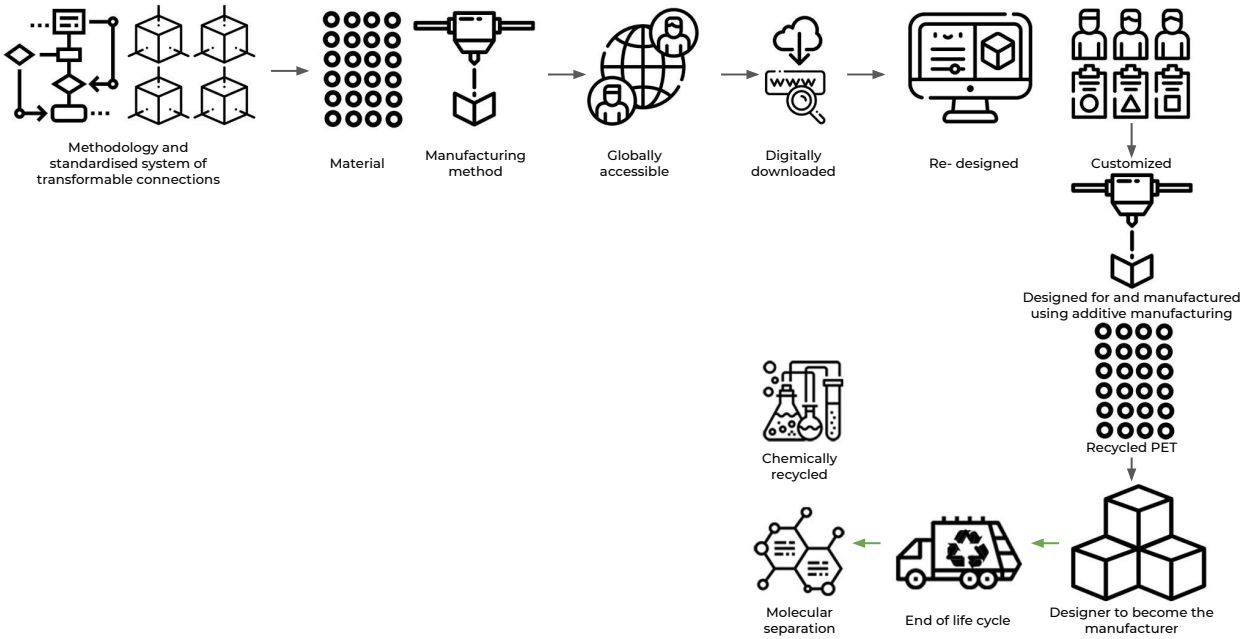
Re- designed
Customized
Designed for and manufactured using additive manufacturing
Recycled PET
Designer to become the manufacturer
End of life cycle
Molecular separation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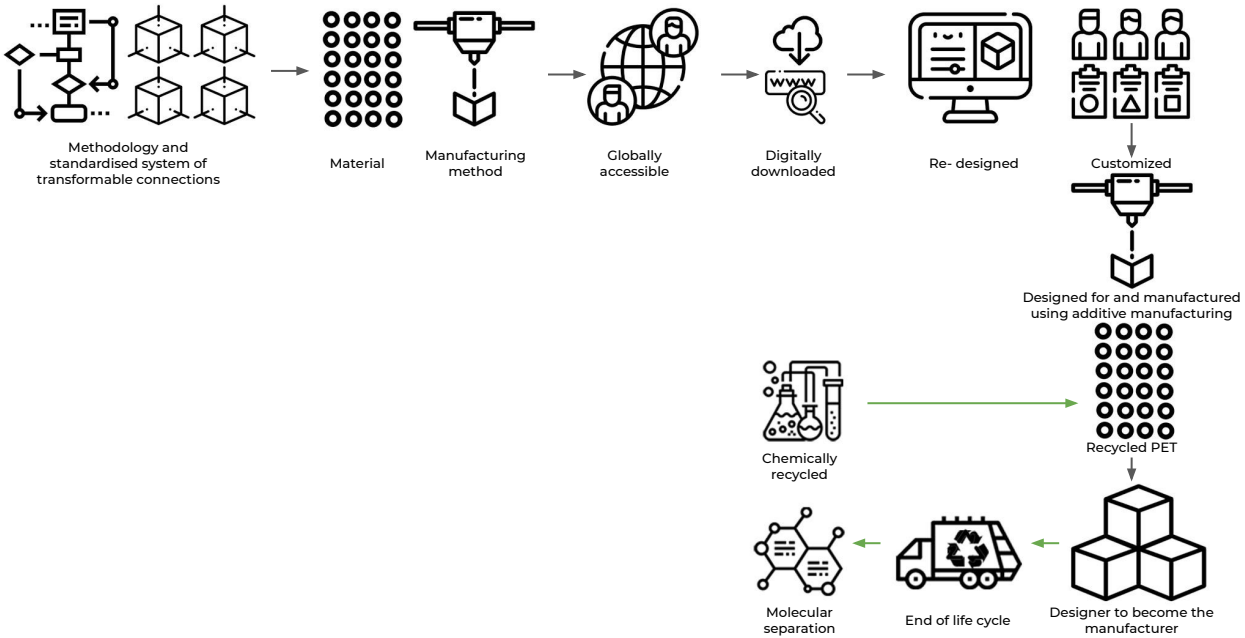
Digitally downloaded
Re- designed
Customized
Designed for and manufactured using additive manufacturing
Recycled PET
Designer to become the manufacturer
End of life cycle
Molecular separation
Chemically recycled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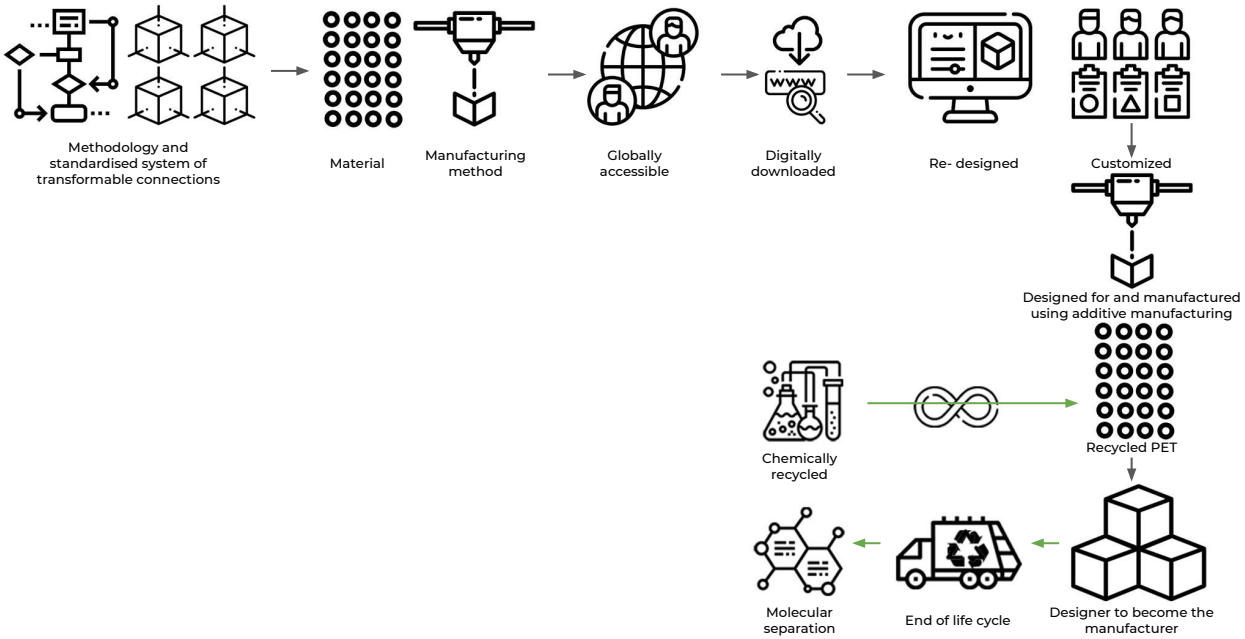
Recycled PET
Designer to become the manufacturer
End of life cycle
Molecular separation
Chemically recycled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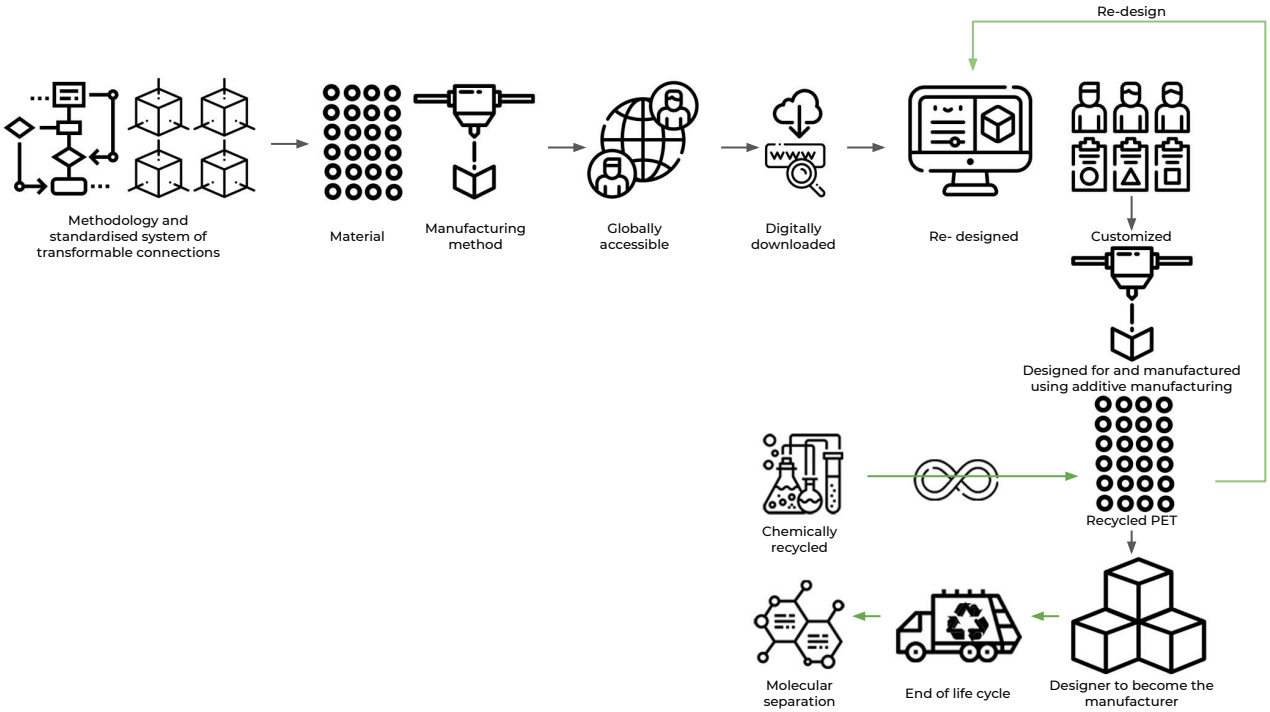
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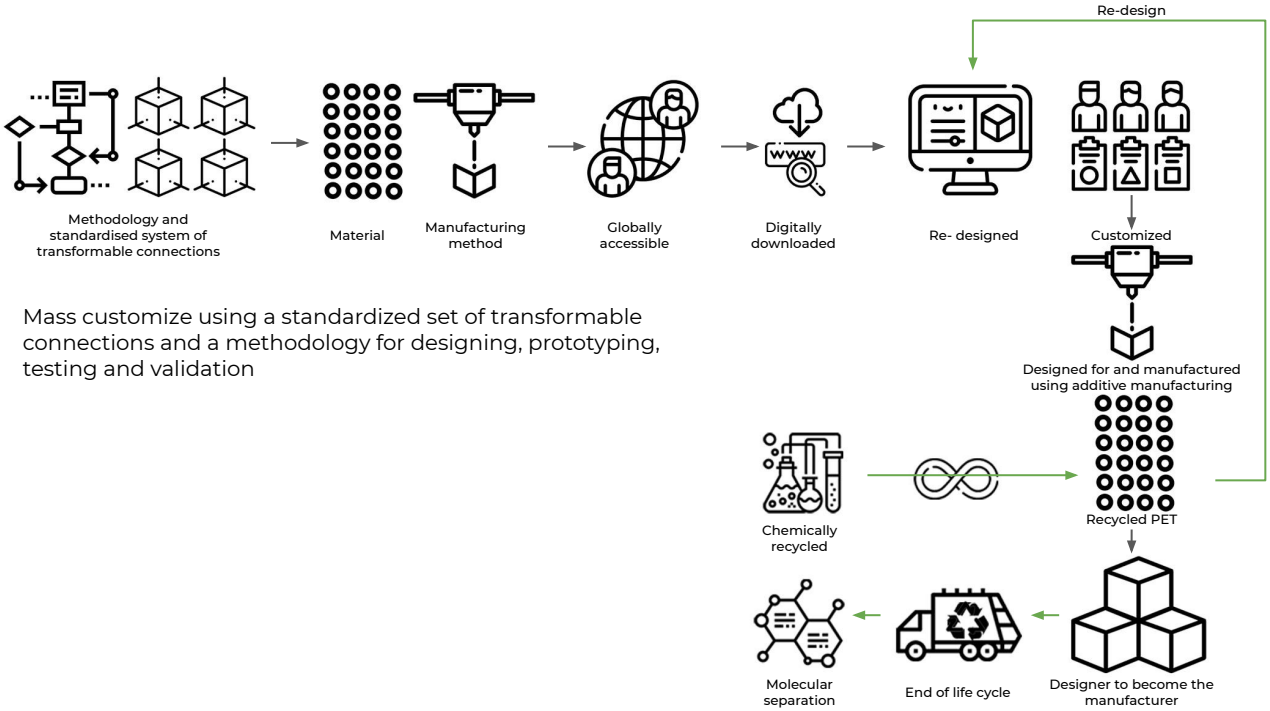
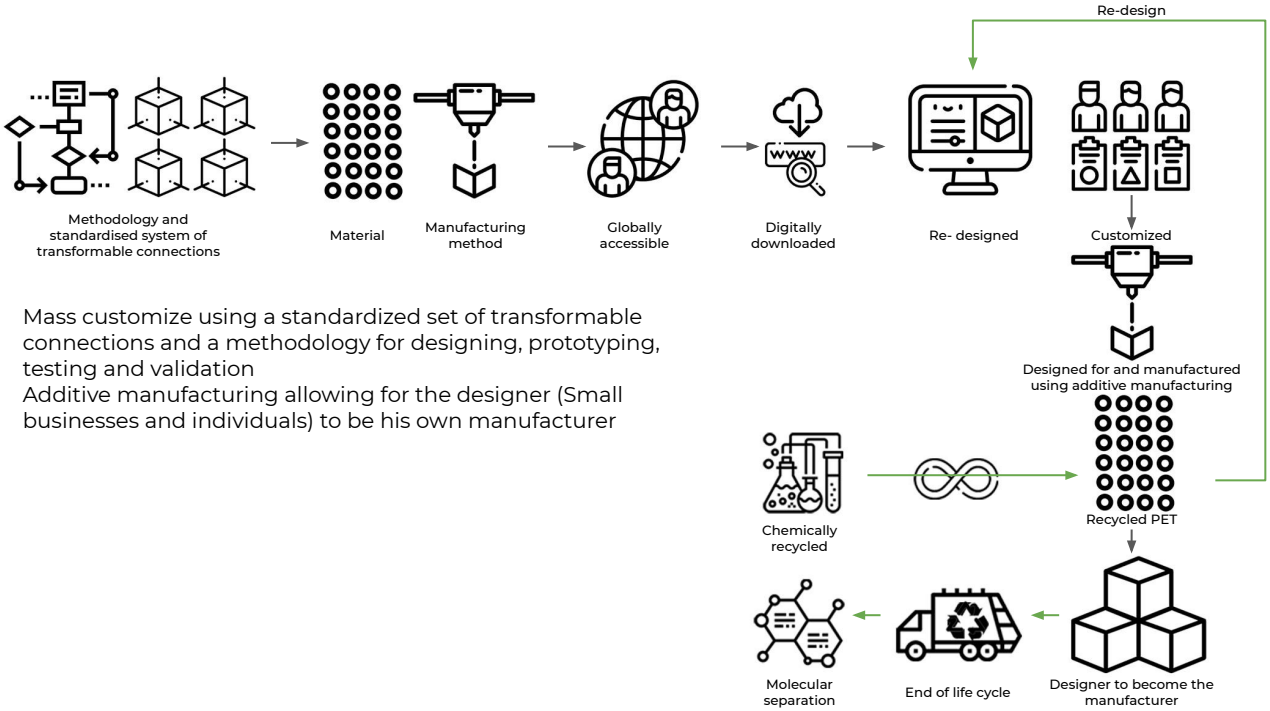
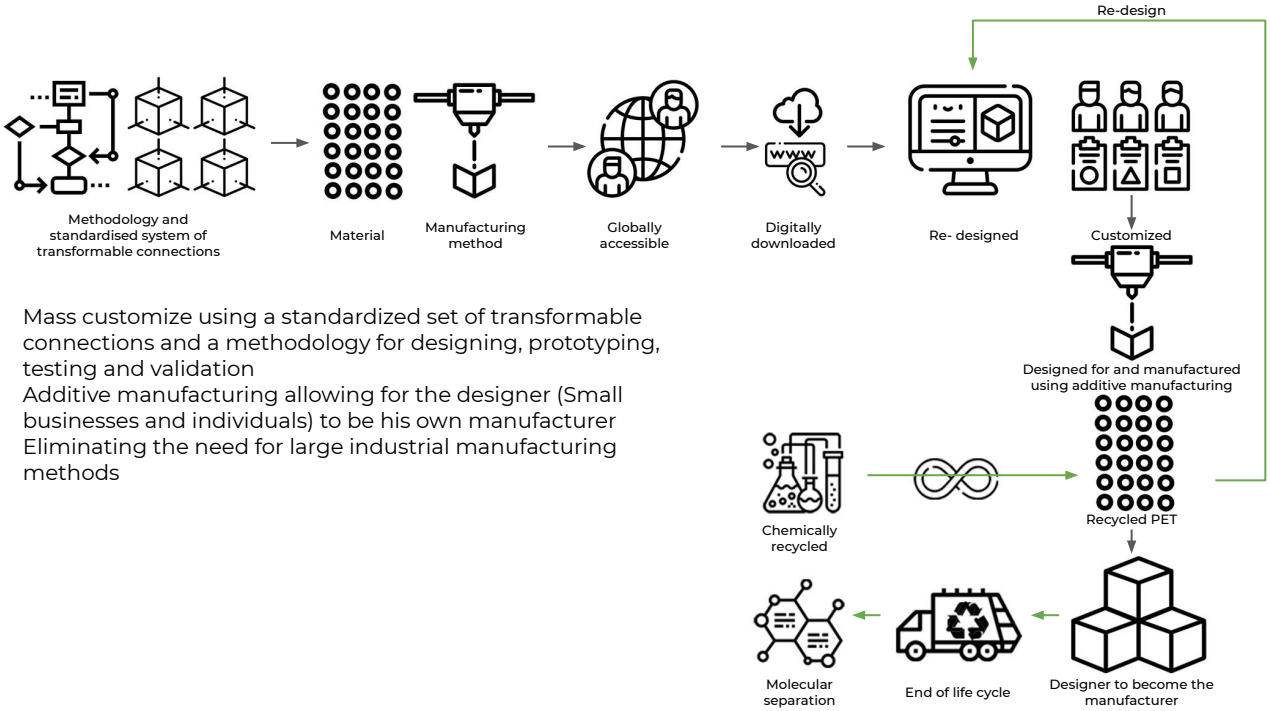


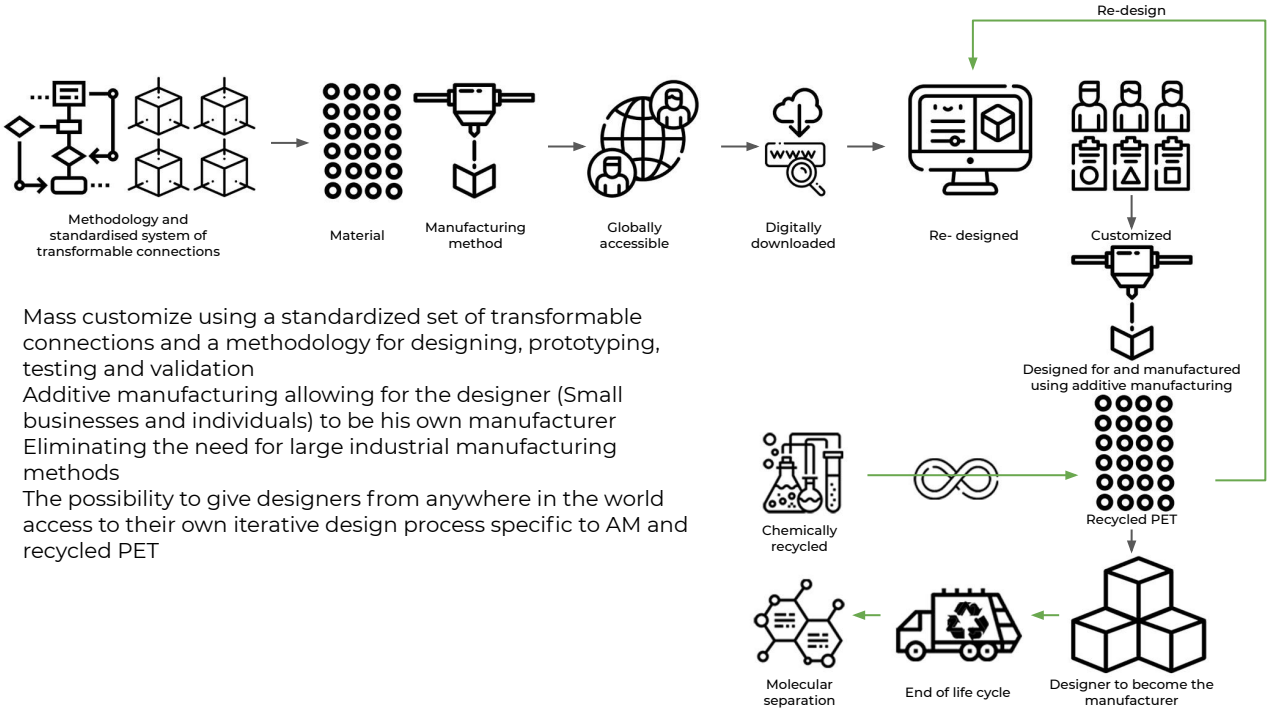
- Mass customize using a standardized set of transformable connections and a methodology for designing, prototyping, testing and validation



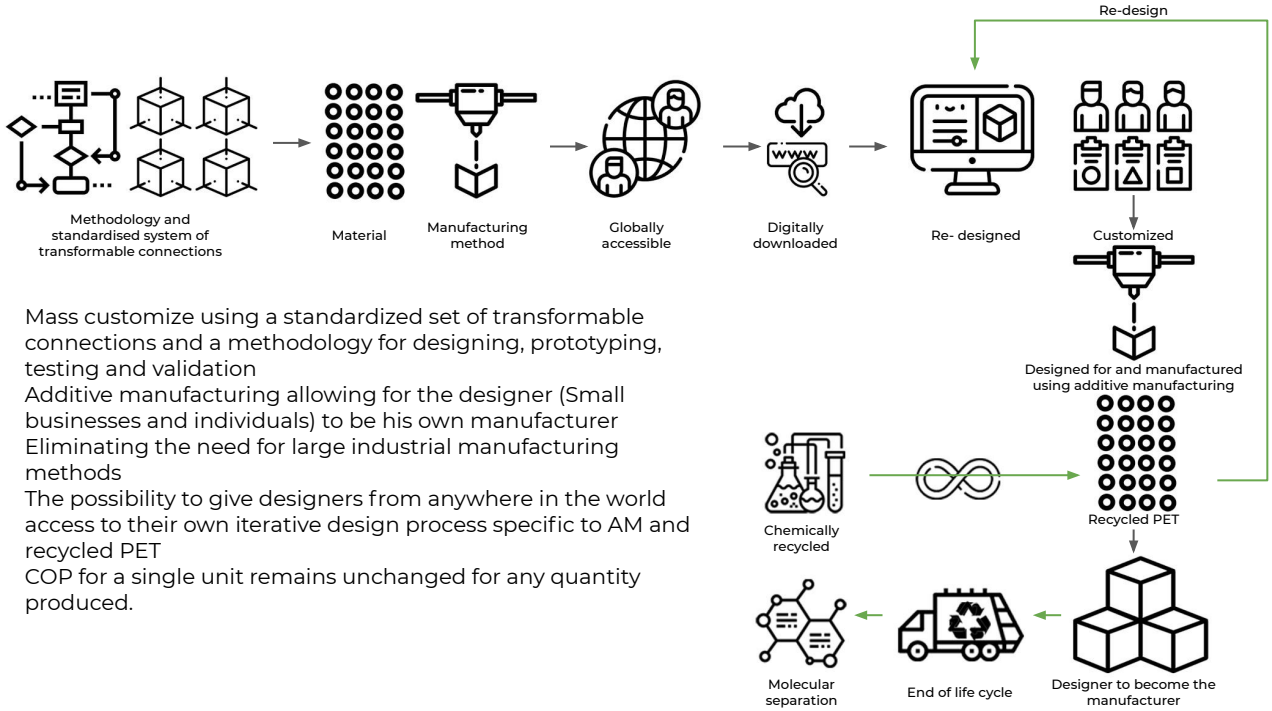
- Mass customize using a standardized set of transformable connections and a methodology for designing, prototyping, testing and validation
- Additive manufacturing allowing for the designer (Small businesses and individuals) to be his own manufacturer



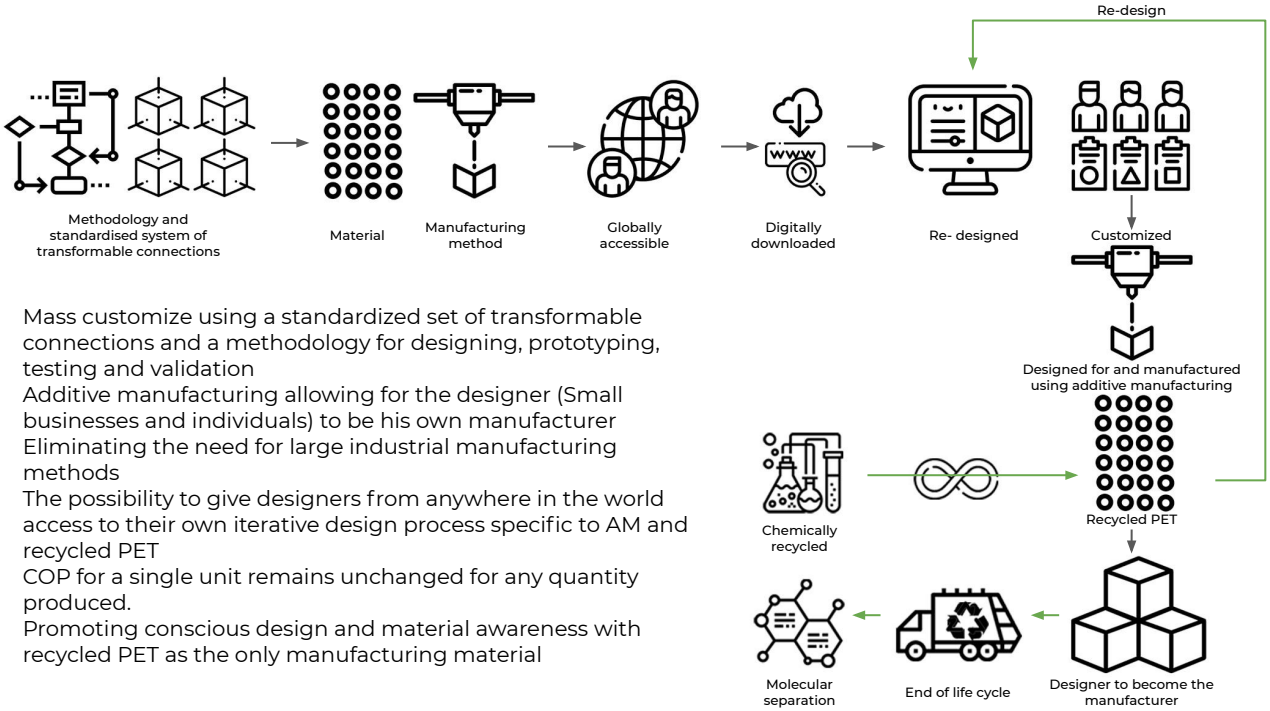
- Mass customize using a standardized set of transformable connections and a methodology for designing, prototyping, testing and validation
- Additive manufacturing allowing for the designer (Small businesses and individuals) to be his own manufacturer
- Eliminating the need for large industrial manufacturing methods



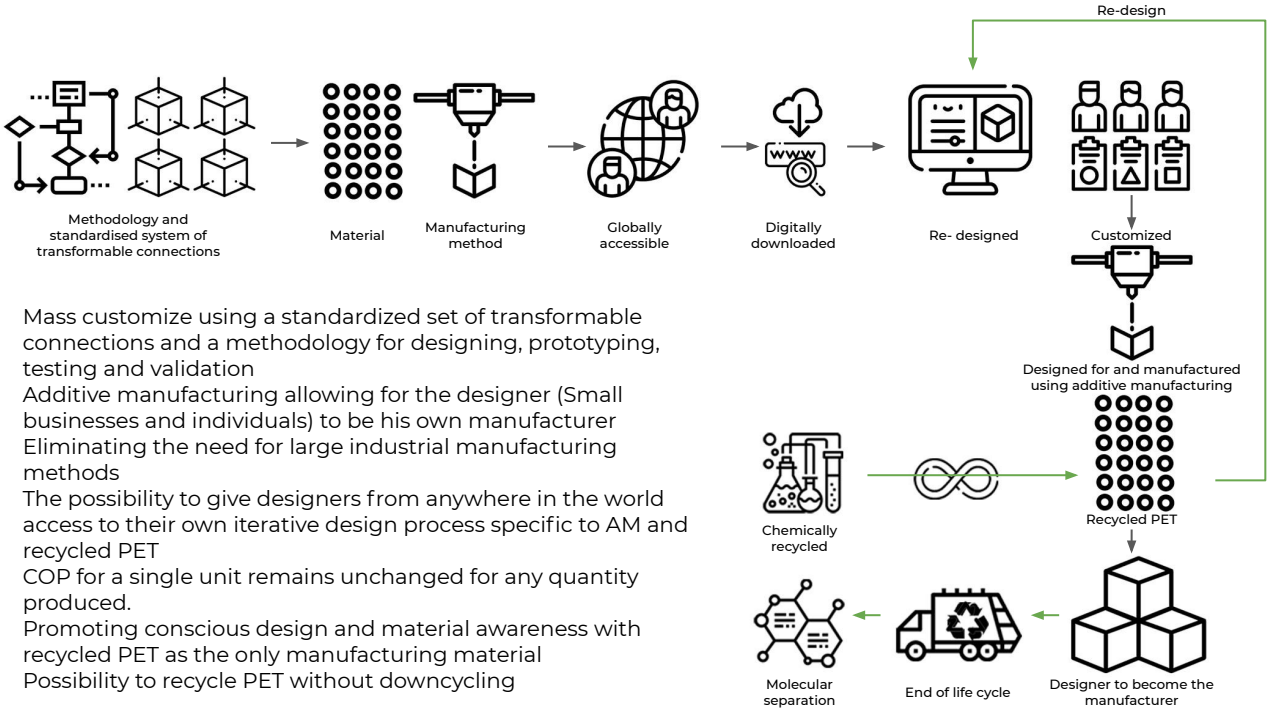
- Mass customize using a standardized set of transformable connections and a methodology for designing, prototyping, testing and validation
- Additive manufacturing allowing for the designer (Small businesses and individuals) to be his own manufacturer
- Eliminating the need for large industrial manufacturing methods
- The possibility to give designers from anywhere in the world access to their own iterative design process specific to AM and recycled PET



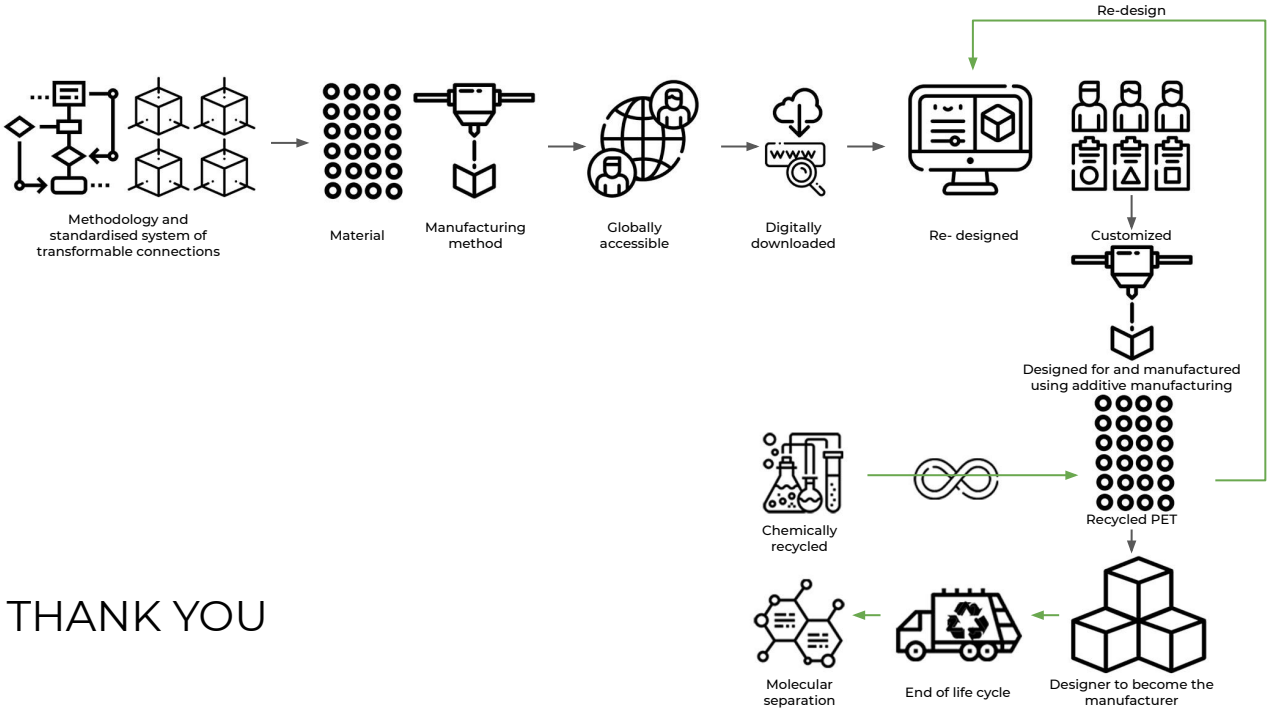
- Mass customize using a standardized set of transformable connections and a methodology for designing, prototyping, testing and validation
- Additive manufacturing allowing for the designer (Small businesses and individuals) to be his own manufacturer
- Eliminating the need for large industrial manufacturing methods
- The possibility to give designers from anywhere in the world access to their own iterative design process specific to AM and recycled PET
- COP for a single unit remains unchanged for any quantity produced.
-



- Mass customize using a standardized set of transformable connections and a methodology for designing, prototyping, testing and validation
- Additive manufacturing allowing for the designer (Small businesses and individuals) to be his own manufacturer
- Eliminating the need for large industrial manufacturing methods
- The possibility to give designers from anywhere in the world access to their own iterative design process specific to AM and recycled PET
- COP for a single unit remains unchanged for any quantity produced.
- Promoting conscious design and material awareness with recycled PET as the only manufacturing material



- Mass customize using a standardized set of transformable connections and a methodology for designing, prototyping, testing and validation
- Additive manufacturing allowing for the designer (Small businesses and individuals) to be his own manufacturer
- Eliminating the need for large industrial manufacturing methods
- The possibility to give designers from anywhere in the world access to their own iterative design process specific to AM and recycled PET
- COP for a single unit remains unchanged for any quantity produced.
- Promoting conscious design and material awareness with recycled PET as the only manufacturing material
- Possibility to recycle PET without downcycling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THANK YOU