

How aligning semantics among designers helps them use AI tools more effectively

Graduation Project IPDBouwe Theijse
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Chair - Derek Lomas Coach - Vera van der Burg Company Coach - Stef de Groot





APPENDICES

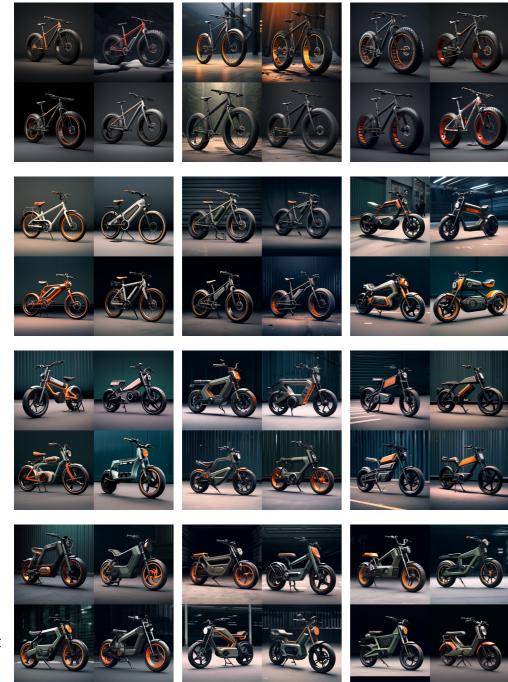
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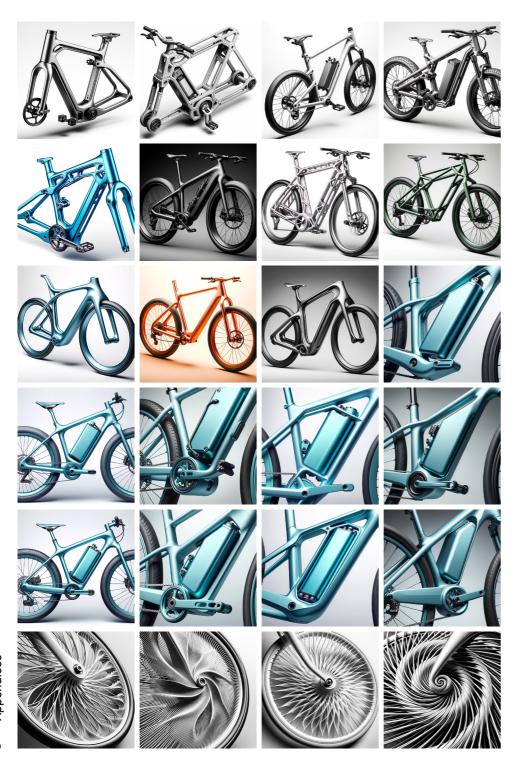


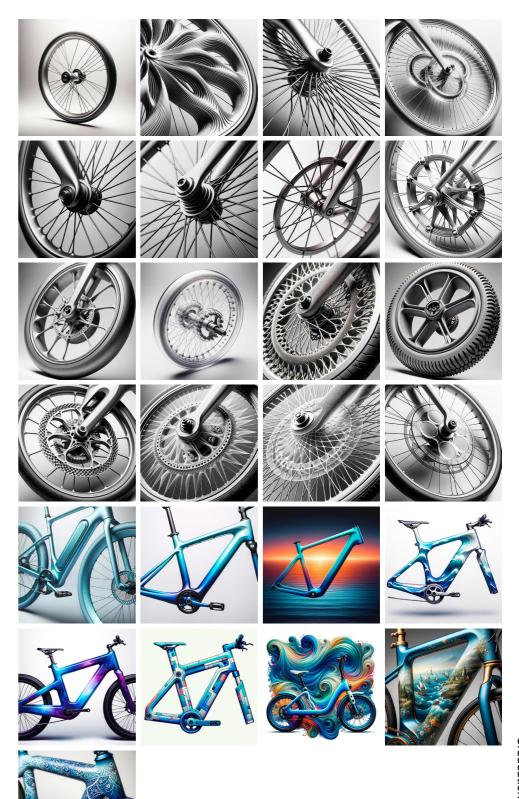
A. MIDJOURNEY





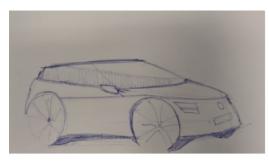
B. GPT-4





C. VIZCOM EXPERIMENT

Most output from Vizcom cannot be shown because we tested wtih "to be released" designs.



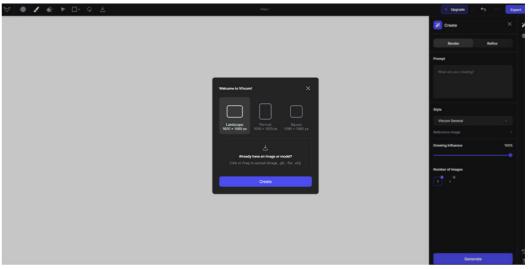


















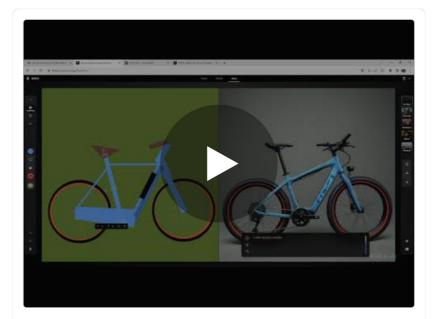
D. KREA EXPERIMENT

Click the videos on the left for screenrecordings from KREA









krea ai apps image realtime first experimentation

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YouTube | Updated 08-12-2023 @ 16:20 GMT+01:00





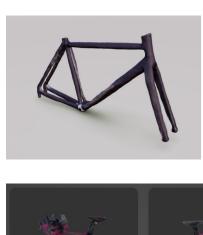
KREA Al experiment 2

3)

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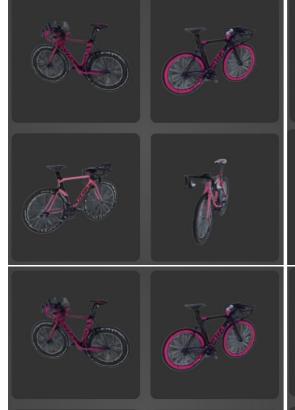
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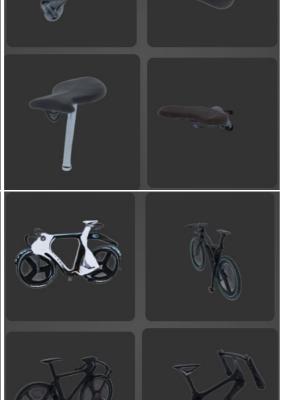
E. LUMA LABS EXPERIMENT





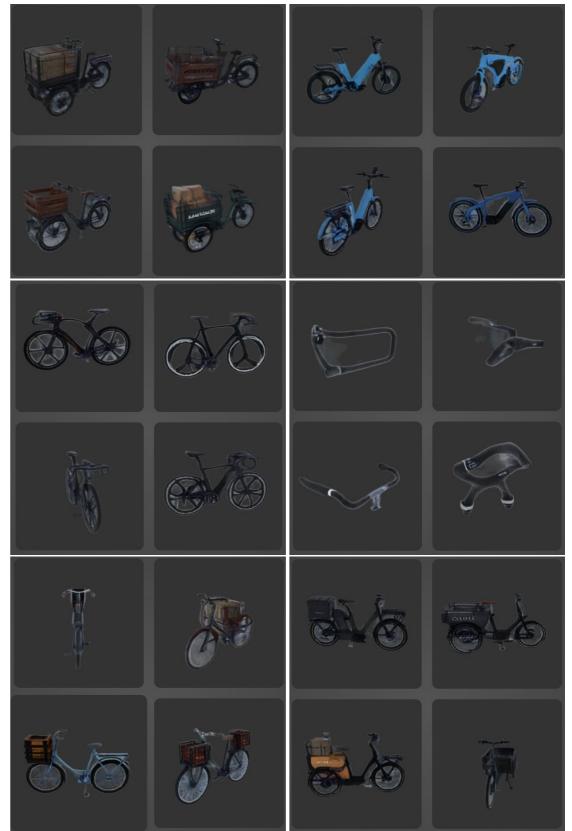








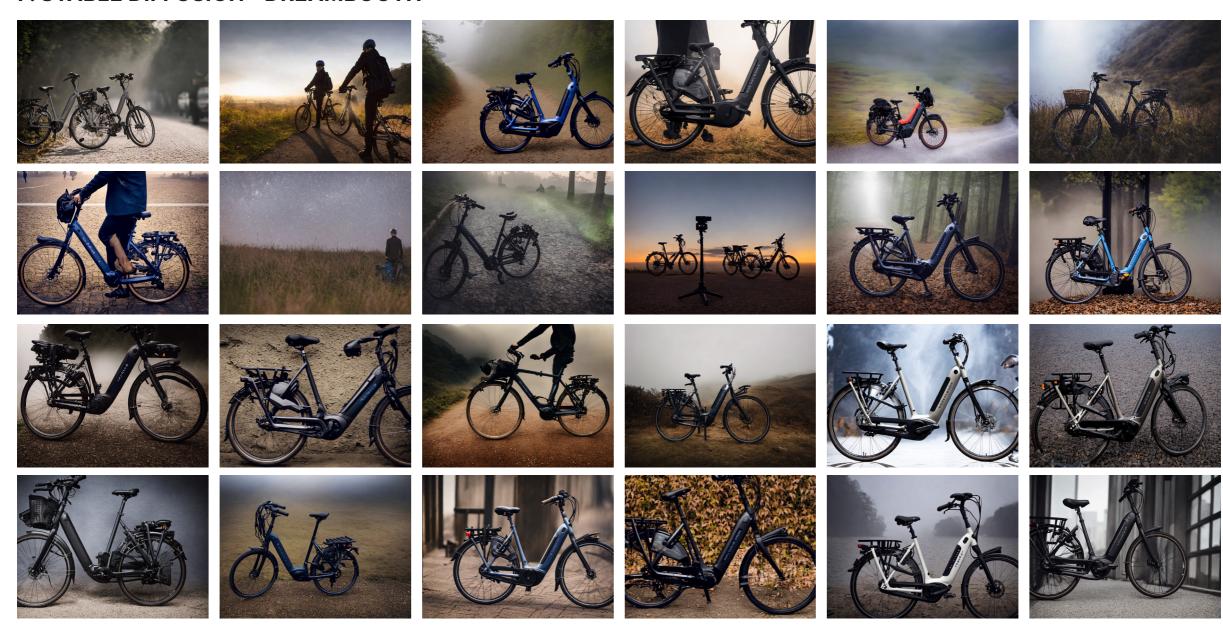




Appendices

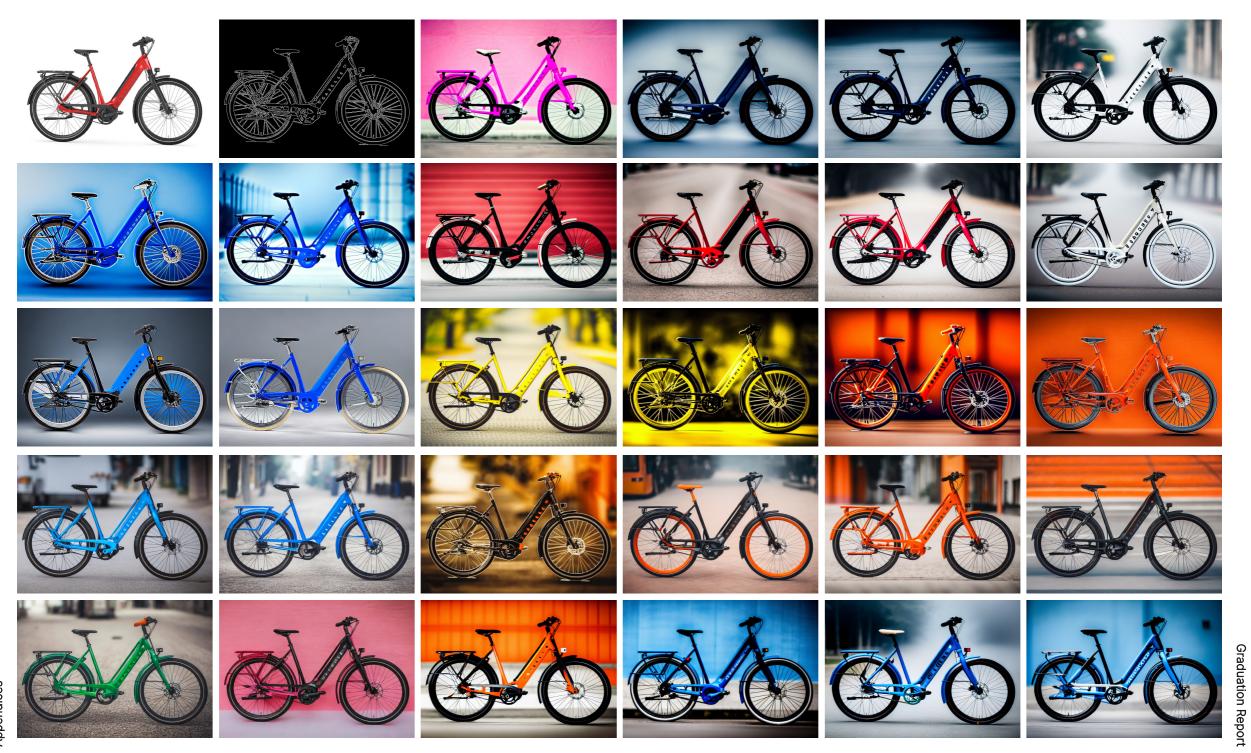
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F. STABLE DIFFUSION - DREAMBOOTH



G. STABLE DIFFUSION - CONTROLNET

Canny image



Appendices

16

Inpainting

		Vision Concepts - concept bikes to drive innovation	Gazelle-specific tuned generative model	Reflection tool - understanding of design style interpretation
	Useful for design quality	1	1	1
	Feasibility	2	1	2
	Useful for design efficiency	-1	1	1
ш	Useful for PDP efficiency	-2	0	1
OR	Useful for brand recognition	2	0	1
SC	Relation to AI	-1	2	1
	Personally interested	2	-1	1
	Easy to code	1	0	0

Useful for design quality	Creating vision concepts will help
	designers at Gazelle put design first
	without the limitations of engineering
	that usually. The process of creating a
	vision concept also teaches a designer
	a lot about their own goals and
	methods. It could, however, create
	overly ambitious designs later on.
	Additionally, the conceptual design
	goal does not necessarily translate to
	marketable designs, therefore this doe

not score 2.

Tuning a model on a Gazelle-specific dataset with fitting pictures and labels will give designers more control when generating images. Nevertheless, control remains limited meaning that the designers will likely refrain from using the tool altogether.

Enabling designers and product managers to coherently understand each other and the design style document gives the designers more confidence and guidance to generate concepts within expectations. Additionally, it will help the designers understand their own design process better.

The score in this catagory resembles the added value towards a high quality design according to Gazelle's design characteristics (comfortable, accessible, and quality) and Dieter Rams' ten principles of good design

ARGUMENTATION

This is very feasible, many companies work with vision concepts or concept products. Al only makes the process quicker in the design and therefore less fully grasp the bikes with the visual time intensive.

Tuning a model can be done, initial testing illustrated that it works, but it also illustrated that the models did not complexity around the spokes and mechanics.

The concept of using AI as a reflection tool or an expectation tool has been proven by Van der Burg (2023) and Chung (2023) respectively. However, both of them mentioned that it the current state it illustrated potential more than results.

The extent to which it expected to be achievable within the timeframe, with the resources available, and with the skillsets involved.

Useful for design efficiency

Creating a vision concept does take time, it will also complicate the design process more because the vision concepts will challenge the designers to inspiration and the rendering steps of come up with more innovative designs.

Creating a tuned dataset and using a generative model will help the designers save time during both the design process. The amount of time sparring steps will be more effective is very debateable and dependable on the designer involved.

The designer will have a better understanding of their own and the company's design style. Therefore validation steps should speed up, and because of mutual understanding of the goal.

The extent to which it expected to speed up the design process. Either to through speeding up tasks of by making the process more linear.

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	Useful for PDP efficiency	The vision concepts will challenge the designers to make more innovative designs which complicate the goals of the engineers. Therefore there would have to be many more meetings and finetuning sessions to solve realise the envisioned innovation.	The only minimal benefit would be that a generative AI trained on a Gazelle-specific dataset will suggest things that look like Gazelle and should therefore be producible. Realistically, this will not be the case most of the time.	If the designers understand each other and the product manager better, the entire process will have fewer moments of disagreement and should become more linear and straight forwards, i.e. less time would be wasted.	The extent to which it helps speeding up the entire product development process. Perhaps through integration of engineering considerations or creating a more linear process.
		Vision concepts would challenge the innovation team at Gazelle to make more unique bikes and recognizeable compared to competitors.	Tuning the model would mainly help during inspiration and ideation, it probably will not have significant effect on the recignizeability of the bikes.	Creating a better and mutual understanding of the Gazelle designstyle boosts the ability of the design team to create a cohesive product portfolio and product family.	The extent to which it helps Gazelle make their product more recognizable to customers
ARGUMENTATION	Relation to AI	While AI could be the key to make vision products a more affordable innovation driver, I would first need to understand the intricacies of designing vision products and would therefore be barely touch AI within the span of this project.	I would have to train or tune a model to make this work, very AI centred.	I would have to train or create a model to illustrate the mindset and interpretation of different people. Therefore, it would be very AI centred.	The extent to which AI will play a role in the direction
ARGUMI	Personally interested	I am super curious to dive into the world of vision concepts. They are very popular drivers of innovation, however, most companies cannot afford them due to the time and material costs. I would be interested to see how AI could make the process more affordable while still teaching the designers enough to set clear directions.	I have experimented with this option the most. I quickly noticed that the problems with its feasibility lay in the visual complexity of the bike. It can be helped, nevertheless, I also noticed that the designers at Gazelle were not really interested in this tool because it does not speed things up significantly. They lack control, which I understand. Additionally, loads of companies are working on this feature and will undoubtedly think of some way to fix it.	I am very intersted in the mental processes linking inspiration to output. It is also an issue that more companies face, motivating me to adress the topic to more people. It might also be useful during testing because of the limited time I have available from the designers to train a model.	The extent to which I am motivated and interested to pursue this direction
	Easy to code	I would dive mainly into the vision concept design process and then look how off-the-shelf AI could be used to make it quicker and more affordable.	I would mainly need to label and tune, and then see how the designers respond to the model. The models are already present online, would need to learn some code but in first glance it seems quite difficult.	I need to find a model that can be trained on the patterns that I want, perhaps, there are some off-the-shelf models present that recognize the	The difficulty I expect in the coding part. Perhaps because it is easy to code, or I can use off-the-shelf models to reach my goals.

I. MOOD BOARDS

Throughout a project, members need to be aligned and work towards the same goal as much as possible. Engineers work towards numeric goals and designers work towards aesthetic goals. The aesthetics of their design should fit the project proposition. Designers can use several tools to communicate aesthetic direction, the most popular are mood boards.

Apart from the project-specific aesthetic direction, the designer incorporated the Gazelle design style, which is currently summarised in a mood board. The designers interpret this mood board in different ways.

MOOD BOARDS

To communicate aesthetic expectations, most designers use mood boards. Mood boards communicate an aesthetic direction without any sketches from the designer required. That is why mood boards are an effective way to share design direction without sketches. Some argue that mood boards have to be explained to be effective communication tools, however, just the pictures themselves will always be interpreted.

Traditionally, mood boards were made by cutting out magazines (Lucero, 2012). Nowadays, most designers make mood boards digitally because more images are readily available (ADDSOURCE). The change from analogue to digital has sped up the process but left some communicative gaps and confusion. For example, digital mood boards do not hold tangible products or artefacts.

Additionally, it is more difficult to cut away parts of images irrelevant to the mood board. That leads to images showing more than the designer might want to present, which leads to more interpretations of the mood board than the designer wants to allow.

MODELS OF MOOD BOARDING USE

Nevertheless, mood boards have been the most popular method to communicate aesthetic direction for decades. How could such a tool better communicate aesthetic direction with minimal variability due to interpretation? Below are some models to better explain.

Proposition to Mood board

[proposition] * [mental process] * [research findings] → [moodboard]

When the designer receives the proposition, he has no design direction. He collects his aesthetic findings in a mood board to set a design direction. That is the blurry image described in the metaphor.

Mood board to Product

[proposition] * [mental process] * [moodboard] → [design]

When the designer has set the mood board - the blurry image - he slowly works towards the final design - the in-focus image. He translates the mood board and the proposition into a design.

REFLECTION AND SIMPLIFICATION OF INSPIRATIONAL IMAGES

The last section contains many complex tasks. All tasks can be simplified to the model below.

[tasks] * [mental process] * [input] → [output]

As mentioned, a complex proposition leads to a complex mental process. A complex task - the proposition in this case - or input - the research insights or mood board - require a complex mental model to generate an output successfully. Complex mental models require large datasets to find the pattern. That dataset does not exist. Therefore, it is difficult to train an Al to predict the output of complex propositions.

Designers and product managers would benefit from understanding designers' mental design processes to manage expectations. A simpler task could give insight into the mental process of designers and product managers. For example, both parties could be asked to rate images on different axes and a model would learn their individual mental model of how they rank images.

[rate image] * [mental model] * [images to be ranked] → [image rating]

The model would predict how different members rate images, which indicates their interpretation. That is a form of reflection and a tool to share interpretations. The problem here would be that some images contain too many aspects to be interpreted similarly by multiple people. In other words, if the "images to be ranked" are too complex, the mental model becomes overly complex. That illustrates the ambiguity of mood boards. If the pictures on a mood board contain multiple objects or features, they quickly become ambiguous and open to interpretation.

J. EXCEL IMAGE TYPE QUESTIONNAIRE

	Do you have 3 years or	If you have worked as	Do you voluntarily		Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic 13		Organic 15	Organic	Organic	Organic	19 Organic	Organic 20	Organic 21	Organic 22	Organic 23	Organic 24	Organi
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Feb 1, 2024	Yes	India	Yes	FALSE	. 7	89	110	103	108	88	119	123	75	84	116	90	118	94	96	66	116	117	121	149	87	123	51	96	118	11
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Graduation Report

K. EXCEL PRE- POST- LONGTERM QUESTIONNAIRE

The excel sheet can be found in the appendices folder.

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Sample standard deviation = 39,0973821			36.88	5.66667	93.6667	12.3333	48.3333			86	29.3333	64.6667	37.3333	20.6667	13.6667				2	19.3333	42.3333	8.33333						69
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Variance Standard deviation s+Q14ample Feb 27, 2024 Chee Yes 123 187 83 99 37 118 36 19 91 76 91 100 80 139 126 122 91 100 80 139 126 122 91 123 187 188 180 181 180 180 180 180																_												12
Standard deviation s+Q14ample Per 123 187 88 99 37 118 36 19 176 91 100 80 139 126 122 91 123 165 166 191 126 109 116 22 125					21.853	22.5733	23.5089	33.1897	28.5229	36.8902	26.3987	20.4015	8.52447	15.6915	6.16441	6.97615	17.5563	8.28654	21.276	12.2565	21.2968	3.55903	13.9284	18.1537	27.7609	7.25718	20.3961	25.8242
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Deviation Two		Average score	102.1733333	82.6667	185	67	91	54.6667	105.333	50	85.6667	73.6667	85.6667	80.6667	103.333	77.3333	97.3333	99.6667	104.333	105	141.333	171.667	138	182.667	113.667	111.333	82	65.3333
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Stdev polarisation 12.29650755 7.13364 3.55903 19.2007 12.0277 16.66 1.63299 24.1661 25.1529 12.9185 10.3387 8.57645 12.4722 11.5854 19.362 11.5758 11.1455 2.16025 15.5421 6.2361 21.746 6.01849 6.3421 12.0277 15.1731 14.6591 14.65		SD bigger or smaller than average		Bigger	Smaller	Bigger	Smaller	Smaller	Bigger	Bigger	Bigger	Smaller	Smaller	Smaller	Bigger	Smaller	Bigger	Bigger	Bigger	Smaller	Smaller	Smaller	Bigger	Smaller	Bigger	Bigger	Bigger	Bigger
Variance 327.2389635		Polarisation of the average	26.76	17.3333	85	33	9	45.3333	5.33333	50	14.3333	26.3333	14.3333	19.3333	3.33333	22.6667	2.66667	0.33333	4.33333	5	41.3333	71.6667	38	82.6667	13.6667	11.3333	18	34.6667
Significance (with outliers included One sided		Stdev polarisation	12.29650755	7.13364	3.55903	19.2007	12.0277	16.66	1.63299	24.1661	25.1529	12.9185	10.3387	8.57645	12.4722	11.5854	19.362	11.5758	11.1455	2.16025	15.5421	6.2361	21.746	6.01849	6.3421	12.0277	15.1731	14.6591
One sided			327.2389635	5																								
Two sided																												
One sided	One sided	Paired	0.02186404	ļ.																								
One sided 0.024308015 80 45 45 45 45 45 45 45 45 45 45 45 45 45	Two sided	Paired	0.043728079)												Dstanda	rd deviati	ion vs po	larisatio	n					Chart T	itle		
One sided 0.024308015 80 Two sided 0.048332117 70 Two sided 0.04861603 60 Decrease 30.1%	One sided		0.024166059)		90								00								4.5						
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Decrease 30.1%	Two sided		0.048332117	7		70	••							<u>5</u> 70			•					3.5						
Decrease 30.1% 10 10 10 10 10 10 10 10 10 10 10 10 10	Two sided		0.04861603	3		60	•		-								•• •					2.5						
Decrease 30.1% 40 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5						50		••						0			•					2						
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		Decrease	30.1%	5		***********	······································				,			S 20		3	•	•	•			0.5						
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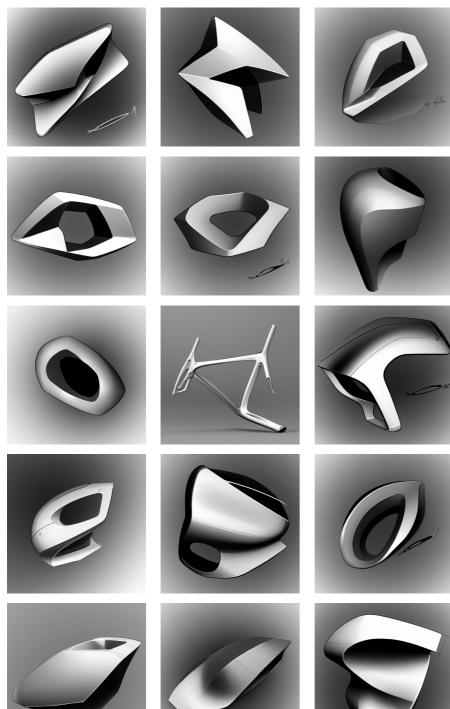
L. EXCEL REFLECTION QUESTIONNAIRE

The excel sheet can be found in the appendices folder.

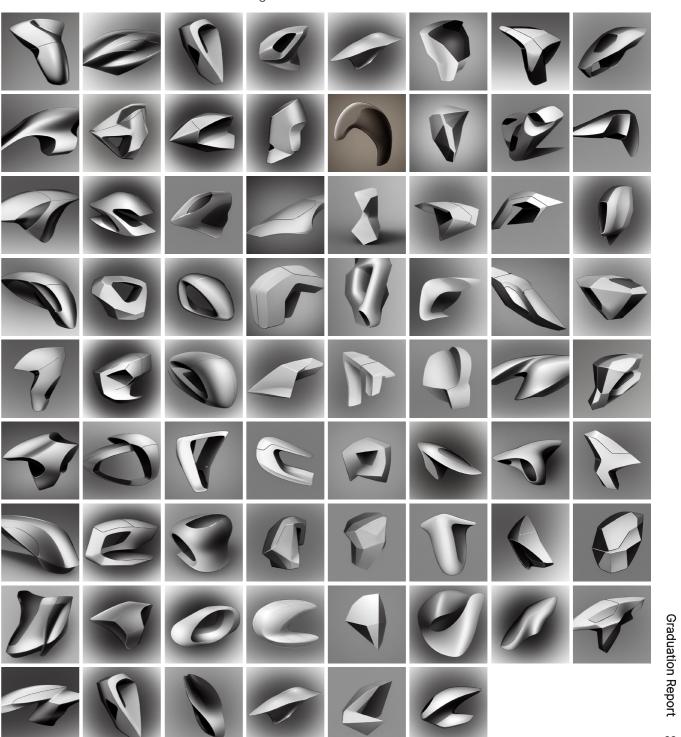
																After the
										The session						session, I felt
										helped me	The session				After the	that the group
		I voluntarily		What is your					The session	better	helped me	The session		Throughout the	session, I felt	had a better
		consent to my	How long have	function in this					helped me	understand how	better	helped me	Throughout the	session, the	that the group	collective
		questions	you been	design team?					better	other	understand how	better	session, the	group started	was more	understanding
	Hi, what is your	being used for	working in this	(manager,	How often do	I experienced	I experienced	I experienced	understand how	participants	the group	communicate	group	using a more and	aligned on the	of how to
Submission	name? (first	research	design team?	designer,	you use image-	the session as	the session as	the session as	I interpret form	interpret form	interprets form	how I interpret	discussions got	more similar	descriptions of	describe form
Date	name suffices)	purposes	(years, months)	junior/senior)	generating AI?	fun	interesting	insightful	studies	studies	studies	images	more effective	vocabulairy	form studies	studies
Mar 12, 2024	3	Yes	11 months	Designer	3	5	5	5	6	6	6	5	6	7	6	6
Mar 7, 2024	1	Yes	8 years	manager	1	4	. 7	7	7	7	7	7	7	7	7	7
Mar 6, 2024	2	Yes	4,2	Designer	4	5	6	6	6	7	6	5	7	7	7	7
					2.666666667	4.666666667	6	6	6.333333333	6.666666667	6.333333333	5.666666667	6.666666667	7	6.666666667	6.666666667

M. LORA OUTPUT INITIAL TESTS

1st training

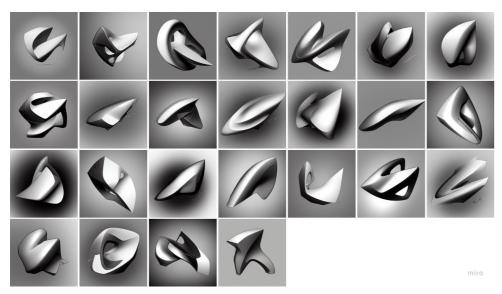


2nd training

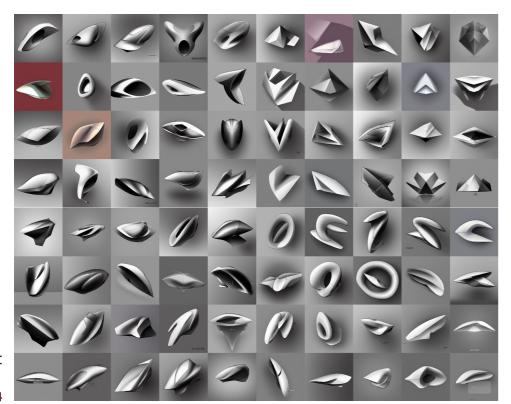


N. LORA OUTPUT LABELLING SESSION

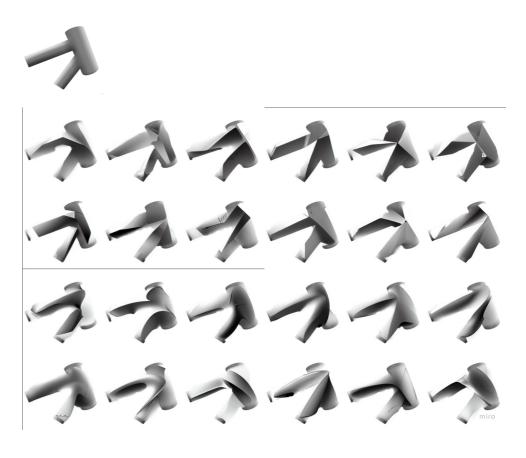
No regularisation images



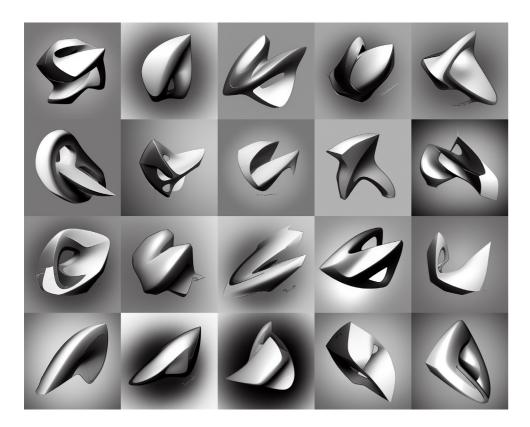
With regularisation images

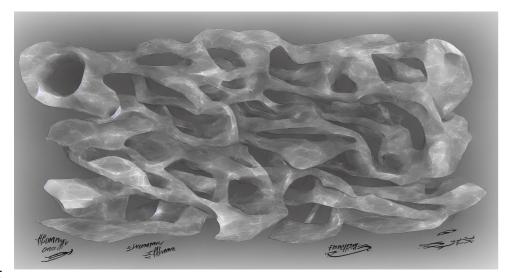


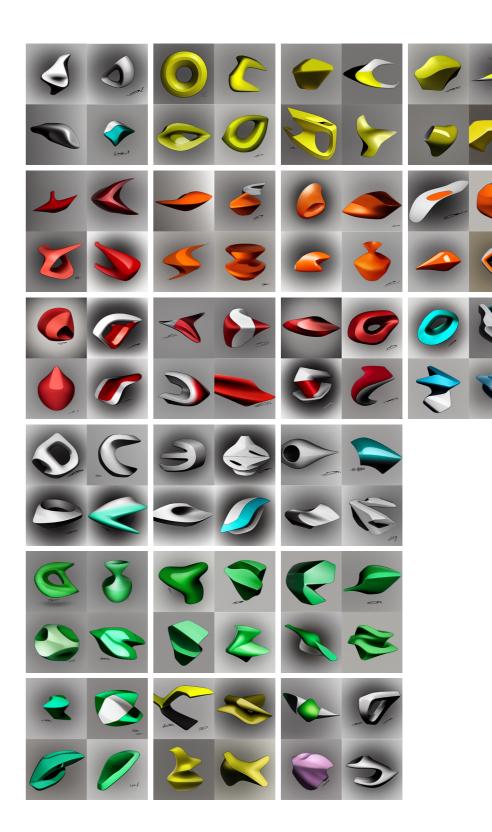
Generation based on a front tube joint sketch



O. LORA OUTPUT SINGLE DESIGNER SESSION







Appendices

P. GRADUATION PROPOSAL

Project proposal on the next page





IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

In this document the agreements made between student and supervisory team about the student's IDE Master Graduation Project are set out. This document may also include involvement of an external client, however does not cover any legal matters student and client (might) agree upon. Next to that, this document facilitates the required procedural checks:

	A & MASTER PROGRAMME Ids and indicate which master(s) you are in					
Family name	2	IDE master(s)	IPD		DfI	SPD
Initials	S	2 nd non-IDE master				
Given name		Individual programme (date of approval)				
Student number	r	Medisign				
SUPERVISORY Fill in he require	TEAM ed information of supervisory team members. I	HPM f applicable, company ment	or is adde	d as 2	i nd mento	or
Fill in he require	ed information of supervisory team members. I	f applicable, company ment	or is adde	d as 2		
		f applicable, company ment	or is adde	d as 2	Ensure a team. In include t	heterogeneous case you wish to team members from the section, explain
Fill in he require	ed information of supervisory team members. I	f applicable, company ment	or is adde	d as 2	Ensure a team. In include t	heterogeneous case you wish to team members from
Chair mentor	ed information of supervisory team members. I	f applicable, company ment	or is adde	d as 2	Ensure a team. In include t the same why.	heterogeneous case you wish to team members from e section, explain
Chair mentor	ed information of supervisory team members. I	f applicable, company menton	or is adde	į.	Ensure a team. In include the same why. Chair she Board of approva mentor in	heterogeneous case you wish to team members from e section, explain

Sign for approval (Chair)			
Name	Date	Signature	

CHECK ON STUDY PROGRESS

To be filled in **by SSC E&SA** (Shared Service Centre, Education & Student Affairs), after approval of the project brief by the chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accume Of which, taking conditional requ account, can be part of the exam	irements into programme EC	NO missing 1 st year courses Comments:
Sign for approval (SSC E&SA)		
Name	Date	Signature
Opes the composition of the Supercomply with regulations?		EAM -> to be checked and filled in by IDE's Board of Examiners nments:
Ooes the composition of the Supervicomply with regulations? YES Supervisory T	visory Team Con Team approved	
Ooes the composition of the Supervicomply with regulations? YES Supervisory T	visory Team Con	EAM -> to be checked and filled in by IDE's Board of Examiners nments:
Opes the composition of the Supervisory Tomply with regulations? YES Supervisory Tomply Supervisory Supervisory Tomply Supervisory Supervis	visory Team Conference	
Opes the composition of the Supervisory Tomply with regulations? YES Supervisory Tomply Supervisory Supervisory Tomply Supervisory Supervis	ream approved ream not approved is Constart the graduation project	nments:





Personal Project Brief – IDE Master Graduation Project

Name student	Student number
PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSECTION CONTROL OF THE PROPERTY OF THE P	SIGNMENT
Project title	
roject dae	
Please state the title of your graduation project (above). Keep the titremainder of this document allows you to define and clarify your gra	
Introduction	
Describe the context of your project here; What is the domain in who and what interests are at stake? Describe the opportunities (and liminterests. (max 250 words)	

have a huge impact on t al., 2023; Lawton et al., rs to "generate, explore, and friction through its te the speed at which Al can is contradictory to the ., 2023).

image / figure 1





Personal Project Brief – IDE Master Graduation Project

Pro	h	lem	Def	in	itid	าท
	~					

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice. (max 200 words)
Assignment
This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:
Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

Project planning and key moments

To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting**, **mid-term evaluation meeting**, **green light meeting** and **graduation ceremony**. Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).

Make sure to attach the full plan to this project brief. The four key moment dates must be filled in below

Kick off meeting	In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project		
	Part of project scheduled part-time		
Mid-term evaluation	For how many project weeks		
	Number of project days per week		
Green light meeting	Comments:		
Cup direction assumes and			
Graduation ceremony			

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.

limited to a maximum number of five. (200 words max)		