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# Acte créatif et l'IA

## Creative Act and The AI

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**Résumé** : L'adaptation des outils numériques a poussé la profession architecturale vers une nouvelle modalité de conception. Si dans le cas de la production architecturale, l'automatisation fournie par les systèmes numériques a un effet beaucoup plus évident, la question du processus créatif aux premiers stades de la conception reste problématique. La nature dialectique des deux approches (créative et numérique) demande une exploration approfondie à la fois de l'origine du processus créatif, de l'origine de l'objet architectural, du rôle de l'auteur, et des spécificités de l'espace numérique lui-même. Les derniers développements en IA et en traitement du langage naturel (NLP) permettent de mettre en scène un mode de communication différent entre l'architecte et l'environnement de conception. Le texte se concentre sur l'utilisation de l'IA dans les premiers stades de la conception.

En considérant la dialectique entre le processus de conception créatif et le processus numérique comme un problème de communication, c'est-à-dire un problème de transition du vague au précis, nous serons alors en mesure de délimiter l'efficacité ou l'insuffisance d'une telle communication et d'esquisser une méthode de conception en conséquence.

**Mots-clés** : processus de conception, processus créatif, objet architectural, environnement numérique, changement de modalité

***[Abstract** : The adaptation of digital tools pushed the architectural profession towards a new modality in design. If in the case of architectural production, the automation provided by digital systems has a much more evident effect, the question of the creative process at the earlier stages of design remains problematic. The dialectic nature of the two approaches (the creative and the digital) asks for a thorough exploration of both the origin of the creative process, the origin of the architectural object, the role of the author, and the specificities of the digital space itself. The latest developments in AI and NLP (natural language processing) allow staging a different mode of communication between the Architect and the design environment. The focus of the text is the use of AI in the early stages of design.*

*Considering the dialectics between the creative design process and the digital process to be a communicational problem i.e. a transitional problem from the vague to the precise, we will be then able to outline the efficacy or deficiency of such a communication and outline a design method respectively.]*

**Keywords** : design process, creative process, architectural object, digital environment, modality shift

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# THE DIGITAL AS A TRANSITION MEDIUM

It must be pointed out that further exploration of the topic is based on a core assumption that the creative and digital processes are different in nature. To name an instance of such difference: one is fluid and in a state of an active feedback loop with the author, and the other is a strict hierarchical system based on an input-output method. For this particular case, we consider the described contradiction between the digital and the creative as a communicational problem.

The emergence of a new modality in design and design thinking relative to the new technological landscape is inevitably changing the design process itself. The question is what constitutes that change from the standpoint of the design process and how does this new modality affect the design and the position of the author?

The digital environment allows for complex operations in high volume to be handled effectively. At the same time, it affects the author's relationship with the design object and the mode of creation, as within the digital environment each design iteration is a complete step and the author can only intervene post factum. As opposed to a modality where intervention by the author does not have to follow a ''schedule''.

On the one hand that which is indispensable in design must remain valid regardless of the shift. Yet, considering the non-binary nature and the vast range of notions and processes that the design act covers, it is not very clear, what is to be defined as "indispensable" in the design process. This is why we will narrow the problem down to the following:

1) the mode of communication between the author and the digital space ;
2) the methodology for an effective design communication ;
3) the consideration of the early stage design in the academic setting.

This is where the AI comes into play. We will not focus on either end of this transmission, neither the receiver nor the messenger, but rather on the transition point.

In the early 90s, the rise of CAD tooling that was promptly adopted by the architects and the designers quickly became a status quo in the design practice not just for the construction stage but also in the conceptual stage. Since then the CAD and now generative processes in design assume multilayered translation of data where any action results in a data point that has its graphical representation. A stereotypical digital design process assumes a frontend framework, this is where one sees the outcome and reacts accordingly, and a backstage where the calculations of form and any transformation or manipulation take place. Normally the backstage remains hidden and the inner workings of the digital systems are irrelevant to the author. However, often these inner systems are what define the course of the next stages in the process and consistently drive the author down one or another lane. An example of this is the popularization of fluid forms with the emergence of spline geometry in CAD tools as Greg Lyn mentions in his analyses of the Digital shift (Greg Lyn, 1997). In other words, whatever the environment allows or makes most effortless becomes the norm. This way the process of the design follows the digital norm without an active awareness of its intrinsic bureaucratic structures and modules. An example of this is the extensive use of fluid forms in design with the integration of underlying spline systems: a CAD logic rooted in uninterrupted curve calculation and spline tooling. What makes a certain operation possible in CAD or BEAM also creates a "digital habit".

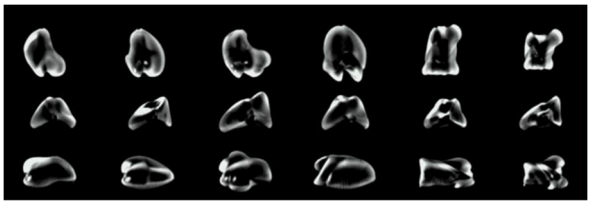

Figure 1 - The endless iterations of form (The Embryological House, Greg Lynn).

What has proven to be true for CAD since its early integration into design in the early 90s and throughout its development can be projected on AI as well namely if the CAD environment (BIM, Mesh-based design, Parametric design, Spline modelling, etc.) has an underlying effect on a loosely formulated design concepts that condition the outcome, the AI-based representational systems, such **as text to image, image to image, style transfer, etc.** will create a set of new underlying rules. Hence it is paramount to understand the nature of projected limitations and effects in the case of Ai and find a workaround for the abovementioned limitations, all the while still working within the existing framework of tooling.

In that sense, the integration of tools with contradictory modalities is an opportunity to integrate a high-performance system, which would otherwise have to be achieved through standardization, in a non-linear process, which will be unique for each use case.

## Medium and the translation process

In the context of the communication of the idea with the bureaucratic system (the word bureaucratic is

applied to describe a system requiring a set of repetitive, pre-determined actions that have to be executed for any operation within the program) of the digital environment, the shift from CAD<>BIM<>Parametric design to AI is not merely a technical one. The integration of AI offers an entirely new typology of communication with the digital toolset. If before each action was represented by a graphical symbol (from a movement of a mouse to a drafting of a line to complex 3D modelling) or in the case of BIM and Parametric design tools a data lists, the AI can process notions on the level of natural language. If in the case of CAD or Parametric design, each action results in a concrete object located within the coordinate system of the given program, the AI operates mainly based on approximation

[**Object A** is more likely to be described as a wall, or **object B** is 98.5 likely to not be a window]

Whether it is **text-to-image** or **image-to-image** transfer, the canvas within which the AI operates is less relevant than the large depository of previously processed data of similar objects and notions.

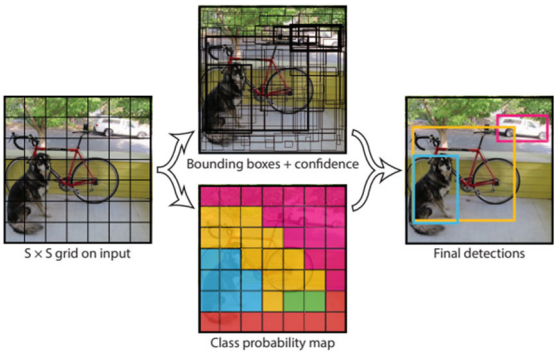


Figure 2 - Class probability (You Only Look Once : Unified, Real-Time Object Detection).

For the sake of isolating the medium and the translation problem, we will not consider the case where the misrepresentation of the object is related to the isolated data set on which this or that model was trained or the lack of topic-specific data used for the Neural Network training, which is most commonly the case in design when using pre-trained Neural Networks on generic data sets. We will focus instead on the topic of translation and communication using AI.

## Text to image

The text-to-image method, on the one hand, solves the bureaucratic (similar meaning as in the previous section) problem one would face when using the graphical method or the parametric method. On the other hand, it allows to translation of complex ideas into action items for the Neural Network. relationships of the Author<>Digital environment has conventionally been action<> command <>graphical output With the utilization of text as a communicational tool we shorten the distance between the action and the output.


Figure 3 – Midjourney image generation through a prompt (by Yubin, 2023).

With all its benefits the text-to-image system represents certain challenges. At times it is not possible to arrive at a specific result or reproduce a previous result. The range of random outcomes is large and fine-tuning the model for a specific topic becomes time and resource-heavy. At times the prompt must be manipulated to achieve the desired result. Building a prompt is similar to building a design logic, each word becomes a component that can be given weight and the order of the used terms also matters. Below is an example of such a structure:

[Detailed description of subject] [Surrounding environment] [Architectural style or time period, Architects, Designers & Photographers] [Parameters]

## Sketch to image

The text-to-image process however does not solve the problem of the transition from the undefined to concrete. In most cases the earliest stages of the design, it is not possible to define or formulate an idea.

We must however remember that for a Neural network, the understanding of the objects is not similar to the human perception. The understanding of the object is complex for established typologies, let alone a sketch.

It must be noted that such a method is not isolated to the digital domain and has been precedent in architectural design specifically for the early stages of the design conceptualization (Fig 4, Fig 5). But what would be the benefits of such a switch, why use a different medium for architectural representation?

Figure 4 - Sketching using a real-time video-to-image translation (Gloomy Sunday (2017). Memo Akten | Mehmet Selim Akten | The Mega Super Awesome Visuals Company).

On the one hand, as each medium is already an established system, a switch of representative medium cancels out the inner structure and the inner logic of the medium. By neutralizing the systems that we use for representation, that which must be most potent in the design is now free from the systematic dominance of the medium. On the other hand, claiming that the systems themselves are now completely blank and neutral environments is also false.

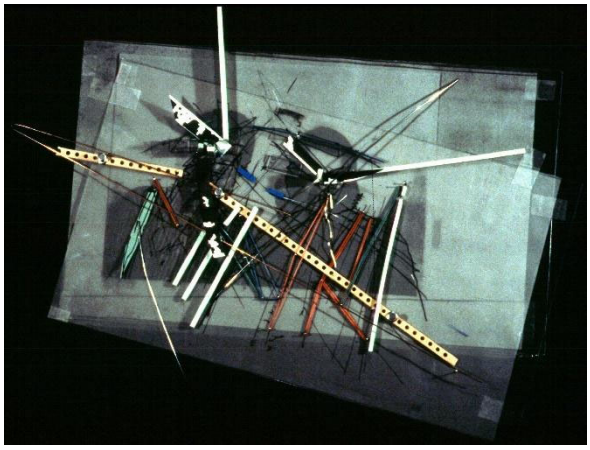

Figure 5 - an architectural sketch (Coop Himmelb(l)au. Method. Coop Himmelb(l)au).

The specificities of the used medium are still present, however, in a new condition, the effect is no longer a dominant one.

This brings us to the topic of an accident in design, or shall we say a positive accident. Since in its early stages, the relationship of the author with the design object is closer to a looped communication, the author is constantly exploring the design problem through the many incarnations of the design object. Hence the objective of such a relationship is to formulate the workspace around the object in a way that will allow each input factor to work at its peak potential in a given context. If we consider such a process positive, then the author becomes an observer. A successful accident is one where the design object brings out the collective effects of the context-driven inputs in an equal capacity. Only after the results of the authors' interventions gain a "form", and we use the term form loosely in this case, it is possible to make a judgment about the next step in the design process. An accident allows us to notice relationships between the factors that otherwise would remain unexpressed and overlooked due to the analytical nature of the design critique.

However, returning to the topic of the **sketch <>image transition,** we must keep in mind that the image here is simply representational and meant to be used as a source for the design conceptualization.

The combination of robust systems such as CAD or Text to image and a fluid system such as sketch to image, allowed to balance out the negative and positive effects of each individual system.

## Style transfer as a method

It is more or less clear how the AI works with objects, edges, and boundaries. By objects, we mean a boundary within an image that can be classified. By edges, we mean an approximation of the object border, the separation line of the classified object from a background or other objects. The process becomes more complex when we consider the relationships between those objects. This is where the "style" comes into play. Here the term style is used in the context of Neural Network style transfer models.

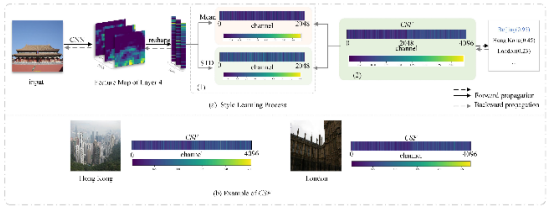

Figure 6 - Deep style learning process and examples of city style feature (Analysis of the Uniqueness and Similarity of City Landscapes Based on Deep Style Learning).

In the early stages of style transfer techniques in AI, the term was applied to describe digital art and graphic work. Later the style became a tool that one can use out of its original context. The style transfer would allow to work with images graphically in bulk, meaning the author now can apply the relationship between parts and overall conceptual wireframes to a new set of concepts.

This becomes crucial for the cases where the concepts cannot be translated into exact terms to be fed to the Neural Network via text.

In regard to the problem of vague to precise processes, style transfer is useful for those cases where the desired effect cannot be defined or

described by text in order to be used as a prompt (referring to the text-to-image technique). In effect, this technique does not eliminate the vagueness but rather allows one to utilize it to one's advantage by relying on the context provided by the given style. This way we can work with images purely graphically and manipulate them freely without having to apply accurate descriptions of the desired result beforehand. Such a process allows to create the feedback loop between the design object and the author at the same time without compelling the author to define the result before the design process is complete: a property that is typical for the input-output system but not advantageous for the early stages of the design.

### Image to CAD

Even with the enormous potential of systems like DALL·E 2 or Midjourney to generate complex scenes, these are still 2D representations of a single view, frozen in time and space. Moreover, in order to be able to turn this snapshot into a working material.

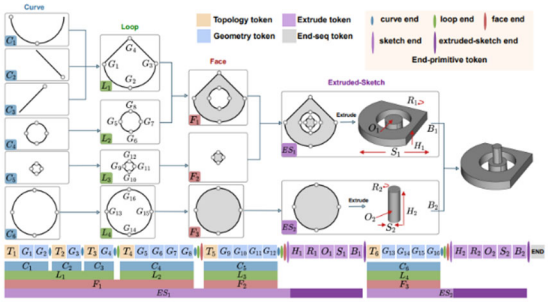


Figure 7 - The sketch-and-extrude model is illustrated as a primitive hierarchy and a code sequence. It consists of two sketches, which are formed by faces, loops, and curves. (SkexGen: Autoregressive Generation of CAD Construction Sequences with Disentangled.

One of the main problems of digital representation is the fact that it represents a 3D space but never actually allows for a full 3D experience. A 3D object is always represented as a dynamic collection of single 2D views or perspectives (Fig. 7). This means we retroactively always work with a 2D view or a snapshot.

If any medium can be used as a creative tool and later successfully be translated into a functional CAD model, then the transfer from 2D to 3D must be developed, in order to have a workaround for this limitation.

## THE SHIFT AS A METHODOLOGICAL TOOL FOR DESIGN THINKING

Even with a thorough understanding of the AI and its effects on the design process, without an established method, similar to CAD and parametric design, the author will stay in a disadvantageous position relative to the digital environment. Hence a method must be established first. However, the objective of the process must be defined before any attempt can be made towards a working method formulation.

In this regard, we need to understand what is in Digital design and Later AI-aided design that we are trying to avoid or take advantage of.

Let us observe the following cases in parallel:

1) text to image translation;
2) image to image translation;
3) image to 3D.

In the first instance (text to image) ether what we are trying to achieve is hard to define, ether The Neural Network has a different understanding of the definitions we are using, hence the prompt gives a completely different result from what was intended or described by the architect.

The second method captures the undefined relationships within the parts of the composition with a bigger success, however, produces results that cannot be precisely traced back or reproduced. In another case, where the **image-to-image transfer** is a **style transfer exercise,** the style becomes the main focus of the output image and the appropriation of what constitutes this or that style graphically becomes the main objective. Regardless of the method, the image-to-image transfer heavily relies on the object detection capacities of the chosen NN and the edge detection. This means the classification of the objects in large data sets used for NN training defines the final outcome. Considering that the majority of NN`s are trained on general classification sets, i.e. the terms and definitions differ from that of an architectural language, the range of definitions familiar to the NN renders is insufficient for the architectural design. The same is true for the objects forms and boundaries that are the cornerstone of NN training. This affects the results of both text-to-image and image-to-image transfers. We must keep in mind that whatever is "unfamiliar" to the neural network, cannot be generated. Hence the existence of general models both for language and image generation is extremely difficult and yet not established.

In the case of Image to 3D, the problem is both technical and conceptual. Ideally, the system would

need comprehensive information about the object before it can generate a working CAD model (view from multiple venting points for instance) (Fig. 7). Alternatively, the AI must "imagine" or "assume" what would the backside of the object look like from a single view. This is only possible if the NN is familiar with the object prior to the process.

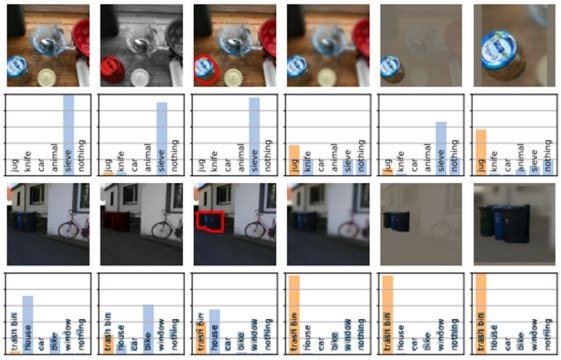

Figure 8 - Object detection using text (Image Segmentation Using Text and Image Prompts).

With objects that have a strict definition and more or less a generic graphical representation (a cup, a chair, a cat etc.) the NN can be practically trained to recognize the object and make that assumption relatively successfully. However, with architectural objects, such an assumption is not trivial, since one view is not representative of the entire object and each design object is different from the previous one in nature not just in form. The classification method cannot be applied to architectural objects because architectural buildings can not be placed in generic classes (for instance, there can be a class called windows but formally a window can be virtually of any shape and kind), this renders the concept of a class useless from the standpoint of data collection and NN training.

Considering these limitations, when proceeding to produce a representation of the design object using the 3 techniques (either in aggregate or individually), we must first meticulously describe them or find a close enough match graphically to make an image-to-image transfer and finally make the transition from 2D to 3D to have a digital duplicate of our design object that will allow to manipulate and develop the concept freely. Each step of the way a reduction in content, resolution, process density, and object quality is reduced this case, the term Process Density stands for the agency of the used system to simultaneously perform actions from different domains (for example: modify and react to change of form or visualize and reposition at the same time)

By arguing that the reduction of the above-mentioned elements is one of the main issues we take with the digital design process, we must consider the possible navigation roots around the systematic reduction that occurs during the digital process.

In the next chapters, we will discuss the possible ways of such a workaround.

# DEFINITION SHIFT

If the core limitation of **Text to image** is the lack of manoeuvring when it comes to vague and loosely defined terminology **(for example vast spaces, open space, clean lines, transparency etc.)** is the main limitation of the AI aided design, then that is the main feature that the Autor must now neutralize when using the text to image method.

Let us look at the term "transparency".

In a common meaning, the word describes the quality of the material and its ability to let through light. However, in architecture, the term can be used to describe the quality of the space or the object.

In this particular case we will not focus on the lack of sufficient data training, specifically catered to the architectural jargon, but rather focus on the abovementioned effect.

The main contradiction is between communicating ideas and transferring information. In the first case to fully understand the meaning of what was communicated, one must be aware of the context, in the second case the information transfer is binary (what was transmitted on one end is identically received on the other).

Figure 9 - A test run of DALL·E 2, text to image (Crenau Lab experiment, Arpi M.).

Instead of attempting to establish a general Language model able to function equally well for all domains including design, we must learn to manipulate the prompt within the existing NNs. Instead, a shift in prompt structure will allow us to overcome the limitations of the system.

Let us look at the following prompt examples.

<Le Corbusier desi**gns** a cave> (Fig. 9)

<Le Corbusier design**ing** a cave> (Fig. 10)

Figure 10 - A test run of Midjourney based on DALL·E 2, text to image (*Crenau Lab experiment, Arpi M.*).

Depending on the wording, order of the same terms and the weights of each term the result will be cardinally different.

## TOOLING SHIFT

A similar effect to the natural language communication method is observed when dealing with a variety of CAD and BIM tools One way or another the author always works within a simple representation of the design object. Whether it is a 3D model, a BIM system, or a grasshopper definition, the complexity of the digital double is irrelevant if the experience of the design object is limited to one view at a time. In addition, each program used has its individual referential frame and operation logic that forms the communicational framework of the program. Since the transfer from the concept to its digital double inevitably must happen, we cannot avoid these limitations while working within one program. But what if we did not use the tool as it was intended but jumped from one to another as needed? This would render all the dominant features of each individual program irrelevant. An example of this is the use of AI in 3D software such as Unreal Engine, where the shortcomings of the AI to produce concrete results are compensated by the possibility of setting up the scene manually in the form of simple geometry, and the tedious process of 3D modelling is overcome by the ability of the AI to create realistic and extremely detailed textures.

Another example of this is the utilization of 2D mapping and texturing as a 3D tool (Fig. 11).

Topographies instead of projections, textures instead of detail and other similar shifts open a different modality in the design process.

Another possible direction of this shift is the scale. What the digital spaces allow is a free manipulation of scale. Virtual models are by default scale-free, the scale is always superimposed. This too can be used as a neutralizer. By switching between scales dynamically the author has the advantage of critical view. Observing a micro object on a macro scale and vice versa can open a level of definition unavailable in a single-scale process.

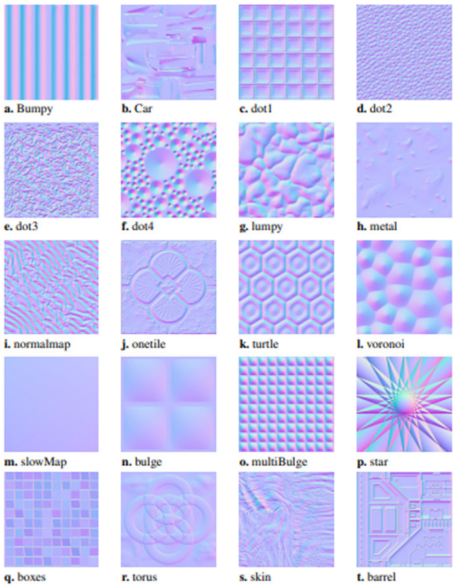


Figure 11 - Normal map display for various geometries. And bumps (High-Quality Normal Map Compression 2006).

## AI AS AN ADDITIONAL FILTER IN THE DESIGN CRITIQUE

Above all AI is a testing ground: a testing ground on a fast track. Let us imagine the design process as a content mediation between the author the design object and the data that the author receives from the environment. With each iteration, the design object is transformed accordingly. Hence the role of the author is to initiate the iterations, mitigate, curate and halt the process when the design object has reached its maximum capacity (content-wise). If this is a game of design, then each time the author applies a filter to include or exclude certain data in their decision-making, the design object takes a different course. For this, a variety of testers or filters are used. The more fluid and effortless the testing process, the more informed iterations one can make. The analogue tooling normally would allow this since there was less bureaucracy involved in the process.

AI has a similar effect. It is capable of fast and detailed representations and a vast number of iterations backed up with simultaneous analyses of a large bulk of data.

# AI AS A TEACHING TOOL IN DESIGN

Considering all the shortcomings of AI in the design practice, AI-aided systems are excellent storytelling tools. Above all, if we consider the teaching practice a domain of constant back and forth between the topic and the author, an experimental space, a place of dynamic exploration, the effectiveness of ideation and conceptualisation would be effortless enough with the utilisation of AI, which brings us to the idea of another filter used in the design process. Though the topic is substantial, it has not been sufficiently explored, therefore this direction is an ongoing research branch in our work.

# CONCLUSION

While attempting to integrate AI into the design workflow in its early stages, not one but a system of multiple approaches would be optimal, to compensate for the variety of limitations in each. The problems of high accuracy and loss of definitions through the “shift” in this case have a double-sided effect. On the one hand, it is a negative point toward the intentionality of the author, on the other hand, the possibility of the accident itself is beneficial when we consider the nature of the early-stage design.

Once the standardization of the Digital environment is overruled through a higher quality shift between the context, the medium, the resolution, and the definitions, it will be easier to distinguish the contribution of the tool against the design process from the contribution of the author. The evaluation of the process in a more accurate manner will in turn give us the data needed to formulate a methodology for design and teaching, all while being aware of the new modality conditioned by a rapidly changing technological and social landscape.

The main argument of the article is the following: If we consider the creative segment of the design to be a movement from abstract, none formulated, undefined, formless ideas into concrete formulations, then the method by which this is done can be considered a communicational problem. Therefore, a successful relationship with the digital environment which we use as our tooling as designers can be considered one where during such a communication the density and the quality of the imported ideas are not lost to the inner mechanics of the system (Fig 12).

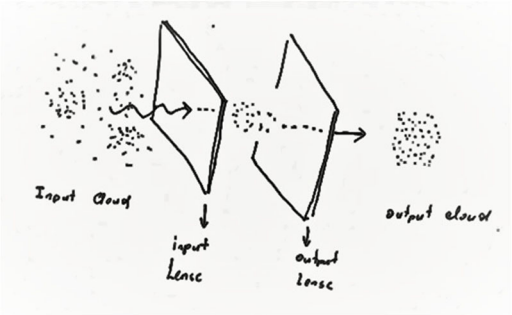


Figure 12 - A diagrammatic representation of a reductive transitional process from the idea phase to prototyping within the digital environment.

Apart from the methodological challenges that the Ai-integrated design practice faces, there are also fundamental sociocultural and moral issues that are not resolved. In addition, a technical issue of the entry data, NN fine-tuning for each specific domain, and consequent output data filtering process has a long way to go before we can claim that AI-aided design is a functioning system for architects and academics alike. The skills required to select successful interactions from a vast number of options are not derivative and need further exploration. Hence the selection of the outcome cannot be emulated without the process and the educational models of our time must consider the new roles that the architect inevitably takes on as an author.

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