GOLDEN GENERATION GENERATOR

VISUALIZATION, REPRODUCTION, AND CLOSURE OF STRUCTURAL BIASES IN RECENT ARCHITECTURAL PRODUCTION IN CHILE, THROUGH MACHINE LEARNING

Deconstruction questions not only the solidity of structures to detect their weakest points but also whether what we understand by structure is actually structural. If we ask, for example, what is structural in a tradition? we can observe – as this research does – that the structure is based on the reiteration of images. But when processing this repetition *ad infinitum* with artificial intelligence tools, the structural failure appears: an architectural image as disturbing as those that evoke deconstruction.

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01· Selección de imágenes sintéticas generadas a través del modelo de aprendizaje maquínico Golden Generation Generator v.1.0. / *Selected synthetic images generated through the Golden Generation Generator v.1.0 machine learning model.* © Fernando Portal

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In the image's upper half, against a background of a most similar color to that of all skies, a figure with diffuse edges and leaning horizontally is delineated **[Fig. 01]**. In the image's lower half, that same figure can be distinguished from a texture that could, at times, resemble treetops, a close-up picture of a moss, a meadow in perspective, or a moving dune. It looks is as if the entire chromatic range of the sky and the geometric patterns that guide plant and mineral growth were collapsed into palettes and textures that, while meaningless, seem to represent everything. Against this background, the central figure holds a strangeness as familiar as it is unknown; even though its diffuse edges welcome the colors and those environmental colors and textures, this figure is no longer a natural subject. While its geometries express a structural idea – sometimes tectonic, sometimes a-tectonic – and its edges – when they are not transparent – approach the visual properties of wood or metal, it is difficult to determine where or how its surfaces begin and end. These alternate textures, opacities, reflections, and transparencies in a fluid and continuous way the latter being perhaps the most indecipherable because we cannot pinpoint what is reflected on these surfaces, nor what we can see through them. In the end, this calculated transition between colors and textures also composes something that sometimes can be understood as a space yet at other times is unintelligible, escaping from the Cartesian order or perhaps from all meaning.

These images were produced through an artificial intelligence algorithm. A machine learning model programmed with the ability to learn, in an unsupervised way, the patterns that make up the structure of the data set used in its training, prompting the generation of new synthetic data.[1] Thus, each image generated by the model responds to the same patterns it recognized when analyzing an original set through computer-visualization procedures. In this way, each synthetic image is a probabilistic projection: a look at what the structure of the original data set could continue to produce if it kept reproducing itself as part of a closed system of information production.

This is why machine learning, as an artificial intelligence line of development, currently finds both its criticism and limit within its ability to block the future[2] since the only agency these systems have, in terms of decisions and actions, is to reproduce *ad infinitum* the structural and cultural conditions of the finite data sets used in their training. It is for this reason that a critical part of the current ethical and political discussion surrounding the use of these systems[3] focuses on the consequences of their potential to automate the reproduction of structural biases – biases capable of discriminating based on race, gender, sex, age, and culture, and which are present, for example, in the racial discrimination observable in surveillance systems based on facial recognition (Amaro, 2020) or in gender discrimination present in access to medical treatment (Correa, 2022). Thus, the prejudices of the very culture that generates this or that set of data will also be reproduced and perpetuated – autonomously and automatically – in the synthetic data generated by the algorithm. These data, in its human-readable configuration, can inform multiple media, such as images, texts, sounds, videos, or interactive environments, and also feed more discreetly but no less decisively the technosocial systems with which we interact daily, such as territorial information, economic simulation or the management of our perception. It does this by capturing and analyzing our behavior patterns and their subsequent intervention in search of their perpetuation: if you liked that, you will also like this.

Machine Learning as a Deconstructive Tool

Among the approaches with which the arts and humanities have addressed artificial intelligence's ethical, aesthetic, and political challenges, deconstruction as a critical methodology is not very common. However, deconstruction appears in recent computer science literature, in which it is conceptually applied when developing of machine learning systems (Schmid et al., 2019) and computer visualization (van den Hegel et al., 2014). In the latter, deconstruction supposes the separation of the main components that make up a subject within an image to identify them individually, an operation that aims to enrich the result of automatic object recognition routines. A human and machine approach in which "deconstruction itself, however, is often misinterpreted as the taking apart of constructions" (Wigley, 1988:11), referring precisely to what Mark Wigley's deconstructivist architecture sought to differentiate from. In his text accompanying the homonymous 1988 exhibition, curated together with Philip Johnson, the author points out that representative projects of the intersection between architecture and deconstruction do not "[...] derive from the mode of contemporary philosophy known as 'deconstruction,'" but "[...] emerge from within the architectural tradition [...]" (Wigley, 1988:10-11). A tradition that, in his case, corresponds to the purity of the modern form on which the deconstructivist architect would demonstrate the ability to "[...] diagnose certain structural problems within apparently stable structures, these flaws do not lead to the structure's collapse" (Wigley, 1988:11). Thus, the deconstructive within architecture would be given by "the view that the flaws are intrinsic to the structure. They cannot be removed without destroying it; they are, indeed, structural" (Wigley, 1988:11).

Furthering this perspective, I propose the use of machine learning to develop a critical exercise to unveil the data's inherent structures. Specifically, I propose to use the limits of the current level of machine learning development[4] in its potential to visualize[5] the aesthetic and procedural limitations of other closed systems of production and reproduction. Systems that, although alien to the paradigm of artificial intelligence, have operated with similar rules, identifying their own patterns and applying them repeatedly, recursively and postcritically; systems capable of producing and reproducing their own data sets and, alongside them, their own structural biases, as well as their own institutional systems for the circulation, valorization and perpetuation of their hegemony through media, markets and academia; systems such as the 'Chilean architecture' – in quotation marks, as a cultural industry – and, within it, specifically, the role played in its conformation by the images of the buildingsof the so-called 'golden generation.'

The Golden Generation as a Closed System

"It happened just at the turn of the century" is the remark that opens the section entitled Power within the Chilean magazine *Capital* when referring to what the same media coined in 2015 as "the golden generation of Chilean architecture" (Soto & Berdicheski, 2015). Consisting of four male and one female architect,[6] this category presented together, for the first time, the diversity of their work as a whole. These figures shared respectable levels of recognition and access to international markets and platforms. Together, they were also understood, in part, as the result of the effort and investment executed by the School of Architecture of the Pontificia Universidad Católica de Chile's academic project, beginning in the mid-80s; a project that, amid of the convulsion of the civic-military dictatorship, moved towards the field of autonomy and craftsmanship, achieving a "continuity and gradual development of that state of thought, inevitably closed on the most 'neutral' heart of the discipline, to limits of metaphysical

excess" (Liernur, 2009:9). A continuity that also expressed "the conditions of possibility of the special richness that can be observed in the showy flowering of the last decade" (Liernur, 2009:9).

Other generations of the same school have developed different readings on this category. While some delve into the analytical critique of its construction as part of an economic and institutional framework of neoliberal *ethos*, associated with the formation of a cultural industry from the architecture produced in Chile (Díaz, 2017), others approach it from a more autonomous position, assuming the practice and the ways of doing of that architecture as an aspirational universal for all architects and students of the country (Grass, 2020). Despite their clear differences, both readings agree that the media ubiquity achieved by the works of the golden generation and the expansion of their field of influence are structurally linked to the digitization of the means of international circulation of architecture – a process that coincides temporally and spatially with the development of these works from the explosive growth and on a planetary scale of Chilean digital platforms such as Plataforma Arquitectura and ArchDaily. In this way, we find a system of production of works based on a 'closed thought,' whose material results are massively digitized as images to be put into circulation through another system, also closed in terms of its algorithmic governance.

The Becoming Image of the Golden Generation and the Agency of its Forms

The digitization of the golden generation's architecture constitutes the first unfolding of this production, one where the architectural forms are detached from their material conditions to exist independently from their own matter.[7] Thus, the form that only circulates as an image acquires the ability to transform its environment to the extent that its influence finds other material substrates, in this case, other buildings that assume their forms, an influence dependent on the action of the institutions and individuals that promote them and take them as a mold, making architecture and its institutions as a relevant agent within the 'complex of images,' that is, within "the network of financial, institutional, discursive and technological infrastructures and practices involved in the production, circulation and reception of the visual-cultural materials" (McLagan & McKee, 2012:9). A complex that, in the integration of architecture, is also capable of shaping the world.

The scope of this dialectical relationship between image, form, and world is present in Flusser's reading of the image as he affirms that, structurally speaking, every image is anti-historical. In his analysis, this implies that, regardless of the type of relationship that each image establishes with the text or with the numerical code, every image can set up magical relationship with the environment. This potentiality is a condition of prehistoric images, which "are not experienced as a result of the environment, but we experience the environment as a result of images" (Flusser, 2016:34). This capacity of the image to shape the world – in its image and likeness – would be immanent in the relationship that we, as image-producing beings, establish with the world.[8] The intrusion of history – and with it of the text – attenuates this structural agency of the image, which subjugates it by interpreting and using it as evidence, representation, copy, and simulation; a subjugation that limits the image to, instead of transforming the world, only copying it, which is interrupted by the appearance of photography. For Flusser, photography is the first post-historical image since its generative process does not involve text, but code: calculation and computation. This is because each photograph is structurally a numerical mosaic, whether through the framing or the calculated chemical behavior of photosensitive emulsions, or the physical behavior of digital sensors.

Hence, if each photograph results from a calculation, it does not represent the world. It is not simulating it but rather projecting it, generating a world of its own that does not exist in the world: "Photographs constitute information intentionally produced from a swarm of isolated possibilities" (Flusser, 2016:96). This projective capacity of the post-historic image is equally applicable to synthetic images, in which "the aspect of computing is more easily recognizable" (Flusser, 2016:97). In this way, the synthetic image produced by the machine learning model is not merely an image that does not represent the world or anything that exists in that way in the world: it only represents its own structural potential for transforming the world.

The Becoming of the Images of the Golden Generation

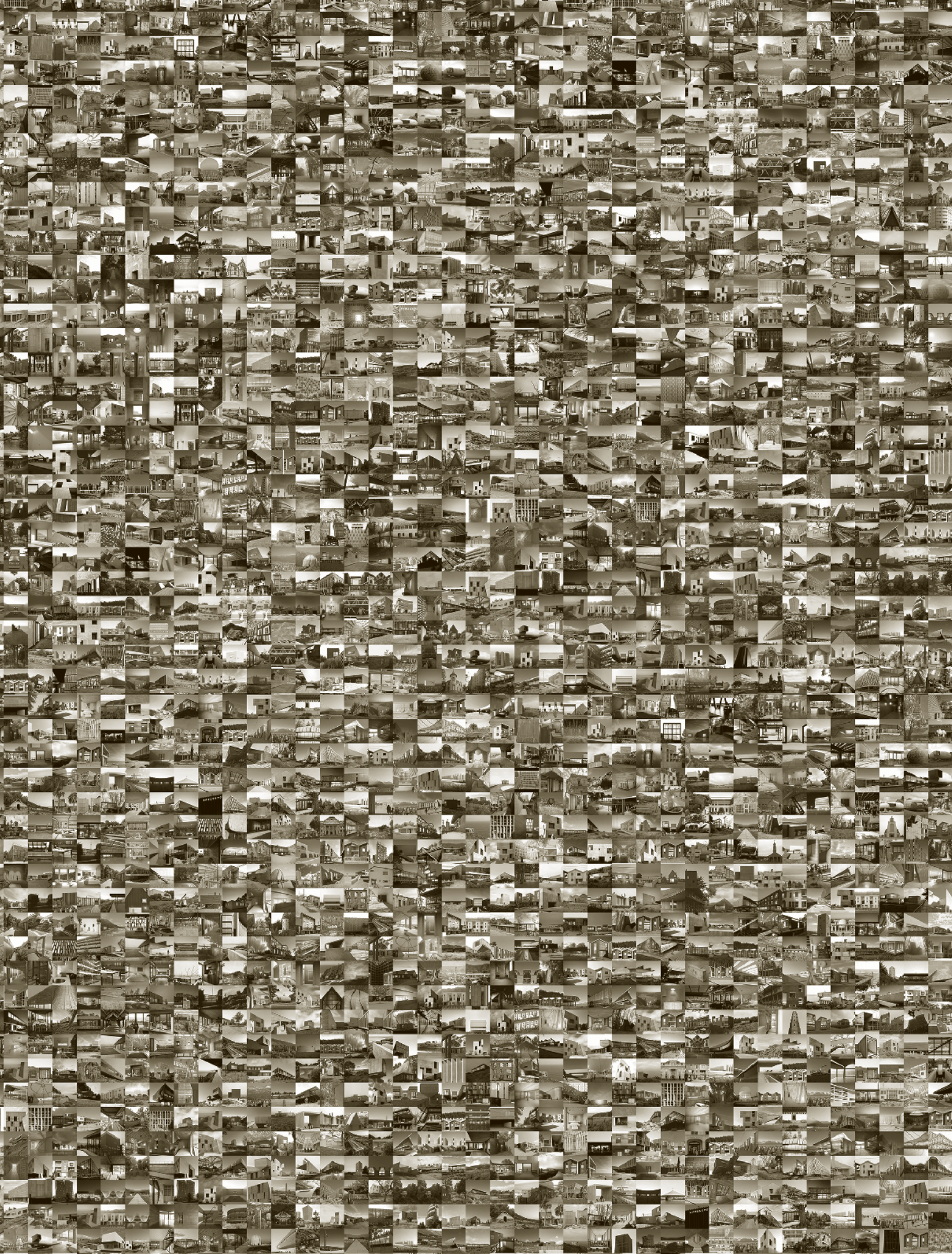
The second unfolding of this form, already transformed into an image, occurs when it becomes a digital file. Its consequent multiplication and circulation as a code through the 'complex of images' allow us to understand the golden generation no longer merely as a category that encompasses a set of authors and the buildings they produced, but also as a category of search and recovery of an accumulation of data distributed heterogeneously in the physical and economic infrastructure of the Internet.[9]

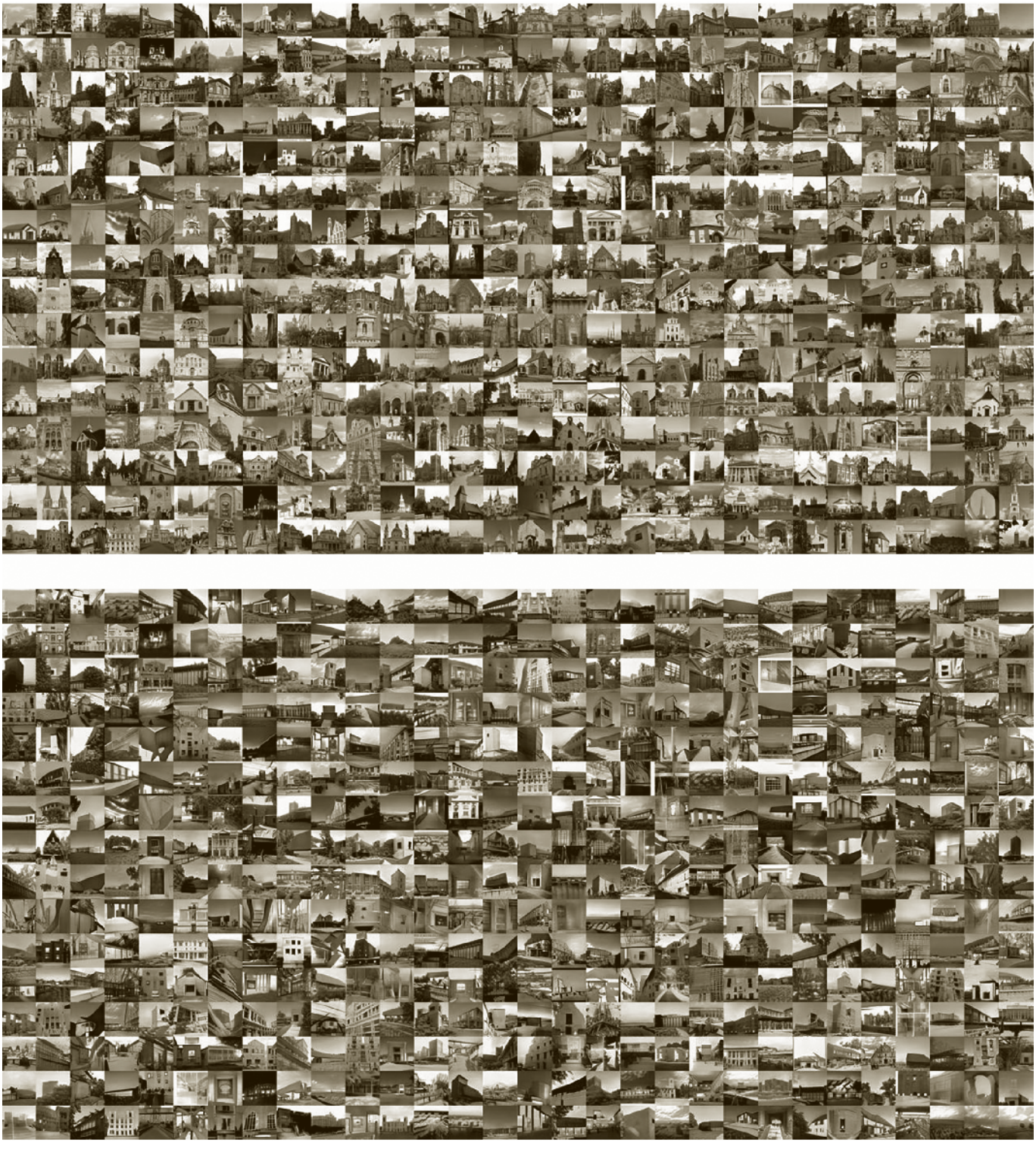
Based on this, the critical exercise proposed in this essay began with the compilation of images for the construction of a data set, which was used in the training of the machine learning model. This operation allowed for the creation of an algorithm capable of generating unlimited sets of synthetic images that, the more they resembled the original photographs, the greater the capacity of the model to account for the limitations of both the algorithm and the formal capabilities of the patterns contained in these images, and thus of its own culture.

The construction of the data set involved the use of scraping tools for the massive download of images from the internet. The downloaded images corresponded to the totality of the Google Images search results for the golden generation's works.[10] On this total, a selection process was carried out, eliminating images of plans, renderings, portraits, and other types of graphic material to leave only the photographs of built works. After this filtering, the data set added a total of 1,609 photographs [**Fig. 02**].

Using the Runway platform, this data set was employed in the training of a StyleGAN 2 model, based on adversarial generative networks, for the development of synthetic images (Karras et al., 2019). In the first version of the Golden Generation Generator (GGG v.1.0), all these images retrained the Churches model,[11] resulting in an unlimited first set of synthetic images. Even though the training process considered 3,000 steps or reiterations [**Fig. 03**], the structural resemblance between the churches' images – used in the original training of the model – with those of the architecture of the golden generation resulted in that a series of attributes recognizable in both types of buildings, which was also recognizable in a large part of the generated images [**Fig. 01**]. To overwrite the original training information of the model and give greater weight to the properties of the new data set (Karras et al., 2020), in the 2.0 version of the GGG, the training was carried out in the Faces model.[12] The differences between the information structure of both data set allowed, with the same number of images and steps, to eliminate the traces of the original set, creating a more consistent version.

Although the images generated by GGG v.2.0 more accurately reproduced the characteristics of the data set, human analysis of the images identified that different types of frames and recognizable subjects were being superimposed on the original photographs [**Fig. 04**]. Thus, and since the only human interference in the process of machine learning is the curating of the data set, a third round of training was carried out. For this version, the data set was segmented,





02· Mosaico con 1600 imágenes recolectadas desde las búsquedas "generación dorada" en Google Images. / *Mosaic composed of 1600 images collected from "golden generation" searches on Google Images.*
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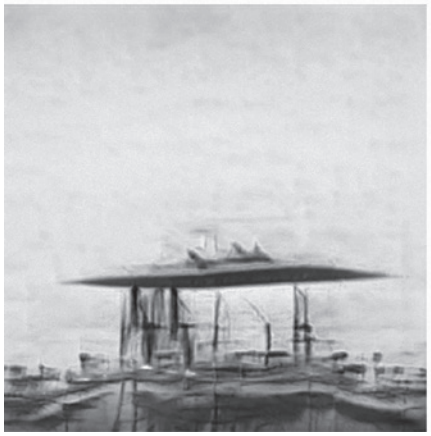
03· Mosaico con vistas de procesamiento del conjunto de datos en 200 y 2.900 pasos. La primera imagen muestra imágenes sintéticas producidas por el modelo Churches. La segunda muestra las variaciones introducidas en el modelo tras su reentrenamiento como GGG v.1.0. / *Mosaic with data set processing views in 200 and 2,900 steps. The first image shows synthetic images produced by the Churches model. The second shows the variations introduced in the model after its retraining as GGG v.1.0.* © Fernando Portal









generating six new models, each one with a specific type of view: complete frontal (CF), complete in perspective (CP), incomplete front (IF), incomplete in perspective (IP), interior (I) and landscape (P). This segmentation allowed us to obtain models capable of generating more precise[13] and coherent images with each type of frame and its subjects [**Fig. 05**].

Deconstructing the Golden Tradition

The fact that the generative requirements in the model deliver images in which the qualities of the architecture of the golden generation are recognizable responds to both the conditions of the model and those of the data set. We know that the main property of the model is to generate images similar to the data set with which it was trained, and that the data set formed through the search category <"golden generation"> delivers images of objects sharing certain formal characteristics. Based on this aspect, and through this exercise, we can corroborate that the architecture produced by these authors has a high degree of formal consistency. Another known aspect that the exercise allows corroborating is the preponderance of the natural environment. As we observed at the beginning of this essay, the figures in the center of the images are defined against colors and textures that come from multiple layers of natural elements.

However, the potential of the generated synthetic images may go beyond these simple corroborations. The original photographs of this architecture have exercised their agency of transformation of the world, operating as references for the design aspirations of architects, students, and clients (Grass, 2020) and influencing the generation of new works of architecture. Through this framework, the immaterial forms carried by the original photographs have found new material substrates to manifest themselves back in the world. Assigning the same capacity to its synthetic images would imply giving the model a generative role of new forms and, with it, of new architectural projects that could prolong the life and influence of this production, expanding once again the scope

GGG v 3.0 / CF - Completa frontal / *Completa frontal*

GGG v 3.0 / CP- Completa perspectiva / *Completa perspectiva*

GGG v 3.0 / IP - Incompleta perspectiva / *Incompleta perspectiva*

GGG v 3.0 / IP - Incompleta frontal / *Incompleta frontal*

GGG v 3.0 / FI - Interior / *Interior*

GGG v 3.0 / P - Paisaje / *Paisaje*

04· Selección de imágenes sintéticas generadas a través del GGG v.2.0, con un FID de 95,92. / *Selected synthetic images generated through GGG v.2.0, with a FID of 95.92.* © Fernando Portal

05· Selección de imágenes sintéticas generadas a través de seis versiones del GGG v.3.0. Si bien el FID aumentó a 145,82 en promedio, la segmentación del conjunto de datos permitió obtener mayor coherencia entre los encuadres de las vistas. / *Selected synthetic images generated through six versions of GGG v.3.0. While the FID increased to 145.82 on average, the segmentation of the data set allowed for greater consistency between the views' frames.* © Fernando Portal

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of the system, but now not only as a closed system but as a self-absorbed one, one only able to reproduce itself.

Faced with this possibility, it is necessary to ask about the need and meaning to continue doing more of the same, and even about the consequences of continuing to project into the future, of the identifiable structural biases in the cultural conditions that have originated the information contained in this data set. Based on that, I propose, from this exercise, an opposite role for these synthetic images: shutting down. If each of these synthetic images represents a calculable possibility for the projection into the future of these biases of the past, perhaps each image presents us with a possibility that doesn't need to be realized. We already know how it might end. We already know what biases it reproduces. We already know what it looks like. Thus, the accumulation of these images would allow us to exhaust, in an accelerated way, the possibilities of developing their own data set.

A possible result of the critical use of machine learning models would be the ability to make obsolete the influence of certain aesthetic categories and their ways of doing based on the visualization of their consistency – understood as an indication of their hegemonic character in processes of material transformation of the world. Such an approach would make it possible to exhaust the field of transfers and stylistic reproductions enabled by the closed-thinking and machine-learning systems brought into play by this exercise.

Finally, this ability to identify and visualize cultural biases in the structure of data sets would allow us to understand this type of use of machine learning algorithms as a tool for the development of processes of deconstruction of architecture – and other formal structures – in a similar way to that proposed by Wigley, that is, through processes capable of identifying intrinsic flaws in the structure of tradition. ARQ

NOTES

1. For a general introduction to machine learning, see Greenfield (2017). For an aesthetic and philosophical discussion regarding the conditions of its use and development, see Celis & Schultz (2021).

2. Relevant scholarship for the formation of this critique has been Pasquinelli & Joler (2021), and Crawford (2021).

3. For a review of the role that images and social biases have in the conformation of algorithmic biases, see Crawford (2019).

4. This exercise was developed between April and December of 2020. At the time of publication in 2022, the models of Generative Adversarial Networks (GAN) used are being outperformed in their ability to maintain semantic consistency between generative requirements and synthetic images by dissemination models, such as DALL-E 2 and Paper clip. In addition to the machine learning techniques, computer vision and synthesis present in the GAN, dissemination models use techniques of Natural Language Processing (NLP) and of Natural Language Generation (NLG). Regarding this, see Goh et al. (2021).

5. "Imagination is the ability to step out of the environment and create an image of it, while visualization alludes to the ability to turn a swarm of possibilities into an image. Imagination is a consequence of an abstraction of the environment; visualization, the power to specify an image from possibilities" (Flusser, 2016).

6. For Soto & Berdicheski (2015), the golden generation consists of Alejandro Aravena, Smiljan Radic, Cecilia Puga, Sebastián Irarrázaval, and Mathias Klotz.

7. "The being of the images is the being of the forms in a foreign matter in relation to their natural subject. Our image is none other than the existence of our form outside our matter, the substrate that allows this same form to exist. [...] If this is true, then we could say that every image is born when the shape of the thing is separated from the place of its existence: *When the shape is out of place, an image is produced*" (Coccia, 2020:92-93).

8. On the specific nature of that relationship in the case of architecture's representation and design tools of architecture, see May (2019).

9. On the evolution of images as a code in internet infrastructures and cultures, see Steyerl (2009).

10. The searches carried out corresponded to the following terms: <"alejandro aravena" arquitectura>, <"sebastian irarrazaval" arquitectura>, <"mathias klotz" arquitectura>, <"cecilia puga" arquitectura>, <"smiljan radic" arquitectura>, <"pezo von ellrichshausen" arquitectura>. Additionally, depending on its stylistic coherence and following the extension of this category proposed by Grass (2020), the results of the search <"felipe assadi" architecture>.

11. The Runway platform <runwayml.com> allows us to train pre-trained models with specific data sets. This procedure, known as *fine-tuning*, is an accessible alternative for training existing models based on original data sets, compared to developing a property model. The Churches model was originally trained with images of the category of the same name in the LSUN data set, generating images of 256 × 256 pixels. For more information about this data set, see Yu et al. (2016).

12. The Faces model is originally trained with the Flicker Faces HQ data set, generating images of 1024 × 1024 pixels.

13. The ability of a model to generate images like those in the data set is measured through its Fréchet Inception Distance or FID Score (Heusel et al., 2018), which, according to Borji (2018), measures the distance between the vector characteristics of the images in the training data set, and that of the generated synthetic images. The shorter the distance the greater the similarity between the properties of both groups of images. The GGG v.2.0 obtained a FID of 95.92, while the average of cohort 3.0 obtained a FID of 145.82, the 2.0 is more similar to a set of dissimilar images, while the 3.0 images are less similar to a set of images more consistent and, therefore, in terms of human perception, more similar to the original images.

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