3.11 — TRIBUTE TO SOL LEWITT
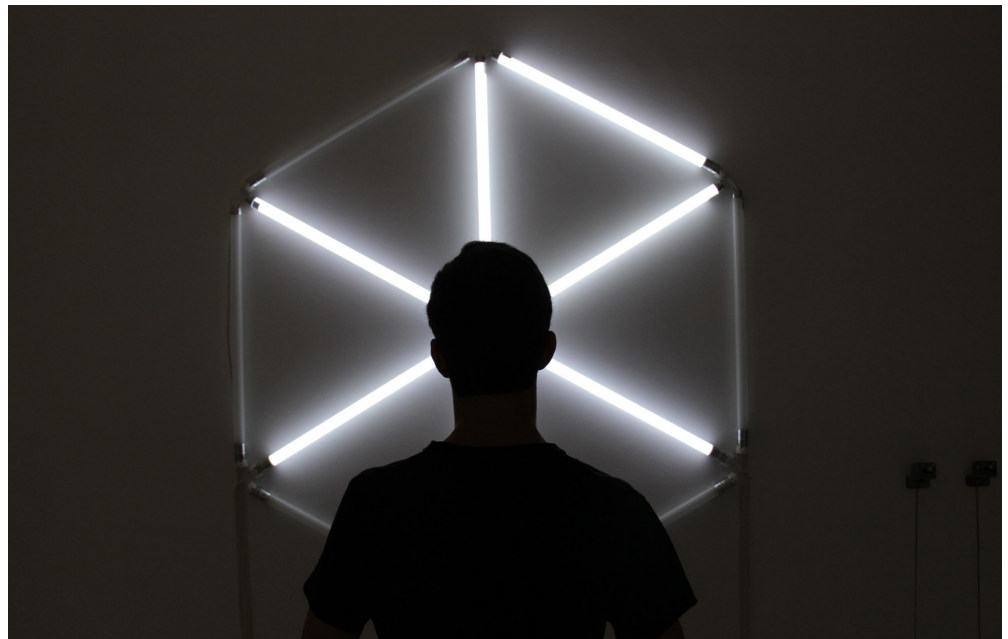
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Abstract

3.11 is an intermedia artwork that revisits Sol Le-Witt's "Variations of incomplete open cubes". *3.11* integrates a provocative reactive system that triggers visitors' actions, transforming them into performers, authors and mediums of the artwork itself. A pair of potentiometers allow humans to control an arduino board, instructed to draw, on a display constituted by twelve T8-LED Glass tubes, any of the 122 variations of LeWitt's work. *3.11* reiterates the algorithmic dimension of LeWitt's work that has been mainly recognised as conceptual art. During the *3.11* design process a mistake on the most widely known diagram of LeWitt's work was identified that hadn't been found before. Being too late to question LeWitt, the mistake is now part of this new

3.11
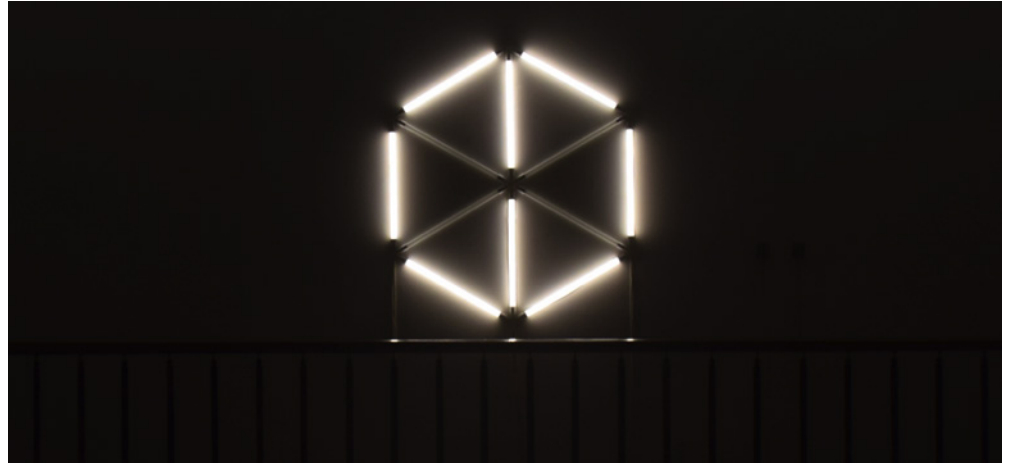
In 'Variations of Incomplete Open Cubes' several media were used by LeWitt in the different materialisations of the 122 possible variations that result from his 'machine that makes art',[1] his idea, his algorithm. Bidimensional and tridimensional mediums as wood, aluminium, photography and drawing were chosen by LeWitt to present his artwork. In all materialisations of the 'Variations of Incomplete Open Cubes' it's possible to visualise simultaneously the 122 variations, because the author presented 122 sculptures, 122 photos or 122 drawings.

One of the objectives in *3.11* was to concentrate the presentation of all 122 variations on the same device, and in order to do this a system was designed that allows changes to its own state. Another objective in *3.11* was to use mediums not used by LeWitt. Light, specifically twelve LED tubes, an Arduino microcontroller, twelve analog relays and the visitors were the chosen ones. Visitors can control the appearance of the artwork by choosing one of the 122 possible diagrams. When a visitor stops interacting the display stays configured with the last choice of the last visitor until another visitor acts to change the artwork.

3.11 has a pedagogic objective, by way of remembering LeWitt's work to some persons and of introducing it to others, while emphasizing its algorithmic dimension because his work has been mainly acknowledged as conceptual but, above all, *3.11* is intended as a tribute and an extension to LeWitt's artwork. From all the materialisations of LeWitt´s work, the isometric projection was chosen due to the visual cultural weight that this projection system has in humanity. The isometric projection system has been widely used in technical, engineering and architectural drawings and nowadays it is massively used on computer and smart phone games that simulate tridimensionality.

The presentation of *3.11* is a premiere: the work has just been prototyped for the audiovisual documentation that integrates this submission.

CONCEPT / ALGORITHM

"Insofar, algorithmic art is the mother of conceptual art." (Nake, 2010)

LeWitt has been mainly acknowledged as a conceptual artist but, in 'Variations of Incomplete Open Cubes', his idea, 'machine that makes art', was an algorithm. It is easily verifiable that LeWitt created algorithms;[2] this conjecture becomes evident when the author himself states:

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[1]
LeWitt (1967) stated: "The idea becomes a machine that makes the art."

[2]
'An algorithm is a step-by-step recipe for achieving a specific goal' (Cope 2007).

'To work with a plan that is preset is one way of avoiding subjectivity. It also obviates the necessity of designing each work in turn. The plan would design the work. Some plans would require millions of variations, and some a limited number, but both are finite. Other plans imply infinity. In each case, however, the artist would select the basic form and rules that would govern the solution of the problem. After that the fewer decisions made in the course of completing the work, the better. This eliminates the arbitrary, the capricious, and the subjective as much as possible. This is the reason for using this method.'

Despite LeWitt not using the word algorithm, the above description and the chosen words to do it are similar to the words used to describe what an algorithm is. This idea that LeWitt in fact created algorithms is corroborated by several authors. Happersett (2003), considers that LeWitt '[...] developed processes of creating art that conform very closely to the Mathematical definition of Algorithm'. Taylor (2014) writes 'Selecting the "basic form and rules that would govern the solution to the problem" as LeWitt wrote [...], describes perfectly the algorithm procedure'. Referring to LeWitt's famous statement 'The idea becomes a machine that makes art', Armstrong (2016) states 'In this way, the instructions are the core of the project: the algorithm.' According to Daudrich (2016), LeWitt implemented algorithmic logic in the realm of artistic production. In the particular case of 'Variations of Incomplete Open Cubes', '[...]LeWitt also developed rules for the production of his project: to create all possible three-dimensional structures of a cube by systematically removing its edges without repeating identical forms' (Daudrich, 2016). Gamwell (2017) reiterates LeWitt's acknowledgment as an algorist when he states that 'Sol LeWitt was the most methodical of the American algorithmic artists [and] he produced artworks by establishing a vocabulary, operations, and then carrying out the permutations. Indeed for LeWitt the algorithm is the artwork[...]'.

It's not the interest of the current text to discuss and distinguish algorithms from concepts, but when the algorithm that integrates *3.11* was designed, Le Witt's 'Variations of Incomplete Open Cubes' was considered as the result of an algorithmic arrangement. *3.11* doesn't use LeWitt's algorithm but its result: the 122 drawings that depict 122 incomplete isometric perspectives of a cube. In *3.11*, the results of LeWitt's algorithm were transformed in a data base stored on the non-volatile memory space of an Arduino board. A simple program was written in order to instruct the Arduino board to retrieve each one of the 122 results as a reaction to specific positions of two potentiometers operated by humans that interact with *3.11*.

The database was built by coding into Arduino language the 122 figures present on LeWitt's matrix depicted in Figure 2. Items in the matrix can be accessed and displayed by turning two potentiometers. The first one determines the vertical location on the matrix and the second one determines the horizontal location. With the Arduino program, the range of values from the first potentiometer is mapped to the number of rows of the matrix. But according to LeWitt's matrix, the number of columns per row isn't constant. In order to implement this idiosyncrasy and to provide a better user experience, the mapping of the range of the second potentiometer depends on the position of the first one. For example when the first potentiometer position determines the first row of the matrix, the second one's range is mapped to a range of three values and when first potenti-

ometer position determines the third row of the matrix, the second one's range is mapped to a range of fourteen values. Basically the arduino is instructed to firstly read and map the first potentiometer position and only then read and map the position of the second one according to the position of the former one. In this way the 'sensitivity' of the second potentiometer is dynamically adjusted so its range is scaled to the number of Figures on each row.
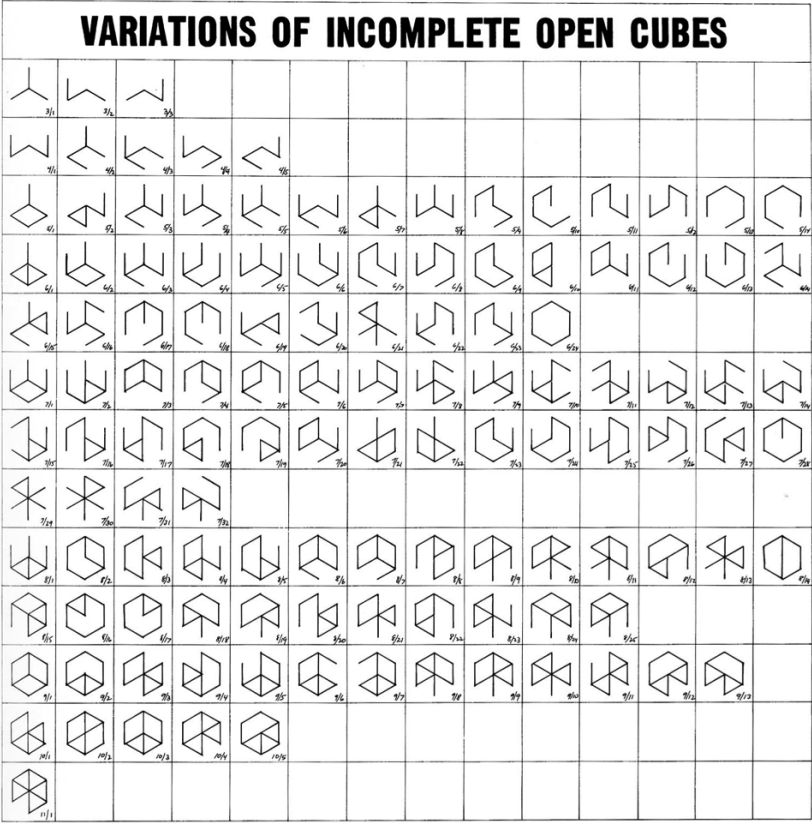
MISTAKE

While coding the data base and the instructions for the Arduino board an error was noticed on the most widely known diagram of Lewitt's work. This diagram was originally published in 1974 on the catalogue of the first exhibition of 'Variations of Incomplete Open Cubes': 'Sol Lewitt Incomplete Open Cubes The John Webber Gallery'. On his matrix, LeWitt organizes and groups, sequentially, the structures according to the number of edges that constitute them. If we consider the group of pictures that depict the eight edges results and if we observe variation 8/15 (first column on the tenth row) we can notice that the depicted cube has nine edges instead of eight (Figure 3). Is this a mistake? A brief research was done to assess whether any one had found this 'error' or there was any discussion about the 8/15 open cube. Natasha Rozhkovskaya et al. (2015) wrote a very interesting article in this respect, titled "Is the List of Incomplete Open Cubes Complete?", where she describes the formulation and use of an algorithm to check the completeness of the list of the structures produced by LeWitt. Rozhkovskaya considered that it was very difficult to check the correct number of possible open cubes using the matrix organised by LeWitt (organised by the number of edges). Instead of using his organisation system, she refined the classification system into subgroups of isomorphism classes of corresponding graphs.

Rozhkovskaya concluded that LeWitt found the correct number of structures (that is 122), and she points that his list contains a mistake in the presentation of a pair of incomplete cubes (diagrams 10 / 4 and 10 / 5) because the artist mistakenly put the same incomplete open cube twice (the second time rotated), instead of two structures that are mirror images of each other. Rozhkovskaya presents the diagrams for the corrected versions of open cubes 10 / 4 and 10 / 5, but she and her software did not notice the 'mistake' on variation 8 / 15.

Fig. 3
Incomplete cube 8 / 15 with nine edges instead of eight according to Sol LeWitt's original list.
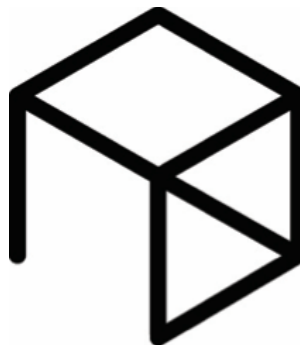
LeWitt also requested professional mathematicians Dr. Erna Herrey and Professor Arthur Babakhanian to check his matrix, and both confirmed that the correct number of structures is 122. However, according to our knowledge the error now identified (open cube 8 / 15 with nine edges instead of eight) was not found or mentioned in any literature before.

The mistake pointed out in the present paper seems to occur only in LeWitt's most widely spread matrix of diagrams that depict the 122 structures because on his aluminium materialisation of the structures, structure 8 / 15 has indeed eight edges (Figure 4). Considering the position of the materialised 8 / 15 structure that has a facet with four edges on the top side of the cube, according to Figure 4, the four possible isometric views of structure 8 / 15 were drawn and are presented in Figure 5.
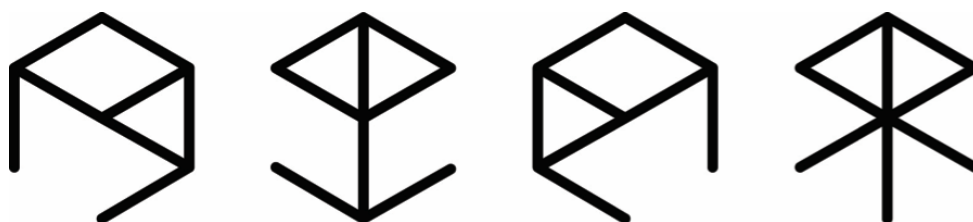
Fig. 4
Aluminium materialisation of structure 8 / 15 with eight edges.
[Source: http://www.art-net.com/artists/sol-lewitt/]

Fig. 5
The four possible isometric views of corrected version of structure 8 / 15.

Although the 'mistake' on structure 8 / 15 was identified during the development of this project, while programming the Arduino that integrates *3.11* it was decided to follow the original diagrams by LeWitt on the John Weber Gallery catalogue. However, after *3.11* was concluded and documented, another hand draw diagram was found, that depicted the correct version of variation 8 / 15

(see Figure 7). Was variation 8/15 on the John Weber Gallery catalogue an intentional mistake to test observers? We may never know.

Fig. 6
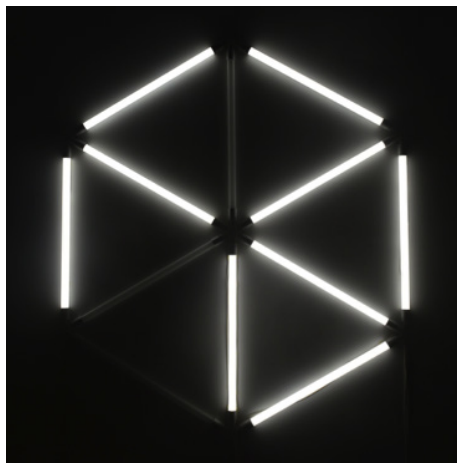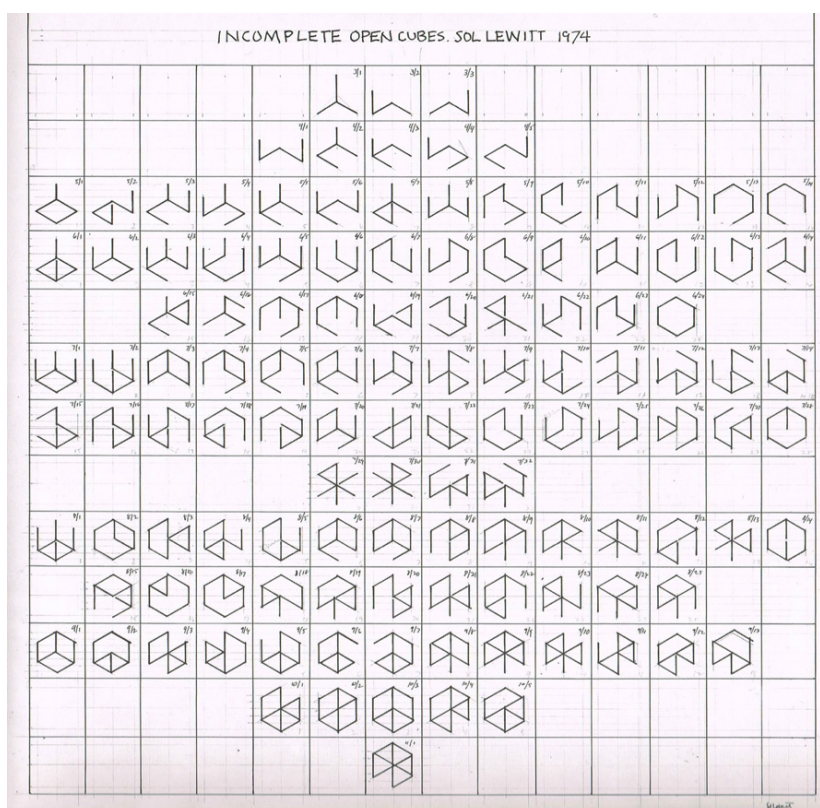Variation 8/15 displayed on *3.11* according to LeWitt diagram.

Fig. 7
Sol LeWitt (1974), Schematic Drawing for Incomplete Open Cubes, ink on paper, Sol Lewitt Dibuixos 1958–1992, Fundació Antoni Tàpies.

VISITORS

On *3.11* the visitor is a medium in the system that constitutes this intermedia artwork. Part of the hardware constituents of this system, specifically the T8 glass tubes display and the potentiometer, are provocative and intend to trigger visitor's actions. The visitor becomes simultaneously spectator, performer and co-author of this artwork. *3.11*, as an intermedia artistic system, is able to provoke movements of different qualities, that amplify human gestuality on an interface that facilitates stimulation and visitor participation in the creative process. Offering the control, the advantages of the final aesthetic decisions are given to the visitor. The space-time of the artwork becomes an integration context where the audiovisual events are controlled through visitor gestures. This possibility could easily lead us as well to see frame *3.11* as a 'happening'.

Fig. 8
Visitors taking control
of *3.11*.
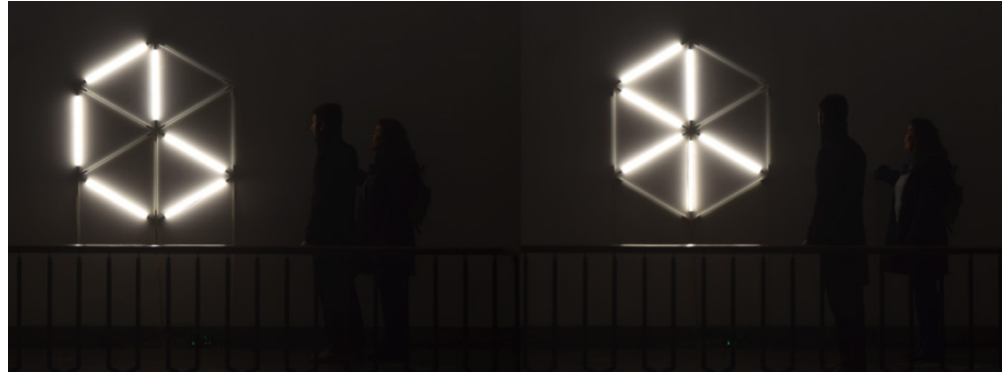
The 'happening' eliminates the void between performance, performer, creator and audience because it structures this space-time. Writing about his 1958 'Stacked Deck' piece, Higgins (2001) describes the use of audience reactions as cues to the performance development, removing the separation between audience and performance in this way creating a 'happening'. According to Higgins (1966), the idea of 'happening' was first formalised by Kaprow, when he 'began to include live people as part of the collage, and this he called a "happening"'. From this point of view, 'happenings' don't have passive spectators, they only have active participants. This participant condition of the spectator allows them to experience the realisation process of the artwork while stimulating their creativity and critical sense. In *3.11* the visitor placement in relation to the artwork is a central question because it brings in variability and indeterminacy.

Robinson (2009) reaffirms the idea that visitors' participation fosters the artwork indeterminacy when he writes about John Cage's 'silent piece' as a model of chance and indeterminacy. In fact, and still according to Robinson, the inclusion of visitors actively in the creation, production and presentation of the artwork structures the gap between creator and receptor.

To affirm the possibility that the visitor is also a medium, let us consider his placement towards media and technology. Parker-Starbuck (2011) considers the majority of 'media-based' performances, effectively position the visitors apart from media on what has become the predictable pattern of television, computer screens or video projections. Emphasizing that audience integration is not something new, Parker-Starbuck realizes 'a shift toward an engagement that foregrounds the materiality of earlier performance experimentations with technology and reconnects us physically as participants while also questioning contemporary impulses to be increasingly virtually present'. Thus, the opposite of placing the audience apart from the media, is the placement of the audience / visitor / spectator as part of the media, that is, the visitor is a medium as any other that integrates the artwork. Still from this perspective, considering the performer as medium for the artwork materialisation, the audience / visitor as a performer and as such also a medium for the artwork materialisation, one could refer Pauline Oliveros thinking that radically took away the division between performers and the audience.

Because it integrates visitor's body as a medium for the realisation of the artwork, *3.11* fits perfectly in Hawkins's (2012) vision when he states 'Particularly important is the work's creation of space to which you take your whole body, bringing […] an understanding of the experience of art not as grasped by a 'solely intellectual act'', but by the complex perception of the body as a whole'. In short, besides interpreter, the visitor can be considered as a tool, as a technology and as a medium. In *3.11* the visitor is as important as any other medium necessary

for the artwork to happen. This idea of equity or equivalence of the visitor to any other medium, can be easily associated to the first phase of the post-media condition proposed by Weibel (2006), where he states the media equivalence, signifying their artistic equivalence and their equal validity.

Fig. 9
Visitor as a medium in *3.11.*

MEDIA ASSETS

Audiovisual documentation about *3.11*.

Fig. 10
Short video of *3.11* pro-totype (https://vimeo.com/203751659).

TECHNICAL REQUIREMENTS

For a setup with 60 cm LED tubes xCoAx should provide:
A flat wall where we can drill or screw with a free area of 140x140 cm; 220V power source.
For a setup with 120 cm LED tubes xCoAx should provide:
A flat wall where we can drill or screw with a free area of 260x260 cm; 220V power source.

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