

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/382360492>

Universal Matrix Definition & Visual Proof, Visual Heuristic, Logical Chain

Preprint · July 2024

DOI: 10.13140/RG.2.2.10045.47843

CITATIONS

5

READS

339

1 author:



Artur Kraskov

Fontys University of Applied Sciences

11 PUBLICATIONS 11 CITATIONS

SEE PROFILE

Universal Matrix

Definition & Visual Proof, Visual Heuristic, Logical Chain

Artur Kraskov

Contents

Contents.....	1
Introduction.....	1
Discovery.....	1
Definition.....	2
Rules.....	3
Visual Proof Proof without words.....	5
Visual Heuristic.....	6
Meaning of symbols.....	7
Conclusion.....	9
Reference.....	10

Introduction

This paper describes a concept for "The Universal Matrix", a graphical representation system that can serve as heuristic rules for organising information, data, or other systems at a meta-heuristic level.

Discovery

The Universal Matrix pattern was initially discovered while seeking a universal symbolic language. And appeared to be a universal process representation. Symbolic depiction of the life cycle from birth to full realisation of potential led to the development of a novel framework for organising complex information. Further research resulted in graphical refinement and programmatic formalisation of this pattern, guided by underlying rules.

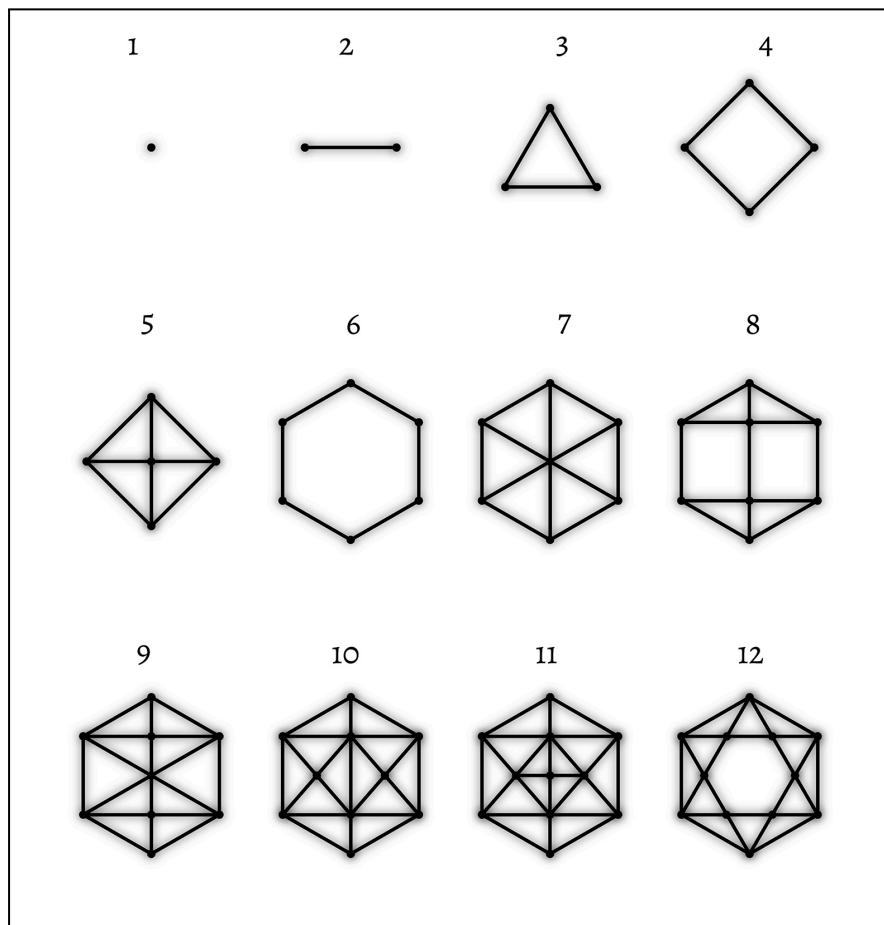
Notably, the discovery bears resemblance to process standardisation and interfacing [1]. The universal matrix can be used as an interface or a standard for depicting processes. The utility of The Universal Matrix is demonstrated in process mining, where it can be applied to simply represent any process with multiple steps. This serves one of the goals of Applied Science – to simplify complicated knowledge and make it accessible to a wider audience through Applied Research. In other words, Universal Matrix makes process mining accessible to users without computer science, data science, IT or process mining background.

The Universal Matrix has potential applications in interacting with Large Language Models (LLMs) and Multimodal LLMs. Additionally, it is a framework for development of cyber-cognitive technology combining cybernetic systems and human cognitive processes. Practical applications and development of the system aim to result into a set of connected heuristic-based tools existing as a meta-heuristic or “glue/protocol” in several domains:

- cognition/mindset,
- AI/cybernetic system,
- visual heuristic/navigational system/UI.

Main benefit for the user must be an ability to solve informational problems faster, make intuitive decisions and organise information in an intuitive way relying on heuristic rules and visual heuristic.

Definition



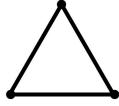
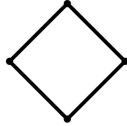
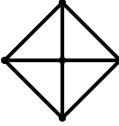
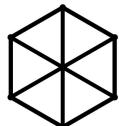
The Universal Matrix pattern

The pattern consists of 12 structures which form a system. It begins with one dot and develops by adding more dots and forming new shapes by following heuristic rules. It is considered that the sequence of shapes develops in a 2D cartesian coordinate system.

Rules

The shapes from 1 to 4 and 6 are created by adding dots one at a time. Shapes 5 and 7 to 12 emerge when new dots appear as lines intersect. Each shape must be the most straightforward solution, with no alternative interpretations. In other words, there's only one way to create a new dot by connecting lines, and that's how it happens. The symbols show the unique sequence of development, which means each shape has a single, clear form.

The Universal Matrix shows this sequence without any ambiguity or uncertainty. This makes it a useful tool for developing systems, as it provides a clear direction for creating new shapes.

Shape	Rules
•	1. One dot.
— —	2. Two dots form a line.
	3. Third dot not on a line forms a triangle.
	4. The Fourth dot outside of a triangle forms a quadrangle.
	5. Usually, the fifth shape in a similar sequence is a pentagon, which is formed by placing another dot outside of a quadrangle. However, in the Universal Matrix the rule for the fifth shape is to place the new dot inside the quadrangle in the centre of intersecting diagonals.
	6. Sixth shape is a hexagon formed by six connected dots. Hexagon is a perfect shape because of its packing properties.
	7. The seventh shape is formed by the intersection of diagonals within a hexagon. It reflects the first step – an appearance of a dot.

	8. The eighth shape is a vertical line crossed by two perpendicular lines within a hexagon. This shape is formed as an optimal solution for creating two more dots without ambiguity or uncertainty. All other alternatives will create options where it is possible to form a new shape in multiple ways – use different angles, lines or intersections. While the provided shape is stable and can't be altered.
	9. The ninth shape is a combination of shapes 7 and 8. It adds a new dot by intersecting diagonals in the middle. As well, this shape leaves no alternatives, no uncertainty. While other intersections will have different options on how to build it.
	10. Tenth shape is created by two smaller intersections within a central rectangle. They form a rhombus in the middle of a shape.
	11. Eleventh shape is another intersection within the rhombus which appeared on the previous stage.
	12. Twelfth shape is a hexagonal star within a hexagon – it is an optimal combination without any ambiguity, leaving no alternatives to build 12 dots.

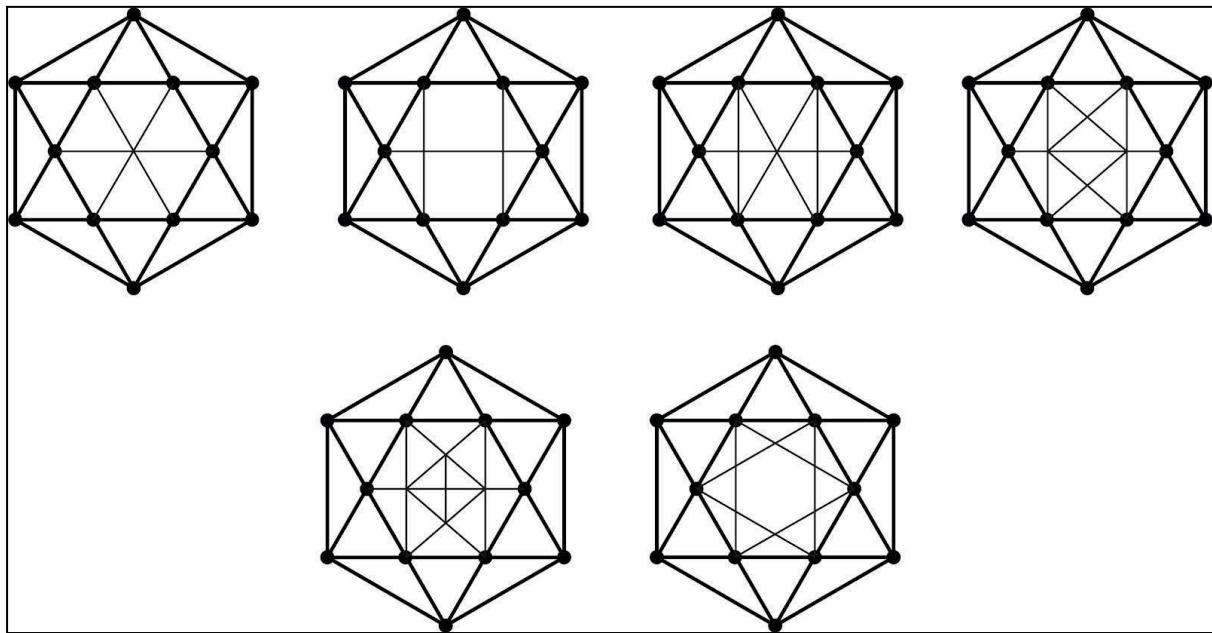
Table 1

In addition to the stated rules there are several more. First of all, new shapes arise from previous ones. Secondly, shapes 7 – 12 reflect shapes 1 – 6 and form a fractal. The pattern can continue infinitely by following these rules and grow internally or externally.

Table 2

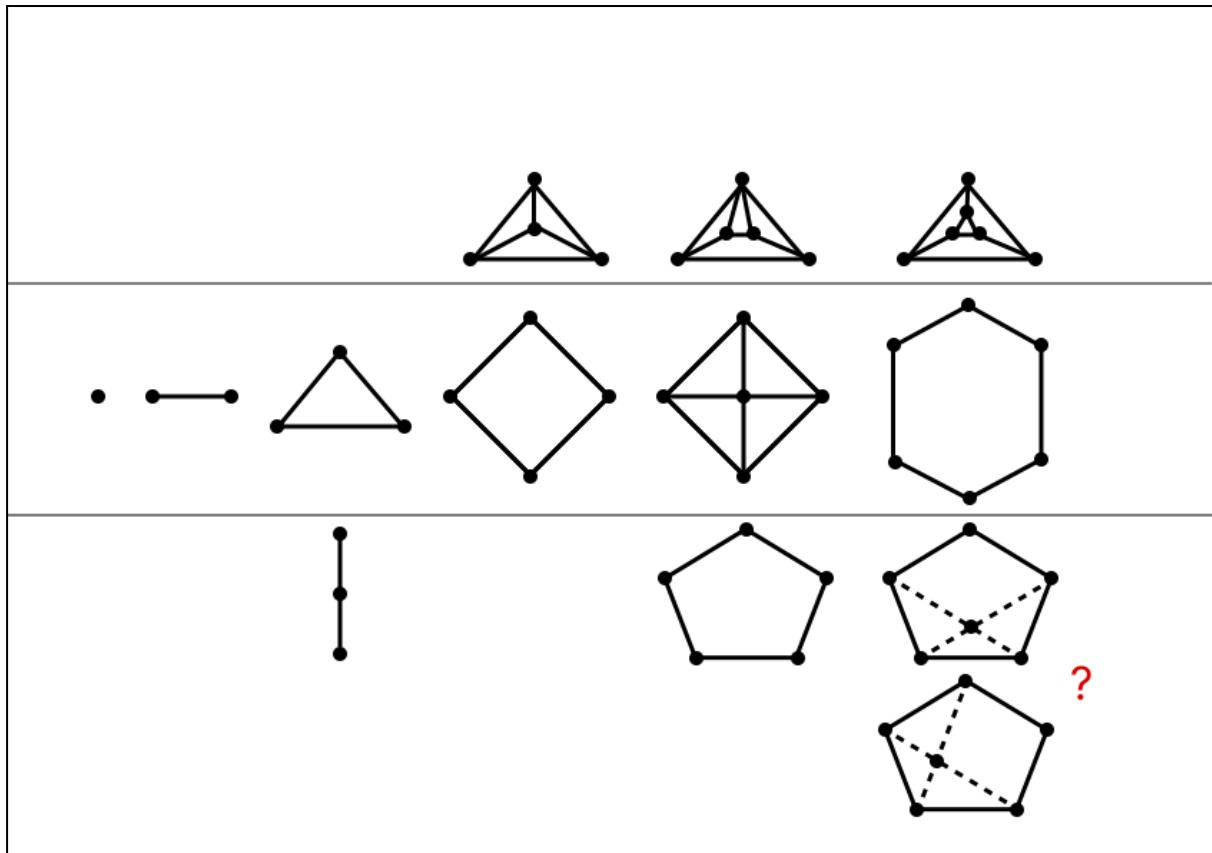
Table 2 shows how shapes 7 – 12 reflect shapes 1 – 6. Basically, shapes 1 – 6 are repeated within a hexagon. Shape 9 doesn't have a triangle, but has three dots on a line inside a hexagon. While all other shapes are clearly reflected.

Table 3 shows the continuation of the pattern following the same rules.

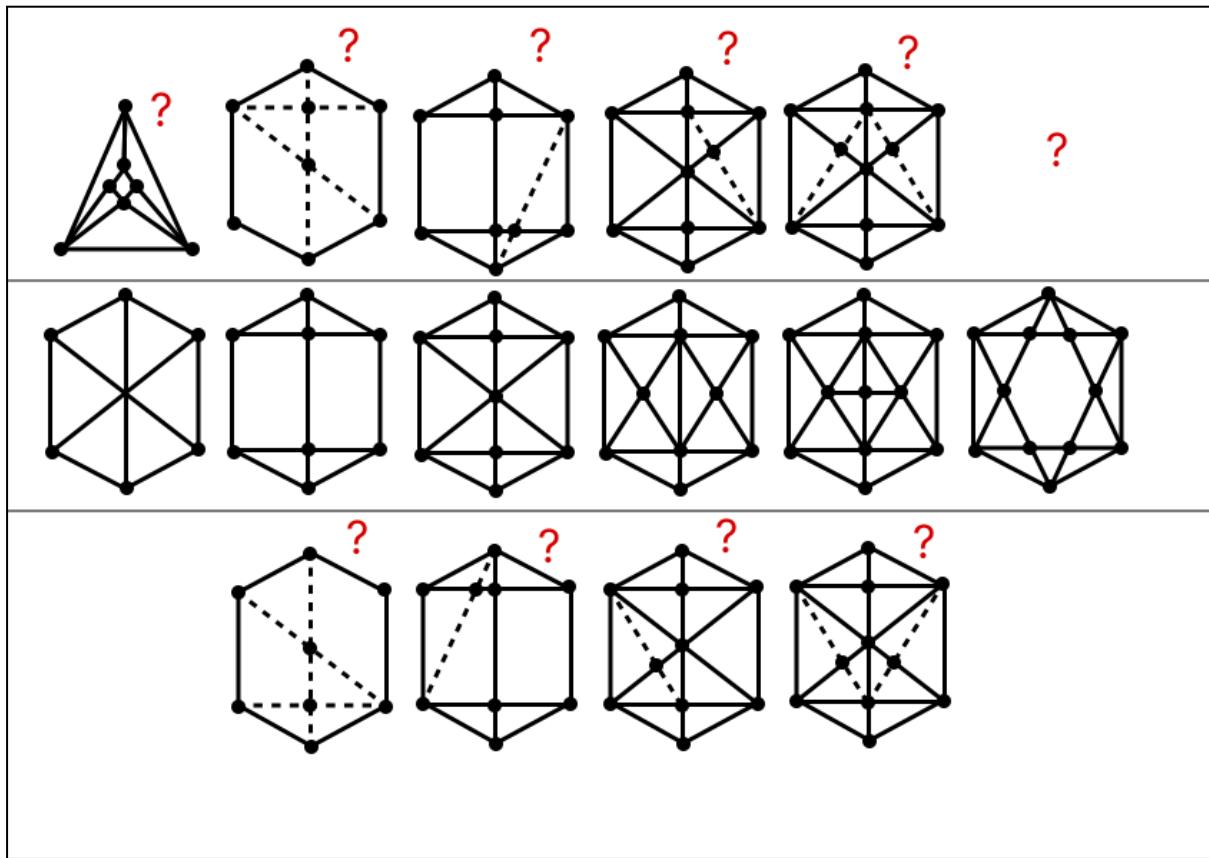


Shapes after 12 (13 – 18)

Visual Proof | Proof without words



Shapes 1 - 6



Shapes 7 – 12

The visual proof reveals why the sequence evolves as it does, showcasing its distinctive form rather than others.

To begin with, triangular forms are disregarded due to their inability to generate new shapes or dots through intersecting lines. Furthermore, shapes with more points tend to develop within shapes with fewer points (for instance, quadrilaterals within triangles), which disrupts harmony and violates rules, making it impractical.

Moving on, pentagonal shapes are disregarded due to their ambiguous nature. With pentagons, numerous possibilities arise, and a definitive outcome becomes elusive. Shapes from 7 through 12 can be generated in various manners; however, only the central line of shapes generates an unambiguous and certain pattern. The question marks denote shapes that offer choices, indicating uncertainty regarding the option to select.

It is possible to conclude that rules of creation, reflection and certainty define this pattern. New shapes must be created through adding new dots that arise from line intersections. Shapes 7 – 12 must reflect shapes 1 – 6 and there must be no alternatives for each shape.

Visual Heuristic

The geometric sequence exhibits a logical structure that can be understood using everyday language. By interpreting the symbols in a straightforward manner, it is possible to

derive a series of logically consistent statements from the pattern. This logic may be viewed as a deduction of known truths, which has roots in the ancient methodology of Pappus of Alexandria and sometimes referred to as heuristics [2]. The first three shapes can be related to Leibniz's monadology:

1. Perception
2. Perception + memory
3. Perception + memory + self-reflection

Then it develops in its own unique way.

Meaning of symbols

No	Figure	Abstract Meaning
1	.	The beginning of the process, the first atom or birth, the initial state. Also the possibility of existence, one short impulse, appearance or manifestation.
2	— —	The life of a point, consisting of many points, as well as many parallel states of one point. Two points with a connection and awareness of their presence required for the appearance of a line. A possibility and a probability of an event. Presence and self awareness.
3		The result of the relationship between possibility and probability, also a state other than presence and self-awareness, a triad of forces, emergence of a third force in the process.
4		The manifested result of the interaction of three forces, also a plane consisting of many lines reflecting different possibilities for development.
5		The centre of the plane, source, stage of vector formation, true motive, choice of the most effective direction of movement. The possibility that becomes a realised event.
6		A completed outer border, limitation of space, limitation of possible spread of energy/options necessary for the realisation of the event.
7		Emergence of a new centre and more solid vector of movement within the emerging boundaries, based on essential desire/goal that was formed on stage 5.
8		Reflection of stage 2 - appearance of the second centre, result of development and work within the space and coordinate system formed on stages 6 and 7. Movement in the direction of the vector along the axis formed on stage 7. Strengthening of the meta quality that contributes the most to the goal.

9		Appearance of the result of a new quality, similar to the third stage, movement in chosen direction, determination of which particular opportunity is realised at a new level.
10		Manifestation of result of interaction of last three stages. Emergence of a possibility for existence of complete state.
11		The most correct direction of movement in the plane of variants of development within formed boundaries.
12		Completion of logical and multi-level development, existence of internal and external boundaries for realisation of all possibilities and probabilities in the existing system.

Table 3

The symbols in this interpretation are abstract, yet they demonstrate an inherent logic. By examining the sequence, it is possible to identify a logical chain or deduce underlying truths. To further clarify the logic within this proof, a series of questions has been provided. These questions serve as guidance, reminiscent of George Polya's "heuristic dictionary" [3]. Use the questions to describe any process similarly to how Polya's table is used to "attack" any problem.

No	Figure	Questions
1		1. What is the starting point or initial state of the process? (Step 1) 1.1. What are the sub-aspects or components of this initial point? 1.2. How does it represent the possibility of existence or appearance? 1.2.1. In what way does it reflect a short impulse or one-time occurrence? 1.3. How can it be described as the first atom in the process?
2		2. What follows after the initial point, and how are these points connected? (Step 2) 2.1. How many points are involved, and how are they connected? 2.2. What is the relationship between these points and their awareness of their existence? 2.3. How does this collection of points form a line or continuity?
3		3. What emerges from the interaction of multiple points or states? (Step 3) 3.1. How does the relationship between possibility and probability manifest? 3.2. What is the resulting triad of forces that forms in the emerging system? 3.3. In what way can this stage be described as an emergence of a third force?
4		4. What is the result of the interaction of three forces or components? (Step 4) 4.1. How does the manifested result reflect the interaction of these forces? 4.2. Can it be described as a state other than presence or self-awareness? 4.3. What are the possibilities and probabilities for development at this stage?
5		5. What is the centre or source of energy and movement within the emerging boundaries? (Step 5) 5.1. How does the centre serve as a choice point for effective direction of movement? 5.2. In what way does it reflect the true motive or desire behind the process? 5.3. What vector or movement emerges from this stage?

6		<p>6. What is the completed boundary or limitation at this stage in the process? (Step 6)</p> <p>6.1. How does the boundary restrict the spread of energy and possibilities for development? 6.2. In what way can it be described as a plane consisting of many lines reflecting different possibilities for development?</p>
7		<p>7. What is the result of work or development within the existing boundaries? (Step 7)</p> <p>7.1. How does a new centre and solid vector of movement emerge from this stage? 7.2. In what way can it be described as an emergence of a new plane within existing boundaries? 7.3. What determines the direction of movement in the emerging plane? 7.4. In what way or how can it be described as a coordinate system for developing possibilities?</p>
8		<p>8. What is the development/improvement process of the result of stage 7? (Step 8)</p> <p>8.1. What is the reflection or manifestation of the second centre or force? 8.1.1. How does the appearance of this second centre impact the development and work? 8.2. In what way can it be described as a result of development and interaction within the coordinate system? 8.3. What movement occurs along the axis determined by this stage?</p>
9		<p>9. What emerges from the interaction of the last three stages (6,7,8)? (Step 9)</p> <p>9.1. How does the appearance of new quality manifest from these interactions? 9.2. In what way can it be described as a choice or determination of which particular opportunity is realized at a new level? 9.3. What direction of movement emerges from this stage?</p>
10		<p>10. What is the result of the logical and multi-level development up to this point? (Step 10)</p> <p>10.1. In what way does this stage represent the completion of development and realization of all possibilities within the existing system? 10.2. How can it be described as a manifestation of the interaction of the last three stages or forces? 10.3. What external and internal boundaries have been formed by this stage?</p>
11		<p>11. What reflects the most correct direction of movement in the plane of variants of development? (Step 11)</p> <p>11.1. In what way does this centre determine which particular opportunity is realised at a new level? 11.2. How can it be described as a source or stage for further vector formation and choice of effective direction of movement? 11.3. What possibilities or opportunities are present in the plane of variants of development?</p>
12		<p>12. What is the ultimate goal or completion of the process? (Step 12)</p> <p>12.1. In what way does this stage represent the realisation of all possibilities and probabilities within the system? 12.2. How can it be described as a logical and complete state that exists both internally and externally?</p>

Table 4

Together symbols, abstract meanings and questions make the definition of the sequence complete as a visual heuristic. Both logical statements and questions are derived from visual symbols which act as a navigational pattern.

Conclusion

The Universal Matrix can be used as a heuristic-based problem-solving method, feeding it into Large Language Models (LLMs) together with problem-solving rules and output format prompts. This sequence, consisting of symbols, abstract meanings, and questions, provides a visual framework for navigating complex processes.

When users learn the Universal Matrix, they can use it as a framework or standard for depicting and describing processes. This knowledge becomes a mental shortcut, allowing users to navigate within any process with any number of steps by relying on the meaning of symbols. In other words, symbols represent archetypal states that can be found in any process.

As a heuristic method, the Universal Matrix implies using assumptions and approximations. The 12 steps or states in the sequence serve as generalised categories, allowing for the inclusion of any state of any process. AI, LLMs, and human minds can all utilise this approach to provide "good enough" solutions.

However, the Universal Matrix is not always suitable for problems that require precise and algorithmic solutions. Instead, it should be applied in relevant domains where heuristic approaches are sufficient. When used as a framework, similar to deduction or heuristic tables, the Universal Matrix can become a high-level process depiction, which can then be decomposed into smaller steps for achieving algorithmic precision.

The visual heuristic aspect of the Universal Matrix can also be employed as a standard for representing information, resembling hexagonal numbers and binary logic [3]. This approach, inspired by Leibniz's work on binary systems [4], enables users to deal with various types of data and problems.

Reference

1. p. 303, Best practices in business process redesign_ an overview and qualitative evaluation of successful redesign heuristics -- H.A. Reijers; S. Liman Mansar -- Omega, #4, 33, pages 283-306, 2005 aug
2. p. 3, A brief history of heuristics: how did research on heuristics evolve? -- Mohamad Hjeij & Arnis Vilks
3. p. xvi, How to solve it? -- George Polya – Second Edition, 1957
4. [Hexagonal number - Wikipedia](#)
5. <https://www.leibniz-translations.com/binary>