MA-UNI

DESIGN PHILOSOPHY

A New Approach to Humanoid Design

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01. The Core Idea

MA-UNI explores a new approach to humanoid machine design — one in which human morphology, the nature of the machine, and engineering functionality are developed as parts of a unified system.

Rather than allowing mechanics to dictate the final silhouette and introducing design afterward in the form of external panels, MA-UNI places morphology at the beginning of the design process.

Form is not a decorative layer applied to a machine. It is part of its architecture.

This means that proportions, the distribution of volumes, limb structure, joint geometry, and the character of movement must be considered alongside the mechanical structure, actuation systems, electronics, and manufacturing constraints.

The goal is neither to create a machine that looks like a human nor to conceal its mechanical nature. It is to establish **a new category of technological objects** — machines with human morphology and an identity of their own.

MA-UNI approaches humanoid design as a unity of form, mechanics, movement, and character.

02. The Problem We Address

Between Mechanics and Form

The development of humanoid robots is driven by engineering requirements. Motors, gearboxes, batteries, structural components, and electronics determine much of a machine's internal architecture.

These requirements are essential to functionality. The problem arises when the external form is developed only after the principal engineering decisions have already been fixed.

At that point, the designer's freedom is limited. The proportions of the torso, the width of the shoulders, the volume of the pelvis, and the geometry of the limbs must often accommodate technical components that are already in place.

The result can be a fully functional robot whose visual structure is nevertheless a consequence of component placement rather than a deliberately conceived morphological system.

Between Individual Parts and a Unified Body

A humanoid is not simply a collection of a head, torso, arms, legs, and joints.

It is a system of interconnected volumes whose proportions, transitions, and relationships create the perception of a coherent body.

When each segment is designed independently, without a shared morphological logic, even well-crafted components can appear visually disconnected.

External panels can conceal mechanical elements, but they cannot, by themselves, create a convincing overall form.

For MA-UNI, design quality is determined not only by the individual details but, above all, by the way those details come together to form a unified whole.

Between Static Appearance and Movement

A robot does not exist only in a stationary pose.

Its form is perceived while walking, turning, bending, crouching, raising its arms, and interacting with objects.

Proportions that appear convincing in a render can produce undesirable visual effects during actual movement. Joints may disrupt the continuity of the silhouette, while external volumes can make the body appear to consist of unrelated parts.

Morphology must therefore be designed not merely as a static sculptural form, but as a form that maintains its logic in motion.

These are not purely aesthetic problems. They arise from the way the design process itself is structured.

03. The MA-UNI Design Position

MA-UNI does not position design in opposition to engineering.

On the contrary, it considers them interdependent disciplines that must contribute to the development of a product from its earliest stages.

The designer is not the final participant in the process, responsible for shaping the exterior of an already completed machine. The designer is a co-author of its spatial and morphological architecture.

This includes defining the primary proportions, the distribution of mass, the volumes of the torso and limbs, the relationship between joints and external form, the visual behavior of the machine.

The engineering structure must realize the design concept, while the design concept must account for actual mechanical, kinematic, and manufacturing conditions.

The process is not strictly sequential. It is iterative: form informs engineering decisions, engineering decisions refine form, and motion testing advances both.

Design is not added to the machine. Design participates in creating the machine.

04. The Concept of Anatomical Machine Design

MA-UNI uses the term *Anatomical Machine Design* as a working concept for an approach that combines the principles of human morphology with the structural logic of a machine.

This is not an attempt to reproduce human anatomy literally.

The human body serves as a morphological reference: a system of proportions, volumes, joint relationships, transitions, and movement. These principles are interpreted and transformed according to the machine's purpose and inherent nature.

The objective is to achieve a form coherent enough to be perceived as a unified body, yet sufficiently independent to possess its own mechanical character.

This approach is based on five principles.

Principle 1. Human Morphology Without Human Imitation

The human figure offers a complex system of proportions and spatial relationships.

The rib cage, shoulder girdle, waist, pelvis, and limbs are not isolated volumes. They form an integrated structure in which each part influences the perception of the others.

MA-UNI draws on this logic without requiring a literal reproduction of human musculature, skeletal structure, or appearance.

A humanoid may be more abstract, more geometric, or more compact than the human body. What matters is that its proportions emerge from a consciously developed morphological system.

Principle 2. Mechanics as Part of Identity

A machine does not necessarily need to conceal every trace of its construction.

Joints, rotational axes, metal components, and functional connections can contribute to the robot's visual character.

However, they must be integrated into the overall form rather than appearing as randomly attached components.

MA-UNI seeks a balance between an explicit mechanical identity and morphological coherence.

Mechanics may remain visible when this is justified both structurally and visually. They should neither be concealed arbitrarily nor exposed merely for effect, without regard for the surrounding form.

Principle 3. Unified Volumes Instead of Arbitrary Housings

The shape of the shoulder must relate coherently to the upper arm. The torso must connect to the waist and pelvis as parts of a common structure. The limbs must maintain a consistent geometric logic throughout their length.

This does not mean that every transition must be smooth or every seam hidden.

It means that every surface, parting line, and change in volume must be justified by the overall composition, the structure, or the movement.

The outer shell follows the morphology and participates in defining it.

Principle 4. Material Honesty

Different materials have different functions, physical properties, and visual qualities.

Metal can express structural precision and mechanical strength. Polymers can define complex exterior volumes. Elastomers can provide flexible transitions and protect moving areas.

MA-UNI does not require every component to be hidden beneath a uniform surface or visually homogenized through paint.

Materials must be selected according to function, safety, wear, manufacturing requirements, and the intended visual character.

Material honesty does not mean exposing everything. It means maintaining consistency between how an element looks, how it is constructed, and the role it performs.

Principle 5. Recognizable Character

The robot's identity must emerge from the product itself.

It is established through silhouette, proportions, head geometry, the relationship between the torso and limbs, joint structure, and the character of movement.

The robot does not need a human face. Its head may be abstract, and its sensors may be integrated without imitating human eyes.

What matters is that the design decisions form a coherent and recognizable system.

If the logo, color scheme, and decorative details were removed, the machine's fundamental character should remain.

05. The Silhouette as the Starting Point of Design

MA-UNI places silhouette before surface decoration.

This is the first level at which the character of a humanoid machine is established.

Before materials, seams, colors, and specific panels are defined, the primary morphological questions must be resolved:

- What is the relationship between shoulder width and pelvic width?
- How does torso length relate to limb length?
- How does the head relate to the rib cage?
- How is visual mass distributed between the upper and lower body?
- What are the proportions of the arms relative to the tasks they must perform?

- How does the silhouette change during walking, bending, and object manipulation?
- What does the overall form communicate — precision, stability, strength, lightness, or compactness?

These decisions are not universal. They depend on the robot's intended purpose and the character the design is meant to express.

MA-UNI's approach is to turn them into deliberate design decisions rather than leave them as incidental outcomes of the mechanical structure.

As in automotive design, where proportions and primary volumes establish character before decorative details are introduced, the silhouette of a humanoid forms the foundation of its visual identity.

The difference is that this identity must remain convincing in motion, across different poses and during real interaction with the environment.

06. Design as an Integrated Methodology

The MA-UNI philosophy becomes an applicable method through three interconnected layers.

Layer I — Morphological Architecture

The primary proportions, silhouette, and volumes of the torso, shoulder girdle, pelvis, and limbs are established.

The overall spatial logic of the body is developed before moving on to the specific design of the external panels.

At this stage, different morphological solutions are explored, and their influence on the robot's character and perception is evaluated.

Layer II — Kinematic and Engineering Integration

The morphology is reconciled with the actual mechanical architecture.

Rotational axes, ranges of motion, actuators, structural elements, battery and electronics placement, service access, and potential collisions are considered.

The selected form is evaluated to determine whether it can be realized without compromising essential functionality, safety, or manufacturing requirements.

When conflicts arise, form and mechanics are reconsidered together.

Layer III — Surfacing, Enclosure, and Materialization

The specific three-dimensional surfaces, panels, seams, finishes, and material combinations are developed.

They must follow the logic of the morphological architecture while meeting manufacturing, maintenance, and operational requirements.

The outer enclosure is not an independent stylistic solution. It is the final expression of an integrated structural and morphological concept.

The Principle of Iteration

The three layers are not entirely separate stages.

They form a cycle in which morphology, kinematics, and surfacing evolve together. Every significant decision must be evaluated in relation to the others.

In this way, MA-UNI aims to establish a methodology that can be applied to different humanoid platforms rather than relying exclusively on individual design intuition.

07. Form Must Work in Motion

A static render is only one way to evaluate a design.

The true form of a humanoid machine reveals itself through movement. Every rotation of the torso, elevation of an arm, or flexion of a knee changes the relationships between volumes and the way the body as a whole is perceived.

MA-UNI therefore treats movement as part of the design architecture, not merely as a technical function.

The design must be evaluated through:

- Primary static poses.
- Natural and functional ranges of motion.
- Changes in silhouette during walking and turning.
- Visual integration of joints during articulation.
- Interaction between the limbs, objects, and the surrounding environment.
- The perception of balance, stability, and control.

The objective is not necessarily to make the robot's movement imitate human movement in every respect.

The objective is to ensure that the external form corresponds to the machine's actual behavior and maintains its character across all important operating states.

08. A Distinct Visual Language

MA-UNI does not seek a single universal silhouette for all humanoid robots.

Different applications may require different proportions, levels of abstraction, materials, and structural solutions.

What must remain consistent is the method through which visual identity is developed.

MA-UNI's visual language can evolve through several interconnected areas:

Morphological rules. Principles for establishing proportions, primary volumes, and transitions between body segments.

Geometric logic. A consistent approach to surfaces, edges, radii, seams, and the relationship between flowing and defined forms.

Mechanical integration. Principles governing the visual role of joints, actuators, and structural elements.

Material hierarchy. A coherent approach to metals, polymers, elastomers, textures, and finishes.

Kinematic character. A relationship between body geometry, movement, and visual perception.

These rules should not turn every robot into a copy of the others. They should provide a shared design logic that can be interpreted according to the purpose of each machine.

09. A Machine with Character, Not an Imitation of a Human

Humanoid form presents a distinctive challenge.

Human perception is highly sensitive to proportions, posture, movement, and facial characteristics. Even small inconsistencies can change how a figure is perceived.

For this reason, MA-UNI does not treat human resemblance as an end in itself.

A humanoid can possess human morphology without imitating a human face, facial expression, or anatomy. Its identity can emerge from the shape of the head, the relationships between its volumes, the placement of its sensors, and the way it moves and interacts.

This makes it possible to establish an independent visual character that is unmistakably mechanical while using human form as a structural and perceptual reference.

Not a human made of machines. Not a machine dressed as a human. A machine with its own interpretation of human morphology.

10. From Design Philosophy to Product Value

The MA-UNI philosophy becomes valuable when it can be translated into measurable qualities of a real product.

This requires distinguishing design objectives from business outcomes that still need to be demonstrated.

Distinct Visual Identity

The robot is recognizable through its primary proportions, silhouette, and geometric logic, rather than solely through its logo or colors.

Potential value: a clearer product identity and the opportunity to build a recognizable brand.

Convincing Presence in Human Environments

The form is designed with the spaces in which the robot operates and the way people perceive it in mind.

Potential value: a more appropriate visual presence and the possibility of improved acceptance, to be validated through real user observations.

Integrated Construction

Enclosures, joints, and service areas are designed as parts of a common architecture.

Potential value: more efficient use of space, improved serviceability, and fewer unnecessary structural elements, where these benefits are confirmed through engineering.

Consistency Between Design and Movement

The form maintains its logic across real working poses and movements.

Potential value: a more complete visual experience and fewer inconsistencies between the design concept and the machine's actual behavior.

Potential for Premium Positioning

The quality of the proportions, surfaces, materials, and details can communicate a carefully developed technological product.

Potential value: a foundation for a **premium product strategy**, provided it is supported by build quality, reliability, and genuine market value.

11. One Approach, Multiple Applications

The MA-UNI philosophy can be applied across several areas without being limited to a single type of robot.

Humanoids for Professional and Corporate Environments

Robots intended for public spaces, hotels, corporate buildings, exhibition centers, and other environments where visual presence is an important part of the product experience.

Industrial and Functional Humanoids

Machines whose morphology must be coordinated with manipulation, mobility, stability, and specific operational tasks.

Design Concepts and Demonstration Platforms

Projects that explore new proportions, mechanical interpretations of human form, and ways of establishing a distinct machine character.

Design and Engineering Partnerships

Collaborations with manufacturers and developers of robotic platforms to integrate morphology, mechanical architecture, surfacing, and product identity.

What unites these applications is not a particular market, but the design method itself.

MA-UNI may develop its own product, work with existing platforms, or turn its methodology into a specialized service. These possibilities are not mutually exclusive, but each requires different resources and strategies.

The primary objective is to establish a body of expertise that can be demonstrated through products and applied across multiple projects.

12. How the Philosophy Is Validated

A design philosophy should not remain merely a text or a collection of visual propositions.

It must be tested through concrete development projects.

The first step is to create a demonstrator through which the core principles can be compared, evaluated, and refined.

One suitable approach is to develop several morphological concepts using the same or a comparable mechanical platform.

This makes it possible to investigate how different decisions regarding silhouette, proportions, volumes, and joint integration change the machine's character under similar technical constraints.

The selected concept can then be evaluated through three-dimensional models, kinematic simulations, and, where possible, physical prototypes.

The evaluation should include:

- Morphological coherence.
- Silhouette recognition.
- Consistency between external volumes and kinematics.
- Functional accessibility and serviceability.
- Manufacturability.
- The behavior of the form in motion.
- Human perception in real environments.

These criteria transform the design philosophy into a working methodology whose results can be discussed, assessed, and improved.

The goal is not to prove in advance that one style is superior to all others. It is to demonstrate how an integrated approach leads to concrete design decisions and under what conditions those decisions create value.

13. Positioning MA-UNI

MA-UNI does not position itself as a correction to existing humanoid robots or as a critique of the engineers and designers who develop them.

Existing solutions often reflect specific technical, economic, and manufacturing constraints. Different visual approaches may be entirely justified by the intended purpose of the product.

MA-UNI asks a different question:

What might a humanoid robot look like if morphology and visual identity helped define its architecture from the very beginning?

This is the starting point of the new direction.

MA-UNI proposes an opportunity to integrate design more deeply into humanoid development and to explore that opportunity through real projects, collaboration with engineers, and systematic evaluation of the results.

Its position is therefore not based on the claim that existing approaches are wrong, but on the conviction that there is room for new methods and new product identities.

14. Long-Term Vision

In the long term, MA-UNI can develop three interconnected areas.

A Distinct Visual Language

A system of morphological and geometric principles that establishes a consistent identity across its machines.

A Distinct Methodology

An applicable process for integrating human morphology, engineering architecture, kinematics, and external surfaces.

A Distinct Product Identity

Concrete machines in which the philosophy is realized through form, function, movement, materials, and quality of execution.

These areas can support different business models: a specialized design studio, a design and engineering company, partnerships with manufacturers, licensing of developed solutions, or the creation of an independent robotic platform.

Their development should follow actual technical capabilities, accumulated experience, and market opportunities rather than being restricted in advance to a single organizational model.

The primary task is to build expertise that can be demonstrated through products and applied in practice.

15. The Fundamental Principle of MA-UNI

MA-UNI approaches the humanoid robot not as a mechanical system that subsequently receives an exterior design, but as a unified form whose morphology, mechanics, and movement must evolve together.

The human body provides a point of reference, not a mandatory template.

The mechanical nature of the machine is not a flaw to be concealed, but an essential part of its identity.

The outer enclosure is not a decorative addition, but an expression of structural and morphological logic.

Movement is not a subsequent technical check, but part of the design intent itself.

These principles lead to the fundamental position of MA-UNI:

Humanoid design should develop from the whole to the detail — from morphology to engineering integration and from there to material realization, through a continuous process of collaborative design.

This is the foundation of Anatomical Machine Design as a direction that MA-UNI aims to explore, develop, and apply.

MA-UNI — DESIGN PHILOSOPHY

Human in form. Machine by nature.

Engineered as a whole.