ApplicationProposal – Natural Fit Ratio in Visual Composition with GRM

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Date:
June 2025

Version:
1.0

Abstract:
This paper introduces the Natural Fit Ratio (NFR) as an expressive extension to the Geometric Ratio Model (GRM). While GRM defines canonical spatial ratios using bounding squares and cubes, the NFR addresses the limitations of fixed proportion by introducing a continuum of visual fit; quantifying how much space a form occupies in expressive, often organic variation.
Through comparative illustrations and multi-domain applications (art, anatomy, AI), the model demonstrates how NFR can function as a visual grammar for balance and deviation.
In addition to its interpretive value, the framework shows potential for improving rendering efficiency and prompt clarity in generative systems.

Inhoud

1. Introduction – Geometry, Art, and the Search for Expressive Balance

1.1 Classical proportion versus expressive deviation

Throughout history, artists have turned to geometry as a guide for structure, harmony, and proportion. From the golden ratio in Renaissance painting to perspective grids in classical architecture, geometric systems have provided a scaffold for visual order. Yet even within these frameworks, the most compelling artworks often arise from deliberate deviation; a subtle asymmetry, a dynamic shift, or a posture that escapes ideal form.

1.2 The role of the bounding square in visual logic

In anatomical drawing, the human or animal body is frequently framed within a square or rectangle, echoing the logic of Vitruvian geometry. These bounding shapes suggest balance and control, but life itself rarely conforms to stillness. A turning torso, an outstretched wing, or a moment of tension introduces irregularity and movement. These deviations are not mistakes. They are expressive. They are alive.

This proposal introduces the ***Natural Fit Ratio (NFR)*** as a new concept within the *Geometric Ratio Model (GRM)*. Where GRM describes geometric identity through proportional occupation of a bounding square (e.g., 0.7854 SAU for a circle), NFR extends this logic to non-ideal, expressive forms. It defines not only what fits *perfectly*, but how *natural deviation* can be described — and how composition can be interpreted across a spectrum of proportion.

1.3 Purpose and scope of this proposal

By shifting from static symmetry to dynamic fit, NFR enables a proportional language for both human and computational perception. It invites artists, educators, and AI systems to see composition not only in terms of geometry, but in terms of *meaningful asymmetry*. This proposal lays the foundation for that interpretive shift, rooted in GRM logic, yet reaching into the visual logic of expression.

This proportional framework is equally relevant in both traditional and digital settings. In digital art tools, bounding boxes, layers, and pixel-based rendering naturally align with GRM logic. In AI-generated imagery, where composition emerges from latent structures and prompt-based control, NFR offers a way to steer visual output toward expressive balance using measurable form ratios. By bridging artistic intuition and computational control, NFR becomes a cross-medium language of visual logic.

2. GRM Recap – Bounding Logic and Fixed Ratios

2.1 Square-based proportional identity (SAU)

The Geometric Ratio Model (GRM**)** redefines how geometric shapes are identified and compared. Instead of relying on internal parameters such as radius, diameter, or area formulas involving irrational constants like π, GRM frames every shape within a bounding square (in 2D) or bounding cube (in 3D). The identity of a shape is then determined by the proportion of the square or cube it occupies.

This proportion is expressed in Square Area Units (SAU) for 2D shapes. For example:

- A circle perfectly inscribed in a square occupies exactly 0.7854 SAU (equivalent to π/4).
- A regular triangle inscribed in a square occupies approximately 0.4330 SAU.
- A regular hexagon inscribed in a square occupies approximately 0.8660 SAU.

These values function as fixed identifiers for pure forms under perfect conditions, allowing a consistent and dimensionless understanding of geometry; not through calculation, but through spatial proportion.

2.2 Canonical ratios: circle (0.7854), triangle (0.4330), hexagon (0.8660)

Each canonical shape has a precise occupation ratio when fully inscribed within its square:

- The circle touches all four sides of the square, yielding 0.7854 SAU.
- The equilateral triangle rests on the base and reaches the top midpoint, yielding 0.4330 SAU.
- The hexagon fits horizontally within the square, its longest diameter matching the square's width, yielding 0.8660 SAU.

These ratios are dimension-independent: they hold true whether the square is 1 cm wide, 100 pixels, or 1 meter; making them especially suited for use in digital media, vector graphics, and AI systems that operate without absolute units.

2.3 Mutual dependency between shape and container

A key principle in GRM is mutual dependency: a shape cannot be interpreted in isolation but only in reference to its enclosing square or cube. This is a reversal of classical logic, where a shape defines itself internally (e.g., a circle by its radius). In GRM:

- A shape is defined by how much space it fills.
- That space is not abstract but always visible and measurable; a bounding frame that makes proportion explicit.
- This creates a visual language of ratio, equally intuitive for humans and interpretable by machines.

Understanding GRM in this way sets the foundation for extending the model into expressive, non-canonical shapes, which is precisely where the Natural Fit Ratio (NFR) emerges.

3. Defining the Natural Fit Ratio (NFR)

3.1 Conceptual definition

The ***Natural Fit Ratio (NFR)*** is an extension of the GRM logic applied to non-ideal, living, or expressive shapes. While traditional GRM ratios describe canonical forms, a perfect circle (0.7854 SAU), an ideal triangle (0.4330 SAU); NFR addresses those shapes that are intentionally or organically different. It answers the question: "*how much of the square does a form occupy when it is not geometric perfection, but still visually coherent?*"

Formally, NFR is defined as:

The proportion of a shape's area relative to its bounding square, interpreted as a meaningful deviation from a canonical GRM ratio.

This allows for analysis and design across a spectrum rather than a single value. A form does not have to match a fixed ratio; it may instead communicate something about balance, expression, motion, or tension by *how much it deviates* from that reference.

Although originally framed within an artistic context, the Natural Fit Ratio also holds significance in ***biological and anatomical analysis***. Many structures in nature, from vertebrate body plans to botanical growth patterns, exhibit proportionally bounded forms that deviate from geometric ideals in consistent, measurable ways. In this sense, NFR can serve as a tool not only for artistic composition, but also for interpreting living form in a scientifically grounded manner, without relying on abstract internal measurements.

3.2 Deviation from canonical SAU: expressive spectrum

Instead of viewing deviation as distortion, NFR treats it as expressive range.

For instance:

- A resting animal might occupy ~0.74–0.78 SAU, close to circular harmony.
- A dynamic pose (e.g., a bird mid-flight) might range from 0.66 (elongated) to 0.87 (expanded).
- A compressed or curled shape might fall near 0.60–0.70, suggesting inward motion or stillness.

This spectrum is not arbitrary. It is anchored to known GRM ratios (e.g., 0.7854) and interpreted in relation to that baseline. In this way, the NFR enables subtle gradations of form to be described with clarity and neutrality, whether in art, education, or computational recognition.

3.3 Tolerance bands and perceptual thresholds

To support practical use, NFR introduces tolerance bands:

- Forms within ±0.02–0.03 of a canonical ratio are often perceived as identical by the human eye.
- Beyond ±0.05, a form begins to be perceived as expressive, distorted, or unique.
- These bands are not fixed rules, but serve as heuristic thresholds for design and analysis.

By using tolerance ranges around known ratios, NFR bridges the gap between rigid geometry and living form. It enables artists to explore movement and tension without abandoning structure, and allows AI systems to assess composition without requiring perfection.

4. Application in Artistic Practice

4.1 Static vs dynamic poses: interpreting visual balance

In visual composition, the balance between stillness and movement is often what gives an image its emotional or narrative depth. While traditional geometry favors symmetry and equilibrium, expressive art frequently relies on tension, imbalance, and flow.

The Natural Fit Ratio (NFR) provides a measurable framework to interpret these differences:

- ***Static poses*** such as a seated figure, a coiled animal, or a frontal portrait; often approach canonical ratios (e.g., 0.7854 SAU for a circle), conveying balance or calm.
- ***Dynamic poses*** such as twisting bodies, stretched limbs, or leaning figures; naturally shift the occupied area and thereby the NFR, signaling energy, tension, or movement.

Instead of relying solely on visual intuition, the artist gains access to a structured spectrum of proportional interpretation; enabling more intentional use of asymmetry, tension, and flow in the composition.

4.2 From anatomical symmetry to living asymmetry

Even when aiming for anatomical correctness, artists rarely depict the body in perfect symmetry. Muscles flex, limbs shift, and gravity interacts with form. NFR allows artists to remain rooted in realistic proportion while acknowledging the natural deviations of life.

Examples:

- A bird resting on one leg might have a body that occupies ~0.76 SAU, with wings tucked in, suggesting internal balance.

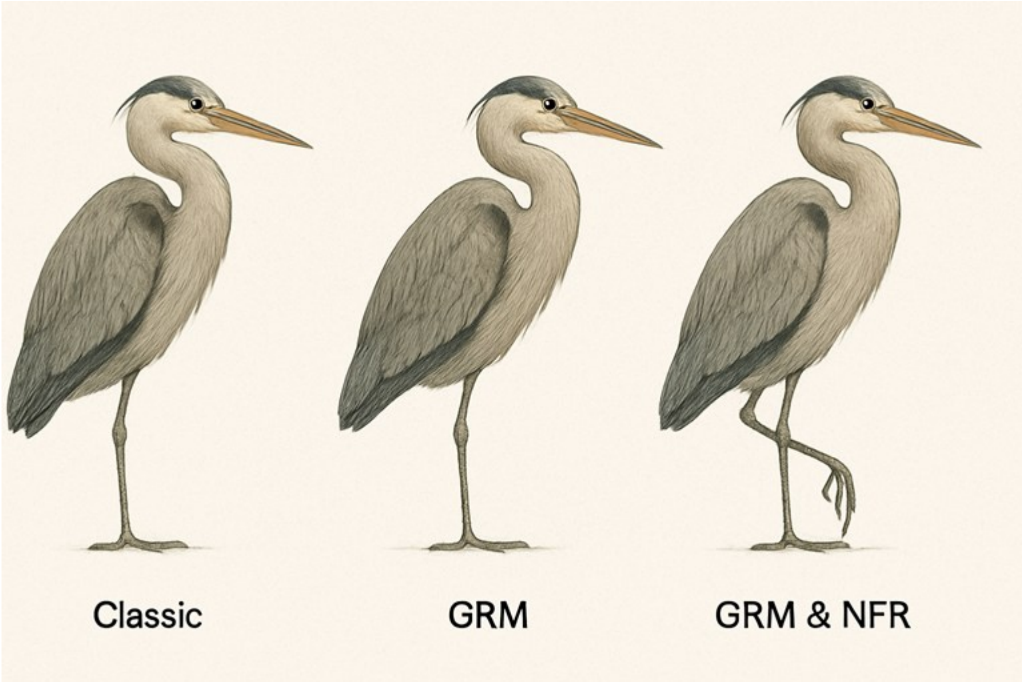

Figure 4. 1 - Heron on One Leg

- The same bird in flight might extend to 0.86 SAU, as wings spread outward and space is filled more dynamically.

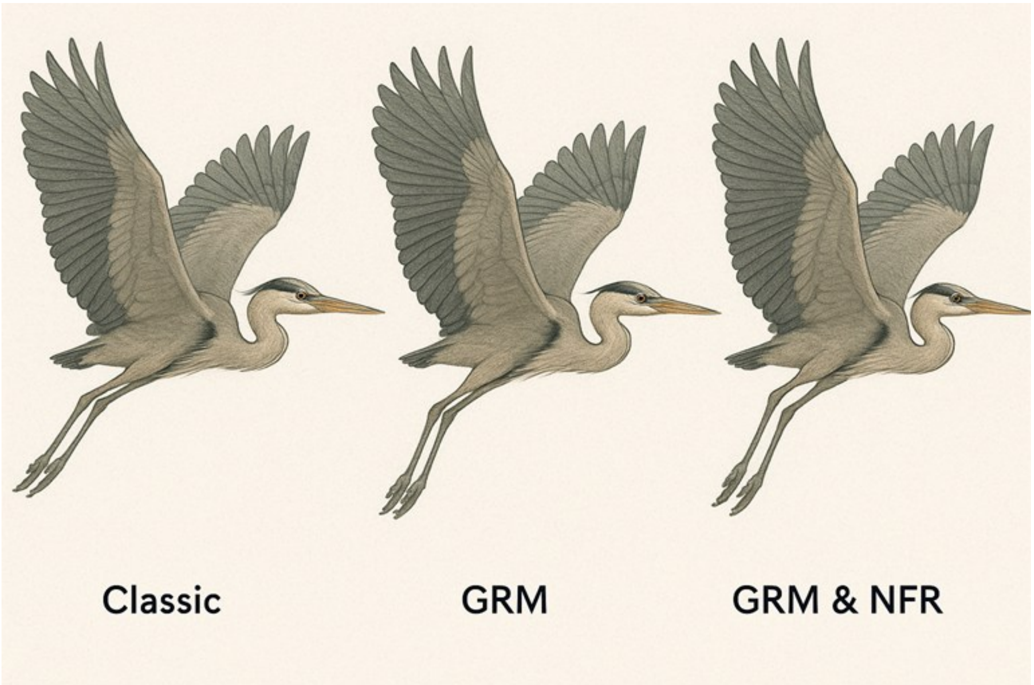

Figure 4.2 - *Heron in Flight*

- A crouching cat or curled snake might drop to 0.65–0.70 SAU, their energy coiled inward.

Figure 4.3 - *Crouching Cat*

Such observations can be guided by bounding-square estimation, allowing the artist to develop an intuitive sense for proportional identity without relying on internal measurements (e.g., ratios between body parts).

Table 4.1 - *Heron on One Leg*

Variation	Description
Classic	A naturalistic depiction of a heron resting on one leg, rendered without structural framing. The posture appears balanced, but no formal reference is applied.
GRM	The same heron is composed within a square bounding frame, aligning its height and width to the GRM canvas. The form approximates 0.7854 SAU, evoking a calm, central presence.
GRM & NFR	The heron remains in a similar resting posture, but with a slight shift in body weight and subtle forward lean. The occupied space is approximately 0.76 SAU — a measurable deviation from canonical balance, expressing internal tension or alertness within a resting state.

Table 4.2 - *Heron in Flight*

Variation	Description
Classic	A heron mid-flight, portrayed with wings outstretched and strong diagonals, but no structural logic is applied to its placement.
GRM	The flying heron is framed within a bounding square. The wings fit snugly within the square, suggesting a symmetrical spread — approximately 0.7854 SAU.
GRM & NFR	The heron exceeds the central balance zone, spreading outward beyond 0.86 SAU. This expansion conveys energy and dynamic asymmetry, typical for expressive motion or tension in nature.

Table 4.3 *Crouching Cat*

Variation	Description
Classic	A lifelike depiction of a crouching cat curled inward, without visible structure. The posture appears relaxed and natural, but no proportional framing is applied.
GRM	The same cat is presented within a square bounding box, showing its structural fit. The shape occupies approximately 0.7854 SAU, expressing geometric balance and centrality.
GRM & NFR	The cat is slightly more compressed, with its body curled more tightly into the lower area of the square. The occupied space measures around 0.66–0.70 SAU, communicating an internalized posture — protective, restful, or preparing for movement.

4.3 Examples in painting, sculpture, and digital art

The Natural Fit Ratio can be applied across artistic media:

- ***In traditional painting***, the artist may use the square as a compositional base, comparing the subject's area to the full frame. This allows for expressive control over form without abandoning structural discipline.
- ***In sculpture***, especially figurative work, bounding volumes help guide the spatial tension of the pose. NFR can guide the positioning of limbs or the curvature of a back within a cubic enclosure.
- ***In digital art***, especially AI-assisted generation or vector illustration, bounding boxes are already native to the design process. NFR provides a new way to *think within the box* — not as a constraint, but as a canvas for expressive occupation.

4.3.1 Anatomical and biological application

In fields such as anatomical illustration, biomechanics, and scientific visualization, forms are rarely ideal but frequently regular. The NFR provides a descriptive ratio for living form, not by dissecting internal geometry, but by observing external occupation.

Whether analyzing the arc of a spine, the spread of a ribcage, or the volume of a curled mammal, the artist or scientist can apply NFR logic to:

- Classify body shapes by proportional identity.
- Compare variation across individuals or species.
- Create educational visuals that bridge geometric understanding with biological realism.

5. Implementation in AI and Creative Technology

5.1 Prompt design for AI-generated images

In AI-based image generation systems, such as DALL·E, Midjourney, or Stable Diffusion, prompts are the primary means of artistic control. The Natural Fit Ratio (NFR) offers a new way to structure these prompts, by embedding spatial proportion directly into the generation logic.

For example:

- Instead of prompting:
  "a resting heron"
  one could use:
  "a heron centered in frame, occupying approximately 0.75 of a bounding square (GRM), with slight forward lean (NFR ~0.76)"

This approach:

- Reduces ambiguity for the AI model.
- Provides a visual logic that aligns with internal rendering structures.
- Enables the user to modulate between static symmetry and dynamic asymmetry.

The use of NFR-coded language creates a bridge between human visual intention and AI's generative structure, a shared vocabulary of proportion.

Universal Prompt Add-On – GRM + NFR Visual Logic
"within a square bounding frame, centered subject with proportional occupation using GRM logic (e.g. 0.74–0.78 SAU), allowing for expressive deviation (Natural Fit Ratio) based on the shape's gesture or posture."

5.2 Bounding-square overlays and visual templates

The GRM and NFR frameworks are particularly suited to overlay-based validation and feedback. Whether in generative tools, digital art software, or machine learning environments, bounding-square overlays can serve as:

- ***Design-time composition aids***: Templates in Procreate, Photoshop, or Figma that allow artists to plan their shapes based on fixed ratios (0.7854, 0.74, 0.66...).
- ***Post-generation diagnostics***: Visual feedback after generation, showing whether a subject aligns with canonical ratios or deviates expressively.
- ***Annotation tools***: For training datasets, enabling ratio-based tagging of objects in images (e.g., bounding-box to object area ratio).

These overlays do not require deep model integration and can function as lightweight add-ons or plug-ins across creative software.

5.3 Integration into generative pipelines and tools

For deeper integration, NFR logic can be embedded as part of the generative pipeline, either:

- ***Pre-generation***: influencing layout and proportion in latent space.
- ***Mid-generation***: guiding attention maps toward ratio-conformant bounding regions.

- ***Post-generation***: filtering or adjusting outputs based on GRM/NFR evaluation (e.g., reranking candidates by compositional balance).

Implementation routes include:

- GRM modules in GAN or diffusion-based architectures (as bounding-box proportion evaluators).
- GRM-based scoring layers for creative scoring, aesthetic filtering, or human-alignment metrics.
- Use in interactive generation interfaces, allowing users to "dial in" ratio bands (e.g., select between 0.68 and 0.80 SAU).

By adding a lightweight, explainable proportional layer, GRM and NFR enhance both creative flexibility and system interpretability, particularly in domains such as education, medical modeling, concept design, and personalized visual communication.

6. Educational and Analytical Value

6.1 Teaching proportion through GRM and NFR

Traditional education in geometry and art often separates numerical proportion from visual experience. The Geometric Ratio Model (GRM) and the Natural Fit Ratio (NFR) bridge that gap by offering a visually grounded system of measurement that is both intuitive and precise.

In educational settings, GRM and NFR can be used to:

- Teach spatial awareness through bounding frames.
- Explain concepts like area, scale, and deviation without reliance on irrational constants.
- Encourage students to observe how living forms fit within space — and how they deviate from geometric ideals.

Because GRM uses a square as a fixed reference, it helps students visualize abstract concepts such as:

- What makes a shape balanced?
- How do we describe a form that feels dynamic or expressive?
- What happens when a form expands, contracts, or leans?

By introducing ratio-as-perception, students gain an entry point into both mathematical reasoning and artistic interpretation.

6.2 Analyzing classical art with GRM logic

Many classical artworks, consciously or unconsciously, align with GRM logic. Subjects are often centered, enclosed in geometric frames, or composed within predictable proportion bands.

With NFR, students and researchers can go a step further:

- Measure how much of a canvas a subject occupies.
- Compare how different artists use space and symmetry.
- Explore how visual tension is introduced through compositional deviation.

This method allows for a quantitative reading of expressive form, transforming art analysis into a dialogue between intention and geometry.

Example applications:

- Analyzing Da Vinci's *Vitruvian Man* through GRM occupation ratios.

- Comparing the spatial identity of figures in Baroque versus Renaissance portraiture.
- Studying posture and framing in religious triptychs or anatomical sketches.

6.3 Toward an aesthetic grammar based on visual fit

GRM and NFR open the door to a new visual grammar, based not on symbolism or style, but on proportional fit. Just as music is structured by rhythm and interval, visual composition can be guided by:

- Canonical ratios (e.g., 0.7854 SAU as a "harmonic center")
- Expressive deviations (e.g., NFR 0.72 or 0.88 as "tension tones")
- Tolerance bands (as perceptual thresholds for variation)

Such a grammar allows for:

- Cross-disciplinary teaching (geometry, biology, design, and art)
- Visual feedback systems in creative software
- Compositional tagging in generative AI and aesthetic training sets

In this way, the GRM/NFR framework becomes more than a tool — it becomes a language of visual coherence, enabling creators, learners, and machines to speak about form with clarity and shared structure.

A note on the Golden Ratio
While the Golden Ratio ($\varphi \approx 1.618$) has long been celebrated for its aesthetic appeal, especially in classical architecture and Renaissance art, it operates primarily as an internal proportion, a ratio between parts within a figure.

In contrast, the GRM and NFR frameworks are external and visually grounded: they define proportion by measuring how much of a bounding square is filled, not how one part relates to another. This shift allows for a direct visual readout of proportion, useful in both traditional art and digital systems.

Rather than replacing φ, GRM complements it by offering a method that is scale-free, dimensionless, and expressive; extending the idea of ideal proportion into a full spectrum of compositional fit. In doing so, it provides both a standard and a playground for expressive deviation.

7. Future Directions and Extensions

7.1 Extending NFR to motion, deformation, and time-based forms

While the current formulation of the Natural Fit Ratio (NFR) is spatial and static, it can be naturally extended to temporal and dynamic dimensions. In animation, biomechanics, or real-time interaction, shapes continuously change their form and occupation ratio.

Potential extensions include:

- Frame-by-frame NFR tracking in animated sequences.
- Motion envelopes that define the range of spatial deviation over time.
- Deformation mapping in soft-body simulations or gesture recognition.

By applying GRM logic across time slices, a moving or morphing object can be analyzed and classified based on how its spatial occupation fluctuates, opening the door to new kinds of dynamic aesthetic reasoning.

7.2 GRM-based evaluation metrics for generative models

As generative AI systems grow in complexity, the need for interpretable evaluation metrics becomes more urgent. GRM and NFR can provide:

- Quantitative descriptors of compositional balance (e.g., how close an image adheres to canonical ratios).
- Expressiveness indicators (e.g., the distance from ideal fit as a proxy for visual tension or uniqueness).
- Filtering tools for outputs that fall within or outside desired proportion bands.

These metrics can be integrated into:

- Model training feedback loops.
- Reranking systems in multi-output generation.
- Aesthetic scoring algorithms in visual search engines or content moderation tools.

7.3 Applications in medicine, design, and the metaverse

Beyond art and AI, GRM and NFR have potential in:

- ***Medical imaging***: describing anatomical structures without relying on internal metrics (e.g., volumetric occupation in 2D slices).
- ***Product design***: assessing visual balance or compactness in packaging, architecture, or interface layout.
- ***Metaverse avatars***: generating or evaluating body forms using proportion bands to ensure believability or stylistic coherence.

In these domains, GRM offers a language of proportion that is both intuitive and mathematically consistent, making it ideal for cross-disciplinary communication.

8. Conclusion

The Natural Fit Ratio (NFR) introduces a new dimension to the Geometric Ratio Model (GRM): the capacity to describe not just ideal geometric forms, but also living, expressive, and dynamic shapes, using proportion as a visual language rather than a strict formula.

By framing every form within a bounding square and measuring how much of that space is occupied, NFR allows us to:

- Interpret deviation not as error, but as expression.
- Compare compositions across artistic, scientific, and technological domains.
- Guide AI systems toward more meaningful and efficient visual generation.
- Teach proportion in a way that is intuitive, measurable, and creatively open.

Whether used by artists to tune the energy of a pose, by designers to validate a layout, or by machines to analyze form without internal metrics, the NFR offers a unifying method of thinking in proportion.

As we move into a world increasingly shaped by digital creation, generative AI, and real-time visualization, such a method provides not only structure, but also freedom. It redefines precision not as rigidity, but as coherent variation within a known space.

Beyond expressiveness and visual coherence, the GRM/NFR framework also provides a pathway to greater efficiency in digital creation. By embedding proportional logic into design prompts, generative algorithms, and analytical workflows, creators and machines can reduce ambiguity, iteration time, and computational overhead.

This is not only a technical benefit, but a conceptual one: by working within clear proportional logic, clarity becomes efficiency. In this way, the NFR does not merely enhance how we see — it also accelerates how we create.

Appendix A – Heart Cross-Section: A Comparative Study

This appendix presents a comparative visual study of a human heart in cross-section, rendered in three conceptual stages:
(1) Classical anatomy, (2) GRM-framed anatomy, and (3) GRM with NFR deviation.

The goal is to illustrate how the Geometric Ratio Model (GRM) and the Natural Fit Ratio (NFR) can be applied to complex anatomical structures without altering their biological accuracy.

Where classical representations focus on internal anatomy and medical realism, the GRM-framed version emphasizes visual occupation and proportional containment. The final variant, with NFR applied, explores subtle expressive deviation, simulating functional variation (such as contraction during systole) while preserving spatial clarity.

In addition to its artistic and didactic implications, this appendix also includes an indicative analysis of rendering efficiency in AI systems. This demonstrates how GRM and NFR can help reduce ambiguity and complexity in generative models, potentially leading to faster, more structured output in medical or educational visualizations.

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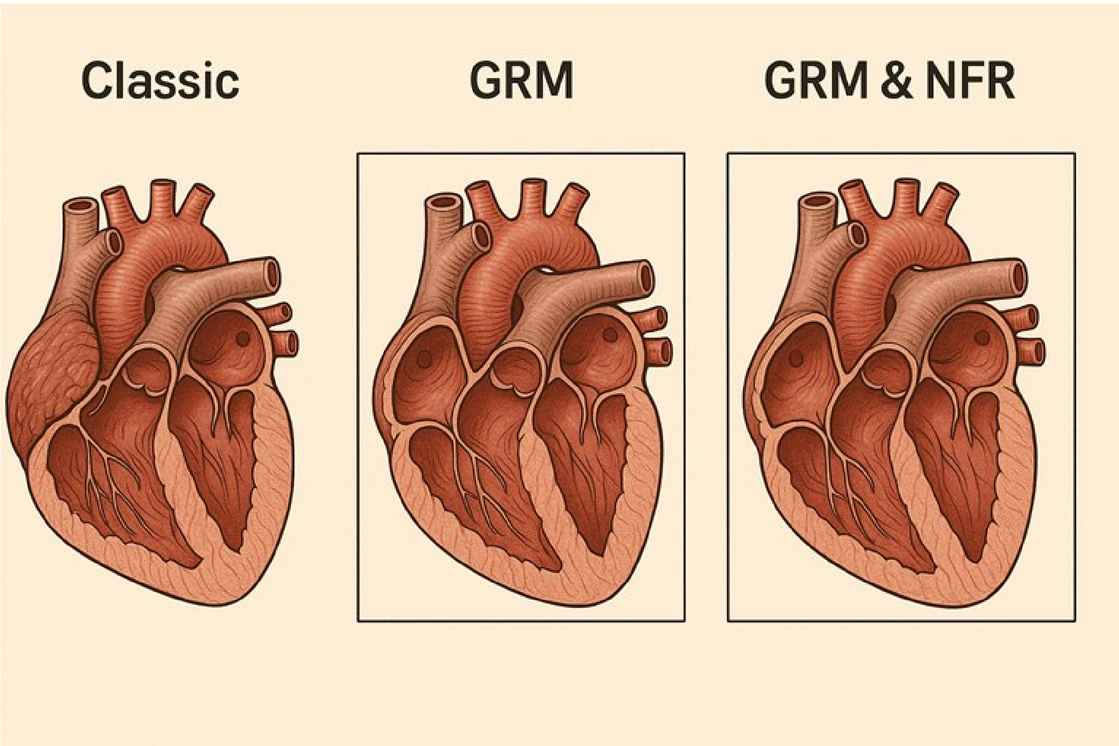


Figure A 2 *- Heart Cross-Section*

Table A 1 - *Heart Cross-Section Description*

Variation	Description
Classic	A traditional anatomical cross-section of the human heart, showing atria, ventricles, valves, and major vessels. Presented without a visual frame or proportional context.
GRM	The same anatomical heart positioned within a bounding square. The structure occupies approximately 0.7854 SAU, representing geometrical balance and structural centrality.
GRM & NFR	The heart is depicted with a slightly compressed silhouette, suggesting internal tension or an expressive focus. The area occupied is ~0.72 SAU, reflecting a deviation toward functional compactness or physiological variance (e.g., during systole).

Indicative Rendering Efficiency (for AI Systems)

Hypothetical example of the impact of GRM logic on image generation in AI contexts (e.g., DALL·E or Midjourney).

Tabel A 2 - *Indicative Rendering Efficiency (for AI Systems)*

Variant	Prompt Length	Iterations (tokens or steps)	Drawing/Render Complexity	Expected Efficiency (%)
Classic	"cross-section of a human heart"	22	High (free positioning)	100% (baseline)
GRM	"centered heart cross-section within square frame (GRM)"	15	Low (centered framing)	~80% of baseline
GRM & NFR	"compressed heart cross-section within square frame (GRM & NFR ratio 0.72)"	17	Moderate (expressive deviation)	~70–75% of baseline

Note*: These values are indicative and serve to illustrate the potential of GRM logic to simplify and structure visual composition, which often leads to fewer iterative corrections and improved rendering efficiency in AI-based systems*.

Appendix B – GRM Ratio Reference Table

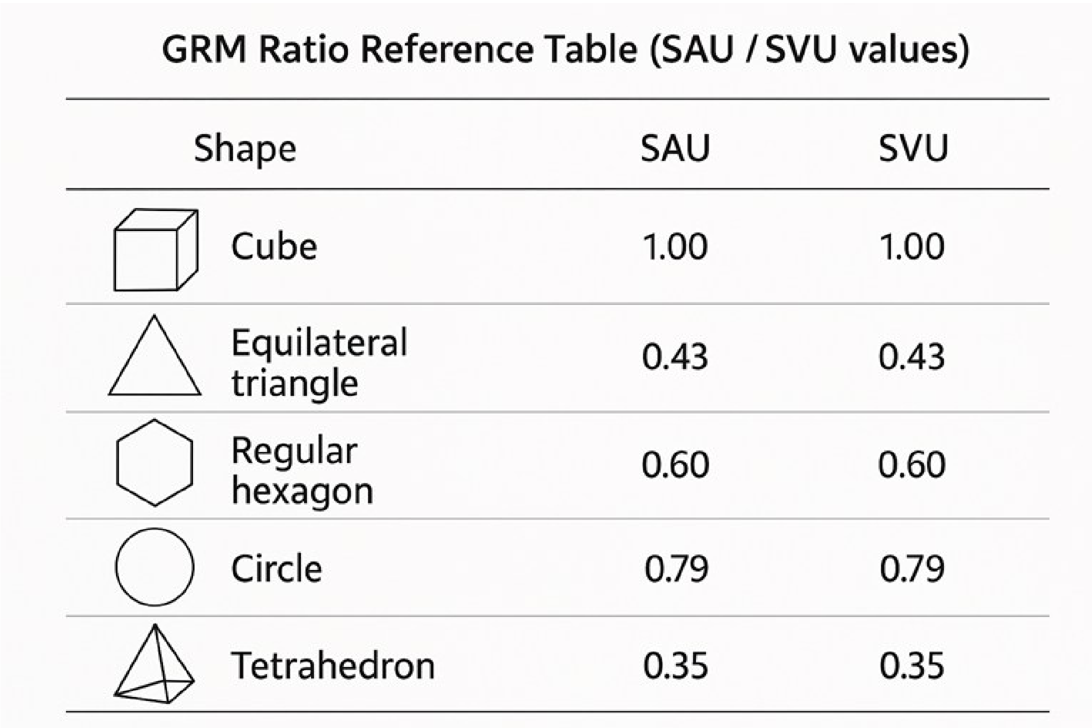
The following table lists canonical geometric forms and their fixed occupation ratios within a bounding square (2D) or bounding cube (3D), as defined by the Geometric Ratio Model (GRM). These ratios are dimensionless and remain constant across scale, making them ideal for visual reasoning in digital systems.

Table B 1- *Canonical geometric forms and their fixed occupation ratios*

Shape/Form	Type	Bounding Logic	Ratio Value	GRM Unit
Circle (fully inscribed)	2D	Square	0.7854	SAU
Equilateral triangle	2D	Inscribed in square	~0.4330	SAU
Regular hexagon	2D	Width = square width	~0.8660	SAU
Square	2D	Reference frame	1.0000	SAU
Sphere (fully inscribed)	3D	Cube	0.5236	SVU
Regular tetrahedron	3D	Vertices touching cube	~0.1179	SVU
Cube	3D	Reference frame	1.0000	SVU

SAU = Square Area Unit
SVU = Square Volume Unit

These values serve as ideal baselines for GRM analysis. When real-world forms deviate from these values, the deviation can be quantified as part of the Natural Fit Ratio (NFR) framework, providing interpretive depth for expressive or organic shapes.


GRM Ratio Reference Table (SAU / SVU values)

Shape	SAU	SVU
Cube	1.00	1.00
Equilateral triangle	0.43	0.43
Regular hexagon	0.60	0.60
Circle	0.79	0.79
Tetrahedron	0.35	0.35

Figure B 1 *– GRM Ratio Reference Table*

Appendix C – Visual Examples of Natural Fit Ratios

This appendix presents a series of comparative illustrations that demonstrate how the **Natural Fit Ratio (NFR)** can be applied across different subjects and postures. Each sequence includes three images, presented side by side:

1. **Classic** – The subject rendered without explicit proportional framing.
2. **GRM** – The subject centered and scaled to fit within a perfect square, occupying a canonical ratio (e.g., 0.7854 SAU).
3. **GRM & NFR** – The same subject in a modified, more expressive posture, occupying a slightly different ratio (e.g., 0.72 or 0.86 SAU), showcasing the impact of deviation within a GRM framework.

These examples serve three purposes:

- To visualize how **expressive variation** manifests through ratio deviation.
- To provide **reference models** for prompt design and compositional analysis.
- To illustrate the **consistency of GRM logic** across domains — from animals to anatomical models.

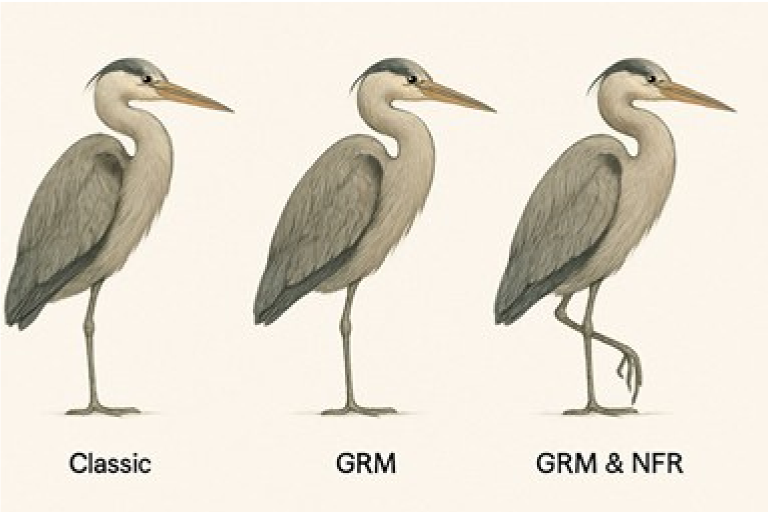


Figure C 1 - *Heron on one leg*

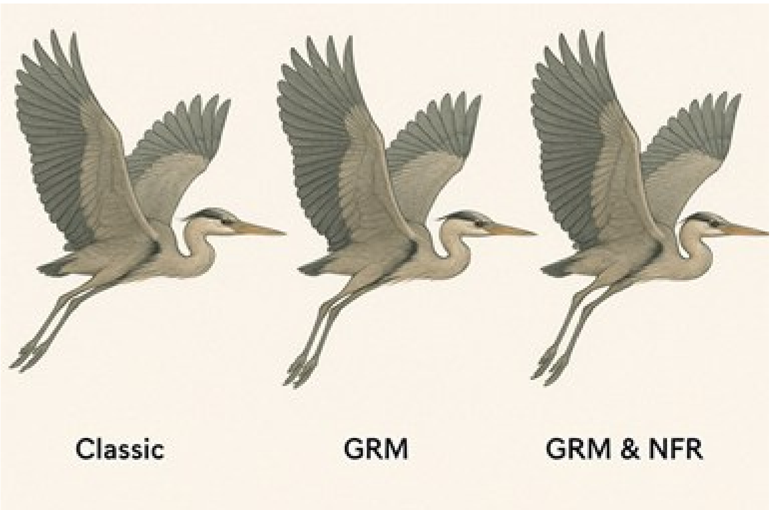


Figure C 2- *Heron in flight*

Figure C 3 - *Crouching cat*

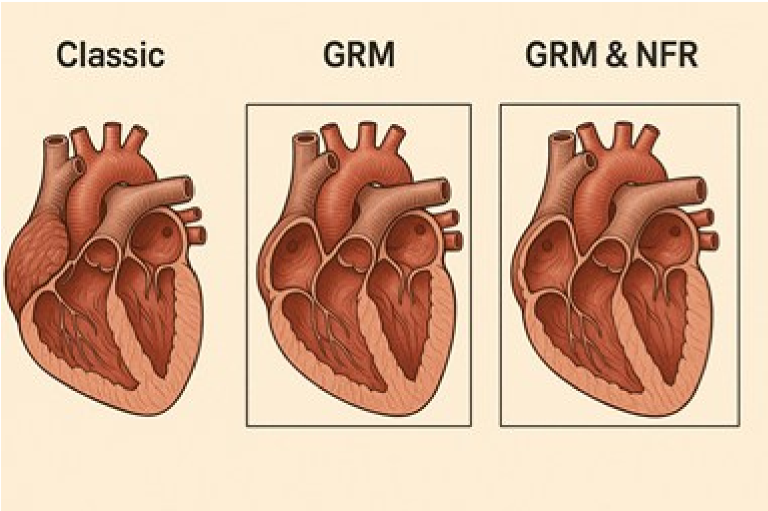


Figure C 4 - *Heart cross-section*

Table C 1 - *Included visual comparisons:*

Subject	GRM Ratio (canonical)	NFR Range (expressive)	Illustration Set
Heron on one leg	~0.75 SAU	~0.74–0.77 SAU	Classic – GRM – GRM & NFR
Heron in flight	~0.78 SAU	~0.85–0.88 SAU	Classic – GRM – GRM & NFR
Crouching cat	~0.74–0.78 SAU	~0.66–0.70 SAU	Classic – GRM – GRM & NFR
Heart cross-section	0.7854 SAU	~0.72 SAU	Classic – GRM – GRM & NFR

These comparative visuals demonstrate how GRM and NFR provide a continuum of proportional identity, from geometric ideal to natural variation, without sacrificing visual coherence.

Appendix D – Glossary of Terms

Term	Definition
GRM (Geometric Ratio Model)	A proportional geometry framework that defines shapes based on their occupation of a bounding square (2D) or cube (3D), using fixed, dimensionless ratios such as SAU and SVU.
NFR (Natural Fit Ratio)	An extension of GRM that allows for expressive or organic deviation from canonical proportions, while maintaining a measurable relationship to the bounding frame.
SAU (Square Area Unit)	The area of a square taken as a reference unit in 2D. A circle inscribed in such a square has an area of 0.7854 SAU.
SVU (Square Volume Unit)	The volume of a cube taken as a reference unit in 3D. A sphere inscribed in such a cube has a volume of 0.5236 SVU.
Canonical ratio	A fixed GRM value representing the ideal occupation of space by a regular form (e.g., 0.7854 SAU for a circle).
Bounding square / cube	The outer frame (2D or 3D) within which a shape is measured or constructed in GRM logic.
Deviation (in GRM context)	The difference between a shape's actual ratio and its canonical GRM value; used as a basis for NFR interpretation.
Tolerance band	A small range (e.g., ±0.02–0.05) around a canonical ratio within which a shape may still be perceived as ideal. Beyond that range, the deviation becomes expressive.
Visual fit	The intuitive or measured proportion of a shape within its container; the core focus of GRM/NFR analysis.
Rendering efficiency	The reduction in computational complexity and iterations in AI generation processes when using structured, ratio-based prompts derived from GRM logic.