"Re-Imagining Mathematical Expression: A Novel Symbolic Language Connecting Humans And Artificial Intelligence"

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Abstract:
The aim of this research paper is to present a new MSL (mathematical symbolic language) that expand the use and applications of the English alphabet, offering a specific and intuitive framework for explaining and representing mathematical concepts. The proposed language seeks to enhance clarity and accessibility in mathematical communication while promoting a deeper understanding of complex ideas. Additionally, this symbolic framework aspires to serve as a robust tool for artificial intelligence (AI) systems, facilitating a better understanding of mathematical expressions and advanced reasoning in mathematical contexts.
Kew Words: *Mathematical Symbols, English Alphabet, AI, Greek Language etc.*

I. Introduction:

The Greek language, like many ancient languages, does not have a single inventor. Instead, it evolved over time through a gradual process within the Greek-speaking communities of the ancient world. The development of the Greek language can also be traced back to its earliest stages, with influences from neighboring cultures and internal changes. During the earliest age the Greek language, known as Proto-Greek, come out around 2000 BCE or possibly earlier. Proto-Greek is considered the predecessor to the various ancient Greek dialects that evolved over time. The specific individuals responsible for the creation of the Greek language are not known, as language development is typically a collective and gradual process that takes place over generations. The Greek alphabet, which is a significant aspect of the language, was adapted from the Phoenician script. The Greeks modified the Phoenician alphabet to suit their needs, and this adaptation is attributed to various individuals in different regions over a period of time. Since it was known that the Greek alphabet was not invented by a single person but rather evolved through cultural and historical interactions. The ancient Greeks played an important role in the development and refinement of the language, particularly during the Classical period (5th and 4th centuries BCE). The works of prominent figures such as Homer, the playwrights (e.g., Sophocles, Euripides), and philosophers (e.g., Plato, Aristotle) contributed significantly to the standardization and enrichment of the Greek language.

History: The history of the Greek language is an interesting journey that spans thousands of years. It has evolved through various stages, each marked by distinct linguistic and cultural influences. Here is a recap of the history of the Greek language:

Table-1 Historical Overview of Greek Language		
Name	**Era**	**Summary**
Proto-Greek	c. 2000–1600 BCE	The earliest form of the Greek language is known as Proto-Greek, which arises around 2000 BCE. This early stage is not well-documented, and much of what is known comes from linguistic reconstructions.
Mycenaean Greek	1600–1100 BCE	This is the initial certified form of the Greek language. The Linear B script, used primarily for administrative purposes, was deciphered in the 1950s, revealing a form of ancient Greek used in the Mycenaean civilization.
Dark Ages	c. 1100–800 BCE	Following the collapse of the Mycenaean civilization, Greece entered a period known as the Dark Ages. During this time, the Greek language underwent serious changes, and the writing system was lost. The oral tradition played a crucial role in preserving the language.

Archaic Greek	c. 800–500 BCE	The Greek alphabet, adapted from the Phoenician script, was introduced around the 8th century BCE. This marked the starting of the Archaic period. The works of famous poets like Homer, who composed the Iliad and the Odyssey, were written in this period.
Classical Greek	c. 500–300 BCE	The Classical period is considered the golden age of Greek literature and culture. It produced some of the famous works in philosophy, drama, and history. The language of this period is known for its clarity and precision.
Hellenistic Greek	c. 300 BCE–300 CE	With the conquests of Alexander the Great, Greek culture and language spread across a vast empire. The Hellenistic period saw the emergence of a common dialect known as Koine Greek, which became the lingua franca of the Eastern Mediterranean.
Roman Period	c. 146 BCE–330 CE	Greece became a part of the Roman Empire, but Greek continued to thrive as the language of culture and education. The New Testament of the Christian Bible was written in Koine Greek during this time.
Byzantine Greek	c. 330–1453 CE	After the division of the Roman Empire, the Eastern Roman Empire, or Byzantine Empire, retained Greek as its official language. The language evolved further, with influences from Latin and other languages.
Medieval and Ottoman Periods	c. 1453–1821	Following the fall of Constantinople in 1453, Greece came under Ottoman rule. Despite this, Greek remained the language of the Orthodox Church and continued to be spoken by the majority of the population.
Modern Greek	1821–present	The Greek War of Independence in 1821 marked the beginning of the modern Greek state. The language underwent significant changes during the 19th and 20th centuries, with efforts to purify it from foreign influences. Modern Greek, as spoken today, has evolved from Koine Greek with influences from various historical stages.

Throughout its long history, the Greek language has demonstrated remarkable continuity and adaptability, playing a crucial role in shaping Western civilization.

The Greek alphabet is the script that has been used to write the Greek language for over two and a half millennia. It has undergone several changes and modifications throughout its history. As of the modern era, the Greek alphabet consists of 24 letters. Here is a brief explanation of each letter:

Table-2 Old Notation for Greek Language		
Greek Language	Greek Symbol	Similarity with English Language
Alpha	α	A
Beta	β	B
Gamma	Γ, γ	G
Delta	(Δ, δ)	D
Epsilon	ε	E
Zeta	ζ	Z
Eta	(H, η)	E but pronounced like long A
Theta	(Θ, θ)	TH
Iota	ι	I
Kappa	κ	K
Lambda	(Λ, λ)	L
Mu	μ	M
Nu	ν	N
Xi	(Ξ, ξ)	A combination of "K" and "S."
Omicron	(O, o)	O
Pi	(Π, π)	P
Rho	ρ	R
Sigma	(Σ, σ/ς)	S, the lowercase form (σ) and the uppercase or final form (ς)
Tau	τ	T
Upsilon	υ	U
Phi	(Φ, φ)	F
Chi	(X, χ)	CH
Psi	(Ψ, ψ)	A combination of "P" and "S."
Omega	(Ω, ω)	"O," but pronounced like a long "O."

II.   New Modified Modern Mathematical Language:

The new modern language define with similar 26 letters as of English Alphabet, that's why it is easy to read and write of course understanding, also help to write mathematical program easily, defined as in table 3 given below:

Table-3 New and modified notation for Greek Language		
Greek Language	**Greek Symbol**	**Similarity with English Language**
Alpha	α	a
Beta	β	b
Chi	□	c
Delta	□	d
Ephisilon	□	e
Fai	□	f
Gamma	□	g
Heta	□	h
Iota	□	i
Jphai	□	j
Kappa	□	k
Lemda	□	l
Mue	□	m
Neu	□	n
Omicron	□	o
Pi	□	p
Qtheta	□	q
Ro	□	r
Sigma	□	s
Tau	□	t
Upsilon	□	u
Vyagar	□	v
wmega	□	w
Xai	□	x
Yasai	□	y
Zeta	□	z

These letters are used to represent both consonant and vowel sounds in the Greek language. The script has a rich history and has been influential in the development of other alphabets, including the Latin alphabet used in English and many other languages.

Read and write Methods:

Table-4 Read and write for Greek Language		
Greek Symbol	**Name**	**Read and write**
α	Alpha	alph
β	Beta	be
□	Chi	chi
□	Delta	del
□	Ephisilon	epi
□	Fai	fa'
□	Gamma	gam'
□	Heta	h'et
□	Iota	it'
□	Jphai	jp'
□	Kappa	kp
□	Lemda	lem
□	Mue	mu
□	Neu	nu
□	Omicron	om
□	Pi	p'i
□	Qtheta	qta'
□	Ro	ro
□	Sigma	sig
□	Tau	tu
□	Upsilon	ups
□	Vyagar	vyr
□	wmega	umg'
□	Xai	xa'

	Yasai	ysa'
⬜	Zeta	ze'

Development in AI of this language: The Greek language symbols in Table-3 can aid AI development by offering a structured representation of linguistic elements. This structured approach helps in natural language processing (NLP) tasks, enabling machine learning algorithms to better understand and generate Greek text, as well as helping us optimize mathematical programs. As a result, it can enhance tasks such as translation, sentiment analysis, and conversational AI.

Examples for Mathematical prospective: We will calculate the trajectory of a projectile (e.g., a ball being thrown) by defining equations using the new symbols by use of python:

```
# Program to calculate projectile trajectory using modified Greek symbols
import math
# Constants defined using modified Greek symbols
g = 9.8 # Acceleration due to gravity (m/s²), represented as gam'
v_initial = 50 # Initial velocity (m/s), represented as nu
ang = 45 # Angle of projection in degrees, represented as qta'

# Converting angle to radians using qta'
qta_rad = math.radians(ang)

# Horizontal velocity component (v_x = nu * cos(qta'))
v_x = v_initial * math.cos(qta_rad)

# Vertical velocity component (v_y = nu * sin(qta'))
v_y = v_initial * math.sin(qta_rad)

# Time of flight (t_f = 2 * nu * sin(qta') / gam')
t_f = (2 * v_y) / g

# Maximum height (h_max = (nu^2 * sin(qta')^2) / (2 * gam'))
h_max = (v_y ** 2) / (2 * g)

# Range of the projectile (r = (nu^2 * sin(2 * qta')) / gam')
r = (v_initial ** 2) * math.sin(2 * qta_rad) / g

# Displaying results using the modified Greek symbols
print("Projectile Trajectory Calculations (Using Modified Greek Symbols):")
print(f"Horizontal velocity (v_x, nu_x): {v_x:.2f} m/s")
print(f"Vertical velocity (v_y, nu_y): {v_y:.2f} m/s")
print(f"Time of flight (t_f, t'u): {t_f:.2f} seconds")
print(f"Maximum height (h_max, h'um): {h_max:.2f} meters")
print(f"Range of the projectile (r, p'r): {r:.2f} meters")
```

Explanation:
a. **Modified Symbols**: This program uses new symbols as aliases:
1. **nu** for velocity v,
2. **qta'** for angle θ,
3. **gam'** for gravity g

b. **Mathematical Application**: The program calculates:
1. Horizontal velocity v_x
2. Vertical velocity v_y ,
3. Time of flight t_f
4. Maximum height h_{max}
5. Range r of the projectile.
The results are displayed using the new symbols for better contextual understanding.

This program combines mathematical modeling with symbolic representation, linking real-life projectile physics to the modified Greek alphabet.

Graphical Representation:
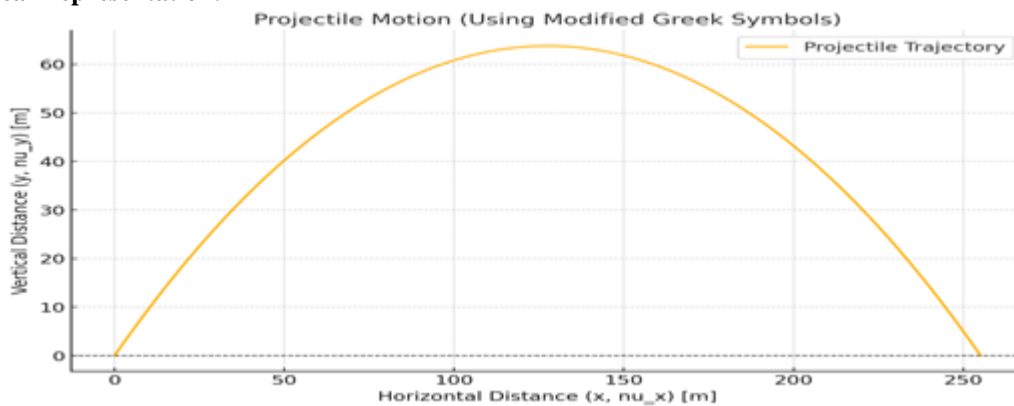
Here is the graph of the projectile's trajectory, calculated using the modified Greek symbols. The curve represents the path of the projectile as it travels through the air, with the horizontal distance (x, nu$_x$) on the x-axis and the vertical distance (y, nu$_y$) on the y-axis.

Square root of □* (pi star) = 3.24:[Ref: Shiv Dayal "Possible to Square a circle with pi-star" International Journal of Physics, Chemistry and Mathematical Fundamentals, ISSN: 2278 -1846, Vol. 02, No. 01, pp.10-18,2012.**]**

Program to calculate the square root of Pi Star (π* = 3.24) using modified Greek symbols
import math

# Constant
p_i_star = 3.24 # Value of Pi Star, represented as p'i*

# Calculation of the square root of Pi Star (sqrt(p'i*))
sqrt_p_i_star = math.sqrt(p_i_star)

# Displaying the result using the modified Greek symbols
print("Calculation of Square Root of Pi Star (Using Modified Greek Symbols):")
print(f"Square root of Pi Star (sqrt(p'i*)) = {sqrt_p_i_star:.4f}")
Explanation:

a. **Symbol Used**: $\pi*$ (Pi Star) is represented as p′i∗ in the program, The square root is calculated using $\sqrt{p'i*}$
b. **Output**: The square root of p′i∗=3.24 is displayed in the modified Greek notation.
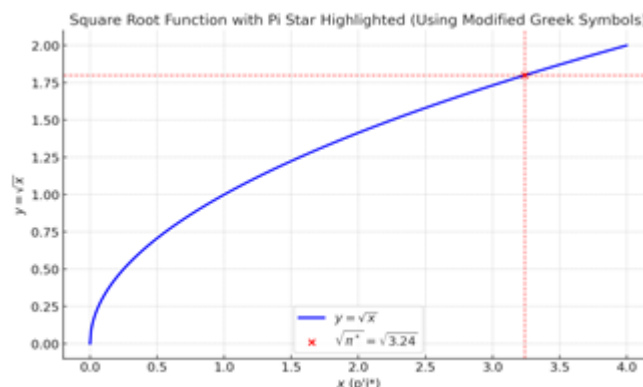
Here is the graph of the square root function $y = \sqrt{x},$ with □∗=3.24 (p′i∗)

The red dot marks the square root of $\pi* \sqrt{3.24}$, dashed red lines indicate the vertical and horizontal projection to emphasize the input (p′i∗) and its square root value on the graph. This visualization provides a clear representation of the square root calculation in relation to the modified Greek symbols.

After analyzing the above examples, we can conclude that this modified mathematical language helps to optimize programming efficiency and enhances the understanding of NLP and ML.

III.   Application Of Greek Language:

The Greek language has a rich history and is widely used in various applications, both historically and in the modern world. We described some specific areas where the Greek language continues to play a significant role:

Literature and Philosophy: Ancient Greek literature, including the works of Homer, Sophocles, Euripides, and Plato, has had a profound influence on world literature and philosophy. For example, Homer's Odyssey has inspired countless modern works about epic journeys, such as James Joyce's Ulysses. Similarly, Sophocles' tragedy Oedipus Rex laid the groundwork for the archetype of the "tragic hero," which continues to shape characters in literature, theater, and film, such as Shakespeare's Hamlet. Plato's philosophical ideas, such as his concept of ideal forms, remain central to discussions in philosophy and education today, influencing thinkers such as René Descartes and modern educators who emphasize critical thinking. [**Ref:** Homer's Odyssey, translated by Robert Feagles (Penguin Classics), Sophocles: Oedipus the King, translated by David Grene (University of Chicago Press)] Many other foundational philosophical texts, such as those of Aristotle, laid the groundwork for what we now recognize as the scientific method. His approach emphasized observation, classification, and logical reasoning. For example: think of how biologists classify animals and plants into species, genera, and families. This hierarchical classification system has its philosophical roots in Aristotle's Taxonomy, where he attempted to classify living beings based on their characteristics.

Medicine: Hippocrates' language, widely recognized as that of the father of medicine, was Greek. Many medical terms and concepts have Greek origins and the Greek language has played a significant role in shaping modern medical terminology. The field of Καρδιολογία (Kardiologia - Cardiology), derived from καρδία (kardia - heart) + λογία (logia - study of)**,** focuses on the heart and circulatory system. Similarly**,** Νευρολογία (Neurologia - Neurology)**,** from νεῦρον (neuron - nerve) + λογία (logia - study of)**,** known with the study of the nervous system and its disorders. Ορθοπεδική (Orthopedikē - Orthopedics)**,** combining ὀρθός (orthos - straight) + παιδεία (paideia - education/training)**,** specializes in correcting bone and muscle deformities. The term Αἱμοσφαιρίνη (Haimosphairinē - Hemoglobin) comes from αἷμα (haima - blood) + γλοβίνη (globin - protein)**,** referring to the oxygen-carrying protein in red blood cells. Παιδιατρική (Pediatrikē - Pediatrics)**,** from παῖς (pais - child) + ἰατρός (iatros - doctor)**,** is the branch of medicine concerned with children's health. The study of mental health, Ψυχιατρική (Psychiatrikē - Psychiatry)**,** derives from ψυχή (psyche - mind/soul) + ἰατρεία (iatreia - healing)**,** focusing on diagnosing and treating mental disorders. Γυναικολογία (Gynaikologia - Gynecology)**,** from γυνή (gyne - woman) + λογία (logia - study of), deals with women's reproductive health. These examples demonstrate how the Greek language and its rich medical concepts have significantly influenced modern medical terminology.

Law and Politics: Ancient Greece, particularly Athens, is considered the birthplace of democracy, influencing Western political thought in many ways. The Athenian system of Δημοκρατία (Demokratia - Democracy) allowed citizens to participate directly in governance, shaping modern democratic institutions. Practices like ὄστρακον (Ostrakon - Ostracism), where political leaders could be exiled to prevent tyranny, and the Δικαστήριον (Dikastērion - Jury System), which used large citizen juries, influenced legal traditions worldwide. Greek Νόμος (Nomos - Law Codes), including those of Solon and Draco, introduced written legislation that inspired later legal frameworks. The Βουλή (Boulē - Senate), a council of 500 citizens, functioned similarly to modern legislative bodies, while Aristotle's Πολιτεία (Politeia - Constitution) laid the foundation for constitutional governance. The concept of Διαίρεσις τῶν Ἀρχῶν (Diairesis tōn Archōn - Separation of Powers) emerged from Greek city-states, later refined by Montesquieu. Public participation through the Ἐκκλησία (Ekklēsia - Assembly) fostered free speech and open debate, while the idea of Πολίτης (Politēs - Citizenship) distinguished civic rights and responsibilities. Additionally, Greek political philosophy, particularly from Plato and Aristotle, greatly influenced the development of Republican Government, later formalized in Rome. These contributions continue to shape modern political systems, governance, and legal institutions.

Art and Architecture: Greek language and culture have profoundly influenced art and architecture throughout history, with classical Greek architecture and sculpture serving as enduring examples. Δωρικός ρυθμός (Dōrikos Rythmos - Doric Order), derived from Δωριεῖς (Dōrieis - Dorians) + ρυθμός (rhythmos - order/style), is the simplest and most robust of the three classical architectural orders, characterized by fluted columns and plain capitals. Ιωνικός ρυθμός (Iōnikos Rythmos - Ionic Order), from Ἴωνες (Iōnes - Ionians) + ρυθμός (rhythmos - order/style), features more decorative elements, including scroll-like volutes on column capitals.

Κορινθιακός ρυθμός (Korinthiakos Rythmos - Corinthian Order), derived from Κόρινθος (Korinthos - Corinth) + ρυθμός (rhythmos - order/style), is the most ornate, with elaborate acanthus leaf decorations. Παρθενώνας (Parthenōnas - Parthenon), from παρθένος (parthenos - virgin), is a symbol of classical Greek architecture, dedicated to Athena, the patron goddess of Athens. Θέατρον (Theatron - Theatre), from θεάομαι (theaomai - to watch/view), represents the Greek contribution to performing arts, with open-air amphitheaters that influenced modern theater design. Γλυπτική (Glyptikē - Sculpture), from γλύφω (glyphō - to carve/engrave), exemplifies Greek mastery in creating lifelike statues such as those of Φειδίας (Pheidias - Phidias) and Πραξιτέλης (Praxiteles - Praxiteles). Μωσαϊκόν (Mōsaikon - Mosaic), from μουσείον (mouseion - place of the Muses), was a decorative art form used to create intricate floor and wall designs. These examples highlight how Greek language, art, and architecture have left a lasting impact on the world.

IV.   Mathematical History Of Greek Language:

Geometry and Music: Greek mathematicians like Euclid and Pythagoras made lasting contributions to geometry and mathematical reasoning, which continue to influence both architecture and music. Ευκλείδεια Γεωμετρία (Eukleideia Geometria - Euclidean Geometry)

Derived from Εὐκλείδης (Eukleidēs - Euclid) + γεωμετρία (geometria - earth measurement), this system forms the foundation of modern geometry. Architects use Euclidean principles to ensure stability and precision in measurements. For instance, the Πυθαγόρειο Θεώρημα (Pythagoreio Theōrēma - Pythagorean Theorem), from Πυθαγόρας (Pythagoras) + θεώρημα (theōrēma - theorem), states that in a right-angled triangle:

$$\alpha^2 + \beta^2 = \gamma^2$$

where α (alph) and β (be) are the legs, and γ (gam') is the hypotenuse. This theorem helps in constructing right-angled corners in buildings, ensuring structural integrity. Pythagoras also discovered that musical notes are mathematically related. The Αρμονία (Harmonia - Harmony), from ἁρμονικός (harmonikos - fitting together), follows simple numerical ratios. If the length of a vibrating string is reduced by half, the frequency doubles, producing an octave. The fundamental frequency f of a string is given by:

$$f = \frac{1}{2L}\sqrt{\frac{T}{\mu}}$$

where L (lem) is the string length, T (tu) is the tension, and μ (mu) is the linear density. This principle is applied in tuning musical instruments like guitars, ensuring correct sound production based on string length and tension.

These mathematical contributions from Greek thinkers continue to shape architecture and music, demonstrating the deep connection between mathematics, structure, and good faith.

V.   Discussion:

The development of a new mathematical Greek language presents a unique way to blend historical mathematical traditions with modern computational and linguistic advancements. Rooted in the rich heritage of Greek mathematicians such as Euclid and Pythagoras, this revised language introduces alternative Greek symbols and phonetics to enhance mathematical notation, making equations and concepts more intuitive. For example, the use of Πυθαγόρειο Θεώρημα (the Pythagorean Theorem) with symbols such as α (alpha), β (be), and γ (gam') provides a structured way to represent geometric relationships, which aids architects in accurate measurements. Similarly, the mathematical basis of Μουσική και Μαθηματικά (Music and Mathematics), involving string tension and length formulas, sheds light on the interplay between numerical ratios and sound frequencies required in musical instrument design. This linguistic adaptation not only optimizes mathematical programming and algorithmic efficiency but also provides a structured framework for Νευρωνικά Δίκτυα (Neuronicē dictēia - Neural Networks) in Τεχνητή Νοημοσύνη (Technētē - Artificial Intelligence), bridging the gap between NLP and ML applications. Additionally, by incorporating Greek terminology into architecture, medicine, and physics, this approach enhances interdisciplinary learning, making mathematical expressions more accessible while preserving the essence of ancient Greek knowledge. Integrating this revised mathematical Greek language into computational science could lead to new ways of understanding and solving problems, reinforcing the timeless influence of Greek contributions on modern advancements.

VI.   Conclusion:

In conclusion, the modified mathematical Greek language bridges the rich heritage of ancient Greek contributions with modern advancements in mathematics, science, and technology. By integrating Greek symbols and terminology into geometry, music, medicine, architecture, and artificial intelligence, this approach enhances conceptual clarity and computational efficiency. From the Πυθαγόρειο Θεώρημα (Pythagorean Theorem) in construction to Μουσική και Μαθηματικά (Music and Mathematics) in instrument design, these

mathematical principles remain fundamental in real-world applications. Furthermore, the influence of Greek thought in democracy, law, and philosophy underscores its lasting impact beyond mathematics. This linguistic and symbolic adaptation not only preserves the legacy of Ελληνική Γλώσσα (Hellenic Language) but also provides a structured framework for future interdisciplinary research and technological innovations.

VII. Future Work:

Mathematical notation in the New Mathematical Greek Language exhibits significant potential for future advances in computational applications and interdisciplinary research. A key area of development is integration into computational systems, where Greek symbols can be standardized in programming languages and mathematical software such as MATLAB, Python, and Mathematica to improve symbolic computation and algorithm efficiency. Additionally, its application in Artificial Intelligence (AI) and Machine Learning (ML) can enhance Νευρωνικά Δίκτυα (neural networks) and Βαθιά Μάθηση (deep learning), thereby improving Natural Language Processing (NLP) and Symbolic Reasoning. Another promising direction is its use in mathematical theorem representation and proofs, which provides a more structured and visually intuitive approach, especially in areas such as geometry, topology, and number theory. In education, the new notation system, if incorporated into the curriculum, can help students understand historical mathematical concepts and also improve participation in applied mathematics and engineering. Additionally, further exploration of Πι-αστέρας (Pi star = 3.24) and other revised constants using this notation can optimize calculations and uncover new mathematical insights. By pursuing these future directions, revised mathematical Greek language can develop the ability to combine historical knowledge with modern technological advances, which can change and simplify the way mathematics is understood and applied.

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