Measures of the Massive Mountain in Aleksis Kivi's play *Kullervo*

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Abstract

The story of a prisoner inside an enormous steel mountain is embedded in *Kullervo*, an early Finnish tragedy by 19th-century author Aleksis Kivi. I focus here on the exceptional size of the mountain, as told by the main character, Kullervo. Although the embedded story has aroused admiration in research, the mountain's size and form do not appear to have done so. If taken literally, and assuming the shape of a double pyramid, at a minimum, the mountain's surface area would be between that of Earth and Uranus, a planet that Kivi was somehow aware of. The mountain's maximum surface area and volume would greatly exceed that of the Sun. This mountain cannot be localized in the near environment of the characters. A prisoner's captivity inside the allegorical mountain creates images of anguish, deprivation of freedom, and possibly of punishment and remorse. It could be interpreted symbolically, as reflecting Kullervo's unbearable shame and wrath toward his own slavery, which are later, expressed toward himself as a murderer and escapee.

Introduction

The focus of the article is on the exceptional measurements of the massive mountain embedded in the tragedy *Kullervo* (1864), an early Finnish classic by author Aleksis Kivi. In the center of the steely mountain, a burning cave encloses a suffering prisoner, as the play's main character, Kullervo, tells. Hopeless suffering, deprivation of freedom, and wrath are central themes in Kivi's *Kullervo*, where with others, Kullervo suffers from his slavery. These are also universal human feelings.

The story of the prisoner inside a mountain is an original element in *Kullervo*, a five-act play by Kivi. In this play, Kivi gives new life to the story of Kullervo, taken from the poems of *Kalevala*, a Finnish epic compiled a few decades earlier by Elias Lönnrot and based on oral folk poems, partially rooted in the prehistoric era. The poems were collected from a Finnish-related language or dialect spoken in Ingria, on the eastern coast of the Baltic Sea [25]. This region suffered under Russian serfdom until 1860. Kivi also understood slavery as the central issue of the American Civil War [21]:117.

Deprivation of freedom is a major theme in *Kullervo*, in which several characters (Kullervo, Kimmo, and Nyyrikki) have been taken from freedom into slavery [1]; [2]:9, 15, 73–74. Kullervo, himself, was enslaved as a child and later sold further into slavery. Slavery arouses shame in him beyond the limits that he can bear. He becomes desperate and sinister: a murderer and a refugee who brings shame and disaster to all around him before he finally ends his own life. *Kullervo* mainly follows the story of Kullervo as told in *Kalevala*; however, the shame and suffering are given greater emphasis in Kivi's play.

The Story of the Mountain

During the play's first act, Kullervo and his companion Kimmo are speaking in the house of their enslaver, Unto. Kullervo, curious about blood vengeance in this unstructured society [7]:62, aggressively asks Kimmo how it feels to be a murderer, since the latter has recently told Kullervo how he had killed a man from Unto's house, which now weighs heavily on his mind. He had revealed to Kullervo that he had buried the man in the mire and covered the grave with moss. Nummi [22]:106 interprets this buried body as a metaphor for resisted memories. After their discussion on slavery and the murder, Kullervo narrates an exceptional story about a prisoner held inside a mountain, which is the focus of the following passage [2]:11–12:

> Kullervo: "[--] Kimmo, have you ever heard of the prisoner in a mountain? There's a steel mountain thousands of leagues [penikulmia; ≈ 10.7 km each] high, thousands deep and thousands long and wide. In the core of the mountain, in its very heart there's a recess so tiny that the prisoner that languishes there can hardly sit all bent

> over, nor is there an air hole big enough for a mosquito to breathe through, let alone flee out into the fresh air. The prisoner was confined to this hot little hole for all time, for he may not die but must suffocate slowly forever, as the temperature slowly rises. And so he lives long in his hidden chamber, as thousands of years pass. This is suffering."
> Kimmo: "Infinite suffering." [2]:11–12.

> Kullervo. "[--] Kimmo, oletko vangista vuoressa kuullut? On teräsvuori, joka tuhansia penikulmia korkeuteen kohoaa, tuhansia tunkee syvyyteen ja sama on sen levyys ja pituus. Keskellä tätä vuorta, sen sydämmessä löytyy komero, niin pieni, että vanki, joka siellä nääntyy, tuskin kymeröissä mahtuu siinä istumaan, eikä läpeä niin suurta, että hyttyinen hengittää taitaisi, juokse tästä ulos raikkaasen ilmaan. Tähän kuumaan ahtauteen vanki ainiaksi tuomittiin, sillä kuolla ei hän saa, vaan tukahtua ikuisesti täytyy, ja ikuisesti enenee kolossaan tulinen kuumuus. Niin hän kauvas kätketyssä kammiossaan asua saa vuosituhansien kuluessa; mutta tämä on tuska."
> Kimmo. "Ääretön." [1]:Kullervo, I.

Kullervo explains the meaning of the story, saying, "This is suffering" [2]:12. He seems initially to be referring to the prisoner's suffering and anguish, but the story may also be a reflection on his own life or on how he imagines the murderer's mental state to be, as suggested by the setting of their conversation. Although Kullervo does not explain who the prisoner is, how he came to be jailed within the mountain, or where the mountain is, the story creates a universal image of unbearable, hopeless suffering.

Krohn [12]:428 connects the embedded story with Kullervo's feelings about slavery and his desire to escape. As a slave without freedom, Kullervo identifies with the prisoner's desperate situation. When Kullervo tells the story, he has difficulties breathing because of his feelings about slavery. The story reflects his oppressive sense of being deprived of freedom. Immediately after telling the story, Kullervo expresses a fierce need for fresh air [15]:96. Strangely, he identifies the fresh air with avenging his slavery and Unto's violence against his family. This has become an obsession for Kullervo. Later, when Kullervo finds his own family, which Unto had supposedly killed during his childhood [2]:33–37, he still plans to demolish Unto [11]:38; [10]:76–77. Kullervo still wants to avenge his slavery and the brand that Unto has burned into his forehead as its mark. The brand is seen as a tragic [12]:428–429 deprivation of his humanity, providing the motivation for his revenge [10]:75–83.

Valkama [28]:119 emphasizes the rich figures of speech contained in the middle of the first scene. Here, Kullervo and Kimmo discuss the story of the prisoner in the mountain. Lyytikäinen [17]:117 considers the embedded story as an allegory of Kullervo's inner life. After telling the story, Kullervo's anguish seems to increase as Kimmo emphasizes the prisoner's eternal pain. Elo [6]:161 considers the whole story to be an anguished monologue. In the first act, Kullervo has yet to reach his full intensity of his anguish. Could the mountain story herald the even greater deprivation of freedom and suffering to be conveyed later in the play?

Measures before the Metric System in Finland

According to the Finnish text of *Kullervo*, the mountain in the embedded story was measured in terms of *tuhansia penikulmia*, which translates literally to thousands of *penikulma*, which are units a little over 10 km (to be exact, 10,688.112 meters). Old measures, based mostly on the human body, were still used in Kivi's texts, as in the Finnish natural science and mathematics textbooks of his time [13]:234, 237. The *penikulma* was the largest unit for measuring length in Finland [1]; [16]:44; [24]:17.

The measures used for the calculations in this article are in *penikulma*, although the English translation uses "leagues" [2]:11, since *penikulma* has no direct translation in English. As an old imperial unit of length, a league is roughly half the length of a *penikulma* and is typically, 4.83 km, although it varies between 3.9 and 7.4 km [5]. The term *penikulma* is used twice in Kivi's *Kullervo*. In addition to the story of the mountain, the term also occurs when Kullervo, as a cowherd and slave to Ilmari, drives the cattle of his second owner's wife a distance of one *penikulma* from Ilmari's house in one day, and the owner's wife wonders why Kullervo went so far. To drive cattle about 10 kilometers sounds like a long distance, although

it is possible for a strong young man to do so. He then walks back to Ilmari's house alone, after giving the cattle over to beasts. [2]:26; [1], *Kullervo*: II. Even though the story took place in the prehistoric era, when writing *Kullervo,* Kivi used the measure units that were in use in his own day. Penikulma was not mentioned in *Kalevala*, which was compiled by Lönnrot a few decades earlier in the 19th century, although it did feature measures such as the *syli* (fathom) [9]: poems 2, 15, 16, 18−20, 23, 26, 31, 42, 44, 48. The spelling of some measures had yet to be established in the 1860s.

Kivi's *Kullervo* had the same spelling for *penikulma* as Heikel's Euclidean geometry textbook [8]:1, 89, translated into Finnish by Europaeus. There was a connection here, since Kivi is known to have owned this book [23]:663; see [14]: 320. Lagerhamn, translated by Blom [16]:43–44, presented the *peninkulma* (with a slightly different spelling) as the longest unit of measurement used in Finland (see [13]: 237), and it was considered the counterpart to the Swedish mile (*mil*) in Swedish-speaking Finn Topelius's [26]:90 well-known primary textbook, translated into Finnish by Bäckwall [27]:128.

Measures of Earth and of the solar system from the Sun to Earth were generally known to 19th-century natural scientists, and the distances Topelius presents are quite close to modern measurements. For example, he describes the distance between Earth and the Sun as 14 million *peninkulma*, and Earth's perimeter as 3,750 *peninkulma* at the equator; this is very close to the 40,030 km measured today [26]:202, 211−213; [20]. These measures offer insight into the general knowledge of the 19th century. The difference in spelling between *penikulma* and *peninkulma* is small, and it is likely that these publications may have had common sources.

Minimum Size and Form of the Mountain

Kivi's text does not describe how many thousand *penikulma* are needed to measure the mountain, but an idea of its size can be estimated by using the minimum and maximum measurements. The text indicates a minimum of thousands (plural) of *penikulma*, which suggests somewhere between two thousand and a maximum of a little less than a million *penikulma*, since a million would no longer be counted in thousands. The maximum would therefore be below 999,999 *penikulma*, corresponding to about 999,999 × 10.7 km. The mountain's minimum measures for "height," "depth," "length," and "width" would thus each be two thousand times one *penikulma*, calculated as 2000 × 10.7 km, or 21,376.224 km [2]; [24]:17.

Is it possible that the mountain did not have a regular form? In the Finnish text, "thousands of ten kilometers" (*tuhansia penikulmia*) describes the mountain's height and depth, and the "width" and "length" are said to be "the same" ("ja sama on sen levyys ja pituus"). These words (*ja sama on sen*) could refer either to parity between width and length or to parity in height and depth, in addition to the width and length. The mountain base is described with extreme measures (longest measures). The minimum size of the mountain would have a height and depth of about 20,000 km, regardless of what "the same" refers to [2]:11–12; [1]:*Kullervo*, I. A question is what form the mountain's base would take. How Kivi describes measures on other occasions? The terms "width" and "length" are also used in Kivi's poem *Kontiolan kaski*, where the "vast area of the slash-burning area" is described as "a thousand paces from east to west, and seven [thousand] and a hundred paces from the direction of the day [south] to the north" (informal translation by author). The east-west dimension and the south-north one form a right angle. If the measures were to be taken along the sides of the area, the area enclosed would form a quadrangle [1]:*Kontiolan kaski*.

Many new words were introduced into the Finnish language in the 19th century, although not all became established. A comparison of words and their meanings in Kivi's texts and in the geometry books of the same era might throw light on his use of geometry. Europaeus, the translator of Euclid (Eukleides/Heikel) [8], which sometimes uses the same unusual geometric vocabulary as Kivi [14]:321, can provide information regarding the dimensions used in Kullervo's story of the mountain. Europaeus [8]:1–2 uses "length" (*pituus*) and "width" (*leweys*) for planar dimensions, and "height" (*korkeus*), "depth" (*syvyys*), or "thickness" (*paksuus*) for the third dimension of an object (the name for the third dimension depending on the context and the use of the object). The only difference from Kivi's *Kullervo* is a change from "y" to "e" in the case of *leweys* and *lewyys*, where the latter might be considered slightly more poetic.

A geometry book by Lagerhamn [16]:41, translated into Finnish by Blom, uses the words *pituus* and *lewyys* as Kivi uses them in *Kullervo* and in the poem *Kontiolan kaski*. This could either be the effect of one on the other, or it could reflect a dialectal or poetic similarity. Both Blom and Kivi use *korkeus* and *sywyys*. In Finnish, the letters "v" and "w" have the same meaning. On the other hand, Europaeus, in Eukleides/Heikel [8]:4, uses the terms "length" (*pituus*) and "width" (*leweys*) for the outer lines of a plane, but not for circles or triangles. By comparison, it seems that Europaeus and Kivi use the terms "length" and "width" similarly for a quadrangle. It seems plausible that Kivi uses these terms in a way that is similar to the geometry book. Kullervo says the width and length were "the same" [2]:11–12 ("ja sama on sen levyys ja pituus") [1]:*Kullervo*, meaning the sides of the base would form a square. Europaeus [8]:97 and Kivi [1]:*Kullervo* also use the word "height" (*korkeus*) for a mountain. As Eukleides/Heikel [8]:101 explains, height is measured once, with only one dimension. "Depth" (*sywyys*) [8]:2 as a third dimension, is an alternative to "height" (*korkeus*), but it is not used again in that book. Depth is used as the opposite of height to describe both the direction of the underground and as the place for the dead in Kivi's texts. Similar to Eukleides/Heikel, Kivi uses "high" (*korkeuteen*, a word from the basic form *korkeus*) for height, such as "thousands of leagues high" [2]:11–12 ("tuhansia penikulmia korkeuteen kohoaa"); [1]:*Kullervo*: I.

In the way Kivi uses width and height, they are not suitable for describing a circular base, nor does he mention a triangular form. The mountain's length and width are described as being "the same" ("ja sama on sen levyys ja pituus"). Compared to the description of the burned area in Kivi's poem *Kontiolan kaski* and as compared to Eukleides/Heikel [8], in addition to the strong emphasis on symmetry in Kullervo's description of the mountain, it is reasonable to assume a square base. The smallest square-based mountain would be a pyramidal cone. A mountain must have at least one peak, although possibly the mountain's surface could have an irregular form that exceeded the mountain's minimum size if the sides, height, and length were of equivalent length [2]:11–12; [1]:*Kullervo*. The minimum size determines whether the mountain could fit into a human environment (Figure 1).

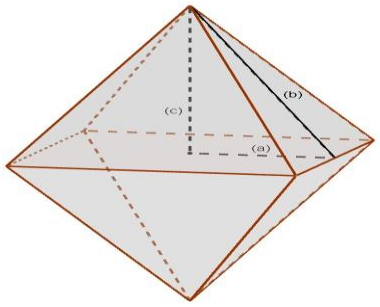

Figure 1: *The steel mountain's minimum and maximum measurements and form.*

If the mountain in Kullervo is a square-based, straight edged double-pyramid, it would have isosceles triangles as congruent faces (Figure 1). The width and length (*tuhansia penikulmia*) of the smallest would be 21,376 km × 21,376 km, and the smallest height (*korkeus*; representing *c* in Figure 1) of the pyramid would also be 21,376 km. If a line was drawn parallel to the pyramid's width but through the base square's central point, it would be, at the least, 21,376 km, and half of it, from the outer line of the square to the central point, would be 10,688 km (*a*). This roughly 10,000 km-long line would be at a right angle to the pyramid's height *c* (roughly 20,000 km). The length of the side face *b* is derived from Pythagoras' rule for a right angled triangle $b^2 = a^2 + c^2$ results in $b = \sqrt{(21{,}376^2 + 10{,}688^2)} = 23{,}899$ km. The area of the isosceles triangle is one half its height *b* times its base *a*, (21,376 km × 23,899 km) / 2 = 255,438,876 km^2, and for four triangles, it is ≈1,021,756,000 km^2 (Figure 1) [2]:11–12; [1]:*Kullervo*.

The mountain thus has a minimum width, length, height, and depth of about 2 *penikulma* × 2000 km. The form of the mountain's foundations in the depths is not described. The mountain's foundations could possibly be wider, but at the minimum, they would mirror the upper part of the pyramid. At the minimum,

the two pyramids would mirror each other with a common base, while the area of the eight faces of the double pyramid would be about 2 × 1,021,756,000 km^2 = 2,043,500,000 km^2 [2]:11–12; [1]*: Kullervo*. Since the minimum size of *Kullervo*'s mountain exceeds Earth's size, it could be compared with planets in size. After Earth, the next largest planets are Neptune and Uranus, which are nearly the same size (Uranus has a diameter of about 50,700 km at the equator, whereas Earth's equatorial diameter is 12,700 km, or about four times smaller). However, the form of a pyramidal mountain is very different from that of the slightly ellipsoid planets. Consequently, the mountain's minimum surface area (assuming a square-based double pyramid) in *Kullervo* is situated mid-way between those of Earth and Uranus. This is because the mountain's minimum surface area is about four times that of Earth, and further, the surface area of Uranus is about four times that of the mountain's minimum surface area [1]; [20].

Neptune was discovered in 1846 [20], 18 years before the publication of *Kullervo*. Kivi did not mention Neptune, although Topelius [27]:147; [26]:212, for example, named it as the most distant planet in our solar system. Although Uranus is not mentioned in *Kullervo* (1864), it is depicted as a distant location in Kivi's later plays, *Leo ja Liina*, *Olviretki Schleusingenissa*: III, and *Canzio/Cantsio*: V [1]. These plays mention Uranus briefly but not at all scientifically. Uranus became topical again in 1865 when its orbit was seen to be completed 84 years after it had first been discovered [20]. In *Kullervo*, the pyramid's volume is, at the minimum, one third of the base area $2a^2$ times the height c, resulting in a volume about 1/3 × (21,376^2 × 21,376 km) = 3,255,905 million km^3, and the volume of the double pyramid is, at a minimum twice that, or about 6,511,810 million km^3 [1]:*Kullervo*. The double pyramid's minimum volume is about six times larger than Earth, but because of its form, the volume of Uranus is about ten times bigger than the double pyramid (Figure 1).

Neither Kullervo nor the prisoner in the embedded story embrace any hope in *Kullervo*. This differs from Kivi's later novel, *The Brother Seven [Seven Brothers]*, which includes an embedded story about a pale maiden imprisoned inside a cave in a local mountain. When she finally gathers the courage to hope, a miraculous savior approaches her from Heaven "as a far distant spark, as if from thousands of leagues [*peninkulma*] away" [3]:146; [1]: *Seitsemän veljestä*, V. Heaven is situated beyond the solar system in *Seven Brothers*, and the distance from earth to heaven is measured in the same size categories as the length of the mountain's side in *Kullervo*.

Gravity and the Impossible Form

The measures Kullervo gives are not suitable for the form of a sphere. In *Kullervo*, the radius at the level of the base square would be half the radius of the height or depth. An ellipsoid form would be possible, but would be more sizable than a pyramidal form. An ellipsoid doesn´t have any mountain peak either. (Figure 1). In space, only the smaller asteroids have non-rounded forms. Stony objects of at least 200 km tend to collapse into roundness due to their own gravity [19]:7. Because the density of steel exceeds that of stone, the size limit for roundness would be smaller for a steel mountain.

It could be that the mountain in *Kullervo* was not old enough to have become rounded. Kullervo said that it existed, but he did not say when it had been formed or when the prisoner's captivity had begun. Another explanation might be that gravity was not taken into account in the mountain's description. Kivi's texts do not seem to demonstrate an understanding of gravity, even if gravity was known to science during his lifetime. In *Kullervo*, the prisoner and the tiny chamber do not collapse inside the mountain. With gravity, the mountain's otherwise possible pyramidal construction would become impossible, although impossible constructions do exist in fiction.

In *The Brothers Seven [Seven Brothers]*, one of the brothers, Simeoni, tells of his visit to the Moon when he was asleep. He doesn´t show understanding of gravity in this story. Simeoni describes a kind of Aristotelian attraction, based on its material origin or the reason for its birth [4]:no. 1013. He describes that he was physically attracted by Earth, from where he came, as well as a piece of leather was originating on and being attracted by the Moon [1]: *Seitsemän veljestä*, X; [3]:271. Marjanen [18]:66 illustrates Simeoni's view of gravity as arousing different kinds of emotions, not as a scientific explanation.

The Mountain's Maximum Size

Assuming that the form of the maximum-size mountain corresponds to that of the minimum size, and that the maximum of "thousands of *penikulma*" would stay below 1 million *penikulma,* then "thousands of *penikulma"* would be 999,999 *penikulma* = 10,688,101 km (the pyramid base's width and length). The height and depth of both pyramids are mirrored around their bases (Figure 1).

Then, half the width, *a* in Figure 1 = 5,344,050 km, and the height of the pyramid's side triangle = $b = \sqrt{(a^2 + c^2)} = \sqrt{142,791,387,066,477} = 11,949,660$ km. The sum of the area of the eight faces, the pyramid's isosceles side triangles is 8 × (10,688,101 km × 11,949,660 km) / 2 = 510,876,730,057,697 km^2 that is approximately 510,876,730 million km^2 at a maximum. The maximum mountain surface area is thus about a million times larger than Earth's surface that is 510,064,472 km^2. When compared with the Sun with a surface area of 6,078,747,547 km^2, the maximum mountain surface area is 84 times larger. The volume of the double pyramid is 1/3 × base area × height × 2 = 813,973,800,392,246,000,000 km^3, which would be about 750 million times Earth's volume. It would also be 578 times larger than the Sun's volume that is 1,409,272,569,060 million km^3 [20] (Figure 1). These enormous measurements are difficult to even conceive.

Perpetual Captivity in the Central Chamber

The description of the tiny chamber "in the center of the mountain" ("Keskellä tätä vuorta") emphasizes the regularity of the mountain's form: it must have a form with a clear center. Its inner part is described as its "heart" in both the Finnish text and the English translation. The "heart" and the translation of "core" both refer to the mountain's most important part. The smallness of the chamber is emphasized by the comparison with the mountain's tremendous size [2]:11–12; [1]:*Kullervo,* I, as Lyytikäinen [17]:117 also depicts. The chamber in the steely mountain's center in *Kullervo* is described as so small that the prisoner could "hardly sit all bent over" ("tuskin kymeröissä mahtuu siinä istumaan"). Nor does it have any connection to the fresh air. The smallness of the recess is emphasized in relation to the mountain's massive size and the eternal duration of the captivity. Since the prisoner has been living in the hidden chamber with no route out, he has been known only because of the story [2]:11–12; [1]:*Kullervo,* I.

The embedded story has connections with the context in which it is told. Slaves Kullervo and Kimmo, together with the mountain's prisoner, have been deprived of freedom for their whole lives [2]:11; [1]. Kullervo sees their entire lifespans as involving hopeless slavery [1] *Kullervo*; [2]. Both Kullervo and Kimmo mention the eternity of the prisoner's anguish inside the mountain. Kimmo concludes that the prisoner's anguish is "[i]nfinite suffering" ("[ä]äretön"), which could mean both an endless time spent suffering and an unbearable amount of suffering in each moment [2]:11–12; [1]:*Kullervo.*

A description by Kinnunen [10]:79–80 suggests that Kullervo understands that both his slavery and his brand are permanent defects that extend beyond death, while Nummi [22]:107 depicts the prisoner's everlasting captivity and Lyytikäinen [17]:117 mentions the infinity of the time. Kullervo explains that the prisoner was buried alive and is on the limits of life but is not allowed to die. At no point does the story express who the prisoner is: no gender, name, or history are given. The audience may project their thoughts and feelings onto the prisoner, but the prisoner reveals nothing. Kullervo's description of the "hot little hole," where "the temperature slowly rises" speaks of perpetually worsening conditions that will certainly increase the burden of the captivity. At the same time, the body that Kimmo buried will be maintained inside the anoxic moss, almost forever [1]:*Kullervo*: I; [2]:10–12.

Conclusion

The story of the prisoner inside the mountain in Aleksis Kivi's tragedy *Kullervo* is extraordinary. The mountain and the prisoner belong neither in the landscape of *Kullervo* nor on Earth. The steel material indicates that the mountain is an artifact, but its maker, age, and reason for existence are not told. The vast

difference between the size of the mountain and the prisoner's space at its center, with its everlasting and increasing heat, creates a strong contrast. The prisoner's identity, the reason for the captivity, the conditions of the chamber, and the prisoner's feelings are all unknown. The prisoner must be non-human to endure in such a harsh and eternal environment. The prisoner in the mountain forms a concentrated figure of hopeless suffering. The portrayal is of endless suffering, and this reflects Kullervo's feelings of hopeless anguish and rage at being deprived of his own freedom. Kullervo internalizes the bitterness of slavery into his own identity. Even though physically, he takes his freedom from slavery, his mental freedom becomes increasingly limited as he spreads devastation, loses his social connections, and is overwhelmed by his desperate thoughts.

"Thousands" could be interpreted as representing "much" or "enormous", but, equally, it could be interpreted as a number. Then, at a minimum, the mountain would have a base that is greater than 20,000 kilometers in orthogonal directions. The minimum and maximum forms of the mountain, as a square-based double pyramid, could be modeled from these as measures for its length, width, height, and depth. The mountain's minimum surface area would be about four times greater than that of Earth, and the maximum would be about 84 times larger than the Sun. At the most, the mountain's volume would be about 750 million times greater than that of Earth. In Kivi's texts written after *Kullervo,* Uranus—the mythical Urania—is the most distant place mentioned, aside from the stars [1]:*Leo ja Liina*, *Olviretki Schleusingenissa*: III, and *Canzio/Cantsio*: V. The steel mountain artifact, with its prisoner inside, could be read as 19th-century science fiction.

Gravity is ignored in these measurements. Although gravity was known during Kivi's era, it was not described or understood in Kivi's texts. Gravity would not only cause high pressure and temperature inside such a steel mountain, it would also cause the mountain to collapse into the form of a ball. In *Kullervo,* it is said that the temperature of the chamber in the mountain's core would rise forever, with no fresh air entering, but it was not filled with liquid steel [1]; [2]. Apart from the scientific implications of gravity, the general knowledge of distance in space in Kivi's era supports the idea of the enormous mountain, even if Kivi might not have calculated the mountain's size or compared it with the heavenly bodies. As the mountain exceeds the size of Earth, so does the prisoner's suffering exceed the limits of our understanding. The story of *Kullervo's* mountain provides an example of the possibilities of using mathematics in literature.

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