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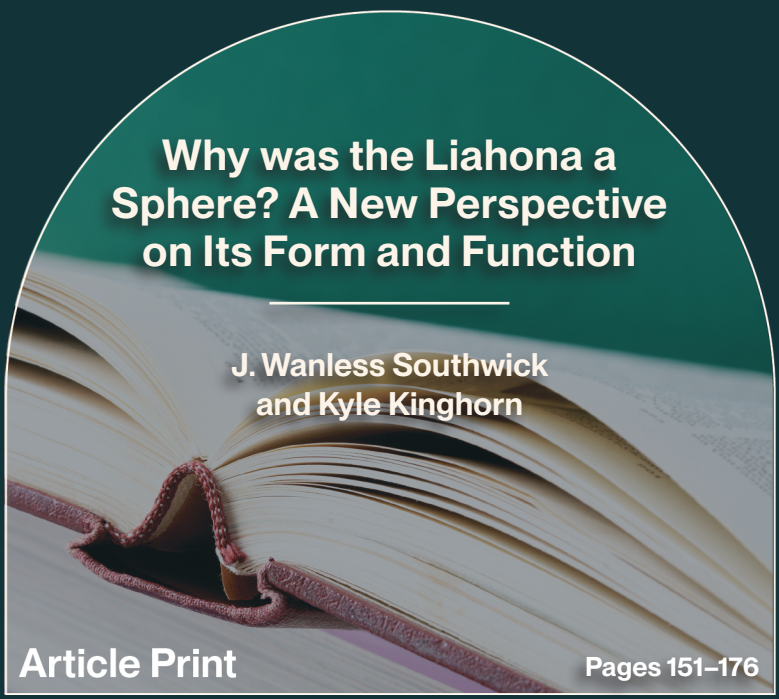

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Why was the Liahona a Sphere? A New Perspective on Its Form and Function

J. Wanless Southwick and Kyle Kinghorn

Abstract: *A new, simpler design for the Liahona is proposed, which, if correct, makes the reason for two spindles and a hollow-ball shape perfectly obvious. Previous proposed models of the Liahona usually show horizontal, compass-like pointers inside an open-top ball, but our model has vertical spindles protected inside a hollow ball with viewing ports to allow the aligned spindles to be superimposed on a view of the horizon, precisely marking the direction of travel. Lehi's first use of the Liahona is discussed. Book of Mormon descriptions of the Liahona and how it was used are compared with modern attempts to visualize its design and function. A greater understanding of the Liahona's two spindles and its surface text may yet be discovered from experimentation with physical models.*

The Liahona was a ball-like instrument made of brass and specifically prepared by the hand of the Lord to direct the travel of Lehi's extended family through the wilderness and across the ocean to a promised land. It acted somewhat like a compass. In fact, Alma explains that the word *Liahona* means *compass*:

> And now, my son, I have somewhat to say concerning the thing which our fathers call a ball, or director—or our fathers called it *Liahona, which is, being interpreted, a compass*. (Alma 37:38)

Why, then, wasn't the Liahona just a flat, compass-like disk with one rotating pointer to show the way? Instead, it was spherical with two internal spindles. What was the significance of having two spindles inside of a ball?

Book of Mormon Descriptions of the Liahona and its Function

Nephi provides a basic description of the Liahona, which was discovered by his father, Lehi, while in the valley of Lemuel. He states that it was "a round ball of curious workmanship; and it was of fine brass. And within the ball were two spindles; and the one pointed the way whither we should go into the wilderness" (1 Nephi 16:10).

The Liahona led them into the more fertile parts of the wilderness so they could hunt animals for food:

> And we did follow the directions of the ball, which led us in the more fertile parts of the wilderness. And after we had traveled for the space of many days, we did pitch our tents for the space of a time, that we might again rest ourselves and obtain food for our families. And it came to pass that as I, Nephi, went forth to slay food, behold, I did break my bow, which was made of fine steel; and after I did break my bow, behold, my brethren were angry with me because of the loss of my bow, for we did obtain no food. (1 Nephi 16:16–18)

After the loss of their best hunting bow and subsequent hunting failures, which caused murmuring throughout the camp, they were startled to read messages written to them upon the surface of the Liahona. The text was written plainly for everyone to read.

> And it came to pass that the voice of the Lord said unto him [Lehi]: Look upon the ball, and behold the things which are written. And it came to pass that when my father beheld the *things which were written upon the ball*, he did fear and tremble exceedingly, and also my brethren and the sons of Ishmael and our wives. And it came to pass that I, Nephi, beheld the pointers which were in the ball, that they did work according to the faith and diligence and heed which we did give unto them. And there was also written upon them a *new writing*, which was plain to be read, which did give us understanding concerning the ways of the Lord; and it was *written and changed from time to time*, according to the faith and diligence which we gave unto it. And thus we see that by small means the Lord can bring about great things. And it came to pass that I, Nephi, did go forth up into the top of the mountain**,** *according to the directions which were given upon the ball***.** And it came to pass that I did slay wild beasts,

> insomuch that I did obtain food for our families. (1 Nephi 16:26–31)

When there was contention among them, the Liahona ceased to work:

> And it came to pass that after they had bound me insomuch that I could not move, the *compass, which had been prepared of the Lord, did cease to work.* Wherefore, they knew not whither they should steer the ship, insomuch that there arose a great storm, yea, a great and terrible tempest, and we were driven back upon the waters for the space of three days; and they began to be frightened exceedingly lest they should be drowned in the sea; nevertheless they did not loose me. . . . And it came to pass after they had loosed me, behold*, I took the compass, and it did work* whither I desired it. And it came to pass that I prayed unto the Lord; and after I had prayed the winds did cease, and the storm did cease, and there was a great calm. And it came to pass that I, Nephi, did guide the ship, that we sailed again towards the promised land. (1 Nephi 18:12–13, 21–22)

After arriving in the promised land, and after Lehi's death, Nephi's older brothers became so jealous and angry with him that they wanted to kill him. Being forewarned, Nephi took all who would follow him and escaped into the wilderness. He had previously used the Liahona to guide his wilderness travel, so he likely used it again to lead his people through the wilderness of the promised land because he had the Liahona with him: "And I, Nephi, had also brought the records which were engraven upon the plates of brass; and also the ball, or compass, which was prepared for my father by the hand of the Lord" (2 Nephi 5:12). The place where they settled became known as the Land of Nephi.

During the centuries that followed, the Liahona, together with sacred records, was transferred from generation to generation of leaders. When wickedness among the Nephites in the Land of Nephi became intense, King Mosiah$_1$ may have used the Liahona to guide his followers from the Land of Nephi to discover the land of Zarahemla. During their trek through the wilderness, "they were admonished continually by the word of God; and they were led by the power of his arm, through the wilderness until they came down into the land which is called the land of Zarahemla" (Omni 1:13). That description of their

travel sounds much like the way the Liahona pointed the way and displayed sacred texts on its surfaces.

King $Mosiah_1$'s son, King Benjamin, transferred the sacred records and the Liahona to his son, King $Mosiah_2$:

> And it came to pass that after king Benjamin had made an end of these sayings to his son [$Mosiah_2$], that he . . . gave him . . . the plates of Nephi; and also, the sword of Laban, *and the ball or director, which led our fathers through the wilderness, which was prepared by the hand of the Lord that thereby they might be led, every one according to the heed and diligence which they gave unto him.* Therefore, as they were *unfaithful they did not prosper nor progress* in their journey, but were driven back. (Mosiah 1:15–17)

King $Mosiah_2$ turned his kingdom over to the rule of judges and transferred the records and other sacred items to the first chief judge, Alma the younger:

> And now, as I said unto you, that after king Mosiah had done these things, he took the plates of brass, and all the things which he had kept, and conferred them upon Alma, who was the son of Alma; yea, all the records, and also the interpreters, and conferred them upon him, and commanded him that he should keep and preserve them. (Mosiah 28:20)

Later, the Liahona was transferred from prophet to prophet and was considered to be a representation of the saving words of Christ, which, like the Liahona, can point to a far better land of promise:

> And now, my son [Helaman], I [Alma the younger] have somewhat to say concerning the thing which our fathers call a ball, or director. . . . For just as surely as this director did bring our fathers, by following its course, to the promised land, shall the words of Christ, if we follow their course, carry us beyond this vale of sorrow into a far better land of promise. . . . The way is prepared, and if we will look we may live forever. And now, my son, see that ye take care of these sacred things, yea, see that ye look to God and live. (Alma 37:38, 45–47)

Moroni, the last of the Nephite prophets, received those sacred things, including the Liahona. In 1829, when he appeared as a heavenly messenger to Joseph Smith and the three witnesses of the Book

of Mormon, the Liahona was among the ancient Nephite relics that he showed them.[1]

Eyewitnesses to the Liahona

In addition to Book of Mormon descriptions of the Liahona, four people were eyewitnesses of its existence. In June 1829, Joseph Smith, Martin Harris, David Whitmer, and Oliver Cowdery experienced a divine presentation of Nephite relics in fulfilment of a promise:

> Behold, I say unto you, that you must rely upon my word, which if you do with full purpose of heart, you shall have a view of the plates, and also of the breastplate, the sword of Laban, the Urim and Thummim, which were given to the brother of Jared upon the mount, when he talked with the Lord face to face, and *the miraculous directors* which were given to Lehi while in the wilderness, on the borders of the Red Sea. (Doctrine and Covenants 17:1)

Of the four men, David Whitmer was the one most interviewed about what they experienced on that occasion. He consistently described the Liahona's shape as a "ball," but sometimes he identified it by the internal, functioning parts, such as "director," "directors," "ball of directors," or "compass."

- Interviewed by Edward Stevenson in 1877: "An angel stood before us and on the appearance of a table was laid the plates, Urim & Thummim, *ball or director*, sword of Laban."[2]
- Interviewed by Orson Pratt in 1878: "There appeared as it were, a table with many records or plates upon it, besides the plates of the Book of Mormon, also the sword of Laban, *the directors—i.e., the ball which Lehi had,* and the interpreters. I saw them just as plain as I see this bed (striking the bed beside him with his hand)."[3]

1. Scripture Central Staff, "Book of Mormon Evidence: Accounts of the Liahona," Evidence 416, 15 August 2023, scripturecentral.org/evidence/accounts-of-the-liahona.
2. "David Whitmer Interview with Edward Stevenson, 22–23 December 1877," in Dan Vogel, ed., *Early Mormon Documents* (Salt Lake City: Signature Books, 2003), 5:29. Spelling and punctuation silently standardized.
3. "David Whitmer Interview with Orson Pratt and Joseph F. Smith, 7–8 September 1878," in Vogel, *Early Mormon Documents*, 5:50–51. Spelling and punctuation silently standardized.

- Interviewed by William H. Kelley in 1881: "A table was set before us and on it the records were placed. The records of the Nephites, from which the Book of Mormon was translated, the brass plates*, the ball of directors*, the sword of Laban and other plates."[4]
- Interviewed by E. C. Briggs in 1884: "The angel appeared in the light, as near as that young man. [Within five or six feet.] Between us and the angel there appeared a table, and there lay upon it the sword of Laban, *the ball of director*s, the record, and interpreters."[5]
- Interviewed by Edward Stevenson in 1886: "I . . . did see the angel standing before us, and on a table were the plates, the sword of Laban, and *the ball or compass.*"[6]

Names Given to the Liahona

Once Lehi finds the brass ball on the ground in front of his tent door, it is referred to by various descriptive names in the Book of Mormon. These names include *ball*, *compass*, *Liahona*, *director*, *pointers*, and *those spindles*. Soon after publication of the Book of Mormon, plural names such as *directors*, *miraculous directors,* and *ball of directors* were commonly used. Given that those names are plural, the implication is a focus on the pointing mechanism (two spindles) rather than on the ball (singular) in which they were housed. Perhaps those *directors*, because they were the functional part of the Liahona, became the identity of the device for some people. If so, the directors must have been easily seen inside the ball.

Speculation about the Design of the Liahona

The ancient Book of Mormon people who possessed the Liahona believed "there [could] not any man work after the manner of so curious a workmanship" when they saw the craftmanship and functions

4. "David Whitmer Interview with William H. Kelley and George A. Blakeslee, 15 December 1881," in Vogel, *Early Mormon Documents*, 5:91. Spelling and punctuation silently standardized.
5. "David Whitmer Interview with E. C. Briggs and R. Etzenhouser, 25 April 1884," in Vogel, *Early Mormon Documents*, 5:121. Spelling and punctuation silently standardized; brackets in original.
6. "David Whitmer Interview with Edward Stevenson, 9 February 1886," in Vogel, *Early Mormon Documents*, 5:162. Spelling and punctuation silently standardized.

of the Liahona (Alma 37:39). Nevertheless, many modern people have tried to reproduce how the Liahona worked and what it looked like. Speculative models of the Liahona commonly put horizontal compass-like pointers inside an open-top ball, but they struggle to find a way to represent the function of “two spindles.” Figure 1 shows two examples, out of many, that use horizontal pointers like a modern compass.

Figure 1. Left: Liahona model with ball that opens to view two horizontal pointers (Deseret Book); right: model with open top to view a horizontal pointer and a compass within (Latter Day Designs).

In 1961, Hugh Nibley acknowledged the wonderful workmanship of the Liahona’s brass ball, but he suggested that the operation of the pointers was ordinary and simple:

> Moreover, while both men [Nephi and Alma] marvel at the wonderful workmanship of the brass ball in which the pointers were mounted, they refer to the operation of those pointers as “a very small thing,” so familiar to Lehi’s people that they hardly give it a second glance. So contemptuous were they of the “small means” by which “those miracles were worked” for their guidance and preservation that they

> constantly "forgot to exercise their faith" so that the compass would work. This suggests that aside from the workmanship of the mounting, *there was nothing particularly strange or mystifying about the apparatus* which Alma specifies as a "temporal" thing.[7]

In 1994, Robert Bunker observed that a single pointer or spindle would be an unreliable way of indicating direction, since it always pointed somewhere. He then innovatively suggests that two horizontal spindles could work together by both aligning in the same direction, one on top of the other, as shown in figure 2. When unified in that way it meant that the director was providing correct information. He adds that such a process would be using an engineering principle called "voting of redundant strings." If the two spindles did not share the same alignment, it meant that the Liahona was not functioning. In his words:

> This is how it would have worked: if an observer viewed the pointers and saw only a single pointer, as seen in [figure 2, left], then they were both aligned in the same direction, one on top of the other, and the director was providing correct information. Lehi's party could then follow the indicated direction with confidence that it was the Lord's instruction. If, on the other hand, the two pointers were cross-ways to each other—forming an "x" as shown in [figure 2, right]—then the device was not functioning, and the pointing information was not reliable. No other information was required of the Liahona, so no more than two pointers were needed. But the requirements demand a minimum of two.[8]

After discussing how the two spindles could have worked together, Bunker admits that "there is *no engineering requirement driving the design to a sphere*—a short cylinder would have been sufficient." He surmised that the Liahona's spherical shape "must have had additional

7. Hugh Nibley, "The Liahona's Cousins," *Improvement Era* 64, no. 2 (February 1961): 108, emphasis added, archive.dev-bookofmormoncentral.org/sites/default/files/archive-files/pdf/nibley/2020-03-26/hugh_w._nibley_ie_64.02_the_liahonas_cousins_february_1961.pdf.
8. Robert L. Bunker, "The Design of the Liahona and the Purpose of the Second Spindle," *Journal of Book of Mormon Studies* 3 no. 2 (July 1994): 6–7, scholarsarchive.byu.edu/cgi/viewcontent.cgi?article=1061&context=jbms.

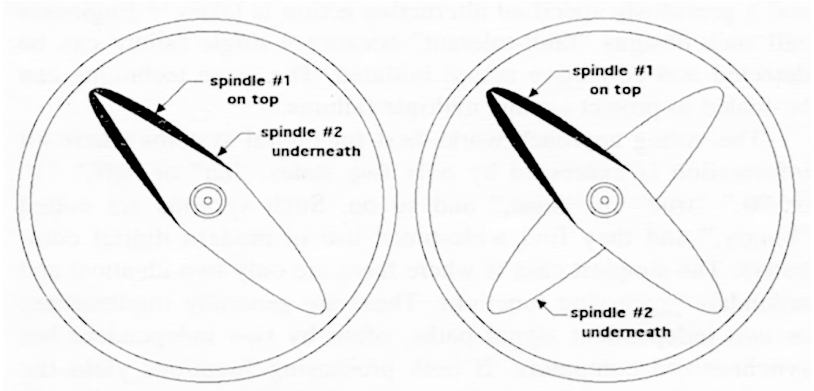

Figure 2. Bunker's 1994 illustration of horizontal Liahona spindles. Left: "proceed as indicated"; right: "not in service."

symbolic meaning. Perhaps it represented the earth, more than half of whose circumference Lehi and his family would be traversing."[9]

In 2013, Del DowDell blogged that "the *second spindle* on the instrument *pointed to north*, so that a directional finding could be determined, just as it is obvious that the first spindle pointed in the direction the Lord wanted the colony to travel." He suggests that the north-pointing second spindle allowed Nephi to know they were traveling in a south-southeast direction.[10]

In 2018, Timothy Gervais and John Joyce argued that the Liahona might have been *a spherical astrolabe* (see an example in figure 3). Moreover, they suggest that "the Liahona may have been a wedding dowry Ishmael provided to Lehi's family."[11] They speculate that "if the Liahona was indeed a gift from Ishmael, Ishmael would have been the primary navigator for the party until his death."[12] They reason that Ishmael was the one who knew how to use the complicated astrolabe to locate known fertile places in the Arabian wilderness, which were identified in writing on the astrolabe's surface. The authors, therefore, tried to reconcile the Liahona to scientific law rather than to faith-based functionality. Their astrolabe proposal does not account for

9. Bunker, "Design of the Liahona," 6.
10. Del DowDell, "The Working of the Liahona," NephiCode.com, 4 April 2013, nephicode.blogspot.com/2013/04/the-working-of-liahona.html.
11. Timothy Gervais and John L. Joyce, "By Small Means: Rethinking the Liahona," *Interpreter: A Journal of Latter-day Saint Faith and Scholarship* 30 (2018), 207, journal.interpreterfoundation.org/by-small-means-rethinking-the-liahona.
12. Gervais and Joyce, "By Small Means," 219.

Figure 3. Spherical astrolabe from medieval Islamic astronomy, c. 1480. From the Museum of the History of Science, Oxford, UK. (Signed by Musa [CC BY 2.0], via Wikimedia Commons.)

there being two spindles. Further, it is inconsistent with Nibley's assertion that "there was nothing particularly strange or mystifying about the apparatus."[13]

In 2019, Don Bradley briefly explored descriptions of the Liahona given by contemporaries of Joseph Smith:

1. Fayette Lapham allegedly had an interview with Joseph Smith Sr. whereby he learned about the Liahona and its function.
2. Gladden Bishop allegedly received his information about the Liahona from Martin Harris (one of the three witnesses).[14]

13. Nibley, "Liahona's Cousins," 108.

14. Gladden Bishop's membership in the young Church was troublesome. At

Although Bradley does not establish the veracity of the claims made by each man, he uses their descriptions to conclude that:

> While it is difficult to visualize the device precisely as Bishop intended, it is clear that on his model there were pictures around the spindles. So, while one spindle pointed a *direction*, the other spindle could point to a *picture*. . . the first spindle mandated the *direction* of travel; the *second spindle*, by pointing to one of the picture symbols around it, identified the *purpose* of travel. Together, the two spindles could show the Liahona's users where to go and what they would find when they got there.[15]

Bradley also speculates that the Liahona was replaced by the Urim and Thummim. He writes:

> While Nephi implies that he also utilized the compass . . . and handed it on to be used by his successors, by the time of $Mosiah_2$'s reign it seems that it was no longer functioning. . . . After $Mosiah_1$ acquired the interpreters [the Urim and Thummim]—presented as a superior instrument . . . the inferior Liahona was no longer needed and was, for the lack of better term, retired by God . . . to stand as a "token of the covenant" handed down among the Nephite kings and high priests.[16]

In 2021, Loren Spendlove conducted a detailed analysis of possible words and phrases in the Book of Mormon that describe the Liahona. He also provided an extensive investigation of Bradley's sources of Lapham and Bishop. Spendlove rejected the idea that the second spindle might identify the purpose of a destination. Instead, he liked Bunker's suggestion of two small spindles uniting to point in a single direction, especially because of the spiritual symbolism of oneness. He writes:

> The Liahona, with its two spindles, presents us with an

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his excommunication trial, Joseph Smith commented that Bishop "was a fool and had not sens [sic] sufficient for the Holy Ghost to enlighten him." Dean C. Jessee, ed., *The Papers of Joseph Smith*, vol. 2, *Journal, 1832–1842* (Salt Lake City: Deseret Book, 1992), 369n1.

15. Don Bradley, *The Lost 116 Pages: Reconstructing the Book of Mormon's Missing Stories* (Salt Lake City: Greg Kofford Books, 2019), 149–50, emphasis added.
16. Bradley, *Lost 116 Pages*, 254.

> excellent *type* of this oneness and unity. If we are willing to unite, or reconcile, our will with that of God, he can lead and guide us through our spiritual wilderness (cf. 2 Nephi 10:24; 2 Nephi 33:9). Alma told us that the members of Lehi's party "were slothful and forgot to *exercise their faith and diligence*. And then those *marvelous works* ceased, and *they did not progress* in their journey. Therefore they tarried in the wilderness, or did not travel a direct course" (Alma 37:41–42).[17]

Spendlove also notes that Alma said *both spindles* were needed to "point the way" (Alma 37:40). He concludes, "The two pointers, or spindles, of the Liahona were *not designed to function independently*."[18]

In 2025, JeaNette Goates Smith wrote about the two spindles of the Liahona and how they may have worked to show Lehi's people the correct direction for travel. In her words:

> Because it had two spindles, it's tempting to imagine the Liahona functioned like an old-fashioned watch. Like an hour hand and a second hand which, one pointed the direction generally, and the other specifically. . . . In contrast, even though the Liahona had *two* spindles it probably functioned more like a compass. One of the spindles always pointed the way Nephi and his family should travel. The second spindle, in my mind, could represent how close the travelers were to going in the correct direction. Their job was to align the second spindle with the first, in other words to align their direction, with the direction the Lord was pointing.[19]

Smith's insight that the one [horizontal] spindle always pointed the correct way for travel and the second spindle showed "how close the travelers were to going in the correct direction" is in harmony with Bunker's idea that both spindles needed to be "aligned in the same direction" to have confidence that the pointers showed the correct direction for travel. Smith's concept is also in harmony with

17. Loren Blake Spendlove, "And the One Pointed the Way: Issues of Interpretation and Translation Involving the Liahona," *Interpreter: A Journal of Latter-day Saint Faith and Scholarship* 45 (2021): 14, journal.interpreterfoundation.org/and-the-one-pointed-the-way-issues-of-interpretation-and-translation-involving-the-liahona.
18. Spendlove, "One Pointed the Way," 28.
19. JeaNette Goates Smith, "How Did Faith Make the Liahona Work?," *Meridian Magazine*, 9 April 2025, latterdaysaintmag.com/how-did-faith-make-the-liahona-work/.

Spendlove's comparison of the Liahona's function with the need to unite our will with the will of God to receive divine guidance.

Definition of Terms

When Joseph Smith translated the Book of Mormon in 1829, Webster's 1828 dictionary described the word "compass" as a "box" with a horizontal "needle" that pointed north.[20] Two of Webster's definitions of the word *compass* seem particularly significant for this discussion. Definition five reads:

> An instrument for directing or ascertaining the course of ships at sea, consisting of a *circular box*, containing a paper card marked with the thirty two points of direction, fixed on a *magnetic needle*, that always points to the north, the variation excepted. The needle with the card turns on a pin in the center of the box. In the center of the needle is fixed a brass conical socket or cap, by which the card hanging on the pin turns freely round the center. The box is covered with glass, to prevent the motion of the card from being disturbed by the wind.

Figure 4 shows an example of a compass consistent with definition seven, which reads:

> An instrument used in surveying land, constructed in the main like the mariners compass; but with this difference, that the needle is not fitted into the card, moving with it, but plays alone; the card being drawn on the bottom of the box, and a circle divided into 360 degrees on the limb. This instrument is used in surveying land, and in directing travelers in a desert or forest, miners, etc.

Figure 4. An example modern compass. (Microsoft Stock Image Library.)

In contrast to a *compass*, the Liahona was ball-shaped with *two internal spindles* that worked together to point at the direction of

20. Noah Webster, *An American Dictionary of the English Language* (1828), s.v. "compass."

travel. Webster's 1828 dictionary described meanings of the word *spindle* in Joseph Smith's day as "the pin used in spinning wheels for twisting the thread, and on which the thread when twisted, is wound"; "a slender pointed rod or pin on which any thing turn[s]; as the spindle of a vane"; or "a long slender stalk."[21] (See figure 5.)

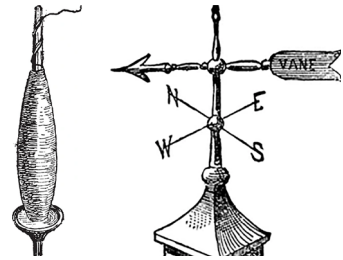

Figure 5. Left: A drop spindle for spinning thread; right: a spindle supporting a weathervane. (Shutterstock.)

Our Design Concept

We agree with Hugh Nibley that there was nothing particularly strange or mystifying about the Liahona's apparatus. We concur with Robert Bunker's and JeaNette Smith's idea that the two spindles needed to align with each other. We also agree with Loren Spendlove that the two spindles inside the ball did not function independently. However, we suggest that the two internal spindles were *vertical*, not horizontal. Using Bunker's engineering logic, those upright spindles would drive the Liahona's design to be a sphere instead of a short cylinder. As shown in figure 6, large openings in the ball's shell let the user look inside the sphere to see the spindles, which were also called "pointers" or "miraculous directors." The distant landscape could be viewed through smaller viewing ports to see where the directors pointed.[22]

We propose that the pointers or miraculous directors, which were protected inside the Liahona, had an axle spindle that was shaped much like the drop spindle in figure 5. One difference would be that the whorl (the disk) would have to be wider so a pointer spindle could be attached to its outer edge. The pointer spindle probably had a thicker spot on its shaft to help discern its position behind the axle spindle during the visual alignment process (see figures 7, 9, and 10). Both spindles would have been firmly attached to the whorl, which could rotate around the axle spindle. The whorl and spindles would have worked together as a unit called the *pointers* or the *miraculous directors*.

21. Webster, *American Dictionary*, s.v. "spindle."
22. J. Wanless Southwick, "Liahona," in *Arabia's Mountain of God where Moses, Elijah, and Lehi met with God* (Rexburg, ID: Southwick Research, 2024), 31–32.

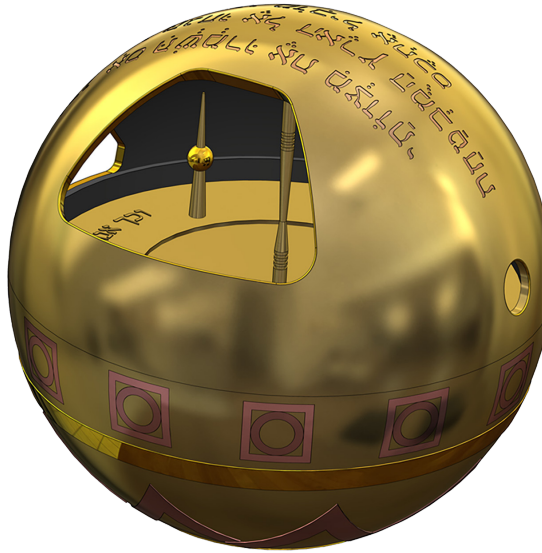

Figure 6. SolidWorks rendering of our Liahona design showing side openings used to view the “miraculous directors” (the pointers or spindles) inside the ball and smaller viewing ports in the sphere’s shell used to sight on the landscape ahead. Patterns on the ball’s surface are artistic speculation. (Image by Kyle Kinghorn.)

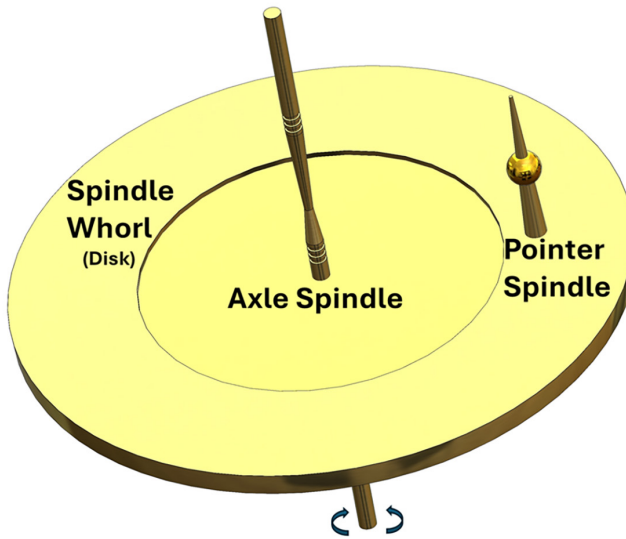

Figure 7. The “pointers” inside the Liahona. This whole pointing mechanism was sometimes called the “miraculous directors,” which consisted of an axle spindle fixed in the center of a wide whorl (disk) and a distinctive pointer spindle attached to the outer edge of the whorl. The spindle whorl and pointer spindle could rotate around the axle spindle. (Image by Kyle Kinghorn.)

How Did the Liahona Work?

In our proposed Liahona design, the hollow ball protects the internal pointers or miraculous directors, which consist of two vertical spindles fixed into a rotating disk (the whorl). Viewing ports in the shell of the ball let the user superimpose the aligned spindle shafts on the landscape ahead.

Although the miraculous directors behaved something like a compass needle, the Liahona was not self-operating like a magnetic compass. Nibley said the Book of Mormon makes it perfectly clear that the Liahona was also "not a magic thing, but [it] worked only by the power of God and only for appointed persons who had faith in that power."[23] Alma explained that if its authorized users "had faith to believe that *God could cause that those spindles should point the way they should go,* behold, it was done" (Alma 37:40).

When God set the orientation of the directors, they would not rotate around the axle spindle anymore, but remain fixed in space, pointing in the direction God wanted Lehi to travel, much like a magnetic compass needle stays in line with earth's magnetic field to point north. We propose that the outer shell of the Liahona and its viewing ports could freely rotate around the stationary directors much like a compass case can freely rotate around a magnetic compass needle. The user could then hold the ball up to an eye, peer through the viewing-port holes, and turn the shell of the ball and himself about until the opposite viewing port was near the pointer spindle. Then, when the pointer spindle was perfectly aligned behind the axle spindle, the two vertical spindles would be superimposed on the view of the landscape ahead, pointing like gunsights at the direction they should travel (see figure 10).

Lehi and his caravan obviously did not travel in a perfectly straight line, but they followed the most prudent path toward the spot in the landscape ahead to which the directors in the Liahona had aimed them. When the next segment of their travel required a change in direction, God would move the pointer spindle to lock onto the new direction for travel, which would cause the spindle alignment to be superimposed on a new spot in the landscape ahead.

But the Liahona worked only when its users were worthy of God's intercession, and it stopped working at times of turmoil and contention. This is pointed out in two scriptural passages:

23. Nibley, "Liahona's Cousins," 108.

- And it came to pass that I, Nephi, beheld the pointers which were in the ball, that they did work according to the faith and diligence and heed which we did give unto them. (1 Nephi 16:28)
- And it came to pass that after they had bound me insomuch that I could not move, the compass, which had been prepared of the Lord, did cease to work. (1 Nephi 18:12)

When the Liahona stopped working, the pointer spindle could have circled aimlessly without stopping to mark a directional orientation. Functional failure could also have been indicated if the pointer spindle became locked in place inside the ball, so it turned wherever the ball turned.

Lehi's First Use of the Liahona

Lehi was surprised to see the Liahona resting on the ground in front of his tent door in the morning after being commanded to break camp and begin his family's trek toward the promised land. His tent was on the north side of the valley (1 Nephi 16:12–13), so the tent door probably faced south. Before him there would have been a green oasis, irrigated by the River Laman, with the valley of Lemuel mountains on the other side of the oasis (see figure 8).

The most plausible place in Arabia for Lehi's ancient encampment in the "valley of Lemuel" is at a small oasis of date palms in a valley known today as Wadi Tayyib al-Ism. It has a deep canyon with perennial flowing water that empties into the Red Sea, which is to the west about two miles away. Because of the uniqueness of the circumstances, the actual location of Lehi's campground has been proposed by onsite explorers and from Google Earth satellite images.[24]

We can imagine Lehi picking up the Liahona for the first time. He would have noticed the two vertical spindles inside the hollow ball and how they *remained fixed in their orientation whether he turned the Liahona left or right.* When looking directly across the valley through the viewing ports of the Liahona, the two vertical spindles were not aligned (see figure 9), but when he turned the view to the right, the spindles came into alignment, pointing at a hidden southward exit from the valley (see figure 10).

24. Warren P. Aston, Godfrey J. Ellis, and Neal Rappleye, *Into Arabia: Anchoring Nephi's Account in the Real World* (Orem, UT: Interpreter Foundation; Salt Lake City: Eborn Books, 2024), 114–16.

Figure 8. Valley of Lemuel, looking south from Lehi's tent site, across the oasis of Tayyib al-Ism, with an arrow pointing toward the only southward exit from the valley. (Image courtesy of Warren P. Aston.)

The aligned spindles "pointed the way whither [Lehi's caravan] should go into the wilderness" (1 Nephi 16:10). It directed them toward an inconspicuous passageway in the mountains south of the valley of Lemuel. When Lehi's family left their oasis campground, they said, "We did take our tents and depart into the wilderness, across the river Laman" (1 Nephi 16:12). At first glance, that wilderness exit appeared to go just a short distance up into the mountains, but it turned out to be a hidden wadi (dry riverbed), which turned eastward behind the valley mountains before continuing upward through the mountains toward the southeast (see figure 11). That easy-to-overlook mountain pass was discovered by Warren Aston during his visit to Wadi Tayyib al-Ism in 2019.[25]

Whenever the traveling group encountered a fork in the trail, the directors inside the Liahona could be consulted to decide which way to go. As long as they gave faithful heed to the Liahona, that kind of divine guidance continued to direct their travel through the wilderness of Arabia and eventually across the ocean to a promised land in the Americas. At sea, it could have been attached to the ship so that the viewing ports were aligned with the keel, which would be the direction

25. Warren P. Aston, "Nephi's 'Shazer': The Fourth Arabian Pillar of the Book of Mormon," *Interpreter: A Journal of Latter-day Saint Faith and Scholarship* 39 (2020): 53–72, journal.interpreterfoundation.org/nephis-shazer-the-fourth-arabian-pillar-of-the-book-of-mormon/.

Figure 9. View through the Liahona from Lehi’s tent site looking straight across the valley of Lemuel. Because the pointer spindle is off to the right, the viewing ports are not in alignment with the two spindles, so straight ahead is not the proper direction for travel. (Image by Wanless Southwick.)

Figure 10. View through the Liahona from Lehi’s tent site after turning the Liahona’s outer shell to the right until the two spindles align like gunsights in the viewing port. The aligned spindles are superimposed on an inconspicuous southward exit from the valley of Lemuel, marking the direction for travel. (Image by Wanless Southwick.)

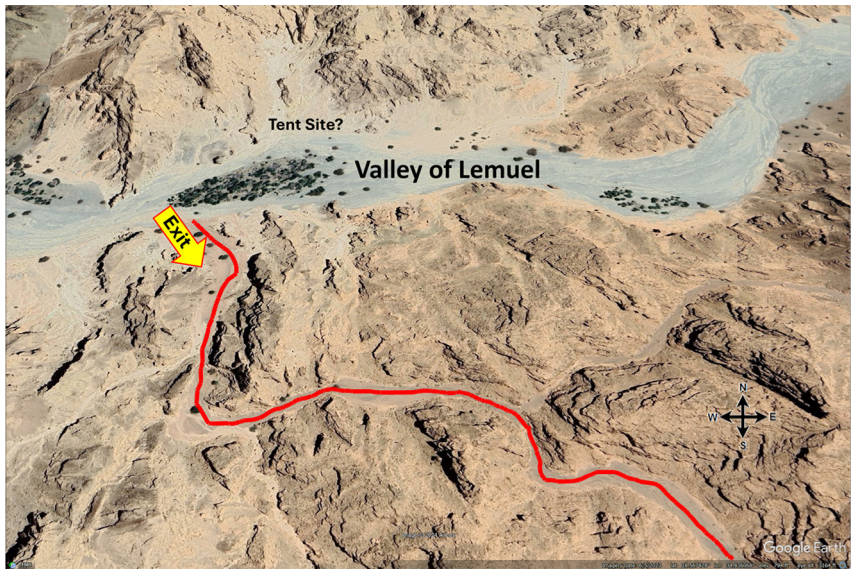

Figure 11. Lehi likely exited the valley of Lemuel by following the Liahona's directions into an inconspicuous mountain pass. (Google Earth.)

of travel. Steering to keep the two vertical spindles aligned would keep the ship moving on its proper course toward the Promised Land.

Text on the Liahona's Surfaces

In addition to pointing out the direction they should travel, the Liahona also displayed text on its surfaces. For example, at the time of the broken bow crisis, words appeared on the Liahona:

> And it came to pass that the voice of the Lord said unto him [Lehi]: Look upon the ball, and behold the things which are written. And it came to pass that when my father beheld the things which were *written upon the ball*, he did fear and tremble exceedingly, and also my brethren and the sons of Ishmael and our wives. And it came to pass that I, Nephi, beheld *the pointers* which were in the ball, that they did work according to the faith and diligence and heed which we did give unto them. And there was also written upon them a *new writing*, which was plain to be read, which did give us understanding concerning the ways of the Lord; *and it was written and changed from time to time,* according to the faith and diligence which we gave unto it. And thus we see that by

> small means the Lord can bring about great things. (1 Nephi 16:26–29)

It is easy to visualize text being written on the ball's outer surface because there is plenty of space there. It would be something like God writing on tablets of stone for Moses (Exodus 31:18) or God writing a message to King Belshazzar on the palace wall (Daniel 5:22–28). However, 1 Nephi 16:28–29 implies that writing also appeared on the pointers. That is how Nibley interpreted those verses when he said, "The working parts of the device were two spindles or pointers. On these a special writing would appear from time to time, clarifying and amplifying the message of the pointers."[26]

Bunker struggled to explain how two horizontal pointers could have had writing upon them:

> The amount of text inscribed on the pointers cannot be ascertained from Nephi's description, but the physical size of the writing must have been small; otherwise, the observation that it "was plain to be read" (1 Nephi 16:29) would have been unnecessary. Assuming the Liahona was about five inches in diameter, then the [horizontal] pointers were about the size of a finger in length and width, thus providing a modest area for text of a few square inches.[27]

By contrast, the working parts in our design for the Liahona were the whorl and its vertical spindles. Together *they were the pointers* or miraculous directors, which both guided the travel direction of Lehi's caravan and gave them written details to enhance understanding. The circular whorl would have provided plenty of space for the "plain-to-be-read" text. The text could have been written on the outside surface of the ball,[28] on the internal pointing mechanism,[29] or in both places. In figure 12, we used modern Hebrew to simulate writing that Lehi and his extended family may have seen on the Liahona (1 Nephi 16:27).

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26. Nibley, "Liahona's Cousins," 89.
27. Bunker, "Design of the Liahona," 5.
28. The surface text on this model is the Hebrew version of 1 Nephi 17:13: ". . . wherefore, inasmuch as ye shall keep my commandments ye shall be led towards the promised land; and ye shall know that it is by me that ye are led." Tom Irvine, "Book of Mormon, Hebrew & English," archive.org/details/the-book-of-mormon-hebrew-english/page/174/mode/1up.
29. Text on the whorl of the pointers is the Hebrew version of 1 Nephi 16:29: "And thus we see that by small means the Lord can bring about great things." From Google Translate.

Figure 12. Model of Liahona showing how text could be written on both the outer surface of the ball and on the whorl of the pointers, also known as the miraculous directors. (Image by Kyle Kinghorn.)

Summary and Conclusions

The reason that the Liahona was a sphere and not a flat compass-like instrument was possibly because it had two *vertical spindles*. Those upright spindles would have needed vertical space inside the Liahona plus protection against physical damage. Sometimes the Liahona's pointing mechanism was called the "miraculous directors," which we suggest consisted of the two vertical spindles attached to a circular whorl. Under divine influence, the two vertical spindles ("pointers" or "directors") aligned themselves with the direction Lehi should travel. They would have remained fixed in that alignment whether the user turned the outer shell of the Liahona to the left or to the right. When the Liahona's viewing ports were aligned with the two vertical spindles, the spindle shafts would be superimposed, one behind the other, on a view of the landscape ahead, thus pointing like gunsights at the proper direction for travel. Further experimentation with physical models of this proposal may yet teach us more about the Liahona's functions.

Appendix

If the original Liahona were available for us to inspect, we wouldn't need to speculate about what the two spindles looked like or guess where writing would appear on the ball; we would be able to observe it for ourselves. Book of Mormon descriptions of the Liahona would then make perfect sense and our misconceptions would evaporate. There are two additional ways to gain insight into the form and function of the ancient Liahona — working models and artwork.

Possible working model

Research for this paper proved the value of having a 3-D printed, physical model to experience how the internal miraculous directors (Doctrine and Covenants 17:1) worked independently within the outer shell of the Liahona (see figure 13). Functional educational models of this vertical-spindle Liahona could be manufactured. The circular orientation of the miraculous directors could be controlled by electronic components in the bottom hemisphere, including a small stepping motor geared to the axle spindle, which would respond to the horizontal rotation of the hollow ball as detected by electronic gyroscopes.

Figure 13. 3-D printed model of the Liahona used during research for this paper. (printed by Kyle Kinghorn)

Instead of having the aimed-direction be under divine control, the angular setting of the pointer spindle could be determined by a button-push to retrieve a random number (1–360 degrees) from an electronic table.

It would also be possible to simulate the writing that appeared on the Liahona's surface by placing a small LCD display on the surface of the Liahona model to display pre-recorded messages.

We envision Lehi trek-simulation games designed to use this Liahona model. The player pushes the button, follows the pointed direction for a certain distance, responds to LCD instructions, pushes the button to change directions, followed by more travel and subsequent LCD instructions, etc.

Liahona in artwork

The Liahona is usually portrayed in artwork as a hand-held ball without showing details of the internal working mechanism — also called the *miraculous directors*. Perhaps my favorite came to me from my son, Christopher Southwick, who served as a missionary in Guatemala from 1988 to 1990. He was attracted to a display of wooden plaques being sold at a local market to tourists. He bought a plaque that reminded him of the glorious quetzal bird he had seen in the jungles of Peten (see figure 14).

The quetzal bird, with its long snake-like tail feathers, represented the feathered serpent deity of ancient Mesoamerica. "The Feathered Serpent is a prominent supernatural entity or deity found in many Mesoamerican religions. It is called Quetzalcoatl among the Aztecs; Kukulkan among the Yucatec Maya; and Q'uq'umatz and Tohil among the K'iche' Maya."[30]

Although my son didn't associate the wall plaque with the Liahona, I did. The Quetzal bird, which rests upon the head of a man, could represent divine influence as the man seeks guidance and direction from a sacred ball (Liahona?), which he holds in his hands in front of him.

Whether the plaque represents a story from ancient Mesoamerican folk lore or is the creation of a modern native craftsman to depict a Book of Mormon scene, the true meaning of the wall plaque is unknown to us. Nonetheless, it reminds me of the Liahona.

30. Wikipedia, s.v. "Feathered Serpent," en.wikipedia.org/wiki/Feathered_Serpent.

Figure 14. Wooden wall plaque purchased about 1990 from a local market in Guatemala that catered to tourists. (Photo by Wanless Southwick.)

[**Wanless Southwick's Note:** *When my son, John Southwick, saw me experimenting with vertical spindles in a crude Liahona model, he commented that one of the vertical spindles could have been stationary. His idea contributed to the final design of the model. Thanks also to my wife, Jerrie, who showed interest and loving patience during the long hours her husband was fully distracted by this project. Special thanks to Warren Aston for his encouragement and to Godfrey Ellis for his suggestions and editorial counsel.*]

Wanless Southwick *(PhD BYU) retired after careers in the US Army Medical Service Corps, environmental epidemiology, and education, all of which included research and study. He served as president of the Intermountain Society of Inventors and Designers in the 1970s. Among books he authored are* Arabia's Mountain of God where Moses, Elijah, and Lehi met with God *(2024) and* The Reason for Everything in the Grand Framework of Existence *(2017). He and his wife, Jerrie, are the parents of eight children, and have thirty-five grandchildren and twenty-three great grandchildren at last count.*

Kyle Kinghorn *(MS BYU) holds degrees in Chemical and Manufacturing Engineering and currently teaches at BYU-Idaho in the department of Engineering Technology. Courses that he teaches include plastics, composites, tool design, prototyping, and CNC programming. He is also the president of Citius Composites, LLC, a company that specializes in the design and creation of products made from carbon fiber and other advanced materials. He has a passion for creating new products and the processes needed to make them. He and his wife, Malia, are the parents of three children.*

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