Augmented Reality as a Tool for Enhancing Cultural Tourism through the Journey of the Sun God in the Amduat

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Abstract

This paper presents an investigation into the application of Augmented Reality (AR) as a tool for enhancing cultural tourism through the exploration of the Amduat, a significant text in ancient Egyptian religious and cultural studies that narrates the night journey of the sun god Re. Employing a mixed-methods approach encompassing descriptive-analytical and design-based research, this study analyzes the artistic, linguistic, and symbolic dimensions of the Amduat. A framework integrating AR, Artificial Inteligence, and interactive design was developed through consultations with experts in Egyptology, tourism, and technology to provide an accessible and innovative presentation of this ancient narrative. The findings demonstrate the potential of AR to promote cultural heritage preservation, facilitate comprehension of complex theological concepts, and engage a broader audience while upholding historical authenticity. The study recommends expanding the applications of augmented reality to enhance the preservation of Egypt's cultural heritage and develop innovative tourism products. It emphasizes the need for collaboration to develop high-quality digital content that combines historical accuracy with technological innovation. Moreover, the study underscores the importance of investing in the necessary technological infrastructure to support these applications.

Keywords: Amduat, Augmented Reality (AR), Ancient Egyptian Heritage, Interactive Design, Heritage Preservation, Cultural Tourism.

Introduction:

Nations are shaped by their heritage, architecture, and arts, which captivate visitors and create lasting impressions (Awangku & Hao, 2011). Culture and heritage are pivotal in crafting tourism experiences, adding value, and conveying a destination's unique identity to tourists (Shen et al., 2024). As travelers increasingly seek authentic and meaningful encounters, cultural tourism has gained prominence, offering insights into local traditions, beliefs, and practices (Tussyadiah, 2014). Destinations now focus on cultural tourism products encompassing knowledge, religion, art, customs, and myths, serving as key drivers of tourism demand (McKercher & Du Cros, 2002; Zhang, 2011).

Egypt's heritage, a cornerstone of human civilization, provides profound insights into ancient life, beliefs, and knowledge, solidifying its status as a premier global tourist destination and a pillar of national identity (Mustafa, 2021). Central to this heritage are the deeply intertwined religious rituals, depicted in temple art and texts like the Ramesseum Dramatic Papyri, which reflect ancient societal values (Gillam, 2006; Geisen, 2018). Similarly, the Book of Amduat, a New Kingdom funerary text, illustrates the Egyptians' fascination with the afterlife, depicting the sun god Re's journey through the underworld's twelve hours (Piankoff, 1954; Hornung, 1999; Darnell & Manassa Darnell, 2018).

Recent technological advancements, including augmented and virtual reality, have revolutionized how we engage with cultural heritage, enabling immersive, multi-dimensional

experiences that transcend barriers of time and space (Georgopoulos et al., 2017; Khalil, 2014). These tools provide realistic visualizations of landmarks and artifacts, enhancing the way tourists explore and connect with Egypt's rich heritage (Orabi, 2022). As historical destinations in Egypt strive to attract and retain tourists, adopting innovative smart technologies becomes essential to preserving cultural heritage and elevating Egypt's standing in the global tourism market (Hadzic, 2004; Orabi, 2022).

The research problem lies in how to leverage smart technology applications to visualize the journey of the sun god to the underworld (as depicted in the Book of the Amduat) in a novel and engaging manner for tourists and to design a unique tourist experience that combines ancient heritage with modern technology. Additionally, this research seeks to explore how to present complex and religious content in a simplified and understandable way to a wider audience. Thus, this study aims to: a) investigate the potential of modern technology in preserving Egypt's cultural heritage and harnessing it for tourism purposes by developing an innovative tourist experience; b) propose an innovative tourism product based on the application of smart technology in visualizing ancient Egyptian heritage and the journey to the afterlife as depicted in the Amduat. This will be achieved through:

1. **Exploring the content of the Book of the Amduat:** Exploring the texts, images, and themes found in the Book of the Amduat to identify the core elements that can be transformed into an interactive journey.
2. **Exploring modern technologies:** Investigating augmented reality and artificial intelligence applications to identify suitable tools and software to achieve the project's objectives.
3. **Designing an engaging user experience:** Designing an immersive interactive experience that attracts tourists.
4. **Developing a prototype:** Building a prototype of the final application or product to evaluate its effectiveness.

Significance of the Research This study will make a scholarly contribution to the field of technology applications in cultural tourism, with a focus on ancient Egyptian heritage as a case study. The results of this research are expected to contribute to the development of new strategies for preserving heritage and enhancing its role in sustainable development.

The authors have applied the framework, which is adapted from Custódio et al. (2020) (see Figure 1) for developing new tourism products that rely on three essential components: (1) identifying the core resources of destinations on which innovative tourism products should be based, (2) identifying the transformative experiences provided by these products, and (3) creating a design for product development processes (Custódio et al., 2020).
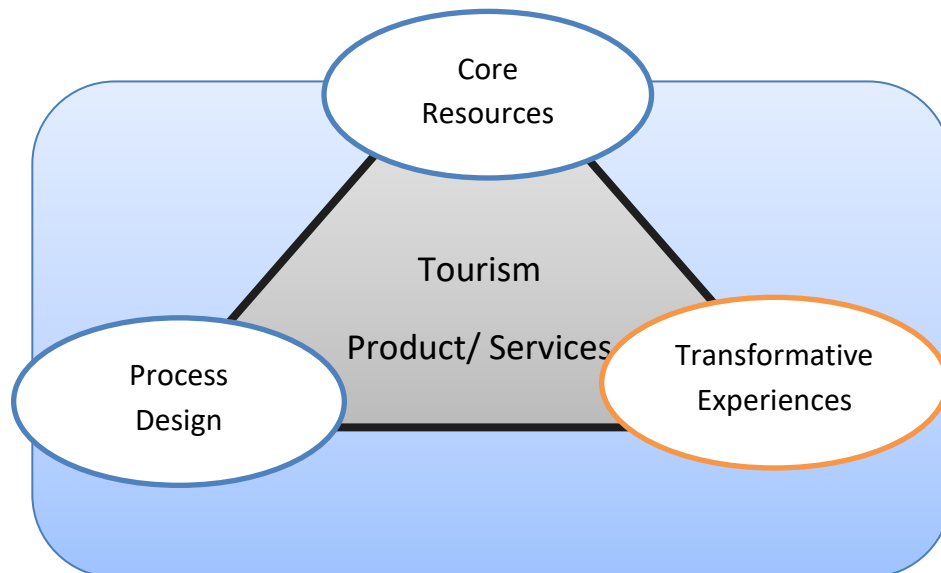
Figure (1) Framework for a new Tourism product/service

Source: Custódio Santos, M., Ferreira, A., Costa, C., & Santos, J. A. C. (2020). A model for the development of innovative tourism products: From service to transformation. *Sustainability*, *12*(11), 4362.

1- Core Resources

The Book of the Amduat:

The Amduat, the earliest Netherworld book, emerged during the New Kingdom and translates to "That which is in the Netherworld" (Piankoff, 1954; Hornung, 1999). Its earliest traces appear in KV 20 and fragments in KV 38, but the first complete version was discovered in the tomb of Thutmose III, encompassing all twelve hours of the composition (Bucher, 1932; Hornung, 1999). Also, Thutmose III's tomb uniquely contains three versions: a long version, an abridged version, and a catalogue of the gods featured in the Amduat (Bucher, 1932; Hornung, 1987-1992 and 1994; Hornung, 2005).

Initially reserved for royalty, the Amduat remained a privilege of kings until the end of the Twenty-First Dynasty. The sole exception was Useramun, the vizier of Thutmose III, who incorporated elements of the Amduat into his tomb's decoration (Hornung, 1961). After Akhenaten's reign, the usage of the Amduat declined, with only portions of the first hour appearing in the tombs of Tutankhamun and Aye. The Amduat was eventually supplanted by the "Book of Gates," starting with the tomb of Horemheb and continuing with Ramesses I, who exclusively used the Book of Gates in his sarcophagus chamber (Régen, 2014; Hornung, 2014). The Amduat saw a brief resurgence during the reign of Ramesses VI, when several hours (excluding the twelfth) were integrated alongside other underworld texts in tomb decorations (Piankoff, 1954; Taylor, 2016; Sadek, 1985). By the Third Intermediate Period (ca. 1050 BCE), the Amduat began to appear on papyri, particularly hours nine through twelve, and later on Late Period sarcophagi. Notable examples include the sarcophagus of Tjaihorpata from the reign of Nectanebo II (Manassa, 2007).

The Amduat as a journey through the Netherworld:

The Amduat is exceptional for dictating how particular hours should be placed on specific walls (Schott, 1958; Abitz, 1995). As the instructions show, the first four hours were to occupy the west wall, the following four on the south, and, finally, the last four hours on the east (Richter, 2008). Reading the Amduat as such, one explores a journey throughout the Netherworld from the entrance of the Netherworld in the southeast corner of the burial chamber to the moment when the sun god rises

Figure 2 Distribution f the hours according to instructions in the Amduat (after Abitz, 1995)

rejuvenated in the morning in the southeast corner (Hornung & Abt, 2007).

The Solar Cycle:

The Egyptian solar cycle comprises twenty-four hours. These twenty-four hours were categorised by Assmann into four phases: rising, transit, landing (sunset), and the nocturnal journey. Assmann underlines two major themes in these stages: the journey across the sky and the process of regeneration, which stands for both life and death (Assmann, 1995).

The first of these phases, 'rising in Assmann's words,' happens at sunrise. This is when the sun god leaves the Netherworld in the form of a scarab (*Khepri*) after the gates of the horizon are opened. Then, Khepri sets out on his diurnal journey on the *mandjet*, his day barque (Assmann, 1995). The journey of Re across the sky from sunrise to sunset is described at length in the Book of the Day. The rebirth of Re at dawn is celebrated by the 'Eastern *ba*-souls': the baboons or sun-apes identified as "those who are in jubilation" (Hornung and Abt, 2007).

As the day ends, now sunset, Re, now aged, reaches the western horizon. At this point, Re transforms into his nocturnal, ram-headed form, known as Atum, and boards the *mesektet*, his nocturnal barque. This marks the preparation for Re's nocturnal journey. Now, Re is greeted by the Western ba-souls: jackal-headed deities (Roulin, 1996).

Voices and Sounds:

The Amduat, as discussed in detail below, is a place where sounds and voices played an essential role in the spiritual and symbolic landscape of the Netherworld. For example, in the second hour of the Amduat, we read that the voices of the gods inhabiting this hour guide the sun god to them:

| *in ḫrw=sns šmsw r=sn* | It is their voices which guide him to them (Hornung and Abt, 2007). |

The texts also show that terms used for enemies being punished are dissimilar to voices of gods. The enemies in the eleventh hour are said to "shriek." A theological significance is also associated with voices in the Amduat. In the third hour, a group of deities is said to "live when he (i.e., Re) calls them" (Darnell & Manassa-Darnell, 2018).

Topography:

Throughout the Amduat, one explores an intricate and symbolic topography (Quirke, 2003). During his nocturnal journey, Re passes over barren, desolate areas that are often inhabited by deities punishing enemies and rebels. Conversely, other areas, such as the lower register of the second hour, are identified as field (*sḫt*). Also, in the tenth hour, the blessed dead are regenerated by being immersed in water. Also, a frequent mention is made in the Amduat of the "utter darkness" of the Netherworld. Only in the last hour of the Amduat is when this utter darkness ends. In the concluding text of the third hour, the gods speak to Re, saying, among other things, "May your two Maat's guide you on the paths of darkness" (Darnell & Manassa-Darnell, 2018).

One Trajectory of many

This paper introduces the Amduat as a path through which tourists can explore the Egyptian Netherworld. It is noteworthy, however, that the Amduat is one of many Netherworld guides that appeared throughout the history of ancient Egypt, starting, in the Old Kingdom, with the Pyramid Texts. Following the Pyramid Texts, a new composition was introduced: Coffin Texts. A number of spells in the Coffin Texts were called collectively as the "Book of the Two Ways." As the title of the Book of Two Ways implies, the concept of different paths through the netherworld was familiar to the Egyptians of the Middle Kingdom (Lesko, 1972). A similar idea can be seen in the various netherworld guides found in the royal tombs of the New Kingdom. However, determining the actual differences between the roads described in these texts is challenging. For example, it is likely not a coincidence that Apophis is slain in the seventh hour of the night in the Amduat and that the same hour marks the punishment of enemies in the Book of Gates (Willems, 1996).

On the structure of the scenes of the Amduat:

The paper adopts a two-fold approach to its structure and content. First, the scenes are arranged chronologically, with the barque of Re at the centre of the middle register, referred to as the "Divine Vessel," while the flanking realms are introduced as "Echoes of the Barque." This arrangement highlights the barque's central role and its thematic connections to the surrounding elements. Second, to balance the paper's scope and purpose, specific scenes are selectively highlighted to effectively introduce them to the reader while avoiding unnecessary repetition for clarity and conciseness. Furthermore, the selection of scenes takes into account the depiction of diverse locales in the netherworld, including arid regions and watery landscapes.

**A journey throughout the Netherworld:**

First Hour:

Middle Register (The Divine Vessel):

Scene 1 (After Darnell & Manassa Darnell, 2018)**:**

The solar bark sails with the ram-headed Re within a shrine. The crew of the barque comprises two deities at the prow followed by a goddess with two horns and a crown on her head. This goddess is designated as "Mistress of the Barque."

Behind the ram-headed Re stands a flacon-headed god, Horus Who Praises, followed by three gods.
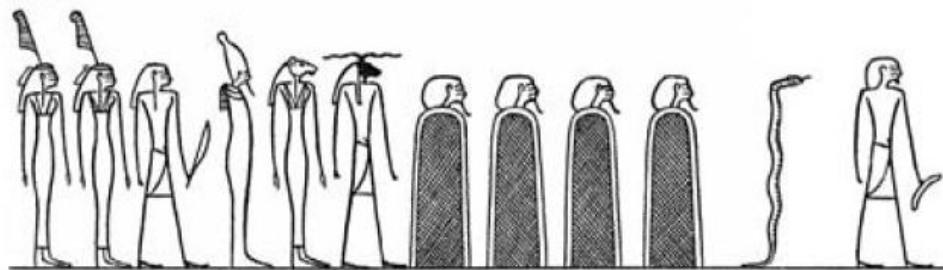
Scene 2 (After Darnell & Manassa Darnell, 2018**):** The solar barque is preceded by twelve deities. From left to right, these are two goddesses identified as Maat, a humanoid god named "Punisher," a mummiform figure designated as Foremost-of-the-West, a lion-headed goddess named Sekhmet, a ram-headed deity identified as Great-Illuminator, four human-headed stelae labelled as Command-of-Re, Command-of-Atum, Command-of-Khepri, and Command-of-Osiris, a serpent standing on its tail called Starry-one, and finally, He-who-traverses-the-hours.

Annotation to the Middle Register: "It is the two Maat goddesses who haul this god in the nigh-bark while sailing in the portal of this locale—it is 120 *iteru.* Afterwards, he traverses water to Wernes, which is 300 *iteru* in length. [He] distributing [fields] to them, namely the gods who are in his following. The floodwater of Re is the name of this field. Keeper of the Flame is the name of its protector. At this field this god brings to proclaim the caring for those who are in the Netherworld."

Echoes of the Barque:

1. **Upper Register:**

The first hour of the Amduat is inaugurated in the upper register by nine kneeling baboons stacked in a group of three above each other. They open for the great *ba*-soul (i.e., Re). These baboons are followed by twelve goddesses arranged in four rows of three. The following is a group of nine kneeling gods depicted with various iconographies. The three gods in the first column are crocodile-headed, those in the second column are jackal-headed, while the gods in the preceding column are human-headed. These gods adore Re. Like the second scene, the following scene shows twelve goddesses arranged in four columns and three rows. These goddesses guide the great god (Re).
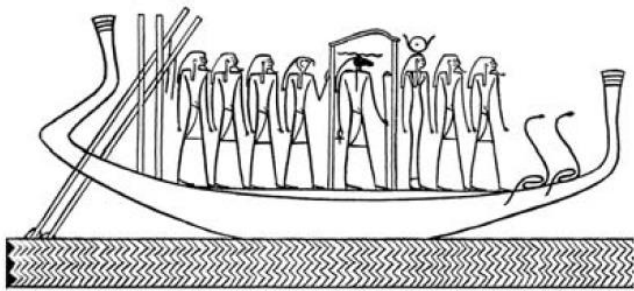
2. **Lower Register**

Scene 3 (After Darnell & Manassa Darnell, 2018): The register begins with nine kneeling baboons who, according to the text, make music for Re when he enters the Netherworld.
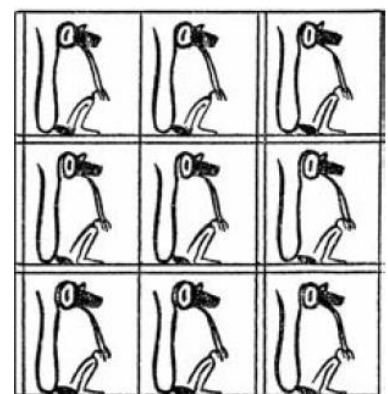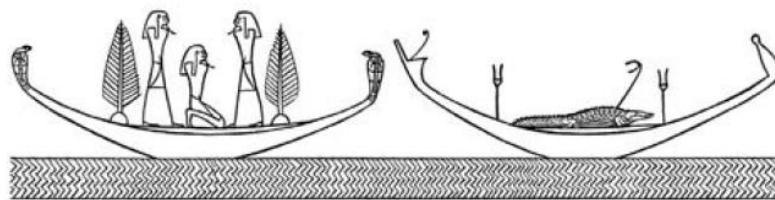
The Second Hour
**The Divine Vessel (Middle Register):**

Scene 4
(After Darnell & Manassa Darnell, 2018): The crew of the solar barque remains unchanged from that in the first hour apart from the addition of two uraei at the prow of the barque.

Scene 5 (After Darnell & Manassa Darnell, 2018)**:** In front of the solar barque, there are two barques. The prow and stern of the first barque are cobra-shaped. Three deities are represented in the barque as well as a couple of large sheaves of grain. The second barque, which contains a crocodile flanked by two *sekhem*-sceptres, has its prow and stern in the form of white and red crowns, respectively (Piankoff, 1954; Darnell & Manassa Darnell, 2018; Hornung & Abt, 2007).
**Echoes of the Barque**
    1. **Upper Register:**
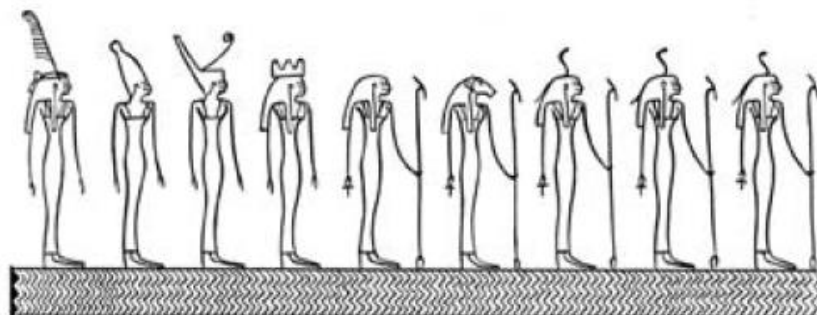
Scene 6 (After Darnell & Manassa Darnell, 2018)**:** The upper register opens up with nine goddesses with various attributes. These start with Maat-Who-is-atop-the-valley, followed by a goddess crowned with the white crown who is designated as She-of-the-white-crown-who-is-atop-the-

valley; the following goddess is wearing the red crown, and she is identified as She-of-the-red-crown-who-is-atop-the-valley. Then follows the goddess who has the sign for the desert on her head and she is designated as the Beautiful West. The following humanoid goddess is identified as Swallower-of-all and she is holding the *was*-sceptre. The following lioness-headed goddess, also holding the *was*-sceptre and *ankh*-sign, is named Sekhmet-of-the-*was*-sceptre. The last three goddesses are humanoids, and they are represented holding the *was*-sceptre and the *ankh*-sign. These are identified as Mistress-of-the-underworld-dwellers, She-who-swallows-the-dead, and She-who-gives-birth-to-herself. (Piankoff, 1954; Darnell & Manassa Darnell, 2018; Hornung & Abt, 2007).
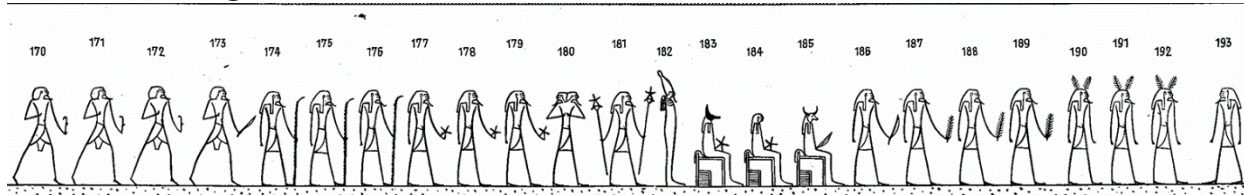
2. Lower Register:

Scene 7 (After Darnell & Manassa Darnell, 2018)**:** The lower register shows a host of deities who begin with four running gods; the first three are bearing the sign for season (*tr*) while the fourth is wielding a knife. The following three deities are holding the sign for the year (*rnpt*). These are followed by three deities holding a star in one hand. The following figure is represented with two human heads. The following deity is holding a papyrus sceptre in each hand with a star on top of each sceptre. Exactly in the middle of the scene, Osiris, mummiform, is represented wearing the white crown. The following three deities are seated with a star on the lap of the first two, while the third has a knife instead of the star. The following four figures are humanoids; the first is holding a knife while the three other figures are represented with an ear of grain. These are followed by three figures represented with two ears of grain on the head of each. The register closes with a figure facing the entire group who is identified as the 'guardian of the field.' (Piankoff, 1954; Darnell & Manassa Darnell, 2018; Hornung & Abt, 2007).

The Third Hour:
**Divine Vessel (Middle Register):**
sounds (Piankoff, 1954; Darnell & Manassa Darnell, 2018; Hornung & Abt, 2007).
The Fourth Hour:
Re lands at Imhet, the desolate desert dwelling place of Sokar, the underworld hawk deity. The sun god has gone so far into the underworld and away from his own light and he must use his voice to guide him and his crew through the darkness. With no water to sail on, Re's only way to get around this barren and dark region is to transform the solar barque into a double-headed, fire-breathing snake. This hour is particularly notable for its unique appearance compared to the others. Re's path is made challenging by the numerous doors that obstruct the expansive sand road that connects the three registers (Piankoff, 1954; Darnell & Manassa Darnell, 2018; Hornung & Abt, 2007).

Divine Vessel (Middle Register):
Scene 10 (After Darnell & Manassa Darnell, 2018)**:** While the usual crew of the solar barque is present, the prow and stern of the solar barque in the fourth hour are depicted in the form of
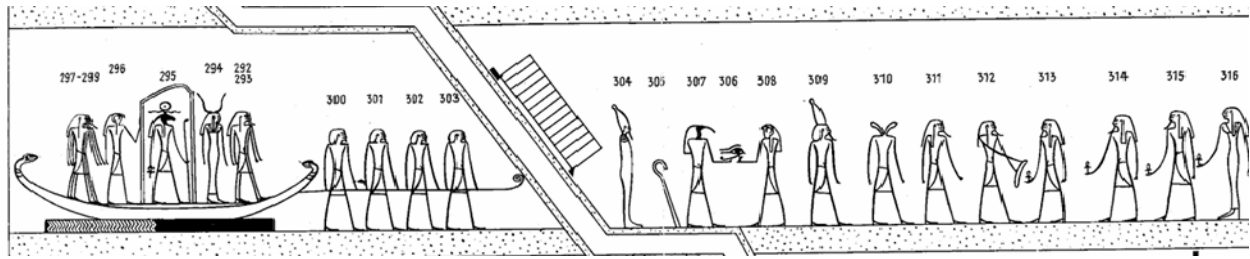
snake heads. The solar barque is being towed by four gods pulling a rope attached to the front of the sun barque. The related text reads: "This great god passes by them like this: It is the flame from the mouth of his barque that guides him on these mysterious ways, without him seeing their images. He calls them in their vicinity and it is his voice that they hear" (Hornung & Abt, 2007).

Eight deities and divine objects with various attributes; from the left, these are a mummiform god wearing the white crown, a large staff, two gods, one *ibis*-headed and the other falcon-headed, raising their arms to support the Wejad-Eye, a god wearing the white crown, a god whose head was replaced with two ropes and, finally, a god without any attributes (Piankoff, 1954; Darnell & Manassa Darnell, 2018; Hornung & Abt, 2007).

**Echoes of the Barque:**
1. **Upper Register:**
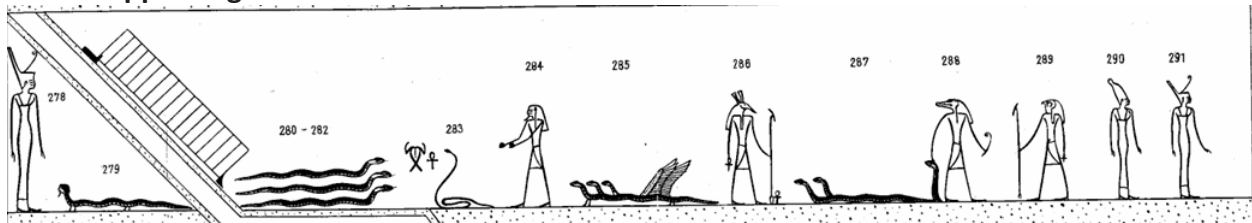
Scene 11 (After Darnell & Manassa Darnell, 2018)**:** The upper register starts with a standing goddess, with no name, wearing the red crown. The text says about this goddess that "She at the rising." Before this goddess there is a representation of a human-headed serpent with four legs and a divine beard. Then follows a representation of the first door of the sandy path of the fourth hour, which is identified as "Sharp one who buries." Beyond the door, the path has three serpents represented.

The following are three snakes stacked above each other; facing them is a serpent with the sign of life (*ankh*) in front of him. Behind the serpent, a humanoid figure is looking at the serpent while holding two pupils. This god is followed by a three-headed serpent with wings and legs (Piankoff, 1954; Darnell & Manassa Darnell, 2018).

The following group of deities shows a Seth-headed god holding the *was*-sceptre and the *ankh-sign*, facing a double-headed serpent. The following is a crocodile-headed deity looking backwards while holding a serpent that comes out from the earth with his left hand while with his right hand he is holding a spiral object. Also looking backwards is the falcon-headed deity that is represented behind this crocodile-headed deity. Then there is a representation of two goddesses, one wearing the white crown while the other is wearing the red crown (Hornung & Abt, 2007).

2. Lower Register:

Scene 12 (Darnell & Manassa Darnell, 2018**):** Beyond the zigzag path of the fourth hour of the Amduat, there is a representation of a three-headed serpent. The serpent is surmounted by fourteen human heads with discs above and stars below arranged in two rows. The lower register ends with a representation of a male figure raising his arm and Maat with the feather on her head. Above them there is a winged sun disc, then the hour closes with the last door.
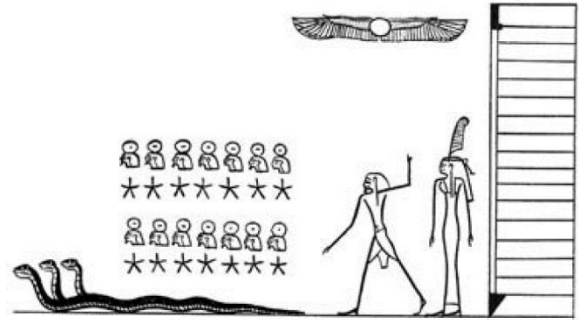
The Fifth Hour:

The structure of the fifth hour is somewhat distinct, with emphasis placed on its centre through the intersection of registers. This hour represents the West, encompassing all the essential aspects of the realm of the dead, including the primeval water (though unseen) that holds those who have drowned.

Divine Vessel (Middle Register):
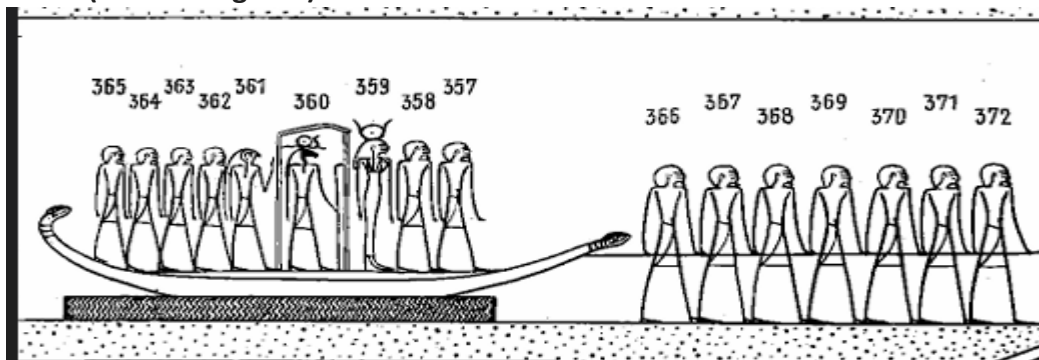
Scene 13 (After Darnell & Manassa Darnell, 2018): The solar barque, as in the fourth hour, has its prow and stern in the form of snake heads and the crew of the sun barque remains unchanged. The barque of Re is towed by seven deities.

Scene 14 (After Darnell & Manassa Darnell, 2018)**:** A pyramidal mound is represented in front of the solar barque. The top of the mound is crowned with the head of goddess Isis. The towrope of the solar barque arches over the mound, reaching its peak at the forelegs of the scarab emerging from its chest.
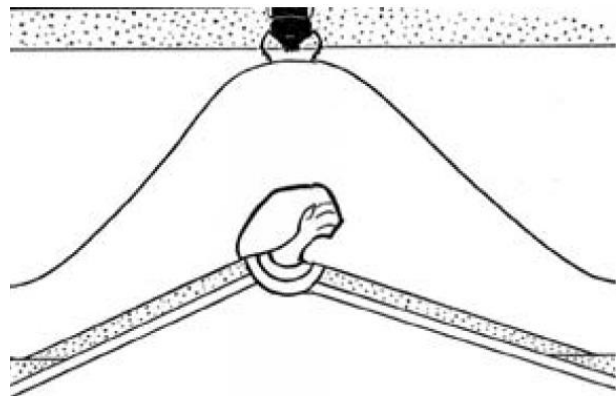
Echoes of the Barque:
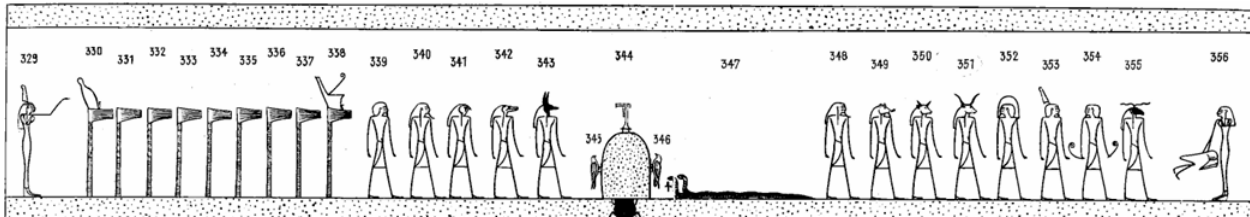
1. **Upper Register:**

Scene 15 (After Darnell & Manassa Darnell, 2018)**:** The upper register begins with a standing goddess with a feather on her head. She is addressed as the "goddess of the West" by Re. The goddess is raising her arms towards nine large signs for god (*nṯr*). The first and the last of these signs are crowned with the red and white crown, respectively.

In the middle of the register there is a representation of the burial place of Osiris, which is flanked by two kite birds that represent Isis and Nephthys. To the left of the burial place of Osiris, five gods are represented. The foremost of these deities is jackal-headed, followed by a crocodile-headed deity, a falcon-headed deity, and two gods in human form. To the right of the mound, a dual-headed serpent with the sign for life in front of him is depicted.

On the far right of the register, eight deities with varying iconography are represented. These are identified as "Slaughterers" who punish the enemies of Re. The iconography of these deities includes a shrew-headed deity and two bull-headed deities of different species. Facing these deities is a goddess who is holding an upside-down enemy (Piankoff, 1954; Darnell & Manassa Darnell, 2018; Hornung & Abt, 2007).

2. **Lower Register:**

The lower register shows a continuation of the "Secret Path," which began in the fourth hour. It also has two doors in the centre of which there is a representation of the Land of Sokar rooted in the two halves of the double sphinx Aker, a god of the earth.

Scene 16 (After Darnell & Manassa Darnell, 2018)**:** Annotation related to the Land of Sokar: "This image exists in this fashion in the utter darkness. That this oval pertaining to this god is bright is by means of the two eyes of the heads of the great god. It is within the coils of the great god that his feet shine while he guards his image. The sound of something is heard in this oval when this great god passes by them, like the roar of heaven when it storms" (Darnell & Manassa Darnell, 2018).

Scene 17 (After Darnell & Manassa Darnell, 2018)**:**

Annotation to the serpent:

"(Serpent of the) Roasting Flame. By means of the flame that is atop his mouth does he live. What he does is to guard the oval without going to any other place in the Netherworld." (Darnell & Manassa Darnell, 2018).
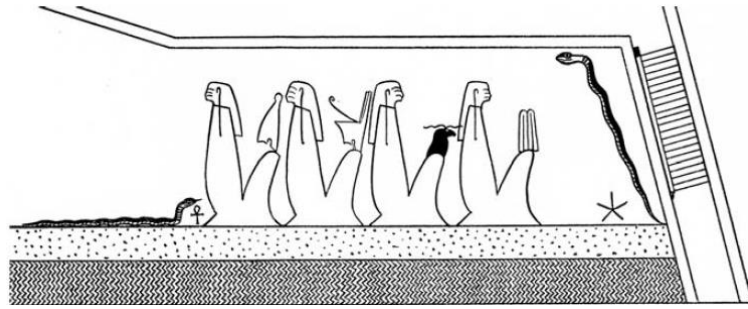
Gods with the Regalia: "The gods who bear the mysterious image of Sokar, who is upon his sand. Their images being what has come from their own bodies. They exist in the following of this great god, unseen and unperceived" (Darnell & Manassa Darnell, 2018).

Annotation to the serpent standing on its tail: "Living god. He comes and goes, traveling that he might open the (door named) One-Who-Cuts" (Darnell & Manassa Darnell, 2018).

Sixth Hour:

Having left the barren area of the Netherworld, the solar barque is now approaching the "waterhole of those of the Netherworld," where the primeval ocean of Nun exists, with all its regenerative power, which is indispensable to begin a new life when Re unites himself with his corpse.

Divine Vessel (Middle Register):
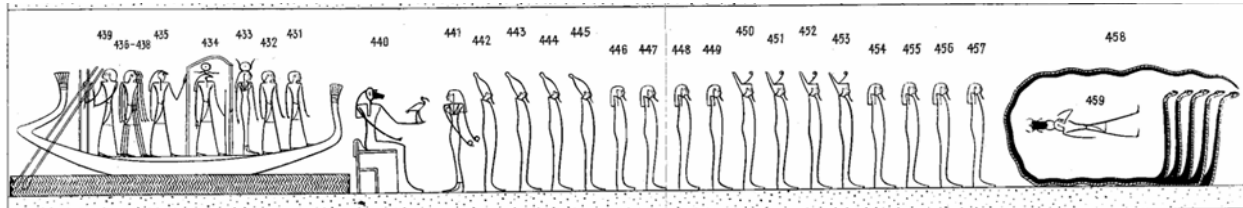
Scene 18 (After Darnell & Manassa Darnell, 2018)**:** The sun barque, with its crew present, is now represented in the form it had in the first three hours. Also, the barque is sailing on a rectangle of water. In front of the solar barque, a baboon-headed deity seated on a throne. This deity is holding an ibis-bird with one hand. Facing him is a goddess who is holding two pupils behind her back (Darnell & Manassa Darnell, 2018). Then follow sixteen mummiform figures arranged in groups of four who represent the kings of Upper and Lower Egypt. The middle register ends with a multi-headed serpent that encircles the corpse of the sun god from whose head a scarab is coming forth.

Echoes of the Barque:
   1. **Upper Register:**
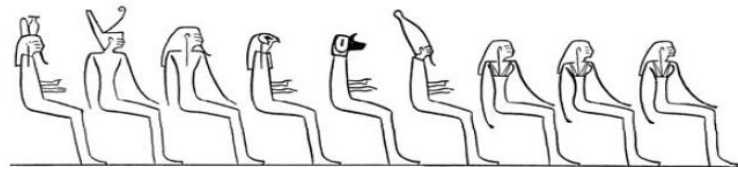
Scene 19 (After Darnell & Manassa Darnell, 2018): A remarkable feature of the deities in the sixth hour is that they are represented in a half-sitting position. This position indicates the renewed life of these gods who just sat from the sleep of their depth. The current scene shows nine deities in half-sitting position. The first of these has a loaf of bread and a jug of beer on his head. He is followed by a goddess wearing the red crown, a deity with no attributes, a falcon-headed deity, a baboon-headed deity, and a deity wearing the white crown. Finally, the last three deities are left without attributes (Hornung & Abt, 2007).
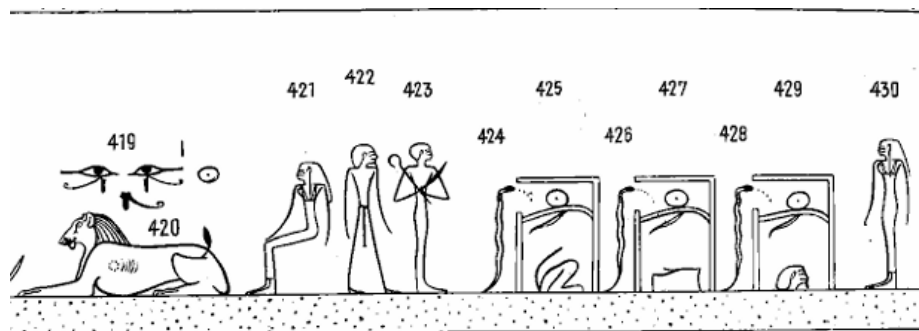
Scene 20 (After Darnell & Manassa Darnell, 2018)**:** This scene shows a recumbent lion facing left with two *Wedjat eyes.* Behind, a goddess in a half-sitting position. The following are two gods who act as guardians of the chests to the right. The first of these two gods is naked while the other is holding the crook and flail. Then there is a representation of three chests with an opening that allows the guardian serpent to spit fire. These chests represent the threefold burial of the sun god: the hind part of a lion, a scarab wing, and a human head.
   2. **Lower Register:**

Scene 21 (After Darnell & Manassa Darnell, 2018)**:** The lower register starts with a crocodile-headed deity in a half-sitting position. Before him, a standing goddess, also crocodile-headed, is represented. Then follow six standing gods without attributes and, finally, four women in a half-sitting position are depicted.

Seventh Hour:
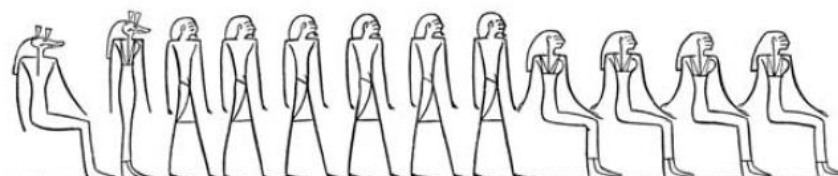**Divine Vessel (Middle Register):**
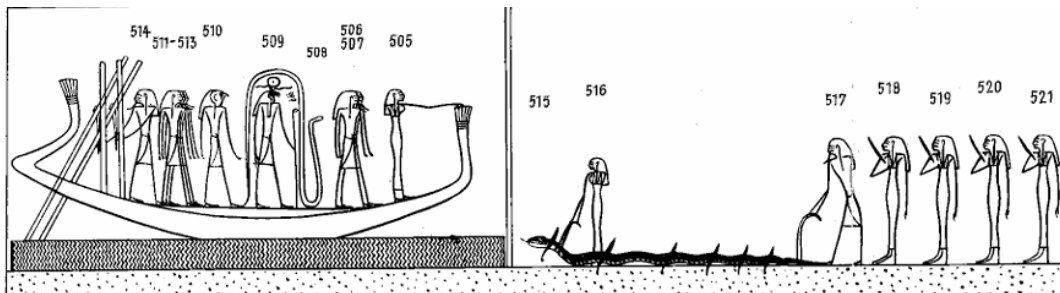
Scene 22 (After Darnell & Manassa Darnell, 2018)**:** The middle register of the seventh hour records the confrontation of the snake Apophis, the archenemy of the sun god, Re. Re, surrounded by the crew of his barque, is protected by the Mehen-snake. At the prow of the barque, Isis and the Eldest Magician, Seth, are standing. Isis is extending her arms against Apophis, who is fettered in front of the barque. Serqet, the scorpion goddess, and a male deity named "Chief-of-his-knives" are securing his bonds. Beyond, four knife-wielding goddesses are standing. The combat against Apophis combines magic (performed by Isis and Seth), lassoing (by Serqet and Chief-of-his-knives) and killing with knives (by the knife-wielding goddesses).

Echoes of the Barque:

1. **Upper Register**
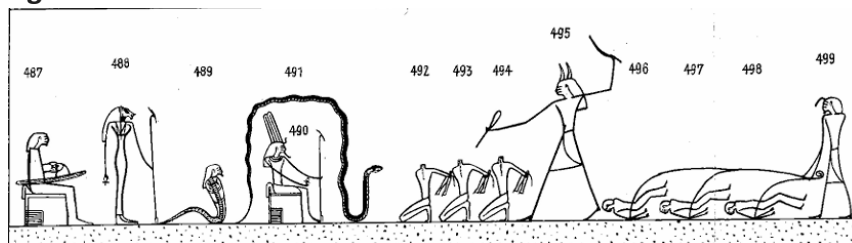
Scene 23 (After Darnell & Manassa Darnell, 2018)**:** The seventh hour starts with a seated figure who holds a magic wand (?) and a hawk head on his lap. In front of him a lioness-headed figure is represented. Then Osiris is represented seated on a throne and encircled by a snake identified as "Alive-of-forms." In front of Osiris, a god with car ears on his head, is shown chopping off the heads of the enemies of Osiris, who are represented kneeling without heads. Beyond, another deity is overthrowing three figures of enemies.

2. **Lower Register:**

Scene 24 (After Darnell & Manassa Darnell, 2018)**:** The lower register starts with a large falcon-headed figure, identified as Horus-upon-his-throne, holding the *was*-scepter and the *ankh*-sign. Facing him are twelve male deities with stars on their heads. Behind these gods, twelve
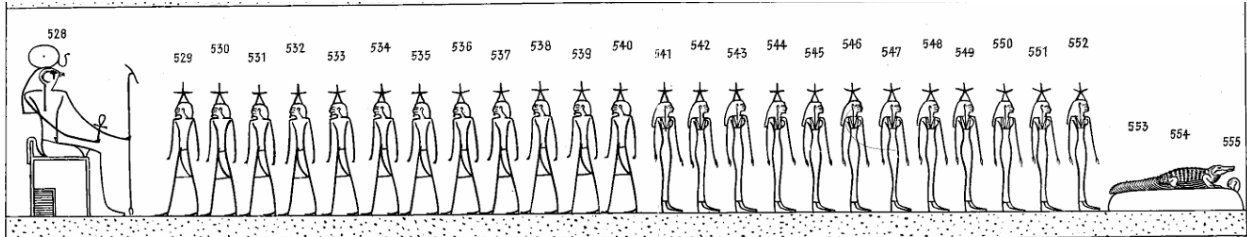
goddesses, also with stars on their heads, are looking in the opposite direction. The register ends with a crocodile on a sand mound from which a human head, head of Osiris, is coming forth.

Eighth Hour:

Art from ancient Egyptian tombs and temples provides a way to visually reconstruct ritual and mortuary activities. Sound can be directly depicted through images of singing, clapping, and musical instruments, or it may be implied in less obvious ways. Sounds in the Netherworld are of great significance for gods and inhabitants, including enemies, of the Netherworld. For example, it is the voice of the Apophis that guides the gods to him in the utter darkness of the Netherworld (Manassa, 2008). Also, the text says that the enemies are being punished in the eleventh hour of the Amduat, 'shriek.' In the Book of Gates, every time one leaves the night hours, the gate of this hour falls shut.

Divine Vessel (Middle Register):
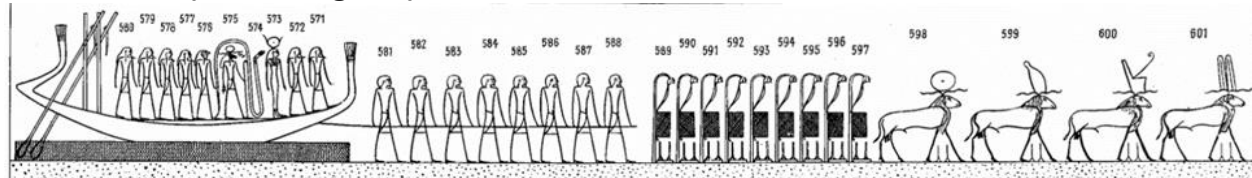
Scene 25 (After Darnell & Manassa Darnell, 2018)**:** Re, protected by the Mehen serpent, is surrounded by the crew of the solar barque, which is being towed by eight gods. Beyond this, eight *Sms* signs, each depicted with a cloth symbol beneath, are positioned in front of the towers of the solar barque. Finally, toward the end of the middle register, four rams, each adorned with a unique crown, are prominently represented.

Echoes of the Barque:

The night hour of the Amduat is distinctive in that the upper and lower registers are divided into ten separate caverns, each housing three netherworld beings. A distinctive sound comes out from each of these caverns.

1. Upper Register:

Scene 26 (After Darnell & Manassa Darnell, 2018)**:**
The sound associated with this cavern: **Swarm of honeybees.**
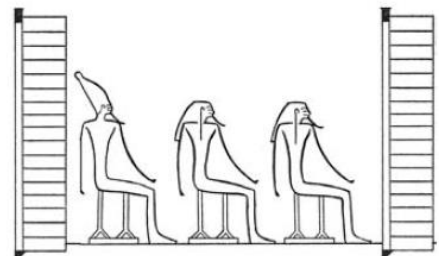
Scene 27 (After Darnell & Manassa Darnell, 2018)**:** The sound associated with this cavern: **Striking Cymbals**
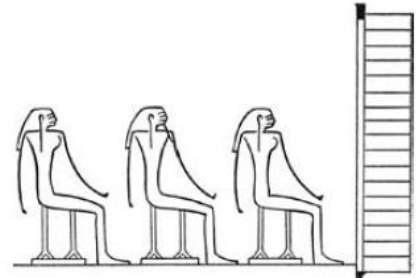
2. **Lower register**

Scene 28 (After Darnell & Manassa Darnell, 2018)**:**
The sound associated with this cavern: **The cry of the tomcat**.
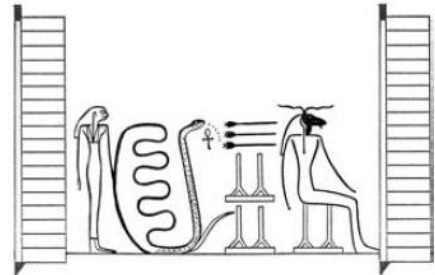
Scene 29 (After Darnell & Manassa Darnell, 2018):
The sound associated with this cavern: **The roar of the living**.
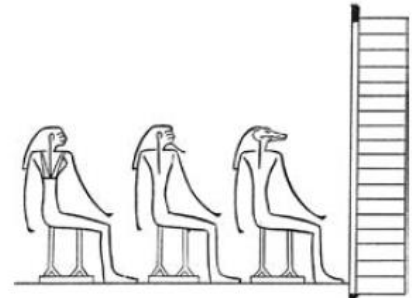
Ninth Hour
Divine Vessel (Middle Register):
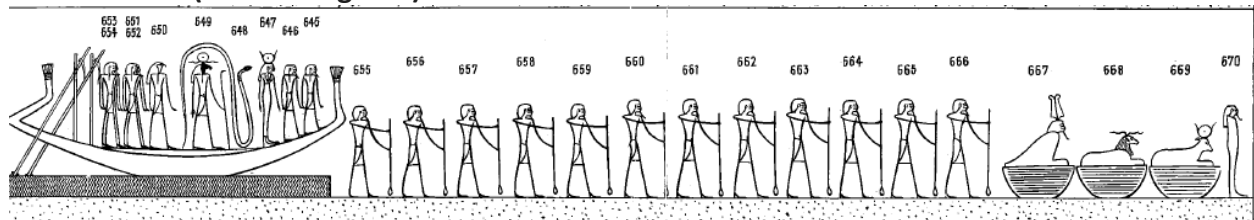
Scene 30 (After Darnell & Manassa Darnell, 2018)**:** The middle register starts with the solar barque, which contains the usual crew of Re. The barque is represented on a rectangle of water. The solar barque is preceded by twelve gods holding oars with both hands. The text says that these are the crew of the sun barque "who row the One within the Horizon, so that he might rest in the eastern portal of the sky. What they do in the Netherworld is row Re at this locale daily" (Darnell & Manassa Darnell, 2018).

Echoes of the Barque:
  1. **Upper Register:**
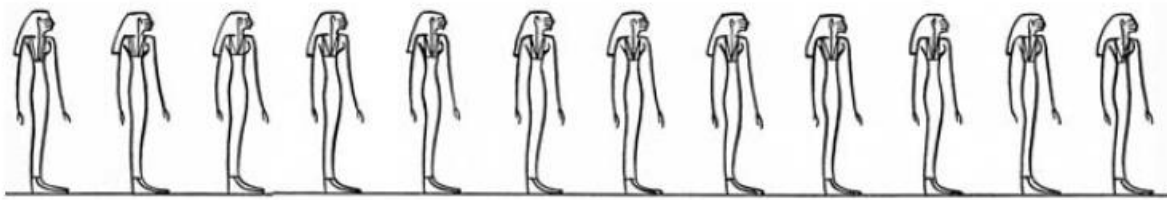
Scene 31 (After Darnell & Manassa Darnell, 2018)**:** Twelve goddesses, without attributes, are occupying the second half of the upper register. These are the goddesses "who raise up life and well-being at the appearance of Him (i.e., Re) of the Netherworld, when he greets the Netherworld, day after day. These are the goddesses walking in the following of Osiris when he has entered the Netherworld" (Darnell & Manassa Darnell, 2018).
  2. **Lower Register:**
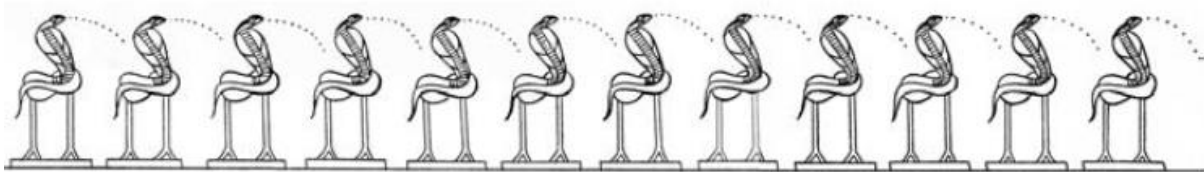
Scene 32 (After Darnell & Manassa Darnell, 2018)**:** The lower register starts with twelve fire-spitting uraei seated on the signs for cloth. They illuminate the darkness in the rooms that contain Osiris. By means of the flame that comes out from their mouth, slaughter is performed in the netherworld daily. They also repel every serpent in the earth, even those whose forms are not known to Re (Hornung & Abt, 2007).

Tenth Hour:
Divine Vessel (Middle Register):
Scene 33 (After Darnell & Manassa Darnell, 2018)**:** The solar barque is occupied by the usual crew, with Re standing in the middle, protected by the Mehen-serpent. Before the solar barque, two goddesses crowned with the red and white crown flank a double-headed serpent, which is also crowned with the red and white crown. The serpent is represented with four legs and it carries a hawk, which is identified as the "*ba*-soul of Sokar." The following is a falcon-headed serpent in a divine barque whose prow and stern are in the form of a papyrus bundle. Then twelve gods are represented. They are arranged into three groups of four. The first four deities have their heads replaced with sun discs. The remaining eight are humanoids. The first group is holding arrows,
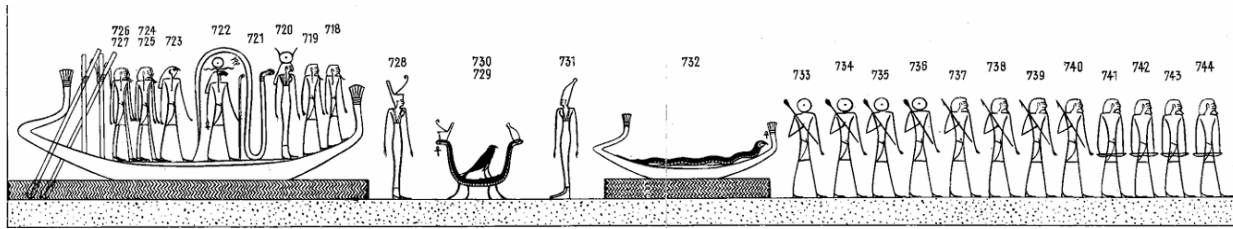
the middle group is holding spears, while the last group is holding bows. These gods repel Apophis so that Re in the utter darkness can pass into the eastern horizon.

Echoes of the Barque:

1. **Upper Register:**
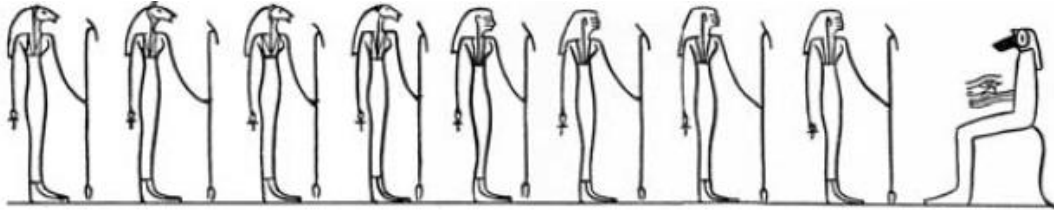
Scene 34 (After Darnell & Manassa Darnell, 2018)**:** Eight goddesses are represented: the first four are lioness-headed while the other four are humanoid. They are all holding the *was*-scepter. Facing them is a baboon seated on a throne while carrying the *wedjat*-eye on his lap. These goddesses are "those who salute Horus, who came into being to cause manifestation to become" (Hornung & Abt, 2007).

2. **Lower Register:**
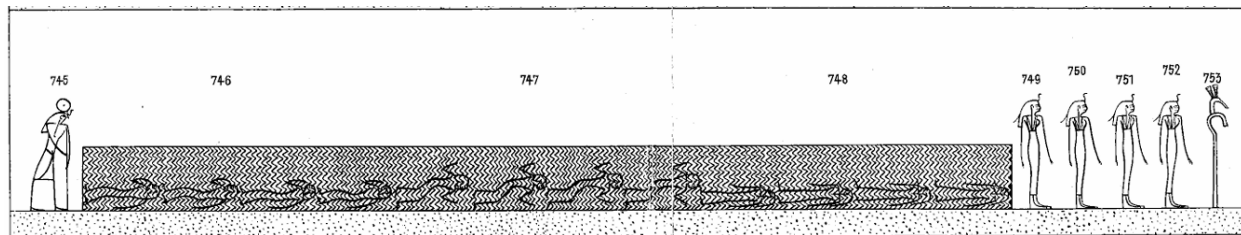
Scene 35 (After Darnell & Manassa Darnell, 2018)**:** The lower register starts with a representation of the falcon-headed Horus leaning on a staff. In front of him, twelve figures are floating in the water. These are representations of the blessed dead in the Netherworld. The texts distinguish them and identify each group with a distinctive designation. The first "drowned ones in the Netherworld," "the upturned ones in the Netherworld," and "those who are stretched out in the Netherworld." The register ends with four standing goddesses with uraei on their heads. In front of them a HoA-sceptre is depicted. These goddesses illumine the road for Re in the utter darkness.

Eleventh Hour:

Divine Vessel (Middle Register)

Scene 36 (After Darnell & Manassa Darnell, 2018)**:** God Re is surrounded by the crew of his barque, which sails over a rectangle of water. The barque is preceded by twelve gods carrying a serpent over their heads. Each deity is carrying two coils of the serpent on his head while supporting the
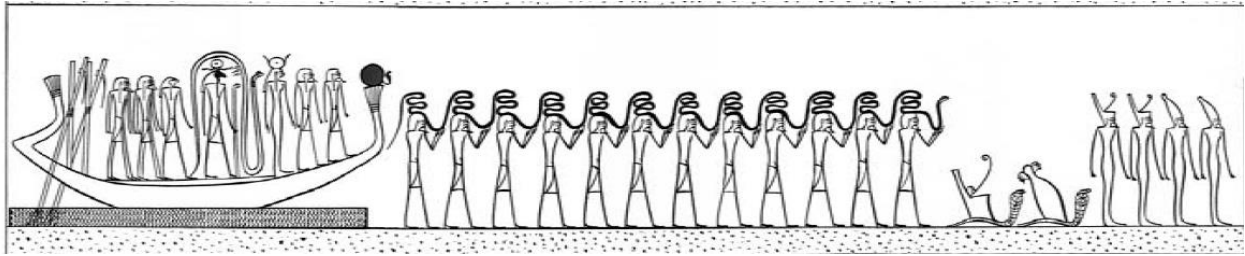
body of the serpent with his raised arms. According to the text, what they do in the Netherworld is put the Mehen serpent on its way.

Echoes of the Barque:

1. **Upper Register:**
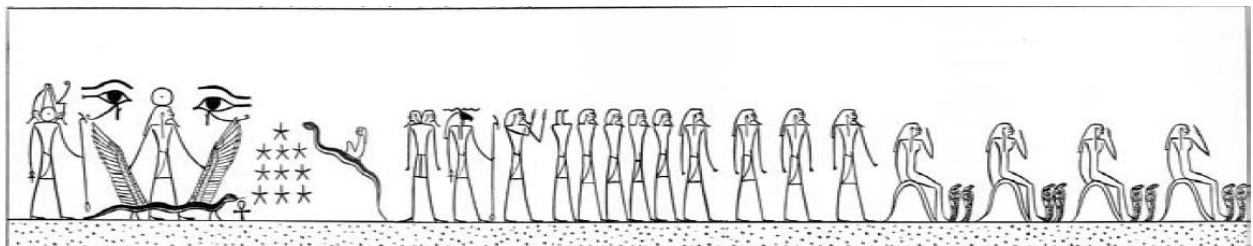
Scene 37 (After Darnell & Manassa Darnell, 2018)**:** A double-headed deity is crowned with the red and the white crown and holds the *was*-sceptre. He is identified as "Lord-of-eternity" and does not leave his place in the Netherworld. Then, Atum, with a disc on his head, is holding out the wings of a legged serpent. A large *wedjat*-eye is represented above each wing of the serpent wings.

2. **Lower Register:**

Scene 38 (After Darnell & Manassa Darnell, 2018): The entire lower register shows the punishment of the enemies of Osiris by the command of his son Horus, who is standing on the far left of the register leaning on a staff. The following is a fire-spitting serpent standing on its tail. This serpent is identified as "He-who-burns-millions." The following are six traps containing enemies or parts of enemies. Five of these traps are attended by fire-spitting goddesses brandishing their knives. The last of these traps, left unattended, contains upside-down figures. Being upside-down in the Netherworld was an abomination of the deceased (Frandsen, 2011). The following are four goddesses, each with the sign for desert on her head. Finally, the register ends with a male facing left and holding the *was*-sceptre and the *ankh*-sign.
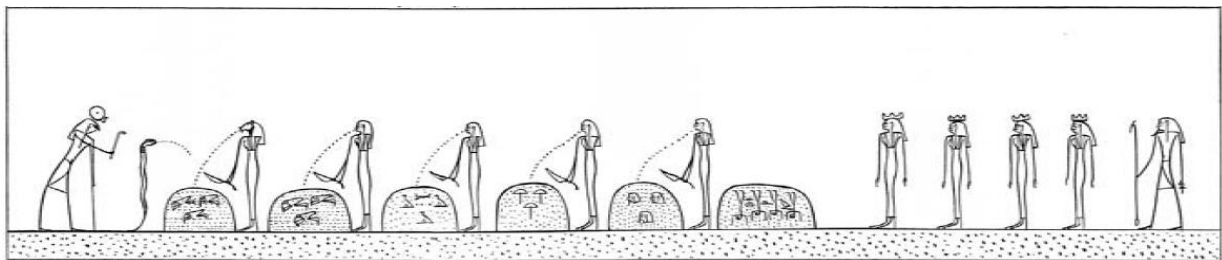
2- Modern Technologies Applications

The utilization of modern technological applications significantly contributes to the preservation of tangible heritage, preventing its erosion over time. Moreover, users of these technological applications enjoy immersive experiences (Fadli et al., 2022). The preservation of cultural heritage serves as a powerful incentive to explore the possibilities offered by digital technology (Poulopoulos & Wallace, 2022). AR not only prevents the physical deterioration of cultural and archaeological sites, exacerbated by mass tourism exceeding physical capacity, but it also provides a wealth of information for acquiring historical knowledge while adding enjoyment (Jung & tom Dieck, 2018).

Archaeological artifacts and inscriptions in Pharaonic tombs are integral to Egypt's tourism identity. Consequently, digital technologies provide an advanced form of data processing for preserving cultural heritage (Fadli et al., 2022). Information and communication technology applications, such as augmented reality, virtual reality, mixed reality, and holography, can enhance the digital environment of the tourism industry and promote smart tourism, aiming to develop tourist experiences through a range of interactive applications (Ceccarini & Prandi, 2019). Cultural tourism is a promising application area for augmented reality, offering significant potential to enhance benefits for destinations, tourists, citizens, and businesses, as well as preserving cultural identity (Khalil, 2014)

AR has the potential to enhance tourist engagement and motivation to explore historical and cultural sites. AR excels at explaining abstract and complex concepts by visualizing intangible objects in three-dimensional models, thereby facilitating comprehension (Han, et al., 2019). AR has been defined as "an application that complements the real world with computer-generated virtual objects that appear to coexist in the same space as the real world" (Azuma et al., 2001, p. 34). AR blends reality and imagination in a three-dimensional interactive environment, allowing users to interact with both the virtual and real worlds simultaneously (Dargan, 2023). AR enriches our physical world by overlaying it with a layer of digital information, such as audio, video, or graphics, altering our perception of reality through computer-generated visuals to enhance user experience (Barbier et al., 2017). AR technologies rely on creating a new scene that is perceived sensorially through a combination of visual and auditory effects and cannot be physically touched (Wei, 2019)..

AR technology can enhance the tourist experience by providing access to vital information, increasing awareness of the visited location, and elevating user satisfaction (Bertocci, et al., 2023). AR, when used correctly, can transform how visitors perceive and experience a destination. It is an excellent way to share knowledge and data in a new, exciting, and engaging manner (Department for Business, Enterprise, Technology and Science, 2014; Khalil, 2014). AR applications benefit the tourism sector by raising travelers' social awareness of their surroundings and helping them gain a better understanding of historical roots in a simple way (Trunfio et al., 2022).

The use of AR in tourism offers numerous advantages and challenges. Benefits include on-site information provision, displaying objects and buildings with historical or ethnographic data, offering virtual tours, and enabling participation in multimedia experiences. The primary challenge is how to make the technology invisible and inclusive enough not to hinder the experience of visiting a site. The technology should enhance the experience, not replace or compete with it (Jacob & Nóbrega, 2021). AR has immense potential in a wide range of tourism

sectors. Through a vast array of options, AR can provide tourists with additional enhanced digital information on any subject, making complex information easier to understand and making the tour more engaging (Griffith, & Alpert, 2022).

AR applications for cultural tourism can be categorized as follows (Khalil, 2014):

- **Fixed augmented experience:** Implemented through a 3D or 4D visualization system and other computer data such as sounds or graphics.
- **Mobile augmented experience:** Through AR applications, the camera is directed at a building or tourist attraction to read its name, construction date, and other information. This enables users to explore the world by adding new layers to their reality, resulting in an interactive and dynamic experience that allows for the revival of historical life and events."

The development and design of innovative tourism products is particularly complex due to the multiple levels that need to be considered throughout the development process. Unlike other sectors where producers can primarily focus on generating physical or intangible product components, tourism product development must consider both types of components. Given the emerging demands of tourists and the need for destinations to differentiate their offerings from direct competitors, providers must also ensure that the available products are perceived as rich and distinctive experiences (Brunner-Sperdin & Peters, 2009). A tourism product based on the use of technology to revive and embody heritage can be viewed as a creative derivative, which can be defined as cultural and creative products inspired by original works of art, such as paintings, sculptures, and designs. Creative derivatives encompass a wide range of products (Shen, et al., 2024) that combine aesthetic, artistic, and functional aspects. Innovative tourism products with cultural value can shape tourists' cultural concepts and transform products into cultural media (Jiang, et al., 2022).

Common characteristics of innovative cultural products (McKercher & Du Cros, 2003)**:**

- **Visual appeal:** This can be recognized through the main senses such as sight, hearing, taste, and touch, all of which enhance customer satisfaction and generate visitation intentions .
- **Entertainment:** This reflects customers' interest in the dramatic features of the product (Han, et al., 2021).
- **Human elements:** Refers to the shared values, beliefs, and history of people.
- **Humanities:** Includes fields such as philosophy, literature, history, and arts.
- **Cultural and creative design:** The application of design principles to products that reflect cultural identity.
- **Product significance:** The meaning and message carried by the product and its impact on the buyer.

Components of a Complete Work of Art applied to the Amduat:
- **Artistic language:** This refers to the formal structure, consisting of colors, lines, and inscriptions.

- **Artistic image:** This refers to the internal structure of the work and the embodiment of the aesthetic image of the scenes.
- **Artistic suggestion:** This includes various symbols and connotations.
- **Defining story elements:** Selecting the most appealing elements from the Amduat to embody in the tourism product.

Designing User Experiences: Visualization of the Night Journey (Amduat)

Experience design: Designing a comprehensive tourist experience that relies on smart technology. Design involves combining elements from the environment and arranging them in a specific configuration to create something that has a function or meaning through the planning of elements and interactive systems (Neuhofer, 2014). There has been a growing interest in developing cultural and creative product design. To design an innovative cultural product, numerous historical and heritage elements must be considered, but it is essential to summarize and refine the important information and elements for cultural and creative design and use them reasonably in the design. This can enhance the significance of cultural and creative product design (Wu, 2021).

In the age of information and digitalization, significant changes have occurred in design methods, and smart design approaches have become a trend. Through smart design, the programmer must identify project requirements, and AR can realize the conceptualized design of cultural and creative products in a virtual environment. With the support of technology, the speed of designing cultural and creative products has increased significantly. Smart design, virtual design, and 3D printing have increased the efficiency of design processes (Neves, 2023)

The researchers have suggested several locations to introduce the innovative tourism product (embodying the Night Journey), including:

1. **Pharaonic Village in Cairo:** This is because it offers a living representation of ancient Egyptian life. Embodying the Night Journey would be a development and integration of what the Pharaonic Village currently offers. It also has a waterway that can be used for tourists to move during the journey and pass through the gates.
2. **One of the royal tombs:** This is due to the availability of original texts and inscriptions of the scenes of the Amduat
3. **A design in the form of a solar boat:** Constructing a solar boat in the Valley of the Kings among the mountains and using it to embody the Amduat, with the use of heights to display the journey.

The development of new tourism products should rely on the characteristics of destinations that give unique features to the developed tourism products (Estevão et al., 2018). Additionally, the introduction of an innovative tourism product requires cognitive, imaginative, relational, and integrative skills (Ratten et al., 2020). To provide a comprehensive tourist experience, a set of key features must be available when applying augmented reality: content, presentation, function, and interaction (Han et al., 2018), while Nóbrega et al. (2018) consider the necessity of a narrative to enhance the value of the innovative tourism product.

Amduat as a comprehensive tourist experience:

Firstly: Content Visual content includes various scenes, landscapes, terrains, and events in a logical sequence. Time plays a fundamental role in changing scenes and events according to the texts of Amduat.

Secondly: Shows In an augmented reality environment, the user is presented with a real-time view that is artificially enhanced with information generated and imposed by a specific computer system, such as digital images, video clips, text, sound, GPS location data, haptic feedback, and other similar information (Fadli et al., 2022), providing a real-time 3D view and visualization of historical places (Panou et al., 2018). The researchers suggest that the presentation should be centered around a solar boat with Re at its center, with the journey starting from the western direction. Different characters in the scenes should be embodied in 3D forms, with the characters moving according to the script of the show, using artificial intelligence applications. The necessary sound and light effects should be added to achieve complete immersion for tourists. Khalil (2014) emphasized the importance of the duration of the presentation, the efficiency of AR technology, and the content in the success of augmented reality applications in cultural tourism.

Thirdly: Interaction Immersion and interaction are essential components of augmented reality experiences. In a narrower sense, since visual inputs take precedence over other senses, immersion refers to the visual component of the experience being the ultimate sensory outcome of augmented reality. A fully immersive augmented reality experience engages all our senses and enables natural interaction with the augmented environment—just as we do in the real world (Fadli et al., 2022). Therefore, the researchers suggest providing a number of points during the hours of the nocturnal journey to create interaction between users and the presentation, in addition to the possibility of producing an electronic application for the nocturnal journey, where the user overcomes a set of challenges to be able to continue the journey on the application. Ganapathy (2012) emphasized the importance of interaction, immersion, and participation as part of enhanced tourism experiences.

Fourthly: Narrative Narrative can help tourists better understand history and culture, create tourist interest, and give a new meaning to the destination. The proposal is based on a presentation scenario based on the narrative of the nocturnal journey. This narrative reaches users through scenes and interactions between components, with the provision of background audio comments to explain events without detracting from the presentation or reducing the full immersion of users. Performance should be improved based on visitor experience, aiming to provide a richer tourism product/service for the tourist while preserving the existing product (Fadli et al., 2022).

Methodology and data analysis

A descriptive-analytical approach was adopted to describe and analyze the scenes and events depicted in the Amduat. Additionally, a design-based research methodology was employed, combining theoretical and applied research to design an innovative tourism product. This methodology aligns with research practices in applied fields, where products are designed for specific purposes (Zeng, 2015). The following steps are involved:

1. **Exploration Phase:**
   - Reviewing literature related to the Amduat, cultural tourism, augmented reality, and artificial intelligence.
   - Conducting interviews with experts in Egyptology, tourism, augmented reality, artificial intelligence, and drama, theater, and arts.
   - Analyzing similar experiences in the field of interactive tourism.

2. **Design Phase:**
   o Designing an interactive experience scenario based on the narrative of the Amduat.
   o Identifying the interactive elements to be used (such as interactive games, illustrated stories, and augmented reality).
   o Designing the dramatic and interactive visualization of the proposed tourism product.

The design-based research methodology also includes other stages—beyond the scope of this current research—such as the development phase, which involves building a prototype of the final application or product using appropriate tools and software and testing the prototype with a group of users to obtain their feedback and suggestions. Additionally, there is the evaluation phase, which involves assessing the effectiveness of the prototype and measuring user satisfaction with the experience.

Research Population and Sample A snowball sampling technique was adopted for data collection as it is particularly suitable for revealing information; researchers ask some participants to help recruit the rest of the sample (Parker, et al, 2019). Therefore, it is suitable for a project to embody the Amduat using augmented reality applications. According to MCLafferty (2004), experts are asked about their perceptions, opinions, beliefs, and attitudes towards a new idea with qualitative analysis rather than statistical data. Given the importance of involving various stakeholders at all stages of new product development, The researchers conducted 44 personal interviews, including 11 interviews with heritage specialists (including Egyptologists), 14 interviews with tourism and tour guide specialists, 9 interviews with technology and augmented reality specialists, and 10 interviews with arts specialists. Each interview lasted an average of 25 minutes. These interviews were conducted between August 1 and November 30, 2024. The researchers relied on semi-structured interviews and divided the interview time into several parts as follows:

- **Introduction and explanation phase:** The researchers present the research idea.
- **Arousing interest phase:** The researchers ensure the interviewee's interest in the research idea.
- **Discussion phase:** The idea, implementation location, design, and the most important required resources, strengths, and challenges are discussed.
- **Phase 4: Redesign:** The proposed framework for the journey to the underworld is redesigned in light of the opinions of experts from the research sample.

To achieve the research objectives, the researchers designed a set of ten open-ended interview questions. The responses of the sample members were analyzed using content analysis. This involved grouping similar responses and then ranking them based on the frequency of occurrence among respondents. The results of the content analysis of the interviews are presented in the following table:

Table (2) Interviews content

Arts experts	Tourism and tour guiding experts	IT specialists	Cultural heritage specialists
What is your overall evaluation of the idea of using augmented reality technology to visualize the Amduat night journey as a tourism product?"			
- A highly innovative idea that opens new horizons for presenting ancient Egyptian heritage. Augmented reality can transform a museum into an interactive theater, allowing visitors to feel like they are part of the story. -I see this technology as a means to invigorate and broaden the appeal of visual arts, particularly among younger audiences. - It is important to exercise caution to ensure that excessive use of technology does not overshadow the artistic essence of the experience. There must be a balance between technology and the human element.	-This is a highly innovative concept that can attract a new type of tourist interested in both history and technology. It can make the tourist experience more interactive and exciting. The implementation of this project should be approached with caution, bearing in mind that tourists come to Egypt to experience authentic antiquities. Augmented reality should complement the real experience, not replace it. - This project may face cultural and religious challenges, and we must be careful to present accurate and respectful information about ancient Egyptian beliefs.	-This is a very creative concept that is well-suited to the current trends in interactive tourism. Augmented reality has the potential to offer tourists an immersive and engaging experience, making them feel like they are part of the narrative. - This is a fantastic opportunity to implement cutting-edge technologies in the realm of cultural heritage. By employing techniques such as image recognition and 3D scanning, we can develop a highly authentic experience. -I anticipate substantial technical hurdles, but with proper planning and sufficient investment, we can produce extraordinary outcomes	- A fantastic opportunity to offer a unique experience for tourists and introduce them to ancient Egyptian heritage in an innovative way. -There may be challenges in preserving the historical accuracy and symbolic significance of ancient Egyptian beliefs. - It is essential to find a balance between creativity and reverence for heritage while steering clear of excessive simplification.
What are the most suitable locations for implementing this project, and what are the justifications for these choices?			
-Large spaces that allow for freedom of movement and dim lighting, such as large halls or theaters, can create an immersive and engaging atmosphere. Valley of the Queens would be an	- Sites that merge technical and cultural aspects, suggesting locations that attract tourists and provide a suitable environment for the experience. They may propose restored and equipped funerary	- Sites that provide a robust technological infrastructure, such as modern museums or cultural centers equipped with high-definition screens and advanced sound systems are justified by	- Sites with connotations related to the afterlife in ancient Egyptian civilization, such as halls used for burial rituals, Valley of the Kings or Valley of the Queens are

excellent place to carry out the project.	temples to accommodate visitors, or multimedia display halls within museums.	the need for an environment that enables the delivery of a high-quality digital experience.	proposed. The rationale behind this choice is that these locations would imbue the experience with authenticity and realism, allowing visitors to better visualize the journey of the deceased.
What is the suggested duration for the nighttime tour that tourists will undertake as part of this project?
- An evening event, incorporating lighting and sound effects to produce an immersive environment. A duration of 45 minutes to an hour is proposed, with the option for multiple showings.	- A flexible schedule that caters to the preferences of tourists at different times of the day, providing a variety of options for diverse tourist groups. A duration of 30-45 minutes is proposed	- Flexible timings that accommodate visitor schedules, whether day or night, are suggested. This allows for a pleasant and seamless experience regardless of the time. A duration of 20-30 minutes is proposed, with the possibility of customizing the experience for each visitor.	-An evening event, possibly in the late hours, to approximate the darkness and mystery associated with the afterlife. - A duration is approximately 30-45 minutes, with the possibility of extension based on the complexity of the narrative.
What is the significance of the Amduat journey in ancient Egyptian beliefs, and how can augmented reality enhance tourists' understanding of this importance?
The Amduat journey is a symbolic representation of the cycle of life and death in ancient Egyptian civilization. Augmented reality can make this journey tangible and sensory, helping visitors to comprehend the profound meanings embedded within it. - Augmented reality can offer an immersive experience that allows visitors to explore the ancient Egyptian underworld	The Amduat journey is a fundamental component of ancient Egyptian beliefs, offering profound insights into the Egyptians' conceptions of the afterlife. Augmented reality can render these beliefs more tangible and vibrant. - Information about the Amduat journey should be presented in a simplified and clear manner, avoiding complex theological terms. Augmented	- As a core component of ancient Egyptian belief systems, the Amduat journey can be made more accessible through augmented reality. Animated visualizations and interactive elements can be used to decipher the symbols and texts associated with this journey. - Augmented reality can enhance the interactive nature of this experience. For instance, tourists could	-The Amduat journey represents the journey of the sun god Re through the afterlife. -Augmented reality can provide tourists with a tangible experience of this journey, offering a glimpse into these ancient beliefs.

interactively, making learning more enjoyable. - It is imperative that we avoid reducing the experience to a mere visual display. Instead, we should concentrate on transmitting the spiritual and philosophical significance inherent in this journey.	Reality can facilitate the understanding of these intricate concepts. - The focus should be on the aesthetic and artistic elements of the Amduat journey, as augmented reality can showcase the magnificence of ancient Egyptian art.	interact with the characters depicted in the journey, or select different paths to explore the underworld. - Through the utilization of big data and analytics, we can tailor the experience for each tourist, considering their specific interests and existing knowledge.	
What are the technical and artistic challenges that may arise when implementing augmented reality to visualize Re's journey through Amduat?			
A primary challenge is maintaining the artistic and creative quality of the experience. The animations and sound effects must align with the aesthetic of ancient Egyptian art. -Creating an immersive and interactive experience necessitates sophisticated technical capabilities, along with a profound knowledge of ancient Egyptian culture. - It is essential to recognize that not all visitors are technologically proficient; therefore, the experience must be easy to use and self-explanatory.	- A delicate balance between historical authenticity and technical realism is essential. A complete and precise reconstruction of the ancient Egyptian underworld may prove difficult. - The experience should be user-friendly and suitable for all age groups. Any elements that may frighten or disturb tourists should be avoided. - The experience must be accessible and appropriate for visitors of all ages. It is crucial to avoid any content that could be frightening or upsetting.	-One of the greatest challenges is creating accurate and intricate 3D models of the ancient Egyptian underworld. Additionally, we must ensure that the experience runs smoothly on a variety of devices. -Creating an intuitive and accessible user interface is another challenge, enabling tourists to navigate the experience effortlessly.	-The precision of recreating the scenes, colors, and symbols depicted in the ancient texts. - Creating a user-friendly and intuitive interface designed for tourists. -Providing an immersive experience without sensory overload. - Ensuring compatibility with various smart devices. .
How can we ensure the historical and symbolic accuracy of the nocturnal journey in the Amduat when using modern technology like augmented reality?			
- Close collaboration with archaeologists and Egyptologists is essential to ensure the accuracy of all details.	- Experts in Egyptology should be consulted to review all aspects of the project and ensure its accuracy.	- A close collaboration with Egyptologists is essential to guarantee the precision of all details. Authentic historical sources can	-Consulting with experts in Egyptology is crucial for reviewing the content and design of the experience.

- Hieroglyphs and traditional Egyptian colors can be utilized to create an authentic atmosphere. - A comprehensive interpretation of the symbolism and significance of each element within the experience must be offered.	- Comprehensive documentation of all sources used in the creation of the experience should be maintained. - Additional information should be provided to tourists regarding the historical and religious origins of the Amduat journey.	serve as a foundation for our work. -Techniques such as photogrammetry and 3D scanning can be employed to create accurate 3D models of archaeological sites. - It is imperative that we handle the original symbols and meanings with care, offering precise explanations for all components of the experience.	-The narrative should be grounded in trustworthy and verifiable sources. - The original symbols and meanings must be handled with care, avoiding any misinterpretation. -Providing additional information to tourists about the historical origins of the experience is essential.
What are the potential impacts of this project on cultural tourism in Egypt?			
-This project can attract a new audience of young people interested in technology and the arts. - It can enhance Egypt's position as a leading cultural tourism destination. - It can contribute to the preservation and dissemination of Egypt's cultural heritage to future generations.	- This project can attract a new segment of tourists interested in both technology and history, thereby contributing to the diversification of Egypt's tourism product. - This project can enhance awareness of Egypt's cultural heritage among both domestic and international tourists. - Effective promotion of this project is essential to attract the maximum number of tourists.	- This project has the potential to position Egypt as an even more attractive tourist destination, particularly for those interested in history and culture. - It can stimulate the local economy by creating new job opportunities in technology and tourism sectors. - This project can help preserve Egypt's cultural heritage and promote a deeper understanding among the youth.	-Attract more tourists interested in history and archaeology. -Enhance Egypt's position as a leading cultural tourism destination. -Stimulate interest in ancient Egyptian culture among younger generations. -Create new job opportunities in the tourism and technology sectors.
What proposals do you suggest to ensure the success of this project and attract the maximum number of tourists?			
- The experience should incorporate an interactive component to enable visitor participation in the narrative. - Workshops and educational events can be organized to	- Collaboration with travel agencies and hotels is essential to integrate this experience into their tour packages. - Interactive events and workshops related to the project should be organized to attract more visitors.	- A comprehensive marketing campaign utilizing social media and other media outlets is necessary to promote the project. - We can collaborate with airlines and hotels to offer special packages for tourists interested in	-Intensive promotion of the project through social media and various media channels. -Collaborating with tourism companies and hotels to integrate the

complement the experience. - Collaboration with musicians and performers can provide live performances to enrich the experience.	- Competitive pricing should be implemented to attract tourists.	the augmented reality experience. - Developing mobile applications can enable tourists to access the experience anytime, anywhere.	experience into their programs. -Organizing interactive events and workshops related to the project. -Providing a tailored experience for children and families.

As evident from the content analysis of the sample responses in Table (2), participants emphasized the significance of responsible use of technology applications in preserving Egyptian heritage, raising awareness among future generations, and enhancing the immersive experience for tourists. This aligns with the findings (Yu, & Yao, 2023; Georgopoulos et al., 2017; Khalil, 2014; Fadli et. al., 2022). Regarding the importance of designing an innovative tourist product based on the Book of Amduat, respondents stressed the need to consider that tourists visit Egypt to experience real antiquities. Augmented reality should complement the real experience, not replace it, a finding that is consistent with Jacob and Nóbrega's study (2021). Moreover, participants highlighted the importance of balancing the preservation of cultural and historical values with the utilization of the latest technologies to provide a unique and innovative experience.

Regarding the most suitable locations for implementing the proposal, respondents emphasized the importance of selecting a site that carries connotations associated with the afterlife in ancient Egyptian civilization. It was also essential that the proposed site be sufficiently spacious to facilitate the movement of tourists, while providing a suitable environment for the experience. Both arts experts and heritage specialists (including Egyptologists) agree that the Valley of the Queens meet these criteria.

Regarding the proposed duration of the experience, experts have agreed that it should last between 30 and 45 minutes. This duration will allow for a focus on the key scenes and events of the nighttime journey while omitting secondary scenes. Concerning expert suggestions for improving the proposal, they emphasized the need for clear explanations of the symbols and underlying meanings behind each element of the experience, in addition to ensuring that the animations and sound effects align with the artistic style of ancient Egypt. Furthermore, they highlighted the importance of creating interactive elements to enhance the visitor's experience and make it truly unique.

When it comes to the technologies proposed for implementing the nocturnal journey project, IT experts emphasized the need for a multifaceted technological approach. They highlighted the necessity of employing 3D modeling techniques to construct realistic representations of locations and individuals. Furthermore, augmented reality technologies were deemed essential to seamlessly blend the real and virtual worlds, creating a more immersive experience. Additionally, artificial intelligence was proposed to generate dynamic and interactive content.

In light of these expert insights, the nocturnal journey project was redesigned, and the final proposed framework is presented in Table (3)

Table (3) Proposed Tourism Product Framework: Nigh Journey

	Storytelling	Visual effects	Sound effects	Kinematics and rhythm	Special effects	Technologies	Immersive experience
The beginning of the journey	The journey of the solar barque through the netherworld is imbued with profound religious and philosophical significance. Upon entering the realm of the dead, the deceased passes through a massive portal and then he is welcomed by baboons. Aboard the solar vessel, accompanied by the sun god Re, the deceased traverses twelve hours, each presenting unique trials and tribulations.	**Dark and somber colors** reflecting the darkness of the underworld.. **Dim and intermittent lighting,** with the focus on a massive portal and the netherworld deities. **The use of ancient Egyptian symbols** such as the Solar Eye, the feather of Maat, and other symbols related to death and the afterlife.	**Sounds of the Wind:** Whispering winds across the sands, creaking sounds of ancient doors, and faint footsteps. **Background Music:** Slow-paced, melancholic ancient Eastern music to evoke a sense of fear and mystery.	**Camera Work:** The camera zooms in on the portal, with lighting effects highlighting the intricate details and carvings of the portal. A slow, haunting musical score accompanies heavy footsteps and echoing sounds. **Sound Design:** To provide an immersive audio experience, the sound appears to come from all directions.	**Tactile Effects:** When touching the portal, the user experiences the coolness of the stone and the roughness of the carvings.	Facial recognition technology will be used to greet each visitor by name, providing a personalized experience. 3D projection screens will display animated visuals of the portal gradually opening, accompanied by synchronized sound and lighting effects. A multi-channel sound system will be implemented to create an immersive auditory experience, simulating the sensation of sound emanating from all directions.	▢ **Choosing the Path:** The user can choose one of three doors, each with its own unique challenges and rewards. ▢ **Solving Puzzles:** The user may need to solve a simple puzzle to open the gate, or select a specific symbol from a set of symbols.
First Hour	The journey commences with the solar barque's arrival in the realm of darkness. Surrounding the vessel are deities, guarding the gateway to the afterlife. Re, the solar deity and the traveler in the form of Re, embarks on his arduous journey across the celestial Nile, accompanied by his divine crew. At this hour, they encounter their initial trials, passing						

	through portals adorned with fearsome imagery.						
The Second Hour	The vessel continues its voyage, encountering tempestuous storms and fathomless waters. Re's adversaries manifest, seeking to impede his progress. The crew of the barque intervenes to defend their deity, employing their divine powers to repel the foes.	A palette of blues and deep blues is employed to represent water. Undulating lighting effects mimic the movement of water, while the use of shadows creates an atmosphere of mystery. Symbols associated with water and the Nile, such as the crocodiles, are incorporated into the design.	Sounds of Nature: The rushing of water, the nocturnal calls of birds, and the rustling of leaves **Background Music**: A serene aquatic melody, accompanied by the soothing tones of the flute and harp	The camera glides seamlessly alongside the boat, the water's surface rippling and the sky's luminosity shifting in time with the stars' dance. A tranquil, aquatic soundtrack gradually builds in intensity, punctuated by the soft whisper of wind and the steady rhythm of oars	**Motion Effects:** Users will experience the sensation of the boat's movement on water and its vibration as it encounters waves. **Wind Effects:** Fans will be used to create a sense of strong winds, particularly when simulating storms **Humidity Effects:** A fine mist of water will be sprayed to enhance the feeling of being on a boat	**Augmented Reality Glasses:** To display 3D images of stars and planets, allowing for interactive exploration. **Motion Sensors:** To synchronize the movement of the boat with the movements of the tourist, enhancing the sense of realism. **Ventilation Systems:** To generate cool, humid air, mimicking the ambiance of sailing.	**Steering the Boat:** The user can direct the boat towards various stars or planets, each direction offering unique rewards or penalties. **Interacting with Characters:** The user can converse with mythological figures appearing on the boat, such as Anubis or Isis, to receive guidance or information.
The Third Hour	The solar barque, joined by three distinct barques, is followed by gods symbolizing boundaries and floodwaters. The	A chromatic palette dominated by hues of red and orange to symbolize fire	**Sounds of the Beasts:** The sounds of jackals, mourning, and	Quick, jarring camera cuts highlight the dramatic confrontations between Ra	Thermal Effects: Employing heat lamps to induce a sensation of	Vibration systems: To induce a sense of fear and terror through simulated ground	**Weapon Selection:** The user can choose a weapon from Ra's arsenal, each with

	registers depict diverse deities, including Khnum, Osiris, ibis-headed gods, mourning goddesses, and reverent figures. Also in this hour, enemies of Re are being ground and defeated.	and imminent peril, while darker tones are employed to evoke a pervasive sense of dread and foreboding.	the howling of storms. **Background Music:** Dramatic music with a fast tempo and harsh sounds to reflect the conflict.	and the inhabitants of this hour. The score is a pulse-pounding composition, enhanced by the primal roars of the creatures and the percussive impact of combat between Re's enemies and the gods defending him.	extreme heat during combat. Seismic Effects: Generating seismic feedback to simulate the impact of creature attacks. Aromatic Effects: Employing noxious odors to symbolize monstrous entities	vibrations, particularly when monstrous entities appear. Dynamic lighting: To create an atmosphere of horror and excitement through sudden and unexpected changes in color and illumination. Immersive audio: To pinpoint the exact location of monstrous creatures, thereby intensifying the sense of peril.	unique strengths and weaknesses. **Offensive and Defensive Maneuvers:** The user can control Ra's movements and attacks to defend himself against monsters
The fourth hour	In the fourth hour of the *Amduat*, Re transforms his barque into a fire-breathing snake to navigate Sokar's desolate realm, guided by his voice	**A chromatic scheme characterized by muted, parched tones to mirror the stark beauty of**	Sounds of the desert: The howling of the wind, the rustling of sand, and the	**Visual:** A slow, steady camera pan across the desert, accompanied	**Heat Effects:** Utilizing heat lamps to simulate the intense heat experienced	**360-degree projection screens:** To display expansive desert	**Searching for Water:** The user can search for a hidden oasis in the desert using a map or visual cues.

	through a sand path blocked by doors. The scene features snake-headed barques, multi-headed serpents, and deities, ending with Maat and the final door.	**desolate environments, with a predominance of yellow to underscore the sandy expanse.** **A luminous, golden illumination to symbolize the sun, and elongated shadows to convey a sense of solitude and detachment.** **The strategic placement of archetypal symbols synonymous with deserts and arid regions, such as pyramids and monolithic figures.**	slithering of reptiles. Background music: A monophonic score with a slow tempo to convey feelings of solitude and isolation.	by shifting sand effects. **Audio:** A monophonic soundtrack with a slow tempo, featuring the sounds of howling winds and rustling sand.	in a desert environment. **Thermal Simulation:** Employing heat lamps to create a realistic sensation of extreme desert heat.	landscapes and shifting sands. **Heating systems:** To create a sensation of intense desert heat. **Motion sensors:** To make the sand react to the tourist's movements.	**Interacting with the Environment:** The user can interact with desert plants and animals, such as watering a plant or feeding an animal.
The Fifth Hour:	The fifth hour of the *Amduat* depicts the West, with the snake-headed solar barque passing a mound crowned by Isis. Scenes include Osiris's burial, punishing deities, and the Land of Sokar guarded by Aker amid darkness and divine light.						
The Sixth Hour	In the sixth hour of the *Amduat*, the solar barque reaches the "waterhole of the Netherworld," symbolizing the						

	regenerative primeval ocean of Nun. The barque, restored to its earlier form, sails on water while a baboon-headed deity and mummiform kings flank its path. The upper register features deities in half-sitting positions, symbolizing renewed life, and chests representing the sun god's threefold burial guarded by fire-spitting serpents. The lower register depicts crocodile-headed gods and figures in half-sitting postures, reflecting the transition to rebirth.						
The Seventh Hour	Ra confronts his eternal enemy, Apophis, the god of darkness and chaos. A fierce battle ensues, culminating in Ra's triumph.	**A palette dominated by dark, cool hues** is employed to evoke the somber atmosphere of	**The Soundscape of the Underworld:** Characterized by the dripping of water, the	**Camera Movement:** A slow, fluid camera movement glides through the chambers	**Shadow Play:** Utilizing lighting to cast enigmatic and dynamic shadows upon the	**Dim Lighting:** To employ dark, cool color palettes to cultivate an atmosphere of mystery.	**Engaging in Enigma-Solving:** Players are able to decipher enigmatic inscriptions adorning the

The Eighth Hour:	The solar barque arrives in a region filled with sound, where strange and terrifying noises can be heard. Ra encounters auditory and psychological challenges.	the underworld, while the color green is strategically used to represent the concept of rebirth and renewal. **Subdued and fluctuating illumination** is combined with strategically placed shadows to cultivate an enigmatic and mysterious ambiance. **The incorporation of symbolic elements** such as floral motifs, botanical imagery, and funerary artifacts serves to underscore the thematic	sensation of sluggish movement, and the agonizing cries of spirits. **Accompanying Soundtrack:** A haunting musical composition incorporating organ and violin.	of the underworld, emphasizing the architectural intricacies and hieroglyphs. **Sound Design:** An enigmatic musical score, featuring haunting organ and violin melodies, is accompanied by the subtle sounds of dripping water and seeping air.	walls, thereby evoking a sense of mystery and peril. **Humidity:** Employing humidity to establish a damp and chilly ambiance reminiscent of the underworld. **Soundscape:** Incorporating the sounds of dripping water and cold air to enhance this atmosphere.	**Ambient Sounds:** To utilize subtle and eerie auditory elements such as dripping water and creaking doors. **Transparent Projection Screens:** To project ghostly figures and statues onto walls.	chamber walls or unravel the complexities of hieroglyphic scripts. **Light Control:** The user can employ a lamp to illuminate dark areas or adjust the light intensity to uncover hidden secrets.
The Ninth Hour:	rThe Ninth Hour depicts twelve gods rowing Re's solar barque, guiding him through the sky. Twelve goddesses, aligned with Osiris, uphold life in the Netherworld. Also, there is a representation of twelve fire-spitting uraei, lighting Osiris' chambers and maintaining cosmic order.						

		juxtaposition of life and death.					
The Tenth Hour:	In the Tenth Hour, Re's solar barque with a crew protected by the Mehen-serpent, as twelve gods repel Apophis to help Re pass into the eastern horizon. Eight goddesses salute Horus, and Horus with twelve blessed dead figures and four goddesses illuminating Re's path in the Netherworld.	**Vibrant and luminous colors** to symbolize the rebirth of the sun, with **white** representing light and purity. **Intense and dynamic lighting,** along with the use of shadows, to evoke a sense of hope and renewal. **The incorporation of symbols associated with birth and new life,** such as the sun, moon, and stars.	**Sounds of New Life:** The auditory experience is characterized by the melodious chirping of birds, the tranquil sounds of flowing water, and the poignant cries of newborns. **Musical Accompaniment:** The background music is vibrant and energetic, featuring the soothing tones of the flute and the rich timbre of the oud.	The camera executes a swift, fluid pan across the celestial expanse, centering on the breathtaking spectacle of the sun's emergence. A pulsating, upbeat soundtrack enhances the visual narrative, incorporating the lively sounds of avian and mammalian creatures.	**Light:** Employing bright and dynamic lighting to symbolize the birth of the sun. **Heat:** Utilizing heat lamps to generate a sense of warmth and heat. **Wind:** Using fans to create a feeling of refreshment and renewal.	**Intense Lighting:** To utilize bright, saturated colors to represent the emergence of the sun. **Joyful Sound Systems:** To employ uplifting music and authentic natural sounds. **Immersive 3D Projections:** To create a captivating visual experience of the sun rising over the horizon.	**Navigating the Paths of Illumination:** The user has the agency to choose among multiple celestial pathways that converge at the solar deity. Each trajectory is fraught with its own distinct trials and tribulations. **Divine Communion:** The user is afforded the opportunity to engage in discourse with the divine entities to express appreciation or solicit divine intervention.
The Eleventh hour	In the Eleventh Hour, twelve gods guide the Mehen-serpent on its path. There is also a double-headed deity and Atum with a serpent, symbolizing eternity, while Scene 38 depicts Horus overseeing the punishment of Osiris' enemies, with fire-						

	spitting serpents, traps, and goddesses enforcing divine retribution.					
The Twelfth hour	The deities celebrate Ra's triumph with great jubilation and accord him a most honored welcome. Cosmic order is restored, and a new day commences.					

Conclusions

This study demonstrates how augmented reality (AR) might revolutionize cultural tourism, with a case study applied to the ancient Egyptian Amduat. The study also shows how old religious books such as the Amduat may be transformed into immersive travel experiences that combine historical accuracy with contemporary innovation by utilising augmented reality, artificial intelligence, and interactive design. The results highlight how significant it is to maintain cultural heritage while modifying it to fit modern travel patterns. AR applications engage a variety of audiences and provide new insights into ancient Egyptian beliefs, in addition to making difficult theological concepts comprehensible. The suggested framework highlights the indispensability of expert collaboration in preserving authenticity while maintaining a balance between innovation and respect for cultural legacy. Besides, there is a practical way to enhance cultural tourism by fusing historical storytelling with modern technologies. In addition to attracting tech-savvy tourists, this approach promotes a deeper appreciation of Egypt's rich cultural heritage. The Amduat, which has been reimagined through augmented reality, is a great illustration of how to exploit and preserve ancient cultural relics in an innovative way to maintain interest in historical tourism for future generations. This work opens the door for more research into relevant technical applications in historic tourism and emphasizes the value of interdisciplinary collaboration in achieving noteworthy and long-lasting results. The study recommends expanding the applications of augmented reality to enhance the preservation of Egypt's cultural heritage and develop innovative tourism products. It emphasizes the need for collaboration to develop high-quality digital content that combines historical accuracy with technological innovation. Moreover, the study underscores the importance of investing in the necessary technological infrastructure to support these applications.

Further research

Further research should focus on developing a prototype to recreate the night journey according to the proposed model and evaluate the tourist experience. Additionally, specific metrics should be developed to measure the effectiveness of augmented reality applications in achieving heritage preservation and enhancing the tourist experience.

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الواقع المعزز كأداة لتعزيز السياحة الثقافية من خلال رحلة إله الشمس في كتاب الإمي دوات

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الملخص

يُعد كتاب الإمي دوات أحد أهم المصادر التي تسلط الضوء على المعتقدات الدينية والثقافية لدى المصريين القدماء. ويصف هذا الكتاب الرحلة الليلية لإله الشمس رع عبر العالم السفلي. تهدف هذه الدراسة إلى استكشاف الإمكانات التي يوفرها الواقع المعزز (AR) لتحويل نصوص الأمي دوات إلى تجربة سياحية ثقافية تفاعلية وجذابة، كذلك تسعى الدراسة إلى تصميم تجربة مستخدم غامرة من خلال دراسة الجوانب الفنية واللغوية والرمزية في نصوص الإمي دوات، ولإجراء هذه الدراسة تم الاعتماد علي المنهج الوصفي التحليلي اضافة الي منهج بحث قائم على التصميم، ولتحقيق أهدف البحث تم عقد مقابلات شخصية مع خبراء في علم المصريات، والسياحة، والتكنولوجيا، والفنون لتطوير إطار مقترح لتقديم منتج سياحي مبتكر من خلال استخدام تطبيقات تكنولوجيا الواقع المعزز في تجسيد رحلة اله الشمس في كتاب الإمي دوات، وقد أظهرت النتائج امكانيات تكنولوجيا الواقع المعزز في تعزيز الحفاظ على التراث الثقافي، وتسهيل فهم المفاهيم والمعتقدات الدينية لدي المصري القديم، من خلال نموذج مبتكر مع الحفاظ في الوقت نفسه على الأصالة التاريخية. وقد أوصت الدراسة بضرورة توسيع نطاق تطبيقات الواقع المعزز لتعزيز الحفاظ على التراث الثقافي المصري، وتطوير منتجات سياحية مبتكرة. من خلال التعاون بين القطاعات المختلفة لتطوير محتوى رقمي عالي الجودة يجمع بين الدقة التاريخية والابتكار التقني.

الكلمات المفتاحية: كتاب الإمي دوات، تكنولوجيا الواقع المعزز، تراث مصر القديمة، التصميم التفاعلي، حفظ التراث، السياحة الثقافية