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Reviving Ancient Human Fossils Using the "Bit Arrangement" Method at the Sangiran Archaeological Museum

Sudibyo[1]*, Widyo Nugroho[2], Bonar S. Panjaitan[3], Yohanes Ari Kuncoroyakti[4]
[1,3]Akademi Komunikasi Media Radio dan Televisi Jakarta
[2,4]Universitas Gunadarma
Corresponding Author: Sudibyo sudibyojs12@gmail.com

A R T I C L E I N F O

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A B S T R A C T

Technological advancements have been able to bring still images to life, but the communication model of the Sangiran Archeological Museum still explains ancient human fossils verbally. This research uses a qualitative method with an exploratory-descriptive case study approach, aiming to deeply explore how Bit Arrangement in realistic role-playing can serve as a lesson and a strategy for performative communication at the Sangiran Archeological Museum. Observations over 5 months show that the combination of role-playing and digital technology in 3D films shown in 4D theaters creates a new space that allows historical interpretation to become more vivid, reflective, and educational. This project expands the boundaries of role-playing into the realm of museums, presenting performances that not only entertain but also educate and stimulate visitors' imaginations about ancient human life.

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INTRODUCTION

In 1996, the Sangiran Site was designated as a world cultural heritage site listed in the UNESCO World Heritage List number 593, under the name Sangiran Early Man Site (Widianto & Simanjuntak: 2014b). However, the communication style of the Sangiran Early Man Museum still relies on tour guides to explain archeological findings verbally. Verbal information tends to be not detailed, difficult to understand, easily forgotten, and more crucially: it does not provide a real experience, let alone a deep impression. In fact, experience is the best teacher.

Considering its world-renowned reputation, the communication model of the Sangiran Archeological Museum should open a multisensory dimension in science. Therefore, this research becomes important and urgent because it offers a creative culture to the Sangiran Archeological Museum in addressing communication gaps. This research is supported by the Ministry of Culture of the Republic of Indonesia and the Education Fund Management Institute thru the 2025 Cultural Endowment Fund Utilization Program.

This research is titled "Reviving Ancient Human Fossils Using Bit Arrangement at the Sangiran Archeological Museum." Intended to answer three important questions in integrating role-playing and film technology into the prehistoric narrative at the Sangiran Archeological Museum. The questions are formulated as follows: 1) How can the transformation of museum communication toward a multisensory model enhance historical understanding and awareness? 2) How to create an authentic and immersive experience for visitors? 3) How does the use of bit arrangement bring ancient humans to life?

LITERATURE REVIEW

This qualitative research uses Aristotle's hylomorphism (Trans. 2004) as the grand theory and three operational theories, namely: 1) Bit arrangement in the realist acting theory according to Konstantin Stanislavski in his books Creating a Role (1961) and An Actor Prepares (1936); 2) Performance theory according to Richard Schechner in his book Performance Studies: An Introduction (2013); 3) Semiotic Theory according to Roland Barthes in his book Mythologies (1957).

Aristotle's hylomorphism is a metaphysical doctrine that states: every physical object is an inseparable combination of matter (hyle) and form (morphe). On one hand, physical substances cannot exist without form, on the other hand, natural forms cannot exist without being instantiated in matter. If its form is acting, then its substance is bits. If bits are arranged beautifully, they will give birth to a unique and special meaning.

Stanislavski (1961) argued that actors should not play general characteristics in their roles because it will lead to clichés and lack of uniqueness. On the contrary, actors should break the script into small units (bits). Each bit is identified based on changes in actions or changes in the character's thoughts. In the context of the Sangiran Museum, bit arrangement is used to design the structure of movement and emotions of ancient human roles in detail (micro), so that the audience gains new knowledge and awareness.

Schechner (2013) expands the definition of performance beyond the confines of the conventional theater stage. He views it as a broad spectrum of human activity (macro). Schechner's main concept is Restored Behavior. This theory is used to dissect how the activities of ancient humans in the past can be revived in the museum. Thus, the Sangiran museum is no longer just a storage place for inanimate objects, but rather a performative space of history that holds significance for visitors.

Meanwhile, Barthes (1972) developed semiotics as a tool to uncover how meaning is produced and consumed thru signs in popular culture. Barthes introduced a two-stage signification system: 1) Denotation: the literal or explicit meaning of a sign (e.g., a picture of a bone is a bone). 2) Connotation: the sociocultural and personal meanings that accompany the sign (e.g., the bone symbolizes evolution or death). When the connotative meaning is considered something natural, objective, and given, a myth or new understanding is formed.

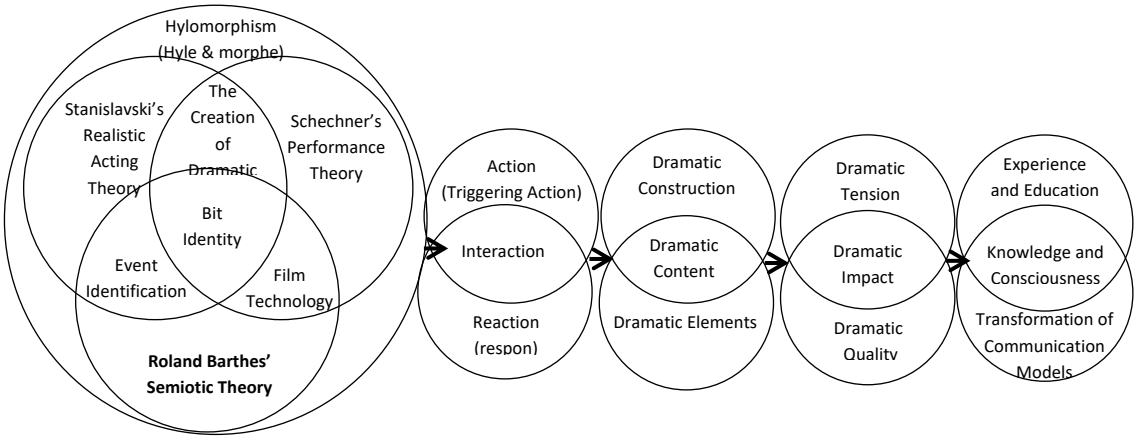


Diagram 1. Theoretical Framework of Communication Transformation at Sangiran Archeological

METHODOLOGY

Epistemologically, this multidisciplinary research (archaeology, performing arts, information technology, semiotics) is prone to a fragmentation of focus. The Metaphysical Function of Hylomorphism from Aristotle provides a very solid ontological bridge for two reasons. First: resolving the problem of dichotomy; and second: a logical operational chain.

Hylomorphism makes fossils the foundation of matter (Hyle), and Bit Arrangement gives it its form of life (Morphe). In the logical operational chain: 1) How to give soul to matter? Answered by Stanislavski. 2) Where and how does the soul interact with the visitors? Answered by Schechner. 3) How do museum visitors capture the meaning of the union of matter and spirit? answered by Barthes' semiotics.

The Stanislavski system serves as a technical foundation and a bridge between archeological research and performative practice. Through-line of action and super-objective provide a framework for connecting factual archeological findings with interpretative dramatic narratives. The relevance of bits with film

technology, both works together to build the overall meaning. That collaboration is guided by arrangement.

Performance theory (Schechner) is positioned as a conceptual framework for transformation in museums. The concept of restored behavior is useful for prehistoric reconstruction. Ancient humans cannot be directly observed, which may be restored behavior based on the interpretation of archeological evidence. Schechner provides methodological legitimacy that performative reconstruction is a valid form of knowledge, not merely speculation. Performance theory according to Schechner offers participation and interactivity. Visitors as co-creators of meaning, not just recipients of information.

This research also employs semiotic theory (Barthes 1972) as a tool for analyzing the production of layered meanings. In this research, bit arrangement becomes a way to organize the Signifier (actor's action/film shot) to create a specific Signified. The goal is for the audience not to stop at the denotation level (seeing people wearing ancient costumes), but to reach the level of connotation and certain myths.

Table 1. Synergy theories: Aristotle, Stanislavski, Schechner, and Barthes

Aspect Study	**Aristotle (Hylomorphism – Grand Theory)**	**Stanislavski (Authenticity)**	**Schechner (Phenomenological)**	**Barthes (Signification)**
Dimensions	Ontological & Metaphysical (The Nature of Being: Hyle – Morphe – Entelechy)	Technical & Practical	Conceptual & Philosophical	Analytical & Critical
Focus	Transformation of ideas (material raw) becomes complete film work through organizing form, where the potential narrative reaches its actuality in A structure dramatic.	Interpret every character action in the film, demonstrating and recording the audio-visuals, structuring the shots (arranging) the entire dramatic, critical and authentic play film.	The film was shown in the AV room with technology immersive. R itual Cinematic between "humans" ancient" and "modern humans" bring to life imagination collective.	Revealing codes culture and myths in visual elements of the film for reveal How meaning produced beyond what is seen (Denotation to Connotation)
Research 1	How fossil (Hyle) obtained digital form / soul (Morphe) via bit arrangement?	Digital personification through action physical and emotional encrypted actor to in data.	Museum space as ritual interaction stage between audiences and digital entities.	Deconstruction digital artifacts as myth new in narrative modern history.

Aspect Study	Aristotle (Hylomorphism – Grand Theory)	Stanislavski (Authenticity)	Schechner (Phenomenological)	Barthes (Signification)
Research 2	How does the actualization process (Entelechy) occur? in reconstruction life ancient?	Internalization character ancient for reach accuracy psychological in audiovisual motion.	*Restored behavior:* Turn on return behavior ancient as present-day experience.	Reading codes cinematic that transforms visual data into message culture.
Research 3	How unity matter – form produce reality new (being-in-actuality)?	Achievement *super-objective* through technique acting that makes simulation felt real / authentic.	Transformation audience from observer passive become participants in room immersive.	Production meaning through synchronization element multisensory as system sign intact.

Source: Sudibyo

RESEARCH RESULT

Bit arrangement design is a way to organize bits/artistic communication stimuli so that the audience receives rational answers. Exploration activities conducted thru observation and interviews, literature review, FGD, or internet searches have yielded relevant data to be presented in this chapter, including: 1) Data on frequently asked questions (FAQ) by visitors at the museum; 2) Data on the number and categories of museum visitors; 3) Comparative data on the museum's film facilities; 4) Data on the filmic object: "Reviving Ancient Human Fossils Using Bit Arrangement at the Sangiran Archeological Museum." Eleven frequently asked questions can be categorized into bit objects, including:

Table 2. *Frequently Asked Questions* (FAQ) at the Sangiran Museum

NO	FREQUENTLY ASKED QUESTIONS	SHORT ANSWERS BY TOUR GUIDES	DATA SOURCE / REFERENCE
1	Whether fossils on display This original?	Part of the collection Can original, partial Can in the form of replica / display for education and conservation.	Principle general modern museology, see the International Council of Museums (ICOM) Code of Ethics on principles replication for conservation.
2	How many age fossils in Sangiran?	His age different, from hundred thousand until more from One million year, depending type findings.	Human Sites Conservation Agency Purba (BPSMP) Sangiran; official website sangiran.go.id; journal

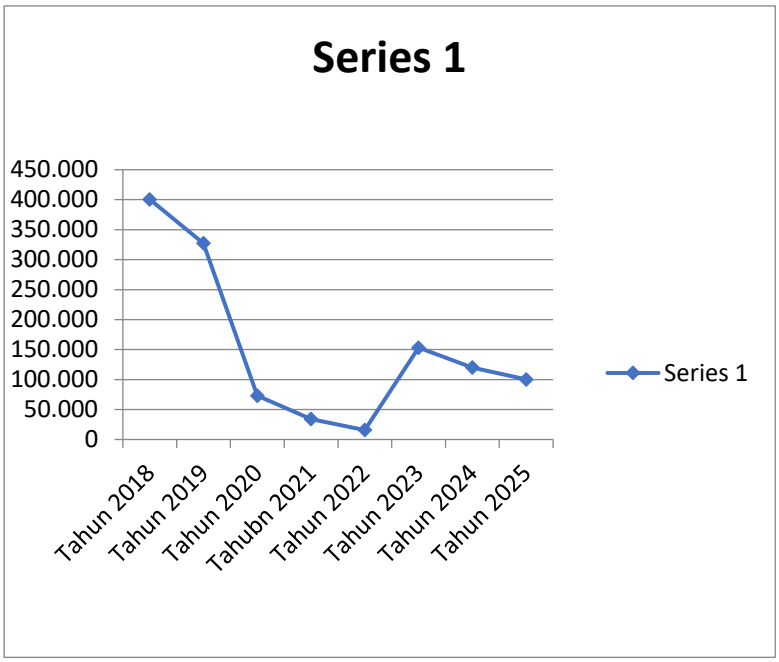
			Widianto et al. (2001) about site chronology.
3	Why Sangiran important for history man ancient?	Sangiran important Because is one of the human sites ancient most important in the world.	UNESCO World Heritage Centre, Sangiran Early Man Site; designation as UNESCO World Heritage 1996 (S-1 & S-2).
4	Human types ancient What was found in Sangiran?	The most famous is findings of Homo erectus, in addition to ancient fauna and environmental data ancient. Sangiran-17 is fossil skull man the most complete Homo erectus skull. almost intact, so that give the clearest picture about form the face of Homo erectus that lived in Java around hundred thousand year Then.	BPSMP Sangiran ; journal Widianto (1993, 2007); Indriati (2004) "The Calvaria of Sangiran 17".
5	What difference man ancient and modern humans?	The most fundamental difference is at capacity brain and shape human face ancient like Homo erectus in Sangiran own sloping forehead behind with forehead protruding and has no chin yet. In intelligence, they Already great Because Can make stone tools, but modern humans far away more proceed Because Already know art, system match planting, and more language complex like We Now.	Human Evolution (Tattersall, 2009; Wood & Strait, 2004); difference in brain volume of H. erectus (~900-1100 cc) vs. H. sapiens (~1300-1500 cc).
6	Why Lots fossil found in Sangiran?	Due to the conditions geology and layers the land keep footsteps past life with Good.	BPSMP Sangiran ; Sémah et al. (2000); Larick et al. (2001) about stratigraphy and sedimentology of the site.
7	Whether all objects in the museum results findings original from Sangiran?	Not always; there are also replicas For need education and security collection.	*ICOM Code of Ethics (2017, ed revision) * *; practice museum standards for replication and cast (museum cast).
8	Whether may hold fossil or collection?	Generally, no, except on interactive media certain.	Principle conservation preventative, see American Institute for Conservation (AIC) guidelines; Canadian Conservation Institute (CCI).
9	How long is the ideal time for visiting?	Usually about 1–2 hours or more, depending amount visited clusters.	BPSMP Sangiran Standard (sangiran.go.id); average duration visits to the Indonesian Archaeology Museum.

10	What the difference fossils, artifacts, and replicas?	Fossil is remainder creature petrified life, artifacts is object artificial human, replica is imitation for display/ education.	Renfrew & Bahn (2016) Archaeology: Theories, Methods, and Practice; Darwin & Penny (2018).
11	Is this site Still researched?	Yes, sites like Sangiran still important for research, conservation, and education.	National Research and Innovation Agency); publication LIPI/BRIN periodical in the Journal of Southeast Asian Archaeology and Geochronology.

The following table shows the dynamics of tourist visits from the pre-pandemic phase, the Covid-19 pandemic period, to the recovery and growth period.

Graph 1. Visitors to Sangiran Museum 2018-2025

Tahun 2018	400.591
Tahun 2019	327.375
Tahun 2020	73.023
Tahun 2021	34.147
Tahun 2022	15.742
Tahun 2023	153.217
Tahun 2024	119.969
Tahun 2025	100.217

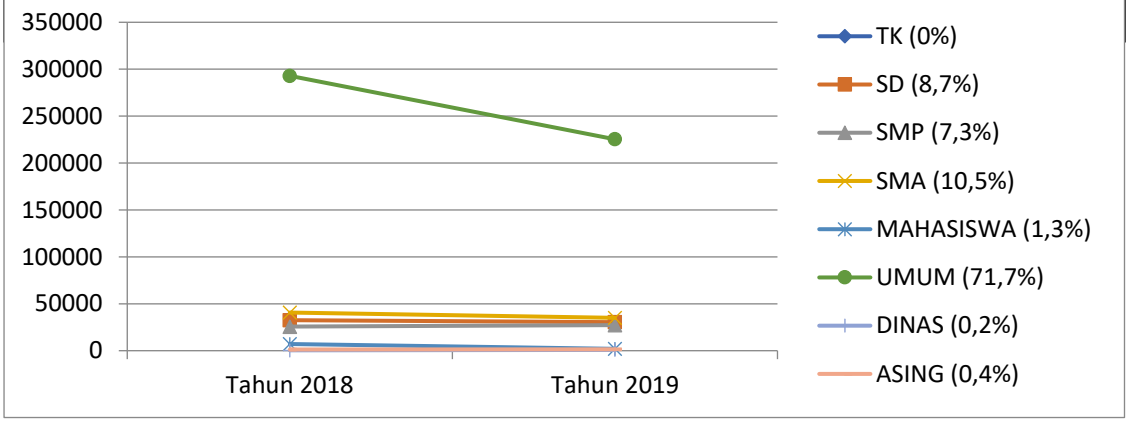


Sumber: Museum Sangiran

To make the analysis more objective, data on the number and categories of visitors to the Sangiran Archeological Museum were separated from the external influence of Covid-19 in 2020-2021. In 2020 and 2021, the museum was either completely closed or severely restricted, resulting in a drastic decrease in the number of groups and visitor engagement. Visits began to return to normal from mid to late 2022. Visitor data that can be analyzed: Pre-Covid-19 years 2018-2019 and Post-Covid-19 years 2023-2025.

Graph 2. Museum Visitors in the Pre-COVID-19 Pandemic Phase

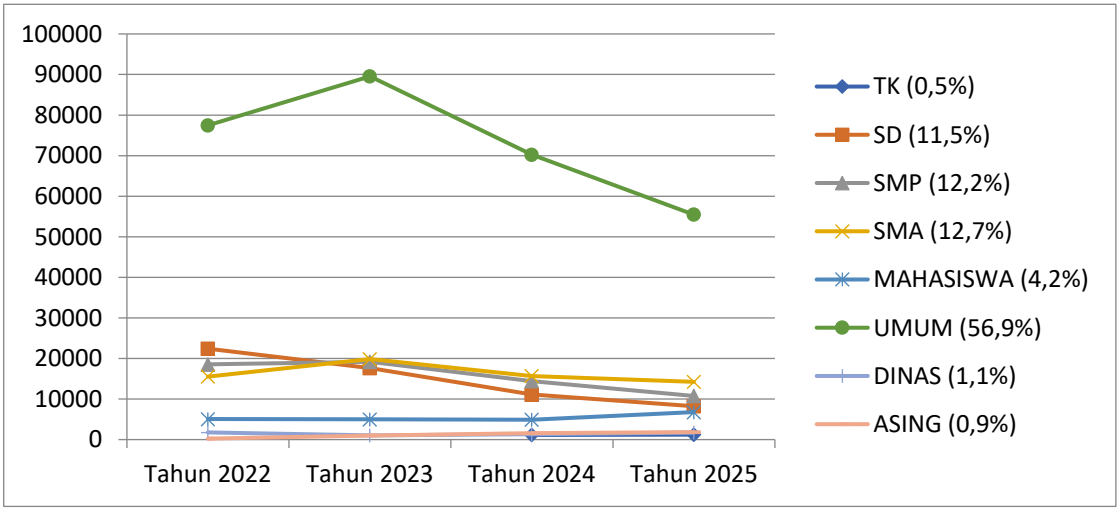
TAHUN	TK (0%)	SD (8,7%)	SMP (7,3%)	SMA (10,5%)	MAHASISWA (1,3%)	UMUM (71,7%)	DINAS (0,2%)	ASING (0,4%)
2018		32.523	25.730	40.650	7.112	292.914	392	1.270
2019		30.422	27.265	35.039	1.991	225.313	826	1.483



Source: Sangiran Museum

Graph 3. Post-Pandemic Covid-19 Visitor Phase

Tahun	TK (0,5%)	SD	SMP	SMA	MAHASISWA	UMUM	DINAS	ASING
2022		22.409	18.528	15.555	5.057	77.466	1.769	238
2023		17.605	19.177	19.850	4.980	89.544	1.040	1.021
2024	1.143	11.114	14.413	15.677	4.891	70.218	1.298	1581
2025	1.215	8.225	10.750	14.234	6.776	55.445	1.727	1.845



Source: Sangiran Museum

Table 3. Comparative Data of Museums with Film Facilities

Museum	Film/AV Facilities	Impact Documented	Relevance for Sangiran	Source
Bandung Geological Museum	cinema, 3D movies	Increased visitor engagement	Both science / history museums natural	Official website: https://museum.geologi.esdm.go.id/ (Accessed [date]). **SPECIFIC IMPACT DATA REQUIRED**
Aceh Tsunami Museum	Immersive audio-visual space	Experience emotional deep	Need an emotional connection with the past	Official website: https://museumtsunami.acehprov.go.id/ (Accessed [date]).
Smithsonian Natural History (USA)	IMAX theater, multiple AV rooms	Jutaan pengunjung/tahun	Benchmark museum kelas dunia	Smithsonian Institution. (n.d.). *National Museum of Natural History*. https://naturalhistory.si.edu/
National Museum of Nature and Science, Tokyo	Theater 360°, interactive display	High visitor satisfaction	Kolaborator Sangiran, standar serupa	National Museum of Nature and Science. https://www.kahaku.go.jp/english/
Jakarta National Museum	Multimedia theater room	Increase Power pull exhibition	The context of Indonesian museums	Official website: https://www.museumnasional.or.id/
Pacitan Song Terus Museum	cinema, 3D movies	Increased visitor engagement	Both are human museums ancient	Official website: https://iha.kemenbud.go.id/portfolio/museum-song-terus/

Data about the film that is the subject of this research is titled Bit Arrangement, Screenplay/Director: Sudibyo JS., who is also Author 1 in this journal. The film was disseminated and exhibited on March 6, 2026, at the Jakarta Institute of Arts, Jl. Cikini Raya No. 73 Central Jakarta. The film that teaches about "bit arrangement in reviving ancient human fossils" was uploaded to YouTube by its creator on March 8, 2026, via the link: https://www.youtube.com/watch?v=McsYsdUEoUk&t=95s. The film offers the concept of integrating the audience as digital actors in an immersive film. Described in the film: the audience sees themselves interacting with Homo erectus.

This film tells the story of the time travel experiences of visitors to the Sangiran Museum who meet and interact with ancient humans two million years

ago. In that encounter, they witnessed the Skull Fossil of a Homo Erectus being brought back to life by the Director using bit arrangement. And even more spectacular in the film, museum visitors see themselves as actors interacting with ancient humans. Moreover, because the film presentation uses immersive technology, visitors also gain an exotic experience. How they respond to the ferocity of nature, such as waves and giant fish shaking the boat in the ocean, crocodiles and snakes ready to prey, the discovery of fire, kinship relations, and so on, is constructed into a dramatic story. The film opens and closes with a scene of a female archeologist cleaning a human skull fossil.

DISCUSSION

The discussion material is based on the data that has been successfully collected to answer the questions in the problem formulation. 1) Data on frequently asked questions (FAQ) from visitors at the museum; 2) data on the number and categories of museum visitors; 3) comparative data on the museum's film facilities; 4) data on the filmic object: "Bringing Ancient Human Fossils to Life Using Bit Arrangement at the Sangiran Archeological Museum."

Discussion on the FAQ data in Table 2 and Graphs 1, 2, 3 regarding the percentage of visitors is useful for answering the first question in the problem formulation, namely: "how does the transformation of museum communication toward a multisensory model enhance historical understanding and awareness?"

In the conventional model, the museum functions as a space for the representation of material (Hyle), where fossils are displayed, labeled, and explained informatively. However, in the multisensory model, the material is given life (Morphe) thru narrative strategies, dramatic reconstructions, sound design, visual composition, and bit arrangement that create emotional actions and reactions. Therefore, the visitor's question is actually answered by the film titled Bit Arrangement, which is the subject of this research. The eleven questions in Table 2 can be grouped into four filmic bits to obtain answers, as shown in the following table.

Table 4. Four BIT Answers Frequently Asked Questions

Element	BIT 1: The Reality Check *(awaken)*	BIT 2: The Time Machine *(bring to the past)*	BIT 3: The Mirror *(to sue to self Alone)*	BIT 4: The Call to Action *(push action)*
Question	FAQ types number 1, 3, 6, 7, 10: focus on the foundation fact Grouped in: 1. What What is the Sangiran Museum? 2. " Why this site? important?	FAQ types 2 & 4 focus on reconstruction chronology time and taxonomy man ancient. Grouped in: 1. " How life man ancient Formerly?" 2. " What the threats they pose face it?"	FAQ type number 5 focuses on comparisons evolutionary between " them " (ancient) and " us " (modern) Grouped in: 1. " What connection I with man ancient this?" 2. " Why I follow surprised	FAQ types number 8, 9, 11 focus on interactions physique visitors, duration visits, and involvement in research that is still ongoing walk. Grouped in: 1. " How turn on man ancient using bit arrangement?" 2.

Element	BIT 1: The Reality Check *(awaken)*	BIT 2: The Time Machine *(bring to the past)*	BIT 3: The Mirror *(to sue to self Alone)*	BIT 4: The Call to Action *(push action)*
	3. " Why? fossil This valuable?	3. " How atmosphere millions year Then visualized ?"	moment see attack snake that?" 3. " What do I feel when the past present in front I?"	" How shot composition can create a dramatic impact?" 3. " How director make fossil felt life?"
Answer with Scene	**Question 1:** Scene 2: HA/Drone LS shows the Establishing of the Sangiran Museum from sky, track to Door Gate. This visual in a way direct answer " what that is the Sangiran Museum " with show form physical and scale institutions. **Question 2:** Scene 3: CU UNESCO Certificate 1996, Heritage World Culture number 593. Scene This answer " why" important " because global institutions have validated its value. **Question 3:** Scene 1: FS Female Archaeologist squatting wipe fossil skull with paintbrush in a way be careful. A gesture of caution This answer " why" valuable " because show treatment special to objects that are not replaced.	**Question 1:** Scene 4, Shot 2 (parallel): MCU ABG Homo Erectus currently Eat mice on two million year then. Scene This answer " how life ancient " with show activity brutal everyday life but real. **Question 2:** Scene 4, Shot 1 (parallel): FS Snake crossing the rocks between framework skull. Snake as predator answer the " threats facing " humans ancient in the wild. **Question 3:** Scene 4, Shot 1-2 (parallel): Snake attacks direct to lens camera, glass display case broken by impact head snake. Effect voice hiss snakes and bites food visualized in a way immersive so that viewer feel present in atmosphere ancient.	**Question 1:** Scene 4, Shot 3: MCU Modern young men and women are surprised at the museum. When the camera wide, visible they currently observe fossil skull head. The visual relationship between Homo Erectus (Shot 2) and the modern young man (Shot 3) is striking. that they are their biological man ancient. **Question 2:** Scene 4, Shot 1 to Shot 3: Attack snake (Shot 1-2) straight impact on reactions startled young men and women (Shot 3). Audience follow surprised Because attack snake penetrates limit space and time: from the past to the present, from fossil to viewer. **Question 3:** Overall Scene 4 (Shot 1-2-3 parallel): Feelings that arise is mixing between awe, fear, and awareness sudden that history No far away, but be behind glass a display case that can	**Question 1:** Sequence 2: The lecturer explains about the bits inside class students. Scene This answer in a way explicit that bit arrangement is method technical that can study and applied. **Question 2:** Scene 4, Shot 1-2-3 (parallel) three shots): Composition parallel snake → Homo Erectus → modern youth creates *dramatic impact* through connection action-reaction Stanislavskian : owner bit (eat) → participant bit (snake attack) → participant bit second (youth) startled). **Question 3:** Tour Guide's Dialogue in Scene 4, Shot 3: " Fossils " This dead and residing millions of years. But in the hands a director, the fossil that has dead millions last year That Can life back." This dialogue is answer direct: director turn on

Element	BIT 1: The Reality Check *(awaken)*	BIT 2: The Time Machine *(bring to the past)*	BIT 3: The Mirror *(to sue to self Alone)*	BIT 4: The Call to Action *(push action)*
			" break " at any time just dramatically.	fossil through narrative dramatic and bit structure.

Considering the trend in data from graphs 1, 2, and 3: the priority for film production is based on the proportion of the most visitors and FAQs, thus two film themes are recommended: the main theme and the additional theme. The following theme table has been directly linked to the bit arrangement method (arranging data fragments: fossils, artifacts, geological context, scientific data into a complete narrative to "revive" ancient human fossils).

Table 5. Integration Matrix of Bit Arrangement Method in Development Strategy Content Interpretive Sangiran

Aspect	Main Theme (Visitors General ~60–70%)	Additional Themes (Elementary–High School Students – College Students ~ 25–35%)
Draft Title	*"Sangiran: Traces the Human Who Connects We" or "From Fossils to Life: Sangiran 17"*	*"Behind the Display Case: Science, Conservation, and Research in Sangiran" / "Laboratory Nature: How scientist Uncovering the Past"*
Bit Arrangement Method Position	Bit arrangement used as approach narrative for compile fragment fossils, artifacts, and context environment become channel a full and immersive life	Bit arrangement explained as method scientific: how data is separated (fragments) bone, layer soil, stone tools, laboratory tests) reconstructed become interpretation scientific
Theme Properties	Narrative - universal and immersive: data fragments are "assembled" into story life man ancient	Educational-scientific and structured: the data collection process is explained step by step
Character Presentation	Edutainment & docu - animation; visualization reconstruction face, environment, and activities based on data bit arrangement	Modular & systematic; reconstruction process infographics, stratigraphic diagrams, digital data overlays
Bit Arrangement Implementation	1) Fragmen fossil → 2) Reconstruction anatomy → 3) Context environments → 4) Simulation life everyday → 5) Reflection connectedness with modern humans	1) Excavation → 2) Documentation & classification → 3) Analysis laboratories → 4) Correlation stratigraphy → 5) Interpretation & publication scientific

Aspect	Main Theme (Visitors General ~60–70%)	Additional Themes (Elementary–High School Students – College Students ~ 25–35%)
Duration & Format	15–20 minutes (flow intact results end from the bit arrangement process)	Flexible per module (each bit arrangement level can learn separate)
Media & Access	AV space as orientation visit; experience witness the result of " bit chaining " becomes life	QR code on the display panel; students can browse every "bit of data" and the process of compiling it
Function Interpretive	Change static objects (fossils) become experience life through coherent data arrangement	Teach method think scientific: understanding that reconstruction of the past is results data synthesis, not imagination free
Reason Scientific & Strategic	Audience general need narrative whole and emotional; bit arrangement works behind the scenes screen for guard accuracy scientific in packaging popular	Students need understanding the epistemological process; bit arrangement is displayed transparent to improve literacy science and understanding method scientific

If the film is produced in One title (option 3), integration strategy as following:

Table 6. Integration Strategies in One Participatory Film Production

CONTENT LAYER	TARGET	PROPORTION	FORMAT
Main Theme	General	55~72%	15–20-minute single film, narrative-immersive
Additional Themes	Students & educators	25~35%	Microfilm series / modules educational, structured & curricular
Layer Optional	Students / foreigners / researchers	<5%	Extended version with English subtitles, stratigraphic data, & references journal (digital access)

Next, the discussion about Table 3 (Comparative Data of Film-Facilitated Museums) to answer the question in problem formulation number 2, which reads: "how to create an authentic and immersive experience for visitors?" ". Table 3 presents a comparison of film facilities in several museums. The comparison of film screenings serves as a basis for identifying areas of innovation that can be developed at the Sangiran Archeological Museum. The novelty of the film is involving actors from the audience themselves. This concept becomes a strategic differentiator that the competitor museums in Table 3 do not possess.

Table 7. Concept Novelty: Cinema Immersive Participatory Bit Arrangement Based in Sangiran

Aspect	Description Draft
Academic Concept Name	Cinema Immersive Participatory with Audience Integration Real-Time Rendering and Digital Consent Based
Position in Bit Arrangement Method	Viewer to be an integrated "contemporary bit" to in narrative reconstruction, without changing scientific data main.
Novelty Strategic	Involving actor from the audience of the film alone; to be differentiator significant compared to competitor museums (see Table 3).
Technology Supporters	AI face swap (non- permanent), pre-recorded compositing, real-time rendering engine, camera capture system AV room.
The Role of the Audience in Narrative	Featured as: < br >• Researcher field < br >• Scientists laboratory < br >• Witness of evolution < br >• Participant in digital reconstruction simulation
Ethical Limitations Scientific	Viewer No may display as Homo erectus or man ancient Because violate ethics paleoanthropology and principles accuracy scientific.
Function Interpretive	Increase involvement emotional and cognitive; strengthening experience of "connectedness" cross time" without distort fact scientific.
Museological Value	Shifting visitors from position passive (viewer) becomes participants reflective in the reconstruction process history man.
Principle Ethics 1	**Explicit Opt-in Consent:** Visitors agree in a way conscious (digital/form) temporary visual processing for show.
Principle Ethics 2	**Non- Identification & Data Deletion:** None storage biometrics term length; data deleted automatic after the show or maximum 24 hours.
Principle Ethics 3	**Narrative Integration, Not Manipulation Scientific:** Visual engagement is not change interpretation scientific or engineer fact evolution.
Impact Strategic Museum	• Differentiation from other museums < br > • Increased engagement and repeat visits < br > • Potential for viral experience (without storing personal data)
Risk & Mitigation	Risk: worry privacy, AI bias, misconceptions scientific. < br > Mitigation: transparency of the process, supervision curators & experts paleoanthropology, data auto-delete system.

Discussion about film data, to answer the question in the problem formulation: "how is bit arrangement used to bring ancient humans to life?" "The opening scene of the film 'Bit Arrangement in Sangiran' serves as a sufficient example." The film does not stop at evoking admiration, but encourages the audience to think: how cinematic techniques, particularly bit arrangement, can

bring fossils and history to life. Bit arrangement is only valuable if its purpose is to foster critical thinking, not just to create enjoyable educational entertainment.

Therefore, the exploration of bit arrangement in the film "Bit Arrangement at Sangiran Museum" is described in four objectives on bit. Bit 1: The Reality Check. The audience is first assured that Sangiran is a real, important, and scientifically and globally recognized place. Bit 2: The Time Machine. After the reality is established, the film takes the audience back to the past thru a dramatic reconstruction of ancient human life. Bit 3: The Mirror. The film then brings that experience back to the present thru the reactions of museum visitors, making the audience feel that the past also touches them. Bit 4: The Call to Action. The film invites reflection and shared responsibility. The audience is made aware that they are part of the long chain of humanity, thus having an active role in the preservation of Sangiran and the strengthening of science literacy for future generations.

Table 8. Objectivity of Bit Arrangement in Film:
Reality Historical to Production Meaning Cinematic

ELEMENT	**BIT 1: THE REALITY CHECK (*awaken)***	**BIT 2: The Time Machine *(bring to the past)***	**BIT 3: THE MIRROR *(to sue to self Alone)***	**BIT 4: THE CALL TO ACTION *(push action)***
Segmen	Opening that shows Archaeologist woman currently clean fossils, followed by the establishment of the Sangiran Museum and UNESCO certification. " Sangiran Early Man Site"	Scene parallel that turns on back to prehistoric times: snakes, Homo Erectus teenagers who are Eat mice, and the atmosphere threat ancient.	Reaction modern young men and women at the museum at the moment see fossils and snake "attacks", then awareness that they currently face to face with footsteps man ancient.	Tour Guide Dialogue that confirms that fossil can "live" back" through hand director, and question lecturer about " how are bit arrangements used?".
Function	Confirm that which is seen viewer is reality scientific and historical: fossils Really there is a real museum and Sangiran recognized worldwide.	Shifting viewer from current reality going to imagination dramatic past, so that man ancient felt alive and close.	Connecting the past with today 's audience through figure modern youth, so that viewer follow surprised, amazed, and felt involved.	Direct viewer for think active: how cinema, especially bit arrangement, can build life dramatic from the actual object dead.
Objective	Build credibility, respect, and awareness will the importance of the Sangiran Site as	Evoking a sense of wonder and experience as if viewer truly	Making a museum not just place see object dead, but room reflection:	Fishing Power critical audience / students For understand technique directing

ELEMENT	BIT 1: THE REALITY CHECK (*awaken)*	BIT 2: The Time Machine *(bring to the past)*	BIT 3: THE MIRROR *(to sue to self Alone)*	BIT 4: THE CALL TO ACTION *(push action)*
	inheritance world culture.	brought to the Homo Erectus era.	modern humans are continuation from history man ancient.	and realizing that the film can turn on history.
Visual Moment In Barthes' Perspective	In Barthes' perspective, the visuals of researchers, museums, and UNESCO certificates are not only show facts, but also build myth authority scientific. This means that the audience No just see fossils, but rather convinced that which is faced is truth history that has verified. This visual awaken viewer that Sangiran is source legitimate knowledge.	At the stage this, visual signs such as snakes, rocks, skeletons, and Homo Erectus Work as code prehistoric. In connotative, all of them leads to a harsh and wild ancient world. The myths that were formed is idea general that origin man is struggle endure live. This bit bring viewer beyond the museum towards experience imaginative past.	Reaction startled modern youth are sign important according to Barthes because He shift meaning from the "past" as object" becomes "past as reflection self". The museum is not Again warehouse object dead, but mirror identity modern humans. Audience see figures that, then in a way No direct see himself Alone.	Tour Guide dialogue and questions lecturer build myth that the film is tool resurrection history. Fossils No life with himself; he brought to life by the narration, direction, and arrangement of the bits. So this bit push viewer No only fascinated, but also encouraged For understand, interpret, even produce meaning.

Table 9. Synthesis Theoretical Bit Arrangement in Film Openings: From Material to Meaning

BIT	HYLOMORPHISM	STANISLAVSKI	SCHECHNER	BARTHES
BIT 1: Reality Check	Fossil as pure Hyle waiting form	Researcher's gestures as seed action motivated	Museum as environmental theater and sacred space	Myth authority scientific and universal legitimacy
BIT 2: Time Machine	Hyle is activated via parallel bit arrangement	Through-line of action: hungry → attack → shocked	Restored behavior: reconstruction life ancient	myths: the past always move threaten now
BIT 3: The Mirror	Hyle and Morphe united moment glass " broken " display case	Emotional memory: body respond before thought	Liminal moment: audience become dramatic participants	Myth reconciliation identity: modern and ancient humans
BIT 4: Call to Action	Hylomorphism declared explicit through dialogue	Super-objective film: giving souls of the dead	Meta-performance:	The myth of the demiurge:

BIT	HYLOMORPHISM	STANISLAVSKI	SCHECHNER	BARTHES
			performance about show	director as creator life

CONCLUSIONS AND RECOMMENDATIONS

Three conclusions and their applications to answer three questions in the research problem formulation, among others:

a. Transformation of Museum Communication Toward a Multisensory Model to Enhance Historical Understanding and Awareness.

Traditional museums have been operating in a paradox: they store matter (real objects) but communicate thru a limited form: only verbal and textual. The multi-sensory model offered is not merely about adding technology (sound, aroma, touch, immersive), but rather an epistemological shift from representational communication to performative communication.

However, in its application, the following critical issues need to be anticipated. Multisensory has the potential to be a double-edged sword: on one hand, it expands understanding, but on the other hand, it threatens the aura of authenticity of the esthetic experience. When museums overly rely on sensory stimulation, they risk becoming theme parks that potentially delegitimize scientific authority. The transformation of museum communication should place fossils in their presence, keeping the matter in "speaking."

b. Creating Authentic and Immersive Experiences for Museum Visitors.

Authenticity in the context of a museum is not about exact replicas (reproduction), but rather about noema (perceived meaning). An authentic experience occurs when visitors feel that-has-been, a meaningful experience of absence. Immersion is not solely built by VR/AR technology, but by emotional and intellectual engagement that transforms visitors from passive spectators into active witnesses.

In achieving authenticity, environmental performance meets the criteria: 1) a balanced spatial relationship between objects and visitors, maintained emotional flow, and cultural encoding conveyed without one-way dominance; 2) the museum's willingness to allow spontaneity and ambiguity, rather than merely presenting a pre-made sterile narrative. 3) The Use of Bit Arrangement in Reviving Ancient Humans. The bit arrangement, consisting of four segments (Reality Check, Time Machine, Mirror, Call to Action), is not merely a directorial technique but an epistemological architecture that determines how knowledge is formed.

BIT	CRITICAL FUNCTIONS
Reality Check	Unpacking illusion authenticity: denaturalization so that the audience No fooled by the display, but also not become total skepticism

BIT	CRITICAL FUNCTIONS
Time Machine	Build temporal dimension that allows comparison but critical approach This risk exoticizing the past which makes man ancient as material hydranth, **object Strange,** not a ' partner ' in history.
Mirror	Segmen this is the most potential revolutionary because force viewer face to face with 'others' however it turns out reflect himself alone. Unfortunately, if the execution week, he precisely will strengthen the superiority complex of modern humans.
Call to Action	Often so sell-out educacional ignore complexity. It is better ended No with instructions, but rather with question open that maintains ambiguity

ADVANCED RESEARCH

Some limitations in this research need to be acknowledged. First: the sample used is limited to one film "Bit Arrangement Di Sangiran" and 100 respondents from the Sangiran Museum visitors, so the results cannot be widely generalized. Second: the observation duration only lasted for five months, which is not enough to see changes in visitor behavior in the long term. Third: the interview method is less supported by more in-depth observation techniques.

For future research, it is recommended to conduct a survey with a larger sample size and include various museums in Indonesia. In addition, longitudinal studies need to be conducted to observe the impact of museum visits on historical awareness over a longer period. A mixed-method approach with participatory observation can also be considered to obtain richer data.

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