Fulbright-Hays Group Projects Abroad
Summer Institute on China 2018

DESIGN CHALLENGE: VISITOR'S CENTER

STACEY CHURCHILL

GRADE LEVEL

9-12 (Project Lead the Way) Introduction to Engineering Design

ORGANIZING QUESTIONS (FROM PLTW)

- How do you decide what information, data, and/or analysis is necessary to inform, support or justify a problem or its solution?
- What strategies, skills, and tools are effective in facilitating communication between designers and their clients?
- What are the advantages and disadvantages of a design team approach versus an individual approach in the problem solving process?
- How do engineers and technical professionals impact society and the environment?

INTRODUCTION

Have you ever walked into a well-structured visitor's center and immediately got a warm sense of welcoming? Did it make you even more excited to visit the actual site you came to see? Have you ever considered the design and aesthetics of a visitor's center? A visitor's center is specific to a certain attraction or place of interest. They provide information, historical context, and a narrative about the location. They also provide tourist necessities such as maps, restrooms, food, and souvenirs. A well-designed visitor's center can make or break a tourist's experience.

The Golden Gate Bridge in San Francisco has a visitor's center in the Presidio that does just this. However, visitors coming from Marin County in the north do not. Your design challenge is to create a visitor's center that incorporates the history of the location (Fort Baker) with a perspective from the northern point of the bridge. We will use the visitor's center at the Mogao Caves in Dunhuang, China as our inspiration.

You will be divided into teams of three. Each team will work together to apply the design process steps to the development of your design of a Marin County Visitor's Center. You will use your knowledge of the design process, engineering tools, and methods of communication to create your visitor's center. At the conclusion of this project, your group will create a PowerPoint presentation marketing your visitor's center to your clients.

OBJECTIVES (FROM PLTW)

- 1.3 Persevere to solve a problem or achieve a goal.
- 2.1 Explain and justify an engineering design process.
- 2.4 Generate multiple potential solution concepts.
- 9.2 Strive to create sustainable solutions to meet the needs of society, without compromising the ability of future society to meet their needs.
- 10.1 Facilitate an effective team environment to promote successful goal attainment.
- 11.1 Communicate effectively with an audience based on audience characteristics.

MATERIALS

- Engineering Notebooks
- Drawing Paper
- Rulers
- Pencils
- Colored Pencils
- Design Brief Handout
- Presentation Handout

SOFTWARE

- PowerPoint

TEACHER PREPARATION

- Organize Materials
- Prepare Mogao Grottoes and Welcome Center PowerPoint Presentation
- Prepare Examples of Team Norms, Gantt Chart, and Decision Matrix

TIME	PROCEDURES

DAY 1	• Teacher will:
	  • Present "Dunhuang Visitor Center" PowerPoint
	  • Introduce Design Challenge, Design Challenge Rubric, Team Norms, Gantt Chart, & Decision Matrix Template.
	  • Discuss Design Criteria and Things to Consider
	  • Divide students into groups of three each.
	• Students will:
	  • Create Team Norms.
	  • Organize their Gantt Charts.

DAY 2	• Students will:
	  • Brainstorm possible design options
	  • Work on finalizing three possible annotated sketches of potential solutions.
	  • Use a decision matrix to compare potential solutions.
	  • Complete an annotated sketch of their final choice.

DAY 3	• Students will begin creating their design.
DAY 4-6	• Students will continue to work on Design Challenge.
DAY 7	• Students will exchange their design briefs with other students in the class for a peer review.
DAY 8	• Students will make changes to their design based on peer feedback.

DAY 9	• Students will:
	  • Complete the Design Challenge
	  • Answer self-evaluation questions

DAY 10	• Students will: • Complete Design Challenge.

	• Present their design solution using a PowerPoint and an oral report to the class. • Submit all of their associated project drawings and engineering notebooks for evaluation. • Teacher will: • Assess student performance using Design Challenge Rubric.

DESIGN BRIEF OUTLINE

COMPONENT	DESCRIPTION
Client	
Target Consumer	
Designer	
Problem Statement	
Design Statement	
Criteria	
Constraints	

DECISION MATRIX EXAMPLE

	Stacey's Boathouse Design	Wesley's Ultra Modern Design	Ryan's Goldrush Design
Meets Criteria	3	4	2
Ease of Construction	3	2	4
Cost Effective	5	5	4
Innovation	3	5	3
Things to Consider	2	1	3
Total	16	17	16

GANTT CHART EXAMPLE

REQUIREMENT	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
1. Design Brief	Ryan									
2. Design Process (Brainstorming)		All								
3. Decision Matrix		All								
4. Gannt Chart		All								
5. Annotated Floor Plan			Wesley	Wesley	Wesley	Wesley				
6. Annotated 1 or 2-pt perspective drawing			Stacey	Stacey	Stacey	Stacey	Stacey	Stacey		
7. How you meet the Design Criteria										
i. Meet the needs of the public				Ryan						
ii. Provide context for the bridge					Ryan					
iii. Incorporate characteristics of Marin County/Nor Cal						Ryan				
iv. Recognize the history of Fort Baker							Wesley			
v. Utilize the Elements & Principles of Design								Wesley		
8. Anything from the Things to Consider List							Ryan	Ryan		
9. Evaluation of design									All	
10. Create PowerPoint presentation				All	All	All	All	All	All	All

DESIGN CRITERIA

Design must:

i. Meet the needs of the public
ii. Provide context for the bridge
iii. Incorporate characteristics of Marin County/Northern California
iv. Recognize the history of Fort Baker
v. Utilize the Elements & Principles of Design

THINGS TO CONSIDER

a. Movement through the visitor's center
b. Traffic to the bridge
c. Memorials, commemorations, etc.
d. Appeal to people of all ages, cultural backgrounds, physical capabilities
e. Elements of weather
f. Engineering ethics

PRESENTATION REQUIREMENTS

1. Design Brief
2. Design Process (Brainstorming) and Team Norms
3. Decision Matrix
4. Gantt Chart
5. Annotated Floor Plan
6. Annotated 1 or 2-pt perspective drawing
7. How you meet the Design Criteria
8. Anything from the "Things to Consider" List
9. Evaluation of design
10. Create PowerPoint presentation

STUDENT SELF-EVALUTATION QUESTIONS

1. What forms of communication did you use while working with your teammates?
2. Did you experience any conflicts with anyone in your group, and if so, how did you resolve them?
3. What was the most challenging part of this design experience?
4. How was the design process used through this challenge?

ASSESSMENT

Elements	5 Points	4 Points	3 Points	2 Points	1-0 Points	Total
Consideration Of Alternatives - Brainstorming	Generates at least three viable concepts. Selects most appropriate concept and clearly justifies the choice using the appropriate criteria.	Generates three concepts. Selects an appropriate concept and is somewhat able to justify the choice using marginally acceptable criteria.	Generates three concepts. Selects an appropriate concept, but cannot justify the choice.	Generates three concepts. Selects one using inadequate criteria.	Generates one concept.	
Sketching	Produces accurate pictorial and sketches of the required design concepts. Is properly detailed for effective communication.	Produces marginally sufficient freehand sketches of required design concepts. Is partially detailed for effective communication	Produces marginally sufficient freehand sketches of required design concepts. Is marginally detailed for effective communication	Produces freehand sketches that are difficult to visualize. Lacks details in sketches.	Produces incomplete sketches. Does not present concept.	
Design Requirements	Fully meets design requirements.	Meets most design requirements and supports the design function.	Meets most design requirements, but not enough to support the design function.	Meets some requirements, but not enough to support the design function.	Does not meet any requirements.	
Teamwork	All team members worked well together and settled differences the correct way.	Showed good team-working skills the majority of the time.	Showed good team-working skills the some of the time.	Showed that understands team-working skills, but does not apply well.	Did not present any team-working skills.	
Presentation	The team created an exciting PowerPoint that marketed its solution completely.	The team created a PowerPoint that marketed its solution.	The team created a PowerPoint that attempted to market a solution.	The team had the start of a PowerPoint, but failed to market the solution effectively.	Did not present the teacher with a PowerPoint.	
					Total /25	

POSSIBLE EXTENSIONS

- Puzzle-piece a floor plan from the Dunhuang Visitor's Center
- Compare and contrast Dunhuang Visitor Center's architecture with the California Academy of Sciences
- Research the architect of the Dunhuang Visitor's Center, Cui Kai
- Math behind security placement in museums, etc.
- Construction and restoration of the caves
- "McDonaldization" of non-American cities as seen at the visitor's center at the Terra Cotta Warriors Museum, the Great Wall, etc.

REFERENCES

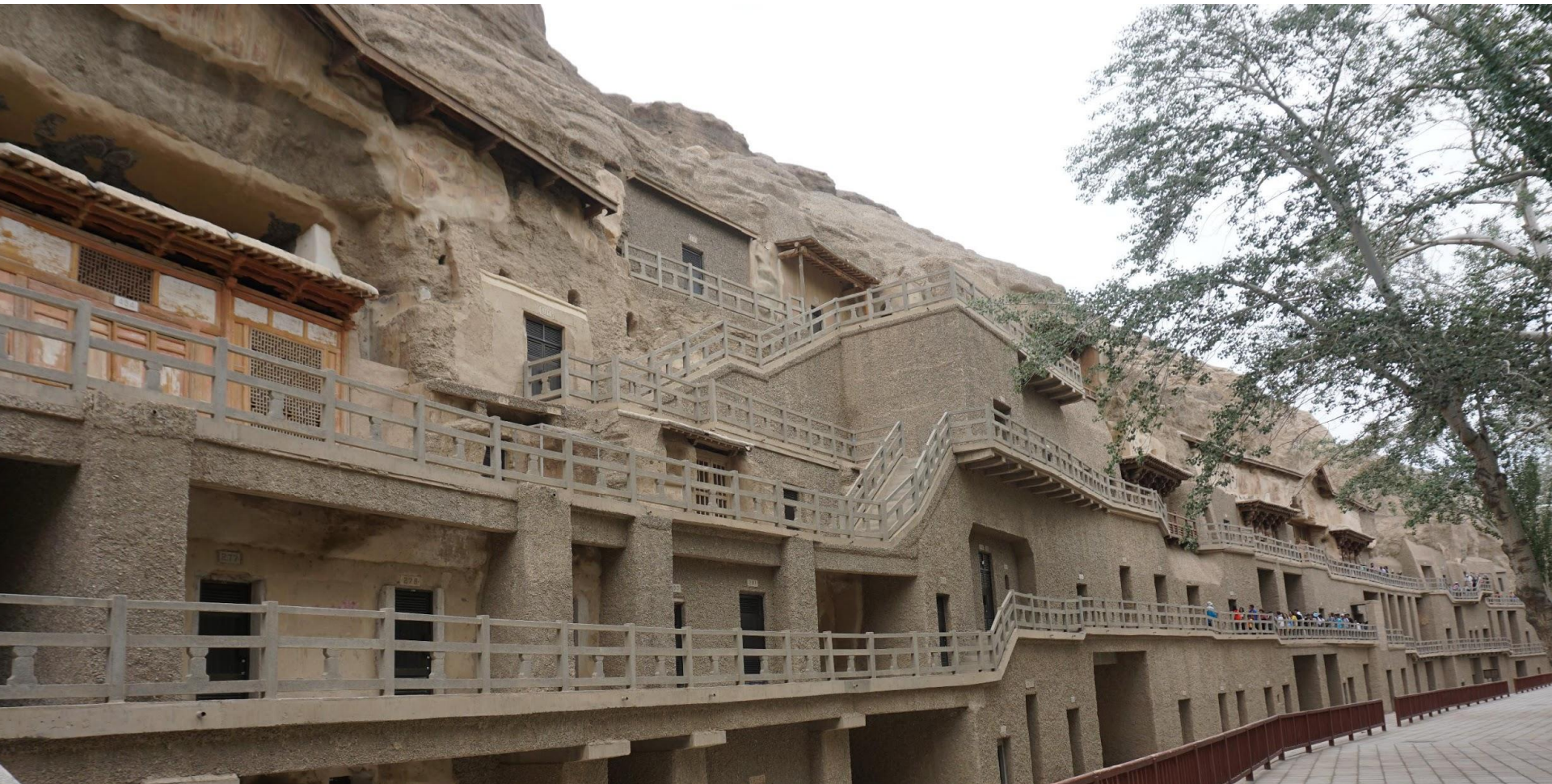
- www.e-dunhuang.com
- Hopkirk, Peter. "Foreign Devils on the Silk Road: The Search for the Lost Cities and Treasures of Chinese Central Asia." Oxfordshire: Oxford University Press, 2011.
- Jinshi, Fan and Yongzeng, Liu. "Appreciation of Dunhuang Grottoes." Jiangsu Fine Arts Publishing House, Nanjing. 2007.
- Sharf, Robert. "Art in the Dark: The Ritual Context of Buddhist Caves in Western China." 2013.

MOGAO GROTTOES

WHERE ARE THESE GROTTOES?

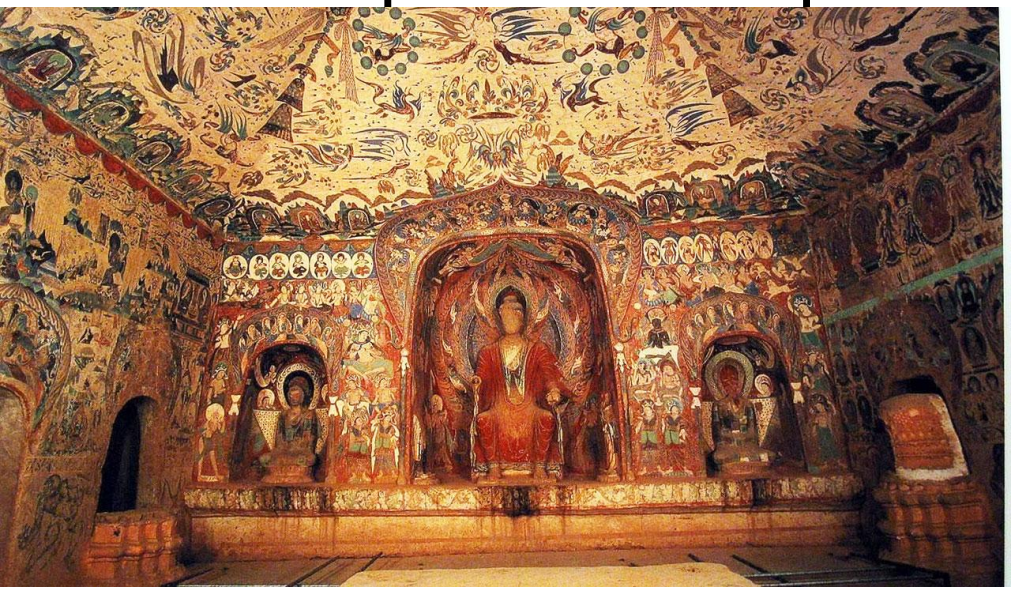
WHAT IS A GROTTOE?

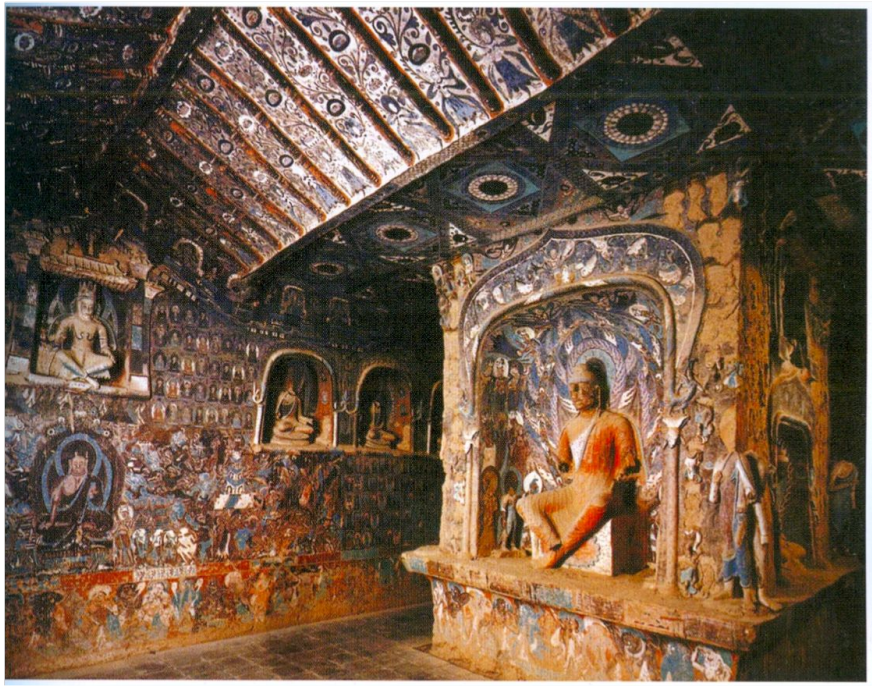
The grottoes are 492 caves along a cliff face covering over 5,511 feet from south to north.



WHAT'S INSIDE THE GROTTOES?

- 2000 painted sculptures





- And over 484,000 square feet of murals

WHO STARTED THE CAVES?

- A Buddhist Monk named Lezun built the first cave in 366 CE.
- Had a vision of a “Thousand Buddhas bathed in golden light” at the Grottoes.

WHO PAID FOR THE CONSTRUCTION?

- Clergy Members
- Local Rulers
- Military Officers

WHY DID THEY BUILD THIS?

- Possibly memorial chapels
- Possibly used for worship or meditation
- Today's scholars argue that "they were monumental public displays of Buddhist devotion and filial piety, and second, they were intended to generate merit for deceased family members, most notably parents, through the creation and worship of sacred icons" (Sharf, 46).

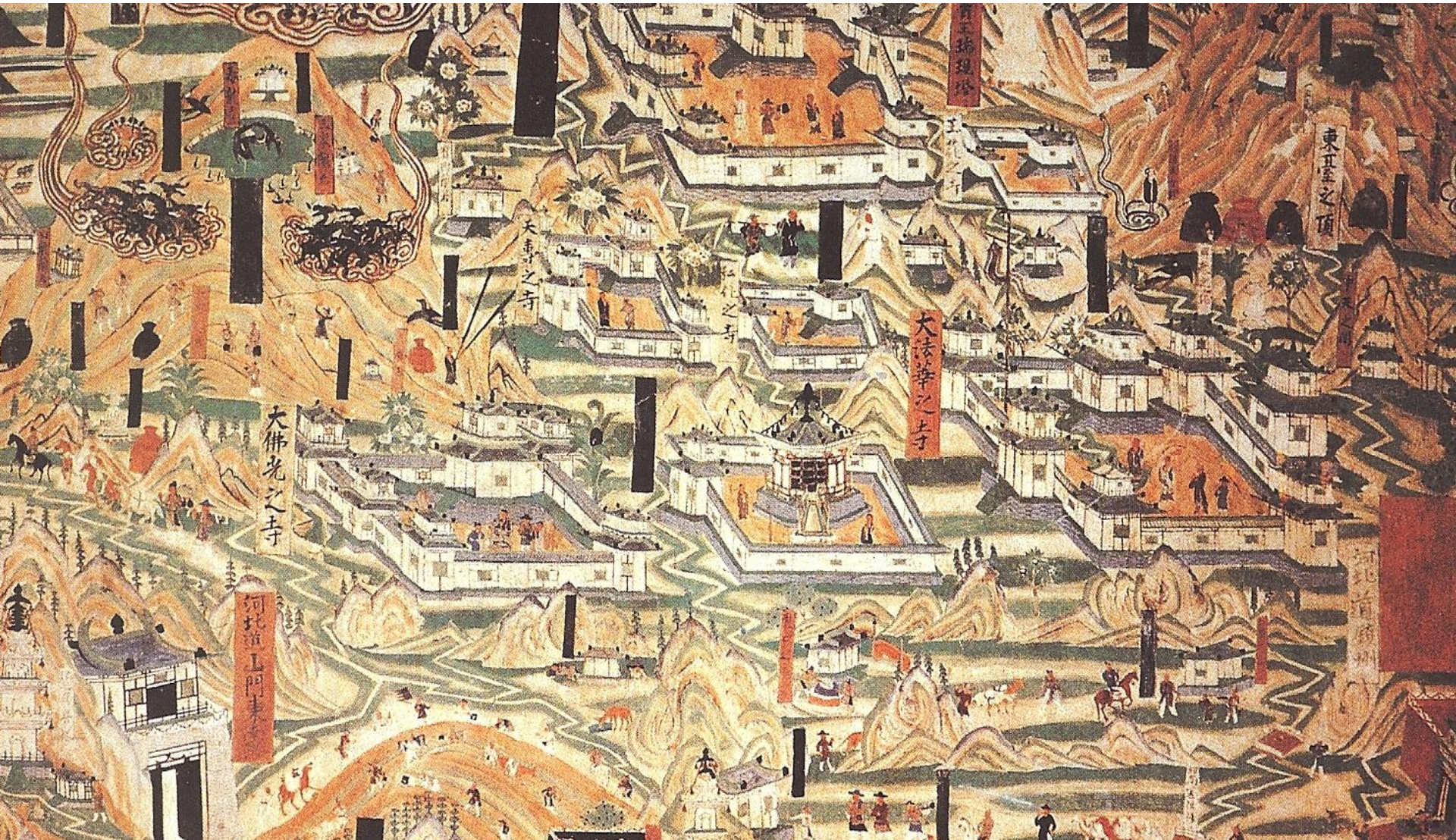
WHAT DOES THE ARTWORK SHOW?

- Narrative paintings of the Buddha's life
- Jataka Tales
- Sutra Illustrations
- Sculptures of the Buddha and his followers
- Paintings of the Donors
- Other Decorative Designs

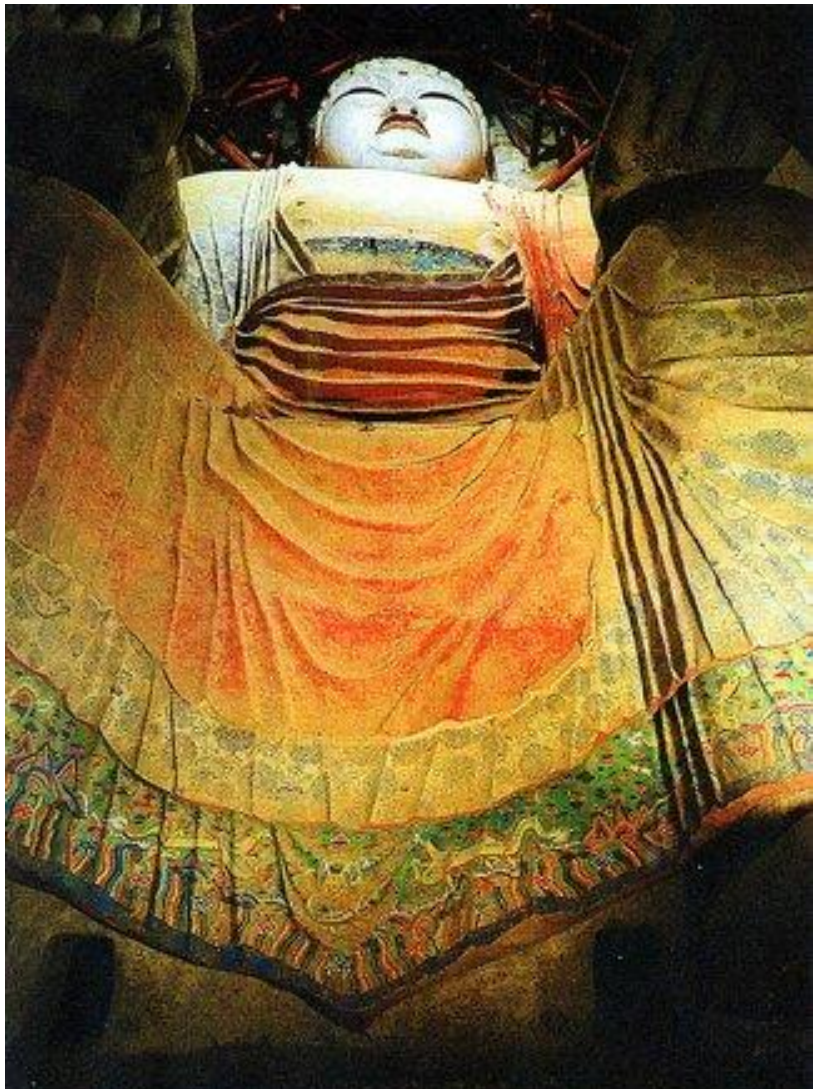
(such as mandalas)

CAVE 257
(NINE-COLORED DEER JATAKA)

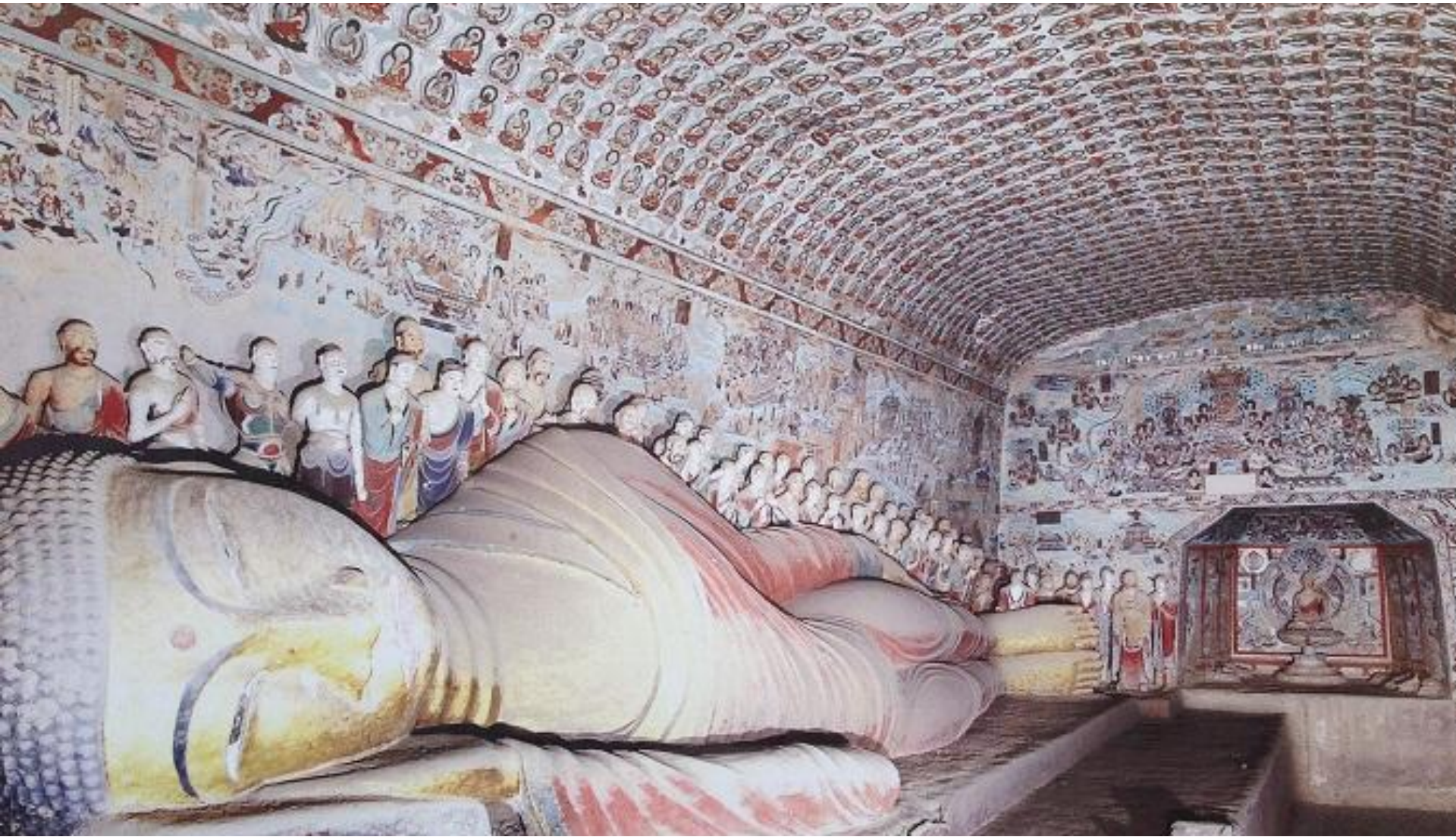
CAVE 61
(Mount Wutai)



CAVE 96
(NINE-STORYED TEMPLE)



CAVE 148
(NIRVANA CAVE)



WHAT IS THE LIBRARY CAVE?

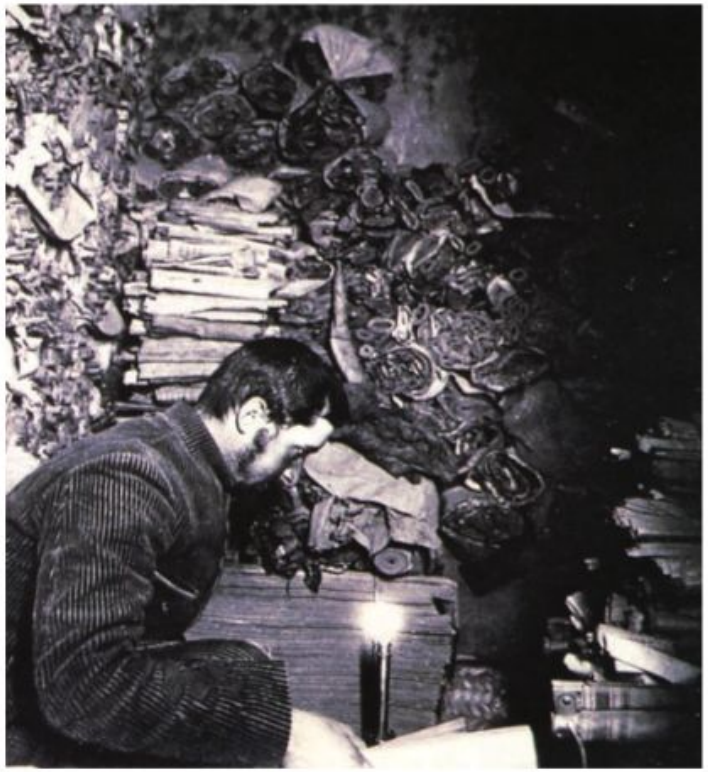
- In 1900, Taoist Wang Yuanlu discovered a cave filled with manuscripts and silk paintings.

WHO IS SIR AUREL STEIN?

- In 1907, English explorer Aurel Stein arrived in Dunhuang and bought 24 boxes of manuscripts and 5 boxes of paintings and textiles from Wang.

WHO ELSE “BOUGHT” ART FROM THE CAVES?

- 1908: French explorer Paul Pelliot arrives
- 1910-11: Zuicho Tachibana & Yoshikawa Koichiro arrive from Japan
- 1914: Sergei Oldenburg leads an expedition from Russia
- 1914: Stein comes back for more scrolls
- 1924: Langdon Warner arrives from America



Pelliot reading manuscripts in Cave 17 at Mogao, ca. 1905. Photograph: Charles Nouette. Musée Guimet/Réunion des Musées Nationaux, Paris.

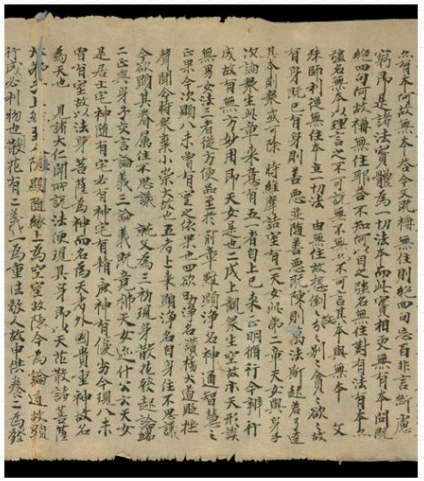
WHERE IS THIS ART NOW?

India

England

Paris

Russia



USA

WHAT HAPPENS NEXT TO THE CAVES?

- 1943: The National Research Institute at Dunhuang puts an end to the vandalism of the Mogao Grottoes
- 1944: Dunhuang Research Academy is founded
- 1956: The first Premier of the People's Republic of China, Zhou Enlai, sanctions a grant to repair and protect the site
- 1961: Caves are declared a specially protected historical monument
- 1987: Caves become a UNESCO World Heritage site
- 2018: Ms. Churchill visits the caves with a group of Fulbright-Hays teachers
- 2018: Her students learn about the caves

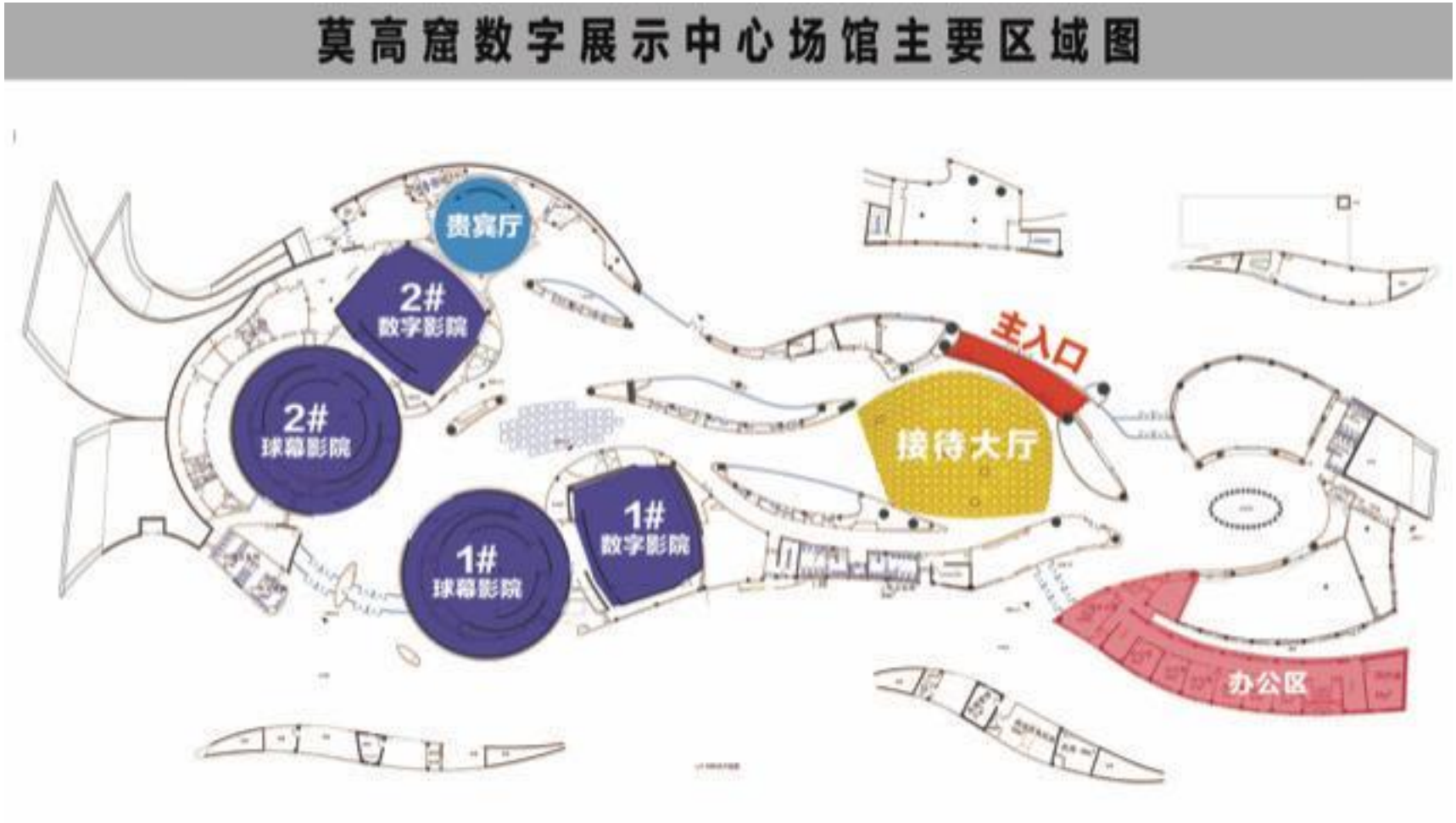
WHAT COULD BE MORE EXCITING THAN THE DISCOVERY OF ALL THIS AMAZING ART???

DESIGN CHALLENGE:
THE MOGAO GROTTOES VISITOR'S CENTER

PREFACE

- Have you ever walked into a visitor's center and immediately got a warm sense of welcoming?
- Did it make you even more excited to visit the actual site you came to see?
- Have you ever considered the design and aesthetics of a visitor's center?

MOGAO GROTTOES VISITOR'S CENTER



ARCHITECT: CUI KAI

DESIGN PROS AND CONS

DESIGN CHALLENGE

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PROCEDURES

1. Divide into teams under the direction of your teacher.
2. Review your Design Criteria.
3. Use the Design Process to generate solutions to the problem.
4. Sketch ideas in your Engineering Notebook.
5. Come together with your group & share your ideas.
6. Use a Decision Matrix to help choose the best design.
7. Use a Gantt Chart to assign tasks and create a timeline.
8. Create final design (Floor plan & 1 or 2-pt perspective).
9. Peer review your design and make adjustments.
10. Create a presentation for your clients.

DESIGN CRITERIA

- Design must:
  - i. Meet the needs of the public
  - ii. Provide context for the bridge
  - iii. Incorporate characteristics of Marin County/ Northern California
  - iv. Recognize the history of Fort Baker
  - v. Utilize the Elements & Principles of Design

Things to Consider

A. Movement through the visitor's center
B. Traffic to the bridge
C. Memorials, commemorations, etc.
D. Appeal to people of all ages, cultural backgrounds, physical capabilities
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PRESENTATION REQUIREMENTS

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7. How you meet the Design Criteria
8. Anything from the Things to Consider List
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10. Create PowerPoint presentation

GRADING RUBRIC

Elements	10 Points	9 Points	8 Points	7 Points	6 Points	Total
Consideration of Alternatives (Brainstorming)	Generates at least three viable concepts. Selects most appropriate concept and clearly justifies the choice using the appropriate criteria.	Generates three concepts. Selects an appropriate concept and is somewhat able to justify the choice using marginally acceptable criteria.	Generates three concepts. Selects an appropriate concept, but cannot justify the choice.	Generates three concepts. Selects one using inadequate criteria.	Generates one concept.	
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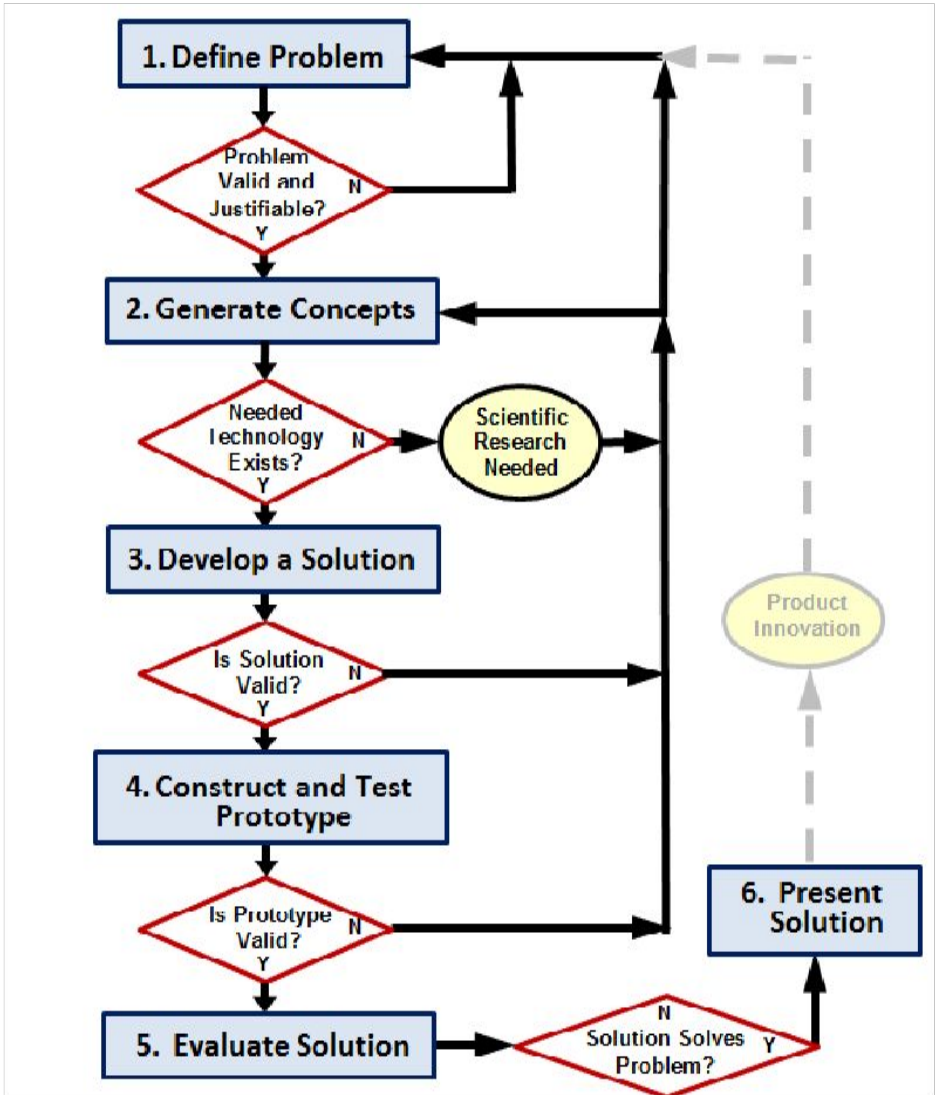
					Total /50	

DESIGN BRIEF EXAMPLE

Design Brief Component	Description
Client	A person, company, organization, or group that requires the talents of an engineer or designer to develop a solution.
Target Consumer	People who will use the design. **Note**: Often the target consumer and the client are one and the same.
Designer	The creative person who is designing a solution to the problem or opportunity.
Problem Statement	A clear and concise identification and description of the design problem or opportunity.
Design Statement	Statement that describes the anticipated design effort to address the needs of stakeholders and problem statement.
Criteria	A list of needs and design requirements that describe what the design solution must do to meet the needs of stakeholders.
Constraints	A list of specifications and design requirements that define parameters or boundaries the design solution must address. These might include time constraints, budget, codes, safety, or physical attributes (size, weight, color).

DESIGN PROCESS



DECISION MATRIX

	Stacey's Boathouse Design	Wesley's Ultra Modern Design	Ryan's Goldrush Design
Meets Criteria	3	4	2
Ease of Construction	3	2	4
Cost Effective	5	5	4
Innovation	3	5	3
Things to Consider	2	1	3
Total	16	17	16

GANTT CHART

REQUIREMENT	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
1. Design Brief	Ryan									
2. Design Process (Brainstorming)		All								
3. Decision Matrix		All								
4. Gannt Chart		All								
5. Annotated Floor Plan			Wesley	Wesley	Wesley	Wesley				
6. Annotated 1 or 2-pt perspective drawing			Stacey	Stacey	Stacey	Stacey	Stacey	Stacey		
7. How you meet the Design Criteria										
i. Meet the needs of the public				Ryan						
ii. Provide context for the bridge					Ryan					
iii. Incorporate characteristics of Marin County/Nor Cal						Ryan				
iv. Recognize the history of Fort Baker							Wesley			
v. Utilize the Elements & Principles of Design								Wesley		
8. Anything from the Things to Consider List							Ryan	Ryan		
9. Evaluation of design									All	
10. Create PowerPoint presentation				All	All	All	All	All	All	All

STUDENT SELF-EVALUTATION QUESTIONS

- What forms of communication did you use while working with your teammates?
- Did you experience any conflicts with anyone in your group, and if so, how did you resolve them?
- What was the most challenging part of this design experience?
- How was the design process used through this challenge?