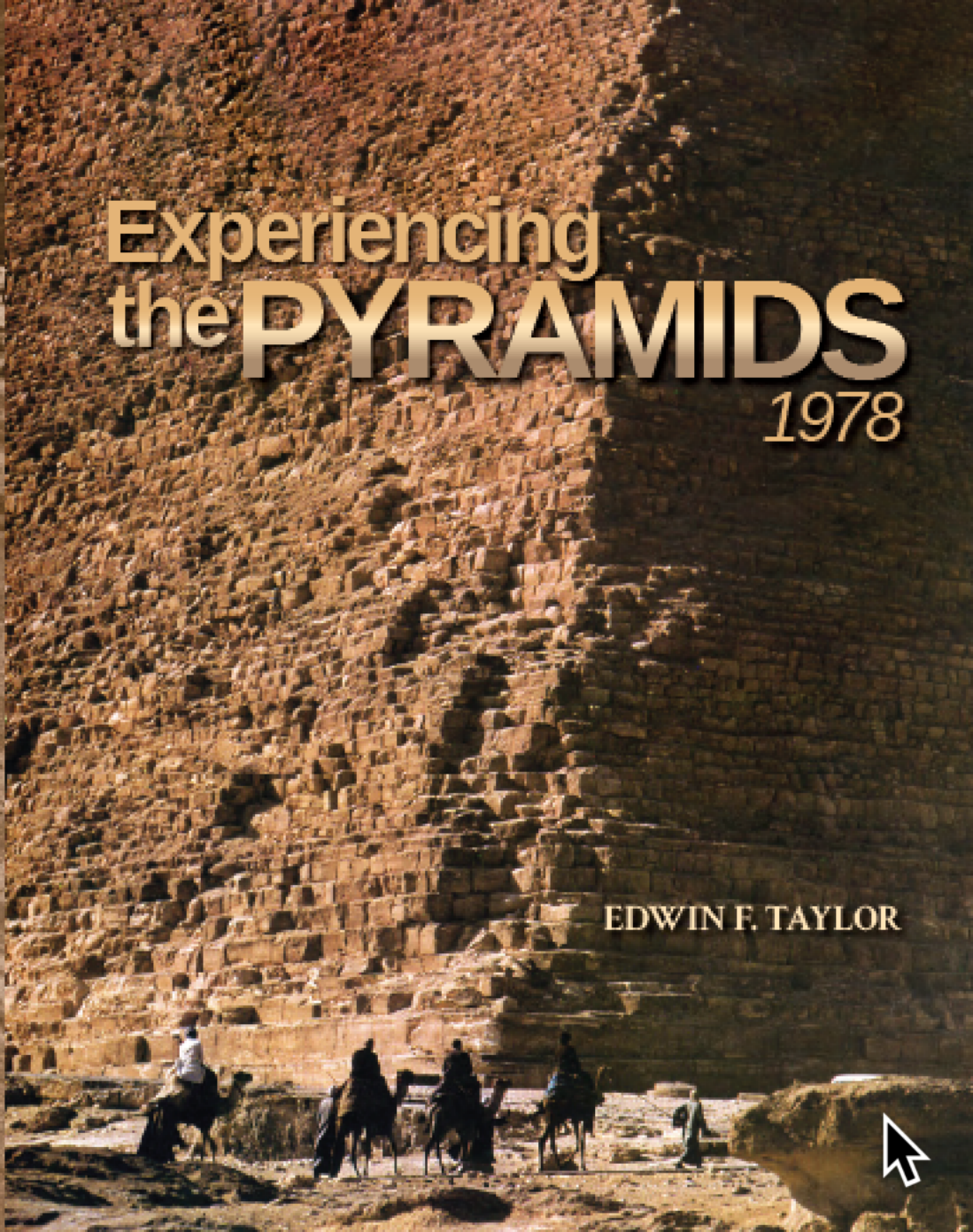


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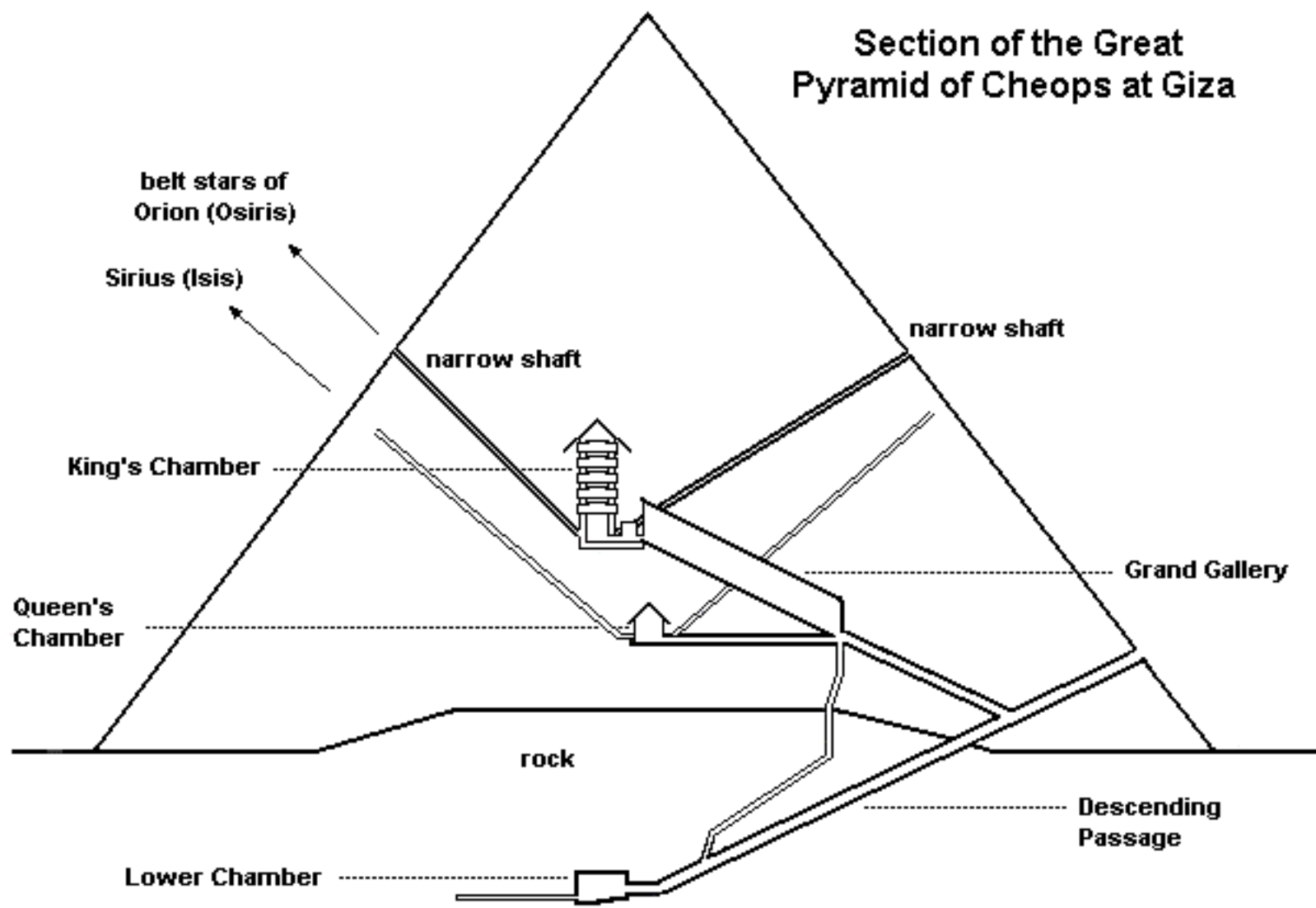


Experiencing the **PYRAMIDS** 1978

EDWIN F. TAYLOR



Section of the Great Pyramid of Cheops at Giza



1 First Church in Belmont, Unitarian Universalist

2 Sunday, July 17, 2016

3 The Spirituality of Science; Is It Enough?

4 Edwin F. Taylor

5
6 The initial detection of gravitational waves is a scientific revolution of the first magnitude.
7 It opens a new window on the Universe. A gravitational wave moves without distortion
8 through clouds in the galaxy, through ionized gas that blocks the light of Creation, and
9 brings us a coded signal from a gravitational convulsion. The first detected convulsion
10 took place more than a billion years ago and more than a billion light years distant, when
11 two black holes orbited each other, then coalesced. There were really two central results of
12 this experiment. First, the detection of a gravitational wave. Second, the first solid, direct
13 evidence for the existence of black holes, in this case two black holes, each about 30 times
14 the mass of our Sun. On June 15 a second detection of gravitational waves from coalescing
15 black holes was announced. I do not have further information about this second detection.

16
17 In the science of an experiment, I include the engineering required to carry it out. The
18 genius of MIT and Cal Tech are their ability to harness both engineering and science to a
19 project such as this.

20
21 The cost was at least 1.3 billion dollars of your money, for which we can be proud as a
22 nation. However the 1000 authors that announced the first detection of gravitational waves
23 were from many nations, all traditions, both genders, all possible sexual preferences, all
24 races, and many religions, including – of course -- no religion at all.

25
26 Each of the LIGO detectors consists of two 4-kilometer-long concrete tunnels oriented at
27 90 degrees from one another, each big enough for you to walk inside. Each tunnel houses a
28 long steel tube 1.2 meters in diameter with a very high vacuum. A powerful laser is at one

29 end and a pendulum mirror at the other. The light beam ricochets up and down each of
30 these tunnels more than 400 times before detection.

31

32 Now we will stop for three minutes to discuss two questions.

33

34 First question: Is the story of gravitational wave detection a spiritual experience for you?

35

36 Second question: Was the first gravitational wave detection a spiritual experience for the
37 1000 research workers who got professional credit for the discovery? (Jack Dennis: check)

38

39 The first detection of gravitational waves may be too recent for us to have perspective
40 about it. Fifty years from now, perhaps sooner – surely in the lifetime of the young people
41 in this room – we will detect gravitational waves from the mighty convulsion of the Big
42 Bang itself, a convulsion that started our Universe. Almost certainly our interferometers
43 for that later experiment will float in space. Fifty years from now, the abandoned remnants
44 of each LIGO structure used for the first detection of gravitational waves may be a tourist
45 attraction. If so, our children and their children will be invited to walk inside the concrete
46 tunnel alongside the steel pipe that by then will no longer contain a vacuum.

47

48 Now I want to to go way back in time, to the abandoned remnants of a huge national
49 project to which we each can react in our own way. Almost five thousand years ago,
50 people who we now call Egyptians built the Great Pyramid of Giza, also called the Cheops
51 Pyramid, which is the only surviving Wonder of the Ancient World. I visited the pyramids
52 of Giza in 1978. I want to tell you several stories about the people I watched reacting to
53 the Great Pyramid, including myself.

54

55 But first, how big *is* the Great Pyramid? Look on the first page of your handout, especially
56 the front cover of a pamphlet that I will publish by the end of July, a view of the bottom

57 rows of stones in the Great Pyramid; it is a staggering structure. In 1978 the tallest
58 building at MIT was the Green Building, twenty floors high, approximately 220 feet. The
59 Great Pyramid is more than twice this height, initially about 480 feet tall (150 meters).
60 Almost five thousand years later, the Great Pyramid is truncated, now has a flat top, as you
61 can see in the aerial photograph. Early in 1978 I spent two weeks running up and down the
62 stairs in the MIT Green Building, until I could do it twice in a row without exhaustion.

63

64 On the first day of my visit to the pyramids, I was captured by an experienced and
65 attentive guide in green cloak and white headdress, who told me to call him Sam. Sam was
66 knowledgeable about the pyramids and an expert in what they call baksheesh, the bribery
67 system: how much to bribe each guard so that we could go into tunnels closed to the
68 public, visit closed burial sites around the pyramids, and allow me at the end of the day to
69 climb the Great Pyramid by myself. Sam's bribes and his personal fee that first day cost
70 me \$125, which I still consider to be a great bargain.

71

72 Now look inside the Great Pyramid. Its layout is on the opposite side of your handout.

73 [Details here]

74

75 On the second day I spent hours alone, loafing around in the Great Pyramid, watching the
76 reactions of tourists to this Seventh Wonder. First in the King's Chamber, where group
77 after group appeared. The guides were badly informed and superficial in their knowledge,
78 impatient to get the present group back outside in order to collect payment from the next
79 group. Gender seemed to separate reactions of the visitors: About half of the men spent the
80 whole time fiddling with their cameras and positioning their families for a picture. About
81 half of the women buried their noses in a guidebook in order to read what they were
82 supposed to see.

83

84 At the bottom of the Grand Gallery, I met a pair of Japanese-Americans. “Is there anything
85 up there?” they asked, gesturing up the Grand Gallery toward the King’s Chamber.

86 “Yes, there is a large room made of black stone.”

87 “But is there anything up there?”

88 “What do you mean, ghosts?”

89 “No, any mummies?”

90 “No mummies but there is a large coffin made of stone.”

91 “Well then, there’s no need for us to go up there.”

92 So they took pictures of each other, then left the pyramid.

93

94 Here’s the point of tourist reactions to the abandoned Great Pyramid and probably to the
95 abandoned LIGO structure fifty years from now: It takes special knowledge and insight to
96 feel wonder and to appreciate the range and depth of technology that built these structures.
97 If you have this knowledge and feel this wonder, your visit to each of them can celebrate
98 both the stunning accomplishment and the compulsive vision that gripped those who
99 carried out each of these mighty works. My visit to the Great Pyramid was, for me, a
100 spiritual experience.

101

102 As I climb the Great Pyramid again at the end of my second day there, I consider the
103 Egyptian system (or lack of system) for managing the pyramids. The passages are
104 dirty, the lighting is terrible, the guides are full of misinformation, and the fees
105 depend on your gullibility. Many westerners would consider baksheesh, or bribes, to
106 be despicable. However, they do deliver the genuine article: There are no pyramids
107 to match these anywhere else. Also, I find the bribe system to be gentle and worldly-
108 wise. Our reflexes are wrong for this part of the world. If you are accosted in Central
109 Park, you expect to be robbed, or worse. In Egypt a friendly or even persistent
110 interest can be satisfied for a few coins for services rendered, and a firm “no”
111 usually turns away the importuner.

112

113 As I climb, I consider what Walt Disney Enterprises would do with these pyramids.
114 A good cleaning; dramatic and thorough lighting; uniformed female guides; a
115 poured concrete “orientation pavillion” with exhibits and a wrap-around
116 presentation of the history of the pyramids; two hundred dollars per person. And
117 because of the liability laws, it really would be prohibited to climb the pyramids.

118

119 I prefer the Egyptian system.

120

121 Here is the last sentence in my account of visiting the pyramids: “I am utterly content.”

122

123 Returning to the detection of gravitational waves, I would say that the life of a scientist can
124 be a spiritual experience. But there is a second part to our title: Is it enough? Enough for
125 what? Here is my refined question: Is the spritual experience of science enough to guide
126 me personally and to guide the power structure of a nation? My personal answer to that
127 question is a definite NO.

128

129 Am I wrong? Let’s look at some other projects of the powerful. First, the cathedrals,
130 synagogues, and mosques of Europe and the Middle East. We know more about the people
131 who built these structures than we do about the people who built the pyramids: I revere
132 Filippo Brunelleschi who addeed the dome to the Florence cathedral and Michelangelo
133 Buonarroto who designed St. Peter’s Basilica.

134

135 On the other hand, the Soviet Union matched us in the huge effort to develop nuclear
136 weapons and intercontinental rockets to deliver them. North Korea is stumbling along a
137 similar path, much to our anxiety. Every home in North Korea is fitted with a speaker that
138 cannot be turned off, through which North Korean propaganda blares day and night; police
139 inspect these speakers annually to be sure they are working.

140

141 Sometimes when Carla comes to a meeting at this church, I stay home and watch the series
142 Nazi Megaweapons. Many remaining reinforced concrete structures in Europe are as
143 stunning as the Great Pyramid, some of them built with slave labor. The Nazis were way
144 ahead of us in submarines and rockets, but – thank God! -- behind us in nuclear weapons.

145

146 I conclude that, personally and in the structures of power, we need more than the genius
147 and organization required to build the Great Pyramid and the cathedrals, to construct
148 intercontinental rockets and nuclear weapons, and to detect gravitational waves.

149

150 Can you see where this is going? Well, it's complicated. We can be inspired by great
151 national and international accomplishments; we can fund them as a nation, participate as
152 scientists or as citizens, and be proud of the results. But the direction of our personal and
153 national lives needs more. For one thing, it needs the messy and turbulent organizations of
154 democracy. Beyond this, some of you Unitarian-Universalists in this room ask for the
155 simplest and most humane set of principles to guide our actions. The First Principle of this
156 church, the worth and dignity of every person, is a great start. But the validity of our First
157 Principle is not obvious; it is difficult to apply; it listens, sporadically, to the teachings of
158 Jesus; for some people in this room, our First Principle bypasses the Almighty, without
159 necessarily denying her existence.

160

161 Sorry, beyond this I cannot tell you how to live. And if I tried, you would make up your
162 own mind anyway. Damn! [about 1800 words]

163

164 *Reference: Janna Levin, Black Hole Blues, 2016, Horizon Book, Alfred A. Knopf, Epilog,*
165 *pages 205-212.*

The First Church in Belmont Unitarian Universalist

July 17, 2016

Edwin F. Taylor

Lanier Smythe, Worship Committee Coordinator

The Spirituality of Science; Is it Enough?

Prelude		Rowan Wolf
Welcome and Announcements		Lanier Smythe
Opening Hymn 108	<i>My Life Flows On in Endless Song</i>	
Chalice Lighting	Life is a gift for which we are grateful. We gather in community to celebrate glories and the mysteries of this great gift.	Lanier Smythe
Responsive Reading	<i>Somewhere in the Universe</i> by Janna Levin	Edwin Taylor

Somewhere in the universe two black holes collide and coalesce, an event as powerful as any since the origin of the universe, outputting – for an instant -- more than a trillion times the power of a billion Suns.

That profusion of energy emanated from the coalescing holes in a purely gravitational form, as waves in the shape of spacetime, as gravitational waves. . . This happened more than a billion years ago. . . .

A vestige of the noise of the crash has been on the way to us since early multicelled organisms fossilized in supercontinents on a still dynamic Earth.

When the gravitational wave moved through our Local Supercluster of galaxies, dinosaurs roamed the planet. As it passed the nearby Andromeda galaxy, the Ice Age Began. As it entered the halo of our Milky Way, we were painting caves.

As the wave approached a nearby star cluster, we were in the final furlong, the rapid years of industrialization. The steam engine was invented and Albert Einstein theorized on the existence of gravitational waves. When I started to write this book, the gravitational wave reached Alpha Centauri.

In the final minuscule fraction of that billion-year journey, a team of a thousand scientists . . . built two observatories to record the first notes

from space. As the . . . wave moved through the interstellar space outside the solar system, the detectors became operational.

As the wave nears the orbit of Neptune, we have only a few more hours. Past the Sun, we have eight more minutes. Someone . . . on duty in the control room, awash in fluorescent lights, listening to the detector through conventional speaker systems or headphones for fun, because she can, might hear something, for just a second or two, that sounds different.

A sophisticated computer algorithm parses the data stream in real time and sends a notification to the data analysts. . . . a fumble for glasses . . . and someone is the first to look over the specs of the trigger and think calmly, "This might be it."

Offertory Hymn 121	<i>We'll Build a Land</i>	
Offering	Offertory music	Rowan Wolf
Candles	Joys and Concerns	Lanier Smythe
Talk	<i>The Spirituality of Science; Is it Enough?</i>	Edwin Taylor
Closing Hymn 1064	<i>Blue Boat Home</i> (Green Hymnal)	
Benediction		Lanier Smythe
Postlude		Rowan Wolf

Reference: Janna Levin, *Black Hole Blues*, 2016, Horizon Book, Alfred A. Knopf, pages 203, 204. [Levin wrote it as a prediction. EFT edited it to turn her description into a report on the initial observation; a few details may therefore be different or wrong.]

Next Sunday, July 24: Alice Trexler and Downing Cless *Air, Earth, Fire, and Water*