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Livni, Joseph

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Cultural Evolution of an Institution: The Sabbath

Joseph Livni

Omega-n, Aviation, Science & Art, Inc.

Abstract

According to the biblical account the Sabbath has been commanded at Mount Sinai during the Exodus. Reasonably, there can be no archaeological evidence to confirm that. However, the archaeological evidence points to a rankless society in pre-monarchic Israel. Lack of social layers in settled societies does raise questions about controlling the lawlessness. Livni and Stone mathematically established that the Sabbath could keep unruliness under control and that later, starting with the Second Temple, it did so. This multi-disciplinary report portrays the history of the Sabbath in terms of socio-cultural evolution combining analyses of anthropologists, archaeologists, biblical scholars, and computation methods. The report shows that the Sabbath is at least 3000 years old.

Introduction

This work will present the Sabbath's history in a new light. It will follow it as an evolutionary process of a random cultural mutation growing into a widely accepted cultural trait that gave us not only the weekends but it also fundamentally shaped our current way of life.¹

The report is a follow-up of a previous investigation (Livni and Stone 2015). That article used the bio-mathematical analogy between spread of misconduct and propagation of infections. It concluded that: "The mathematical model alone cannot prove a pre-monarchic origin of the Sabbath but it does support it."

This report goes further. It describes the evolution of the Sabbath from random and unintentional cultural mutations that occurred in the pastoralist past of pre-monarchic Israel's ancestors. These ancestors were similar to many other

¹ The essential role of the Sabbath in the survival of the covenantal system is treated by Livni and Stone (2015): the Pilgrims were a covenantal society and had a critical impact on the American constitutional democracy (Tocqueville 2000; Elazar 1997; Lutz 1988); the American constitutional model affected the way of life of other democracies (e.g. Billias 2011).

Corresponding author's e-mail: yossilivni@hotmail.com

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pastoralist nomadic tribes and chiefdoms. They shared an egalitarian ethos as many of these tribes. They also had particular cultural traits. The report finds that the cultural evolution of the Sabbath involved two particular traits: the habit to assemble every seventh day and the transmutation of the hierarchical concept of covenant into an egalitarian conviction in a bond between each individual and the divinity. The report discusses how, after settling, these two particular traits gave birth to the Sabbath and to the covenantal society a societal type that will be treated later.

This work also numerically examines competing theories claiming that the Sabbath was institutionalized during the Babylonian exile. The theories fail the examination; the results of time history simulations indicate that by the time the Sabbath would have been institutionalized the exiled communities would have fallen apart.

In Livni and Stone (2015) we showed that the Sabbath was *a* solution to the problem of justice administration of pre-monarchic Israel; this work makes the case that the Sabbath was the *only* solution.

Cultural Evolution of the Sabbath

It is very appealing to explain the origin of cultural institutions in terms of evolution theory (see more in Shennan 2008, Richerson and Henrich 2009). Both in biological and cultural evolution one investigates the fate of a random mutation. In cultural evolution a random mutation is an innovation and its fate could be one of the following three (Cavalli-Sforza and Feldman 1981: 130):

1. Fixation: the innovation is adopted by all;
2. Extinction;
3. Polymorphism: some adopt the innovation, some conserve the old routine.

The proportion p of new imitators at time $t + 1$ is proportional to both:

1. the proportion of models $p(t)$ at time t ;
2. the proportion of those who still did not imitate the models $[1 - p(t)]$.

Or:

$$p(t + 1) = p(t) + \alpha p(t)[1 - p(t)] \quad (1)$$

Equation 1 is recognized as horizontal and oblique cultural transmission (see equation 3.1.3 of Cavalli-Sforza and Feldman 1981, 133). Equilibrium is achieved when $p(t + 1) = p(t)$. This implies that either $p = 1$ or $p = 0$. In words, the trait reaches equilibrium either by fixation or by extinction. If the trait is advantageous then extinction is ruled out.

The Sabbath

The Sabbath institution is essential to the covenantal society (Livni and Stone 2015); therefore I shall treat its evolution in parallel with the evolution of the covenantal society. The “supercomplex chiefdoms created by some nomads of Eurasia” (Bondarenko, Grinin, and Korotayev 2004) are a proper point of start.

The nomadic origin of the Israelite settlers is controversial, and some scholars, for example Dever (2006) advocate a settled Canaanite origin. Nevertheless, this work assumes as many others (e. g. Finkelstein, Mazar, and Schmidt 2007: 93, 150; Faust 2008: 182; Knohl 2008: 53) a nomadic pastoralist origin because in virtue of Schneider’s principle (Boehm 2001: 103, 104), it is more likely that the egalitarian ethos of the settlers (discussed later) originated from nomadic pastoralists. Schneider’s principle is based on economic factors leading to stratification: settled agriculture involves stability in economic success in the sense that the rich remain rich; as opposed to that the size of nomadic pastoralist’s cattle herd varies and “today’s Big Man may become tomorrow’s poor man.” Therefore stratification is less predictable in nomadic pastoralist societies than in settled farming societies.

Some of these tribes settled on the Central Hill of the Land of Israel; later these settlements became Israel. Not surprisingly the entity has various names like Israel of the Judges (Hackett 1998; De Geus 1985), pre-monarchic Israel (Faust 2015; Gottwald 1993; Meyers 1978; Gottwald 1975), Israel of Iron Age I (Mazar 1990, 2005; Hawkins 2007; Faust and Katz 2011) or Proto-Israel (Dever 2006). The historical dates of this period are somewhat controversial; however Mazar’s suggestion, namely the interval between 1200 and 980 BCE, is reasonable (Mazar 2005). The differences between the settlers on the hills and the rest of the Land of Israel comprise house architecture, pottery, pork consumption, burial customs, administrative and religious buildings (Faust 2008). In chapter 11 Faust (2008) describes a wide consensus regarding the lack of stratification on the hills as opposed to developed stratification elsewhere. As mentioned earlier, an egalitarian ethos is consistent with nomadic pastoralist lifestyle. However, once the pastoralist tribes settled and engaged in growing and storing crops and owing land the egalitarian ethos became an endangered cultural trait; it had two possible outcomes: to vanish or to adapt.

In evolution terms, adapting implies a random unintentional mutation that allows survival. In our case the survival took two mutations: a habit of *weekly assemblies* and the concept of *covenant*. The term *covenant* will be treated later. First, the term “*weekly assemblies*” requires attention because in those days the notion of seven-days-week was not yet in circulation. The known units of time were *day, month, season, and year* (Horowitz 1996). The seven-day period is not a period of any natural phenomenon and the cultural mutation in question gave birth not only to the Sabbath and the covenantal society, but also to the *week* and

to our *weekend*.

We are told that in Canaan and Mesopotamia, the Full Moon was called *Sabbath* (Wood 1916, Meek 1914). There are two hypotheses arriving from a Full Moon celebration at a weekly assembly:

Hypothesis 1. The pastoralists had a habit of meeting at an odd interval of seven days. They borrowed the term Sabbath from the Canaanites or Babylonians because their “holy convocation” shared common features with Full Moon assemblies of others.

Hypothesis 2. Long before settling, the pastoralists celebrated the Full Moon and as others, they called it Sabbath. New Moon is easily discernable, but Full Moon is more problematic (Figure 1). There are two ways to arrive at an agreed day of Full Moon convocation: one counts either fourteen or fifteen days from New Moon (Figure 1). Tribes counting fourteen days could match count at half-time convocations seven days after New-Moon.

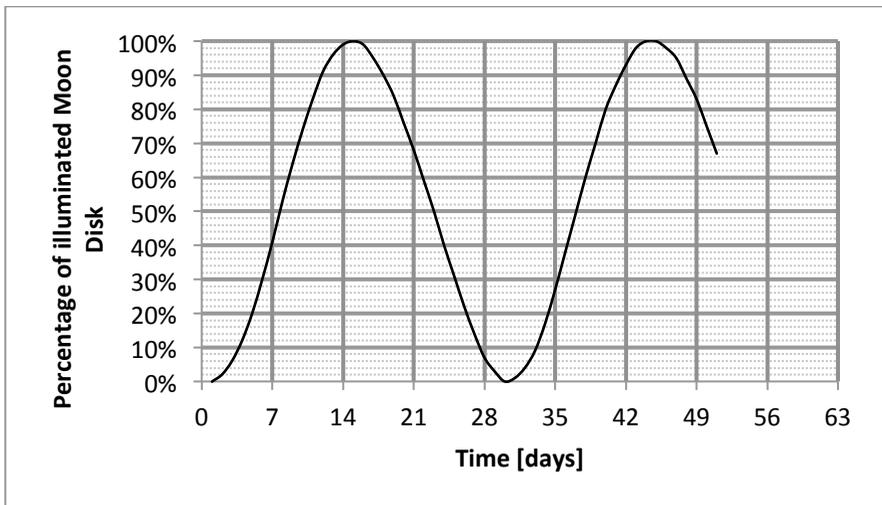


Figure 1. Percentage of the Moon illuminated at midnight Eastern Time from Jan. 10 2016 to Feb. 4 2016 (US Navy 2007); on the 14th, 15th and 16th day the moon was 99%, 100%, 99% full, respectively; the need to distinguish between 99% and 100% makes the Full Moon easy to miss.

This convocation assured participation at the Full-Moon (Sabbath) assembly. One cannot rule out directives like “Remember the Sabbath day...” [Exodus 28: 8].

Ultimately the intermediary meetings were also called Sabbath. After settling, the habit conflicted with agricultural work. The expression became:

Remember the Sabbath day, to keep it holy. Six days shalt thou labour, and do all thy work: But the seventh day is the Sabbath of the Lord thy God: in it thou shalt not do any work... [Exodus 20: 8–10].

In (Livni and Stone 2015), we established that these convocations played an essential role in keeping the egalitarian lifestyle due to its odd seven-day frequency. Tribes with convocations at known time units like monthly or half-monthly could not. This makes sense because each meeting of the assembly triggers the repentance coefficient (see 'The mathematical model' below), so the more frequent the meetings, the lower the equilibrium level for transgression. The day was also a known time unit. Daily convocations would have reached maximum frequency; nevertheless they were not practical because the egalitarian ethos required unrestricted participation, which at its turn hinges on labour prohibition.

At this point we are ready to explain the term “covenantal society.” It is a particular form of a non-ranked ‘mega-community’ conforming to the definition of Bondarenko, Grinin, and Korotayev (2004) including the “four concentric circle level.” The attribute that makes it particular is the notion of *covenant*.



Figure 2. Notice the analogy of the network of ancient Israel with current Presbyterian organization. Readers familiar with the Jewish communities of the Diaspora will recognize that they also fit this schematic. In ancient Israel, within the town there was a smaller concentric unit (not shown)—the extended family (King and Stager 2001: 39–40).

The Covenant

The covenant is not an Israelite invention. Covenants existed in Israel’s ancient world (e.g. the Hittite covenant in Mendenhall 1955: 29); the Israelites’ persuasion only slightly modified the concept; instead of signing it with a mortal sovereign, the Israelites preserved their egalitarian ethos by “signing” a covenant with an immortal one. And instead of designating someone with power of attorney, the Israelites believe that each one of them is signatory party to the covenant and so are his/her descendants: “Face to face the LORD spoke to you on the mountain out of the fire” [Deut. 5.4].

Israel was surrounded by strongly stratified societies; maintaining an egalitarian ethos next to pharaonic Egypt and oligarchic Philistine or Canaanite city-states required strong cohesion forces.

Typically egalitarian societies settle disputes by mediation; they need neither a clear distinction between right and wrong, (Sillitoe 1998: 159) nor a consequential allocation of guilt (Dickson-Gilmore 1996: 101). However in Israel, the egalitarian ethos absorbed from hierarchical neighbours concepts of penal norms like guilty, innocent, justice, and punishment; penal norms restrict arbitration to disputes that do not involve violation of norms. The encounter of egalitarian societies with hierarchies was not unique to Israel; for example, the Celtic tribes of Iron I also bumped into Roman rule (Luley 2016). However the outcome of the two encounters was different: Israel maintained its egalitarian ethos while the Celtic people became stratified.

By hypothesis, the Israelites squared the circle using the notion of *covenant*. Reasonably, the faith in a God sanctioning a covenant with each member of the community was the spiritual projection of the covenantal polity. After all, “every religion is to be found in juxtaposition to a political opinion which is connected with it by affinity” (Tocqueville 2000: 241). Scholars note that the covenant is of the suzerainty type (Mendenhall 1955: 29). One cannot sign such a covenant with more than one sovereign. That does not necessarily imply subscribing to full monotheism of current times and denying the existence of other gods. At that stage the covenant only forbade *serving* other gods (Bright 2000: 160). Bright observes that neither the term henotheism nor monolatry would fit because:

“... the existence of other gods was not expressly denied, neither was their status granted. Because of these difficulties many scholars seek some compromise word like *incipient monotheism, implicit monotheism, practical monotheism, or the like*” (Bright 2000: 159).

Regardless of the terminology, my contention is that a covenant allowing serving other gods undermines itself. Therefore, from this point of view the monotheistic nature of such a faith stems from its covenantal arrangement and not the other way around as inferred by Knohl’s hypothesis linking Israel’s monotheism to Pharaoh Akhenaten (Knohl 2008: 110).

In socio-political terms, the egalitarian notion of covenant gave rise to an egalitarian societal type called *covenantal society* (Elazar 1998; McCoy, Baker, and Bullinger 1991; Smith 2008).

Pre-Monarchic Israel was Egalitarian; Was it Covenantal?

As mentioned in an earlier example, the Hebrew Bible testifies that in the Era of the Judges, Israel had a covenant (e.g. Exodus 24: 7,8; Exodus 34: 27; Deut. 5.4).

Scholars assume that these texts were edited during the monarchy.² The report shall revisit this assumption in the next section (see 'Tests' below).

Can we rely on texts revised under monarchy claiming that the divinity covenanted with the people of Israel and not with its rulers? Yes, we can! “Even if all the textual evidence is ‘propaganda’ its very existence proves that there was an audience for it ... In Egypt such a propaganda was unnecessary” (Faust 2008: 105). The “audience” consisted of cultural descendants of pre-monarchic Israel; the difference between Egypt and Israel must have come from the difference between the two pre-state ideologies.

Competing Theory

Contrary to the previous section some scholars claim that Sabbath observance was born during the Babylonian exile (Table 1). Even the scholars of the exilic school note that some form of Sabbath custom existed prior of its institutionalization. Our interest is in “holy convocation” and in the prohibition of work. “Holy convocation” without work prohibition leads to oligarchy. Since “Sabbath observance” also implies work prohibition these scholars belong to the exilic category.

(Knohl 1987) examines the two priestly codes of the Torah: the Priestly Torah (PT) and the Holiness School (HS). He finds that contrary to what was believed before him HS came after PT and “the earlier school PT has a ‘purer’ priestly cultic conception while the laws of the later school—HS—display a priestly-popular orientation” (Knohl 1987: 102). PT does not prohibit work on Sabbath, while the popular tradition oriented HS does (Knohl 1987: 76). For PT the Sabbath is not a holy convocation while for HS it is (Knohl 1987: 72). Knohl (2007: 328) dates HS to the rule of King Hezekiah. Then the pre-exilic Sabbath is obvious. Knohl’s analysis is consistent with the former contention that the convocations were inherited from a past with no King and no Temple. It is not surprising that PT’s Sabbath omitted holy convocations. These institutions conflicted with the priestly struggle to centralize the cult. The popular practice held the Sabbath convocations not because of the Temple but in spite of it. The later HS school introduced elements of this popular worship into the Scripture (Knohl 1987: 100). If the Sabbath convocations were pre-exilic then they were pre-monarchic because the evidence indicates that the Temple was reluctant to keep the convocations, let alone introduce them.

² Most biblical experts date Deuteronomy to the monarchy (e.g. Cook 2004: 152; Freedman and Myers 2000: 341; Halpern and Hobson 1991: 196; Joosten 2016). Exodus 34: 27 is attributed to J, (e. g. Sandidge 2005: 122) a priest; we are told that he wrote in the tenth or ninth century BCE (Sandidge 2005: 337; Lemche 1998: 160). Some disagreement notwithstanding (e.g. see Levinson 2004), Exodus 24: 7,8 is also considered by many preceding Deuteronomy (Chavel 2015: 171; Levinson 2004).

Table 1. Review of studies about institutionalizing the Sabbath; One distinguishes two-schools: pre-exilic and exilic.

Category	Reference	When?	What?
Pre-exilic	Meek (1914)	not ... earlier than the settlement of the Hebrews in Canaan.	observance of the seventh day
	Albertz (2003: 108)	Before the exile	Interruption of agricultural work
	Williamson (2006: 94)	Early times before exile	weekly celebration
	McKay (2001: 31)	Before issue of rules for Temple sacrifices.	holy rest; holy convocation.
	Knohl (1987: 74–76)	before exile	Forbidden labour, holy convocation
Exilic	Pasachoff and Littman (2005: 45)	Babylonian exile	Sabbath observance
	Davies (2015: 144)	Hasmonean rule	Sabbath observance
	Batsch (2005: 248)	Persian rule	Weekly Sabbath

However some date HS to the exilic period (Coogan et al. 2007: 142). Then the “popular” Sabbath convocations of HS could also be exilic. Let me show why exilic origin of the Sabbath is not the case.

The following is a typical rationale in favour of an exilic origin of the Sabbath

The Jews of Babylon managed to preserve their religion and adapt it so that it did not require a shrine. The observance of the Sabbath became a main focus... (Pasachoff and Littman 2005: 45)

In other words, the new environment required a cultural trait for the survival of the Jews as a group. Let us put this hypothesis to test. Let us see how long can a covenantal group with no law enforcement survive without assemblies and compare this duration with the time required to reach a Sabbath institution up and running.

The Mathematical Model

The mathematical model of Livni and Stone (2015) studies whether the justice

administration of a covenantal society may fail because the society has no dedicated police force. Next to the Creator only the assembly, has the authority of judging wrongdoers and punishing them by ridiculing, gossiping, finger pointing, condemning, snubbing, excommunicating and possibly even stoning. If the assembly gathers only at fixed intervals³ then the capability to maintain law and order is questionable.

$$\begin{aligned}
 \frac{dS}{dT} &= \alpha R - \beta ST / N \\
 \frac{dT}{dt} &= \beta ST / N - \gamma(t)T \\
 \frac{dR}{dt} &= -\alpha R + \gamma(t)T
 \end{aligned}
 \tag{2}$$

Transgressors T corrupt susceptible congregants S , (Equation 2); a *corruption coefficient* β determines the rate of such conversions. Some transgressors repent and become righteous R under pressure of the assembly at a rate associated with a *repentance coefficient* γ . Under specific conditions (poverty, influence of foreign cultures and competitive greed) some righteous become susceptible and this conversion rate depends on a *lapse coefficient* α .

The difference between a stratified and a covenantal society consists of the definition of the *repentance coefficient* γ . In the stratified case one assumes a constant γ . By hypothesis, in the covenantal case the repentance coefficient $\gamma(t)$ is a time dependant periodic function represented by a Fourier series:

$$\gamma(t) = \bar{\gamma} + \sum_{n=1}^{\infty} \left(a_n \cos \frac{n\pi t}{\tau} + b_n \sin \frac{n\pi t}{\tau} \right)$$

In the previous expression $\bar{\gamma}$ and τ represent the average rate of weekly repentance and the period of assemblies respectively. The other two coefficients namely the *corruption coefficient* β and the *lapse coefficient* α are constants as in the stratified case.

³ This makes the mathematical modelling more important challenging the model to answer if conditions of equilibrium and stability can be achieved even when the temptation to sin is continuous while the correction works in periodic impulses.

Tests

Figure 3 shows three simulations using Equation 2: one with a reasonable contagion rate of transgression of $\beta = 1.5$ suggested by Livni and Stone (2015) and two with an upper bound and a lower bound of +50% and -50% respectively. All three simulations have a zero repentance coefficient; all three indicate that instituting a Sabbath with the highest possible repentance coefficient but later than 100 days is too little too late.

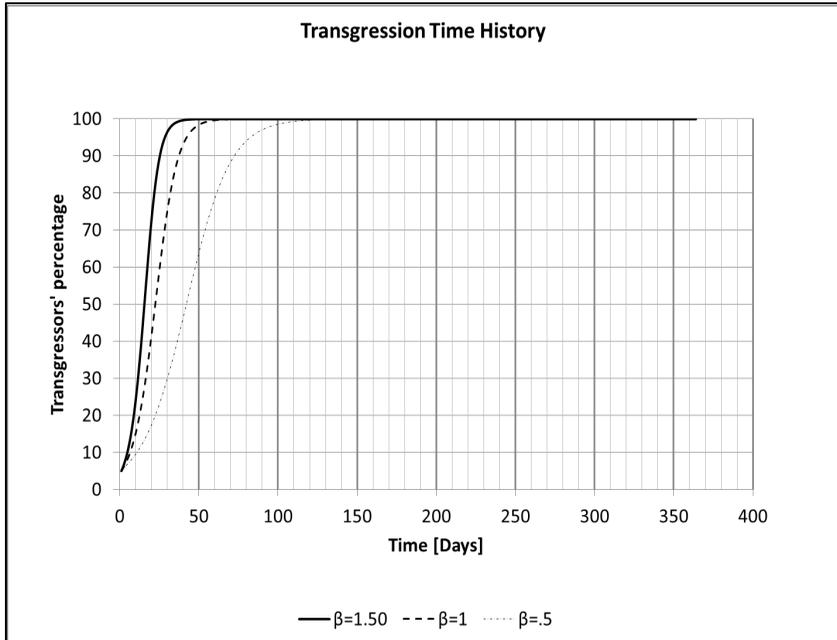


Figure 3. Three simulations illustrate the collapse of covenantal communities with no repentance mechanism. Each simulation represents a different corruption coefficient. The value of 1.5 for this coefficient is reasonable. Even for one third of this value the collapse is a matter of a couple of months. These and other simulations showed that the lapse coefficient has a negligible effect on the expected time to collapse. Parameters of these simulation: repentance coefficient = 0; lapse coefficient = .2.

How long could it take to institute working Sabbath assemblies? Boyd and Richerson (1987) deal with evolution of ethnic markers in a new environment. They distinguish between *neutral* and *adaptive* markers. The exiles will acquire new traits because they consider that the new trait will enhance their survival.

These new traits are *adaptive markers*. They might acquire a new way to pronounce a word. Such a new trait is a *neutral marker* because its effect on survival is negligible. Let us assume first that the prohibition of work on the seventh day was a *neutral ethnic marker*. A child born to a non-observant family will imitate Sabbath observant socializers with a probability equal to the proportion of Sabbath observers of his community (see more in Boyd and Richerson 1987). At time t_i this proportion is $p(t_i)$. The proportion of non-observant families at time t_i is $1 - p(t_i)$. Thus at time t_{i+1} one obtains:

$$p(t_{i+1}) = p(t_i) + p(t_i)[1 - p(t_i)] \tag{3}$$

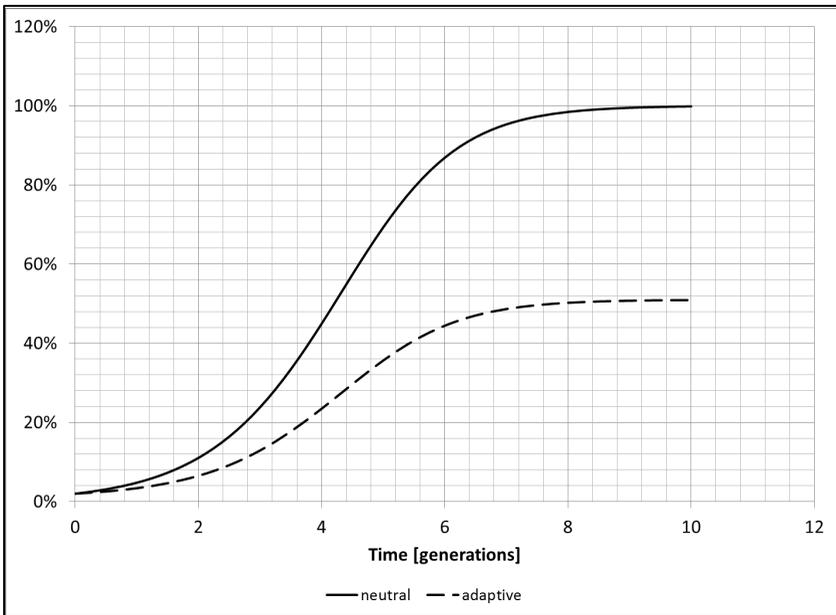


Figure 4. The bold line shows simulation results of a neutral marker gradually adopted by imitators of socializers per Equation 3. The dashed line simulates the growth of an adaptive trait per Equation 1 with $\alpha=.25$.

In Equation 3 the product $p(t_i)[1 - p(t_i)]$ expresses that of the $[1 - p(t_i)]$ children born to non-observant families, only the sub-proportion of $p(t_i)[1 - p(t_i)]$ will imitate Sabbath-observant socializers. Equation 3 expresses that in the subsequent generation the proportion of carriers of the neutral marker will increase by this product. If in Equation 1 one substitutes $\alpha = 1$ one arrives at Equation 3 which is not surprising because both equations are models of oblique and horizontal transmission of cultural traits. The substitution of $\alpha = 1$ is

required to match Boyd and Richerson (1987). Converting Equation 3 from its formulation in discrete time steps, to a continuous time domain formulation, one arrives at:

$$\frac{dp}{dt} = p(t)[1 - p(t)] \quad (4)$$

The continuous line of Figure 4 shows the simulation of Equation 4 predicting that it takes about seven to ten generations for the Sabbath to become functional. Now let us consider the Sabbath as an adaptive cultural trait. The derivation is similar; however the probability of imitating a Sabbath observing model involves the probability of a Sabbath observant to be considered *successful*. It is hard to justify any correlation between Sabbath keeping and success in a new life in the Babylonian exile. Reasonably, it is unlikely that a displaced Jew in Babylon projected a successful image just because he/she refused to work on every seventh-day.

Nevertheless, the dashed line of Figure 4 represents the results of a simulation attributing an exaggerated 25% probability of a Sabbath observant expatriate to become a model for imitation. Even with this overestimated likelihood, the Sabbath is not functional in ten generations. This test did not assume that pre-monarchic Israel was covenantal. If the Sabbath could not be instituted during the exile, then one can argue *a fortiori* that the covenantal concept is also pre-exilic.

Furthermore, the scenario of the Sabbath being initiated by a leader of the exile requires the coincidence of the following:

- An abstract theorist had to understand that the covenantal system is unstable.
- The same sage had to foresee that a periodical general assembly is a practical answer to *the problem*.
- The same far-sighted thinker had to know that no natural time period is sufficient to assure the stability and invent the seven day weekly period.
- This exceptional reformer lived exactly in the time of the exile.
- The congregation of this visionary promptly accepted this innovative institute.

Conclusion

1. The biblical scholars disagree on the Sabbath's origin: pre-exilic or post-exilic.
2. The hypothesis of exilic origin of the Sabbath assemblies failed the mathematical test because it took several generations while it was needed to be up and running in a matter of weeks.

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3. Therefore the Sabbath assemblies started before the exile. Since local assemblies obstructed the central authority of the monarchy, these assemblies were tolerated only because they were inherited from the pre-monarchic settlements.
4. Cultural evolution explains how a random habit of a seventh day of rest facilitated a covenantal pre-monarchic Israel and led to its current cultural descendants.
5. In a pre-monarchic settlement farming was prohibited on the seventh day; the day was consecrated to public affairs like enforcing the covenant.
6. The seventh day of rest and its linkage to the covenant is the reason why “whatever its origin was, the Sabbath took on a peculiar meaning which made it an institution peculiar to Israel” (De Vaux 1997: 480).

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