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Babies and the Blackout: The Genesis of a Misconception

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Nine months after the great New York City blackout in November 1965, a series of articles in the *New York Times* alleged a sharp increase in the city's birthrate. A number of medical and demographic articles then appeared making contradictory (and sometimes erroneous) statements concerning the blackout effect. None of these analyses are fully satisfactory from the statistical standpoint, omitting such factors as weekday–weekend effects, seasonal trends, and a gradual decline in the city's birthrate. Using daily birth statistics for New York City over the 6-year period 1961–1966, techniques of data analysis and time-series analysis are employed in this paper to investigate the above effects.

1. BABIES AND THE BLACKOUT

At exactly 5:27 PM, November 9, 1965, most of New York City was plunged into darkness because of a massive power failure affecting much of the Northeastern United States. On Wednesday, August 10, 1966, the *New York Times* carried a front page article with the headline "Births Up 9 Months After the Blackout," which began: "A sharp increase in

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births has been reported by several large hospitals here, nine months after the 1965 blackout." Above average numbers of births the previous Monday were said to have occurred at Mount Sinai, Bellevue, Columbia–Presbyterian, St. Vincent's, Brookdale, and Coney Island hospitals, while births at New York and Brooklyn Jewish Hospitals were reported to be normal. The article added that "there were 16 births at Mount Sinai yesterday [Tuesday], 13 at Columbia–Presbyterian and 10 at St. Vincent's, all above average;" this was contrasted with Nassau and Suffolk counties, "many of whose commuters were stranded in the city Nov. 9," and where "the number of births was reported normal," as well as "hospitals in Albany, Rochester, New Haven and Providence," where "the lights went on in midevening."

Next day (Thursday, August 11), a follow-up article appeared (buried on page 35) with the somewhat more cautious lead "Theories Abound on Birth Increase—Possible Link With Blackout Will Not Be Determined for Two More Weeks." By Friday readers were informed that "The birth rate began returning to normal in several leading hospitals here yesterday [Wednesday] following a sharp rise nine months after the 1965 blackout," and the case was closed on Saturday with a short article on page 50 entitled "Birth Rate in City Returns to Normal."

A week later the British magazine *New Scientist* reported the "Apparent sharp rise in births in New York City" (Low, 1966); a year later *The Lancet,* a respected medical journal, stated unequivocally "the last time New Yorkers demonstrated an unexpectedly vigorous procreative urge they were stimulated . . . by the stygian darkness of electric-power cuts" (Anon, 1967). At present the story of the "blackout babies" appears to be an accepted part of American folklore. The episode seems plausible, the story carried by a respected and usually reliable newspaper. But just how good is the evidence for an increase in births 9 months after the blackout? Is it really credible that a 1-day increase in conceptions would result in a 1- or 2-day elevation in births 271 days later with virtually no variability or spread? Considerations such as these suggested that, 15 years after the *New York Times* articles had appeared, an assessment of the published evidence was in order.

2. THE TIMES' EVIDENCE

The first article carried by the *Times* cited six hospitals as having experienced a sharp increase in births on Monday, August 8. Of these six, Mount Sinai hospital certainly experienced a sharp rise in deliveries (28 compared to a daily average of 11). But one hospital does not a baby boom make. Of the five other hospitals mentioned, four (see Table 1) reported increases of no more than four over their daily average, hardly convincing evidence given that two other hospitals are said to have had a normal number of births and the absence of any information about the

TABLE 1

Daily Birth Data as Reported in Four *New York Times* Articles

	Average	Aug. 8 Mon	Aug. 9 Tues	Aug. 10 Wed	Aug. 11 Thurs
Bellevue	20[a] or 6[b,c]	29	Slightly above average	1	2
Bronx Municipal	7	16	16	9	8
Brookdale	10	13[a] or 15[b,d]	15	14	13
Brooklyn Jewish	15	Normal	Slightly above average	18	8
Columbia–Presbyterian	11[a] or 12[c]	15	13	Average	18
Coney Island	4[d] or 5[a]	8	7	Average	Average
French	3		5	Average	10
Mount Sinai	11	28	16	17	15
New York	13	Normal	Slightly above average	Average	5
St. Luke's	5	14–15	14–15	9	7
St. Vincent's	7	10	10; Average	Average	Average

[a] In T1.
[b] In T3.
[c] In T4.
[d] In T2.

variability in these numbers or how the hospitals cited were chosen (there are over 100 hospitals in New York City). Finally Bellevue, the last hospital for which data are given, presents somewhat different problems. On Wednesday the *Times* had reported that "At Bellevue there were 29 new babies in the nursery yesterday, compared with 11 a week ago and an average of 20." This statement is ambiguous as to when the new babies referred to were born; if Monday or Tuesday is meant, it is simply incorrect. Without remarking on the inconsistency with the Wednesday article, both the Friday and Saturday reports in the *Times* state the average number of births per day at Bellevue to be 6. Data we present later show, in fact, that there were only 4 deliveries at Bellevue on Monday, 7 on Tuesday. The "baby boom" has begun to burst.

The three subsequent articles in the *Times* series describe a pattern of continued increase in births on Tuesday, followed by a decline and return to normal on Wednesday and Thursday. (To facilitate the discussion we shall refer to the four articles in the series as T1, T2, T3, and T4.) The data given in T1–T4 are summarized in Table 1. There are a number of inconsistencies, none serious. (It is interesting to note that St. Vincent's, whose 10 births on Monday were cited as evidence for a "sharp increase in births," is described in T1 as having 10 births on Tuesday but in T2 as only having an "average" number of births that day.) All in all, the data seem inconclusive and one inclines to adopt the opinion of Dr. Christopher Tietze (quoted in T1), that "I am skeptical until I see data from the entire city. There can be daily fluctuations in individual hospitals that can be misleading."

Such data, giving the number of live births in New York City occurring by day from 1961 through 1966—a total of 2191 days of birth data—were obtained by us from the New York City Department of Health. In Table 2 we list a portion of the data, the number of births for each day in August 1966; these numbers are graphed in Fig. 1. As Fig. 1 clearly shows, although an increase in births did indeed take place on Monday and Tuesday, August 8 and 9, 1966, similar increases took place on *every other* Monday and Tuesday of that August! In fact, the fluctuation in births throughout the week from a low on the weekends to a high in the early part of the week is a characteristic feature of the entire series of birth data throughout all 6 years. (Such weekday–weekend variation is attributed in Menaker and Menaker (1959) to a preference for performing elective deliveries when the patient is delivered by her personal physician, while Borst and Ostley (1975) opine that it is "probably caused by induced or delayed labor through conscious intent of the mother with or without medical assistance.") Figure 1 also shows that births on August 8th and 9th were not appreciably different from those on any other Monday and Tuesday in August. In fact, as seen in Table 2, births

TABLE 2
Total Live Births Occurring in August 1966 for New York City

August	1	Mon	452	17	Wed	461
	2	Tues	470	18	Thurs	442
	3	Wed	431	19	Fri	444
	4	Thurs	448	20	Sat	415
	5	Fri	467	21	Sun	356
	6	Sat	377	22	Mon	470
	7	Sun	344	23	Tues	519
	8	Mon	449	24	Wed	443
	9	Tues	440	25	Thurs	449
	10	Wed	457	26	Fri	418
	11	Thurs	471	27	Sat	394
	12	Fri	463	28	Sun	399
	13	Sat	405	29	Mon	451
	14	Sun	377	30	Tues	468
	15	Mon	453	31	Wed	432
	16	Tues	499			

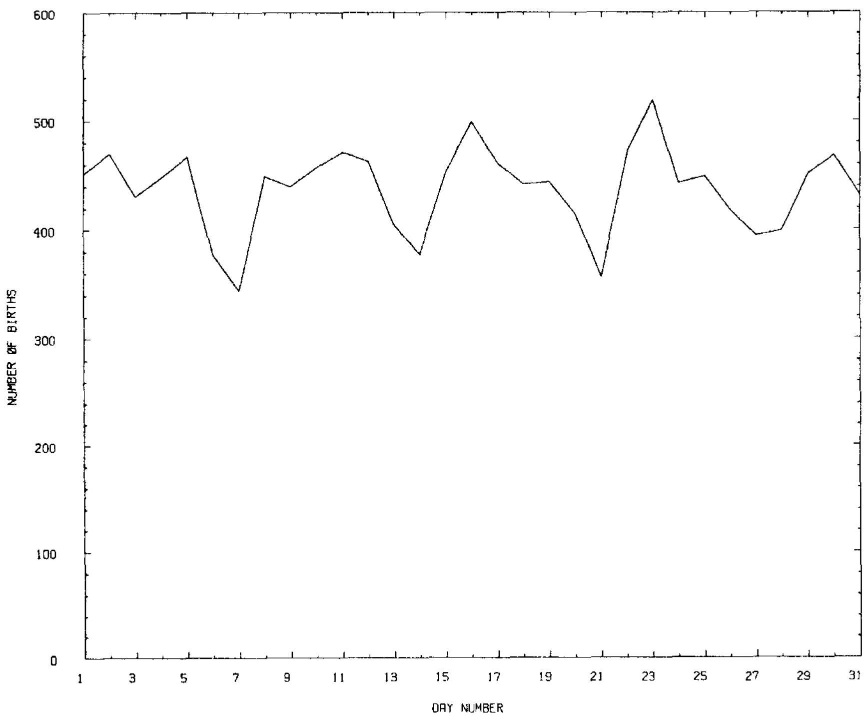

FIG. 1. Total births in New York City, August 1966.

on those 2 days were, if anything, slightly lower than usual: 449 births on August 8 (compared to 452, 453, 470, and 451 births on other Mondays in August) and 440 on August 9 (compared to 470, 499, 519 and 468 births on other Tuesdays in August). The "baby boom" has vanished.

3. A REVIEW OF THE LITERATURE

Despite such (to us) unequivocal evidence against a 1- or 2-day surge in New York City's birth rate 9 months after the blackout, an article has appeared in the professional literature claiming precisely such an effect. In 1968, Professor L. B. Borst reported in the *American Journal of Obstetrics and Gynecology* that "daily birth records in New York City disclose a 30% increase in live births at five Manhattan hospitals on August 7 (!!), 1966, 270 days after the blackout of Nov. 9–10, 1965." (Borst, 1968). Noting that while power had not been "restored until the following day in Manhattan and parts of the Bronx, whereas in Brooklyn and Queens power was restored at various times during the evening and, in Richmond, almost immediately," Borst reasoned that computing the ratio of Manhattan births to total New York City births would simultaneously correct for the weekday–weekend effect discussed above *and* detect a blackout effect on the birthrate in the form of a percentage increase in the number of NYC births occurring in Manhattan. Using statistics for the number of live births in five (unspecified) Manhattan hospitals from August 1 to 13 and dividing the sum of these by total New York City births, Borst observed a distinct peak on August 7 which he concluded was a "very special day" (the percentage for August 7 differing from the mean percentage excluding August 7 by seven average deviations from the mean).

Professor Borst omits from his article two pieces of information necessary to assess the validity of his conclusions. On the one hand, there is the disturbing issue of data selection: no mention is made of how the five hospitals studied were chosen. On the other, although the aggregate percentage of New York City births which occurred in the five hospitals under study can be approximately read off from a bar graph, the raw data for the individual hospitals is not given. Upon request, Professor Borst very kindly provided us with a copy of his data which is given in Table 3. (Note that data for Mt. Sinai was collected but not used by Professor Borst in his 1968 article.)

Several interesting points emerge from inspection of Table 3. First, as mentioned earlier, the data for Bellevue Hospital show that births there were not unusually high on August 8–9, 1966, and in any case, were not as high as 29 on either day. Second, the total births in the five hospitals studied by Professor Borst (last row of Table 3) do not display noticeable nonrandom variation throughout the 13-day period for which statistics are provided. Certainly nothing exceptional appears to have

TABLE 3
Daily Birth Data for Six Individual Hospitals in New York City, August 1966

	August												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Bellevue	2	1	5	7	7	6	10	4	7	2	2	1	2
Harlem	13	6	7	11	6	8	3	5	3	8	7	10	9
Metropolitan	11	14	5	10	11	6	6	8	7	10	8	9	6
Mt. Sinai	6	14	14	11	17	12	9	28	16	20	16	20	11
New York	8	11	6	13	10	10	11	12	10	13	6	11	16
Sloan	10	14	14	8	11	5	13	15	13	12	18	11	12
Total[a]	44	46	37	49	45	35	43	44	40	45	49	42	45

[a] Omitting Mt. Sinai births.

happened on Sunday, August 7. The effect reported is entirely due to the seemingly innocent "normalization" of dividing these totals by total New York City births (which decrease on Sundays). If the daily trend in the five hospitals under study were the same as that for New York as a whole, this would seem a reasonable procedure. If, however, the trend in these five hospitals differs from that of the city as a whole, then the computed birth ratio of the two will exhibit variations unrelated to hypothesized blackout effects. We suggest that this is the case here. If the weekday–weekend variation exhibited in total New York City births is due to induction of labor at some hospitals to avoid weekend deliveries, scheduling of elective deliveries primarily on weekdays, etc., this would be an effect more likely to occur in private hospitals where patients are frequently delivered by their own personal physician or a specialist than in large municipal hospitals with a large charity caseload and interns on duty at fixed hours. Indeed, such a difference has been reported by Menaker and Menaker (1959), who state that "considerably less variation occurred in this regard at the municipal hospitals as compared with the 'private' hospitals, which showed a weekend decline, most marked on Sunday." Three of the five hospitals used by Professor Borst fall into the former category (Bellevue, Harlem, and Metropolitan); the other two (Sloan and New York) are "private voluntary" (as opposed to "proprietary"). With the possible exception of New York, all handle a large volume of so-called "service" cases. (It is perhaps not insignificant that Mount Sinai, the one hospital not used, alone displays a sharp increase in births on Monday.) Taking a ratio with a roughly stable numerator and a denominator which is minimized on Sunday, Professor Borst has observed a percentage increase in births which appears to be an artifact of his methodology.

If the above explanation is correct, we should expect to see similar peaks in this birth ratio the Sundays before and after August 7. Unfortunately, it is not possible to check this from Professor Borst's data as his statistics range only from the Monday before until the Saturday after August 7. However, in 1970 Dr. Walter Menaker (1970) obtained statistics allowing him to compute the ratio of total Manhattan births to NYC births for the three Sundays in question; the results—98/356 (or 27.5%) on July 31, 97/344 (or 28.2%) on August 7, and 110/377 (or 29.2%) on August 14—indicate that August 7 was in no way exceptional.

While a 1- or 2-day effect on births seems clearly ruled out, it is still possible that an effect on the birth rate took place over a longer period of time. Indeed, going on to note that 800,000 people were caught in the subways during the blackout and citing newspaper headlines such as "30% of Labor Force Too Weary To Work," Dr. Menaker felt it far more likely that the blackout would *depress* rather than increase the city's birthrate. Looking at births 1 week before and 1 week after August 9, Dr. Menaker noted that total births for this period were lower than the combined total for the week immediately prior and the week immediately following.

Over the entire 6-year period, 1961–1966, of our study the daily New York City birth data range from a low of 303 to a high of 563, with a mean and standard deviation of 446.74 and 40.84, respectively. In Fig. 2 we have graphed a smoother version of the series using weekly totals (see Table 7 for a complete listing). Throughout 1961–1963 the overall birth level remains relatively stable, while during 1964–1966 there is a noticeable decline in births. In addition, the series exhibits a regular seasonal pattern, namely two peaks, the first of which is smaller in magnitude and also of shorter duration than the second; the second peak occurs during the summer and is typically bifurcated with a single dip whose extent varies from year to year. (Such seasonal birth patterns for a number of countries have been extensively studied by Rosenberg (1966).) The yearly variations in the summer peak thus make it impossible to conclude from simple inspection of Fig. 2 whether or not any increase or decrease in births in late July–early August would be "significantly" different for 1966. In any case, such an effect would be quite small (a difference of at most several hundred births during a 1-month interval in which over 12,000 births occurred.) Indeed, Dr. Menaker himself concluded that "the evidence presented here for a decrease in conceptions during the Blackout cannot be considered direct or conclusive. 'Statistical significance' would have little or no meaning here. It should be emphasized that those who have postulated an increase in conceptions during the Blackout have failed to produce satisfactory evidence for such an increase. The evidence presented here suggests a decrease."

An attempt to give "statistical significance" to such aggregate birth statistics was later undertaken by Professor J. Richard Udry (1970). Udry reasoned that "if there were an unusual number of conceptions on No-

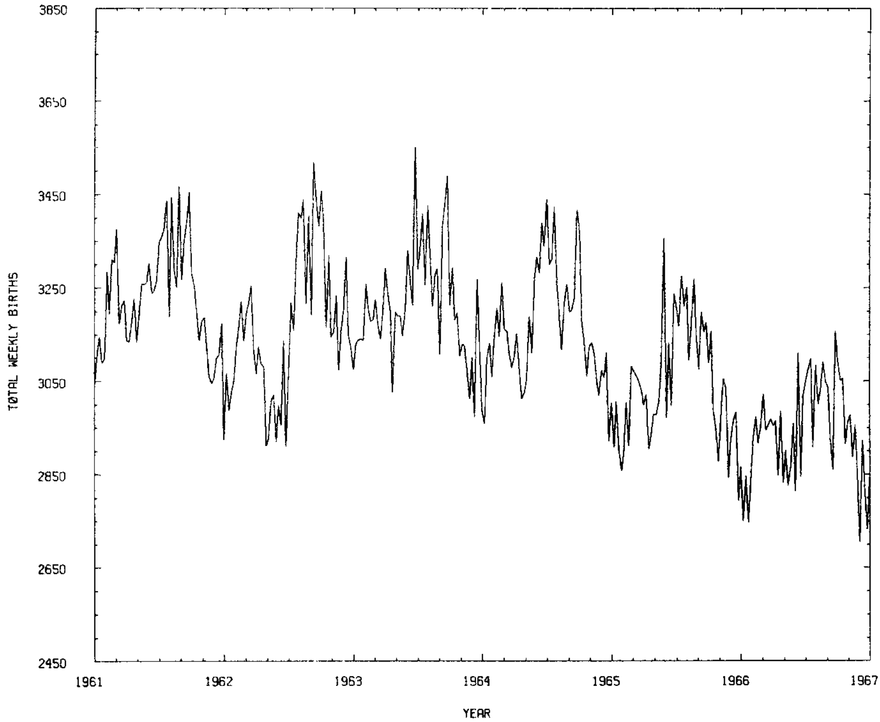

FIG. 2. Total weekly births in New York City, 1961–1966.

vember 10th, then the period between June 27 and August 24, 1966, would contain a greater percentage of the year's births than that contained by the same period in other years." Udry's calculations (which we have confirmed) are given in Table 4. The results appear to support Udry's conclusion that "1966 is not an unusual year . . . we therefore cannot conclude from the data presented here that the great blackout of 1965 produced any significant increase (or decrease) in the number of conceptions."

TABLE 4
Percentage of Year's Total Births Occurring in New York City, June 29–August 16,[a] during 1961–1966[a,b]

	Year					
	1961	1962	1963	1964	1965	1966
Percentage of year's total births	13.9	13.9	13.9	13.9	14.1	13.9

[a] For 1964: June 28–August 15.
[b] Table 1 in Udry (1970). Reprinted with permission of the author and publisher.

Professor Udry's article, however, contains several "loose ends." Little attempt is made to contrast the seasonal pattern for 1966 with those of previous years, nor is there mention of the downward trend in New York City births that Fig. 2 exhibits. (The existence of this trend makes the comparison of yearly percentages such as those in Table 4 somewhat dubious.) More troubling is the lack of attention to considerations of statistical power. A simple order of magnitude calculation will make the problem clear. Assume that on the night of the blackout the incidence of intercourse in New York City rose 25%. If such an increase resulted in a corresponding increase in conceptions, approximately 110 extra births would occur 9 months later, spread over a 2-month interval. (There were approximately 446 births per day during the 1961–1966 period.) Professor Udry's test attempts to detect this increase of 110 during a 7-week interval in which 21,290 births occurred. In terms of the percentages given in Table 4, an increase of 0.06% is in question, although the percentages involved are only calculated to the nearest 10th! If a (still sizeable) increase in conception of 10% occurred, the possibility of detection is even worse. At a very minimum, a power calculation to determine an optimal test interval seems in order.

This last point highlights the real fallacy of a "baby boom." Even if a sizeable increase in the incidence of coitus took place on the night of the blackout, the intervention of natural and human agencies would result in few additional conceptions (e.g., contrast the average of 446 births per day with any reasonable (Bayesian?) estimate of the number of acts of intercourse taking place in New York City on any given night). These additional births, at most several hundred in number, would largely occur over an 8-week period 9 months later. Engulfed in a sea of variability resulting from long-term trends, seasonal effects, weekend–weekday effects and random fluctuation, even the most sophisticated of statistical techniques will be hard put to detect any effect actually present.

4. ARIMA MODELING OF THE WEEKLY BIRTH TOTALS

For a variety of reasons, including data handling, available computer memory and storage, and convenience, we transformed the daily birth series into a series of $N = 313$ ($= 2191/7$) weekly birth totals. The blackout, which occured on November 9, 1965, therefore falls in the middle of the 254th week after January 1, 1961. These weekly birth totals (see Table 7) are now modeled as an integrated autoregressive-moving average (ARIMA) process using the methodology of Box and Jenkins (1976) and the computer programs discussed in Nelson (1973).

4.1 Modeling the Birth Data

The Box–Jenkins approach assumes that the weekly birth totals, $[Y_t]$, though obviously nonstationary in appearance, can first be transformed to stationarity by differencing the series a finite number of times, and then modeling the differenced series as a (stationary) autoregressive-moving average process. Since the weekly birth totals are seasonal with a period of 52 weeks, the ARIMA model (following the notation of Box and Jenkins (1976, p. 305)) is here referred to as an ARIMA$(p, d, q)\times(P, D, Q)_{52}$. In practice, d (the nonseasonal differencing parameter) and D (the seasonal differencing parameter) are 0 or 1, and p (the order of the nonseasonal AR component), P (the order of the seasonal AR component), q (the order of the nonseasonal MA component), and Q (the order of the seasonal MA component) are 0, 1, or 2.

The actual modeling procedure is accomplished through an iterative three-stage cycle of identification, estimation (using the method of maximum likelihood), and diagnostic checking of residuals. Use is also made of the χ^2 "portmanteau" test statistic of Box and Pierce (1970) given by

$$Q(K) = n \sum_{k=1}^{K} r_k^2, \tag{4.1}$$

where $n = N - d - 52D$ is the number of observations used to fit the model, and r_k is the k-lag sample autocorrelation coefficient of the residuals. The statistic $Q(K)$ is compared with the percentiles of the $\chi^2_{K\text{-}p\text{-}q\text{-}P\text{-}Q}$ distribution. The cumulative periodogram of the residuals is recommended by Box and Jenkins (1976) as a further diagnostic tool.

The identification stage of the fitting process for the series $[Y_t]$ indicated that an appropriate and parsimonious model for the data is an ARIMA $(0, 1, 1)\times(0, 1, 1)_{52}$, i.e.,

$$(1 - B)(1 - B^{52})Y_t = \theta_0 + (1 - \theta_1 B)(1 - \theta_{52}B^{52})a_t, \tag{4.2}$$

where B is the backshift operator defined by $B^m Y_t = Y_{t-m}$, $[a_t]$ is a Gaussian "white noise" process with mean zero and variance σ_a^2, and θ_0 is a constant for the overall level of the differenced series. The maximum-likelihood estimates and associated standard errors of the four parameters in the model (4.2) are:

Parameter	MLE	SE	t statistic
θ_0	−0.33	0.79	−0.41
θ_1	0.74	0.04	18.03
θ_{52}	0.81	0.03	29.86

The model shows no obvious signs of inadequacy other than elevated values for the Box–Pierce statistic calculated for the first 12, 24, and 36 values of the sample autocorrelation function (see Fig. 3). These may be due in part to the presence of a substantial number of outliers in the data, the majority of which occurred on public holidays. The Box–Pierce statistics may be improved by switching to either an ARIMA $(1, 0, 1)\times(0, 1, 1)_{52}$ model or even an ARIMA $(2, 0, 1)\times(0, 1, 1)_{52}$ model. However,

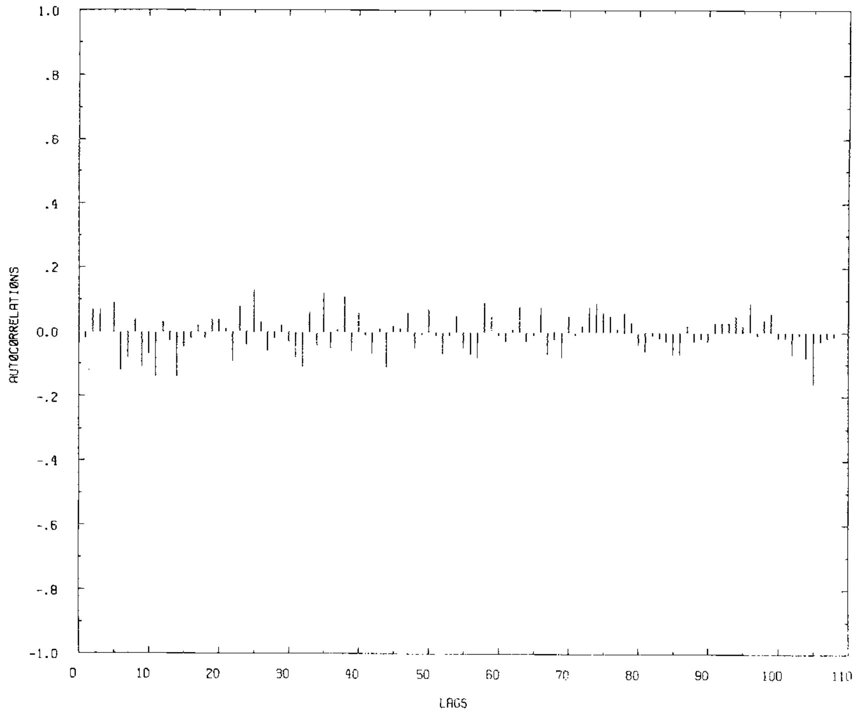

FIG. 3. Autocorrelation function of residuals from the series ARIMA (0, 1, 1) × (0, 1, 1)$_{52}$. Estimated standard errors of autocorrelations are as follows: for lags 1–12, SE = 0.06; for lags 13–60, SE = 0.07; for lags 61–108, SE = 0.08. The dotted lines in the figure represent ±2SE.

the three models form a nested sequence; see Table 5 for a comparison of the model statistics. Model (4.2) gives a good fit to a time series of not inconsiderable length and is a multiplicative seasonal model that is both well understood and has found wide application. The two major features of the weekly birth series, seasonal nonstationarity and long-term trend, are both captured by the model. In the analysis below, details are given only for this model, although the analysis was carried out for all three with similar results.

4.2 *Intervention Analysis*

In the next stage of the analysis an effect of the blackout is introduced into the model. This is accomplished using the "intervention" model of Box and Tiao (1975), in which an exogeneous variable, X_t say, is added to the model (4.2) to account for the possible effect, if any, of the intervention of the blackout on the birth series.

The intervention variable, X_t, is constructed here as an approximation to the true gestation period (i.e., time in weeks from conception to birth) and its corresponding frequency distribution. The relevant biological lit-

TABLE 5
Box–Pierce Statistics for Birth Series Models

Model and fitted model	Residual standard error[a]	Box–Pierce statistic[b]	Degrees of freedom	p value
1. ARIMA $(0, 1, 1) \times (0, 1, 1)_{52}$	87.89	$Q(12) = 20.2$	10	0.027
$(1\text{-}B)(1\text{-}B^{52})Y_t = -0.33 + (1\text{-}0.74B)(1\text{-}0.81B^{52})a_t$		$Q(24) = 32.7$	22	0.066
(0.79)[c] (0.04) (0.03)		$Q(36) = 51.7$	34	0.026
2. ARIMA $(1, 0, 1) \times (0, 1, 1)_{52}$	87.13	$Q(12) = 17.3$	9	0.044
$(1\text{-}0.93B)(1\text{-}B^{52})Y_t = -3.10 + (1\text{-}0.66B)(1\text{-}0.80B^{52})a_t$		$Q(24) = 28.4$	21	0.129
(0.03) (1.81) (0.06) (0.03)		$Q(36) = 48.8$	33	0.038
3. ARIMA $(2, 0, 1) \times (0, 1, 1)_{52}$	86.64	$Q(12) = 14.4$	8	0.072
$(1\text{-}0.71B\text{-}0.19B^2)(1\text{-}B^{52})Y_t = -4.82 + (1\text{-}0.53B)(1\text{-}0.81B^{52})a_t$		$Q(24) = 25.0$	20	0.201
(0.11)(0.09) (2.56) (0.10) (1.03)		$Q(36) = 44.7$	32	0.067

[a] Residual standard error is an estimator for σ_a.
[b] Used for portmanteau lack-of-fit test.
[c] Numbers in parentheses below equation of model are standard errors of parameter estimates.

erature was consulted to obtain the appropriate form of this distribution. We refer the interested reader to the papers by Treloar, Behn, and Cowan (1967) and Hammes and Treloar (1970). The approximation most commonly used is the time from onset of the last menstrual period (LMP) to birth, usually called the *gestational interval*. The distribution of the gestational interval is seen in all published studies to be highly peaked with very long tails and slightly skewed to the left. The mode typically occurs at 40 or 41 weeks after the LMP, although a very small percentage of the distribution appears beyond the range 28–49 weeks; indeed over 50% of the distribution is concentrated in the 40 to 41-week interval following the LMP. The distribution that was used here was taken from Treloar *et al.* (1967), Table 1, and the relevant part of that table is reproduced in Table 6.

TABLE 6
Actual And Percentage Frequency Distributions for Gestational Interval (LMP To Birth) as Recorded in 2080 Menstrual Histories[a]

Gestational interval (weeks)	Actual	Percentage
28	3	0.14
29	3	0.14
30	3	0.14
31	5	0.24
32	2	0.10
33	11	0.53
34	17	0.82
35	16	0.77
36	34	1.63
37	63	3.02
38	113	5.43
39	278	13.37
40	517	24.86
41	590	28.37
42	282	13.56
43	87	4.18
44	26	1.25
45	15	0.72
46	8	0.38
47	1	0.05
48	1	0.05
49	2	0.10
50	—	—
51	1	0.05
52	2	0.10
Total	2080	100.00

Note. Source: Table 1 in Treloar *et al.* (1967).

[a] Three additional cases with gestational intervals less than 175 days were omitted from the analysis here.

Thus, X_t consists of the empirical distribution of gestational interval, centered about some suitable week number (roughly 9 months after the occurrence of the blackout) and then preceded and followed by a sequence of zeros.

Equation (4.3) now takes the form:

$$(1 - B)(1 - B^{52})Y_t = \theta_0^* + \beta X_t + (1 - \theta_1^* B)(1 - \theta_{52}^* B^{52})a_t^*, \quad (4.3)$$

where θ_1^* and θ_{52}^* are moving-average parameters, θ_0^* accounts for the overall level of the differenced series, β represents the effect of the blackout intervention, and $[a_t^*]$ is a white-noise process with mean zero and variance $\sigma_{a^*}^2$. The centering of the empirical distribution of the gestational interval was accomplished by setting its (empirical) mode at each week number from 292 (i.e., 38 weeks after the blackout) through 295 (41 weeks after the blackout) to give the models the maximum possible chance of detecting an effect on the birth series from the intervention. If coition is to result in successful conception, the former must take place about 2 weeks following the LMP; hence, the natural centering of the distribution would be around Week 293, which is 39 weeks after the particular week of the blackout. The maximum-likelihood estimates and associated standard errors of the four parameters in the model (4.3) for this case are:

Parameter	MLE	SE	t statistic
θ_0^*	−0.15	0.83	−0.18
β	0.028	0.04	0.67
θ_1^*	0.74	0.04	18.012
θ_{52}^*	0.65	0.06	11.07

For this fitted model, $\hat{\sigma}_{a^*} = 99.38$ and $R^2 = 0.517$. Clearly, a 95% confidence band around β covers the value zero (in fact, the limits are $(-0.06, 0.11)$), showing that the so-called "blackout effect" is not statistically significant in terms of an effect, positive or negative, on the subsequent birthrate. The residual diagnostics for the intervention model (4.3) are good, with the Box–Pierce statistic, $Q(60) = 68.4$ on 58 degrees of freedom, giving a p value of 0.165. It is of interest to compare the two sets of estimated parameters for the models (4.2) and (4.3). Except for the obvious difference in estimated magnitude between θ_0 and θ_0^*, the results are similar, consistent with the conclusion that the inclusion of the intervention variable X_t has no serious consequences for the chosen model.

We note that alternative centerings of the gestational interval distribution also fail to detect a significant blackout effect.

4.3 Discussion

Intervention analysis of the New York City birth data does not detect a "significant" increase in births that can be ascribed to the blackout.

TABLE 7
Total Weekly Births in New York City, 1961–1966

Week	1961	1962	1963	1964	1965	1966
1	3039	2926	3075	2990	3003	2865
2	3107	3066	3131	2961	2908	2751
3	3144	2988	3139	3098	3006	2846
4	3088	3029	3141	3132	2905	2747
5	3098	3050	3139	3060	2858	2835
6	3283	3122	3258	3148	2891	2930
7	3195	3171	3208	3206	3004	2974
8	3309	3221	3179	3146	2911	2918
9	3304	3137	3183	3261	3081	2953
10	3374	3198	3225	3161	3073	3022
11	3173	3220	3171	3158	3062	2945
12	3214	3255	3141	3111	3049	2956
13	3222	3113	3209	3079	3030	2969
14	3137	3066	3291	3104	3000	2955
15	3135	3123	3237	3151	3021	2965
16	3179	3087	3199	3081	2904	2848
17	3227	3081	3027	3013	2935	2986
18	3134	2911	3199	3026	2979	2833
19	3197	2926	3190	3055	2979	2901
20	3259	3006	3190	3189	3009	2825
21	3258	3021	3147	3110	3085	2867
22	3260	2921	3205	3269	3357	2960
23	3302	2999	3328	3316	2973	2814
24	3239	2956	3260	3282	3133	3109
25	3243	3137	3213	3389	2998	2844
26	3264	2910	3550	3339	3237	3017
27	3347	3067	3289	3440	3206	3048
28	3357	3219	3331	3300	3169	3077
29	3374	3158	3409	3312	3276	3096
30	3437	3304	3256	3423	3211	2908
31	3188	3410	3426	3261	3251	3083
32	3443	3400	3323	3186	3094	3001
33	3288	3439	3211	3117	3181	3029
34	3251	3216	3279	3218	3269	3091
35	3466	3404	3291	3257	3153	3049
36	3268	3193	3107	3199	3075	3036
37	3353	3518	3382	3203	3199	2929
38	3395	3440	3437	3230	3156	2861
39	3454	3382	3487	3418	3176	3157
40	3280	3457	3213	3369	3089	3093
41	3253	3387	3293	3182	3157	3052
42	3191	3166	3181	3132	2987	3055
43	3139	3319	3197	3061	2948	2915
44	3180	3145	3103	3122	2879	2959
45	3186	3155	3129	3133	2987	2978
46	3125	3234	3124	3108	3055	2886
47	3059	3074	3074	3050	3033	2956
48	3045	3156	3013	3021	2843	2849
49	3056	3204	3101	3073	2927	2706
50	3100	3315	2973	3058	2965	2923
51	3106	3151	3268	3111	2983	2824
52	3174	3121	3124	2922	2795	2735
53						2853

However, it is instructive to approach this question from another viewpoint. Suppose we ask: what is our best (point) estimate of the effect on births due to the blackout? Given that $\hat{\beta} = 0.028$ and an input empirical distribution of 2080 births, the estimated increase in births is $0.028 \times 2080 \simeq 50$ births effectively spread over a 1- to 2-month period during which some 12,000 to 24,000 births in total occurred.

But, of course, the only reason the blackout effect became of popular interest in the first place was an assumed increase in sexual activity on the night of the blackout. Given that there are approximately 450 births per day in New York City, it seems not unreasonable to postulate that there are somewhere between 100 and 1000 acts of coition for every live birth in New York City. If this ratio is posited to have held the night of the blackout, our point estimate translates into an estimate of somewhere between 5000 and 50,000 additional acts of coition, a change in the behavior of between 10,000 and 100,000 persons. Given that $t_{\hat{\beta}} = 0.67$, this means that a change in the behavior *of at least 30,000 to 300,000 persons* in New York that night would have been required before a "statistically significant" difference in birth rates could have been detected 9 months later.

5. CONCLUSIONS

The availability of extensive data on daily births in New York City permits a careful case study into the origins and factual support for the widespread popular belief in a baby boom 9 months after the 1965 New York City blackout. Close analysis reveals that not only did a substantial increase in births not take place 9 months after the blackout (as first noted by Udry (1970)), but that *no* effect whatever, positive or negative, can be discerned.

The episode of the vanishing baby boom illustrates the creation and growth of a modern myth. The story originated in a series of articles in the *New York Times* with only limited evidence adduced in its favor. Nevertheless, due to its surface plausibility, picaresque nature, and the prestige of the *Times*, the story soon gained wide credence in the professional literature and the popular mind. Initially accepted, today it is often unsuspectingly cited by otherwise careful scholars, creating a snowball effect. It is now one of those innumerable facts that everyone "knows."

What is perhaps most shocking is the lack of even a shred of evidence supporting the existence of a blackout effect. Social questions such as this are often difficult or impossible to answer due to the absence of adequate data. It is disturbing to reflect how many other of our widely held popular beliefs may be similarly ill-founded.

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