

# Anticipating the Year 2000

## Howard Nielson, BYU, and Statistics

*Natalie J. Blades and G. Bruce Schaalje*

For BYU, 1960 was a watershed year: *BYU Studies* began its first full year of publication.<sup>1</sup> KBYU-FM aired its first broadcast. The Ballroom Dance Company was formed. Three BYU students formed the Lettermen and recorded their first song.<sup>2</sup> The honors program was established. The MBA program was approved. Rex Lee, future BYU president, was student body president. Enrollment topped ten thousand for the second year in a row (up from forty-five hundred in 1950). In the midst of construction in Provo that would more than double the value of its physical facilities, BYU also purchased 135 acres in Anaheim, California;<sup>3</sup> 313 acres in Portland, Oregon; and 249 acres in Phoenix, Arizona,<sup>4</sup> as sites for satellite campuses in an ambitious expansion program.<sup>5</sup> And a statistics department was organized at BYU.

Of course, the campuses in Anaheim, Portland, and Phoenix were never built, and the formation of a statistics department with just one professor and five students seems hardly worth mentioning, given concurrent major developments.<sup>6</sup> But these events are connected in a fascinating way. The Statistics Department slipped into existence through the chance opening of a narrow window of opportunity directly tied to the confidence of the 1950s, a rapidly growing church, escalating enrollment at BYU, and BYU's land purchases. The interconnections of these factors reveal much about a remarkable historical period for both the Church and BYU.

### **Demand for Wood and a Statistics Department**

Keenly aware of the rapidly increasing enrollment at BYU, and with even greater increases looming as baby boomers reached university age in the 1960s and 1970s, BYU President Ernest L. Wilkinson formed the Bureau

## Natalie J. Blades and G. Bruce Schaalje

I first heard the compelling story of the formation of the Statistics Department at a faculty social sixteen years ago. As the speaker at the social, Howard Nielson reported on his recent mission to Hungary and also recounted his role in the founding of the department. I thought at the time that this story should be told more broadly but did nothing about it. In the run-up to the fiftieth anniversary of the founding of the Statistics Department in 2010, I recounted the story to Natalie Blades, who was working on ways to celebrate the anniversary. She agreed that the story should be told and suggested that it could be spiced up by tracking down the original Church membership projection of 1957. She tenaciously dug into the archives in the library and found the report. Her first reaction was that the projection wasn't very accurate, but on closer inspection and comparison of the regional projections to actual Church membership in 2000, an interesting story emerged. A

Google search of events in 1960 that might be used as background for the article alerted us to the BYU land purchases for satellite campuses in 1960. A later interview with Howard Nielson confirmed the connection of the membership projection to the BYU expansion plans. We were able to interview all previous chairs of the Statistics Department as part of the research for this article. Shortly after our interview with Mel Carter, he passed away. We felt fortunate to have been able to record his memories about the founding and early development of the Statistics Department before his passing.



Natalie J. Blades



G. Bruce Schaalje

—G. Bruce Schaalje

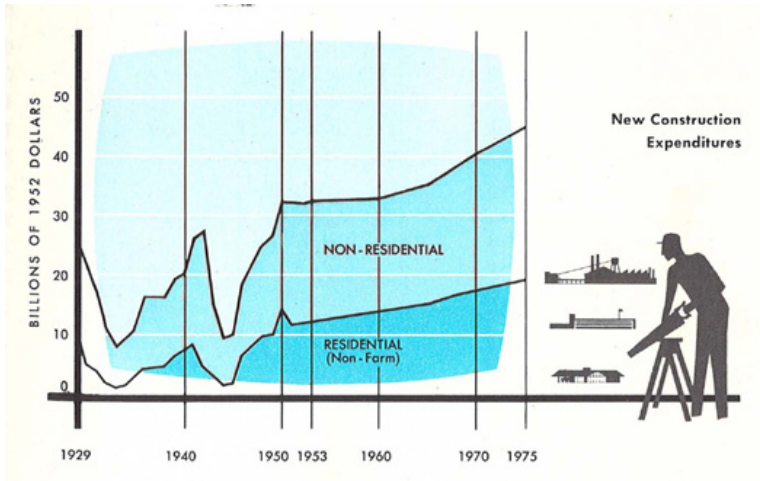


FIGURE 1. Projected construction expenditures from the 1954 report *America's Demand for Wood 1929–1975* by the Stanford Research Institute. Pivotal in midcentury economic forecasting, the model accounted for increases in demand, competition, changes in technology, and shifts in home design. The report garnered national press and the attention of Ernest L. Wilkinson, who wanted to forecast Church membership growth for long-term education planning.

of Church Studies at BYU in the mid-1950s to predict overall Church membership and, more specifically, university-aged Church membership through the year 2000.<sup>7</sup> To spearhead the study, he hired an academic from the Stanford Research Institute, Howard Nielson,<sup>8</sup> whose work had caught his attention: Nielson had created for the Weyerhaeuser Timber Company a sophisticated projection entitled *America's Demand for Wood* (see fig. 1).<sup>9</sup> At the time he contacted Nielson, Wilkinson did not know Nielson was a member of the Church, born in Richfield, Utah, and educated at both BYU and the University of Utah.<sup>10</sup>

Nielson completed the Church growth study (discussed in the next section) in 1957, and the results provided Wilkinson with the forecasts he needed to facilitate long-term planning for the Church Educational System.<sup>11</sup> When he discovered Nielson was LDS, Wilkinson urged him to stay at BYU teaching statistics as part of the Economics Department. Nielson decided to stay for a year, ultimately teaching statistics classes in four different departments: economics, agricultural economics, accounting, and mathematics.<sup>12</sup> Among other difficulties associated with working for several departments, in the winter term of 1958 his name was spelled four different ways in the class schedule.

After Nielson's first year at BYU, he was offered a job by IBM at three times his BYU salary, based on the continued esteem of the *America's Demand for Wood* study.<sup>13</sup> He talked to Dean Weldon Taylor about the decision he was facing.<sup>14</sup> In the course of the conversation, Nielson mentioned that teaching statistics at BYU would be a lot easier if one department, a statistics department, did all the teaching. Taylor, apparently fearing that Nielson would take the IBM job, said he would form the department. Nielson agreed to stay; he wanted to raise his growing family in the friendly atmosphere of Provo and thought he could make up much of the difference in salary by consulting with Hill Air Force Base and Hercules Powder Company.<sup>15</sup> Nielson later admitted that his suggestion for a statistics department was a long shot; he did not anticipate Taylor's expeditious support and would likely have stayed even without a statistics department to sweeten the deal.<sup>16</sup> Thus an unintended consequence of the 1957 membership projection for the rapidly growing Church was the formation of the Statistics Department at BYU (see fig. 2).

The almost nonchalant decision to form a statistics department in order to retain a promising faculty member says something about the organizational climate of BYU at the time. It also was a larger academic step than the administration may have realized. Statistics was a latecomer as a distinct academic discipline. The first statistics departments in the United States were formed as recently as 1934 at Iowa State University, 1935 at George Washington University, and 1941 at North Carolina State College.<sup>17</sup> Later, in the 1940s and 1950s, amid a perfect storm of postwar science, computing, and population growth, departments sprang up at about a dozen research universities, including Stanford, Cornell, Berkeley, and Harvard. However, such eminent universities as Wisconsin, Texas A&M, and Yale added statistics departments in the 1960s, *after* the formation of BYU's department.

Even today, a few major universities do not have distinct departments of statistics; neither the University of Utah nor Utah State University currently has a statistics department.<sup>18</sup> So having a statistics department at BYU in 1960 was, if not quite *avant-garde*, decidedly progressive and unique for a school not in the same league as major research universities. The first PhD program at BYU had been started only three years earlier; it was not even clear at the time that there would be trained LDS statisticians available to staff the new department.

### **The 1957 Church Membership Projection**

As indicated, establishing a statistics department at BYU was a direct, if perhaps fortuitous, result of the Church membership projection study that President Wilkinson hired Howard Nielson to spearhead. Nielson's

**Y Establishes Statistics Dept.**  
**Nielsen Chosen New Chairman, Takes Post Autumn Semester**

An amalgamation of the statistics courses taught at Brigham Young University has just been formed into a new Statistics Dept., President Ernest L. Wilkinson announced.

**WITH DR. HOWARD C. Nielsen**, associate professor of statistics, as chairman, the department will begin operation autumn semester.

To be housed in the College of Business, the new department is a combination of courses now being taught in Accounting, Agricultural Economics, Business Management, Economics and Mathematics Departments. The department will develop more concentration in the field as other university departments join the program.

"For example," said Dr. Nielsen, "a minor in statistics is an excellent complement for majors in psychology, sociology, education, economics, business management, accounting and in the physical sciences."

He pointed out also that many fields such as journalism and political science will find this department helpful in giving students tools for such activities as public opinion researching.

**THE DEPARTMENT OFFERS** a major in statistics in either the College of Business or in the College of Physical and Engineering Sciences.

Dr. Nielsen explained that the curriculum in statistics is designed to serve two purposes: (1) to educate students for careers as professional statisticians in industrial organizations, government agencies and research institutions, and (2) to provide an integrated series of courses which will serve the entire university in many subject-matter areas.

"Although a relatively recent professional field of study, statistics has been given a greater emphasis by a number of leading universities," Dr. Nielsen said. "There is a growing demand for statisticians in the natural and social sciences as well as in industry, especially since the development of electronic data processing equipment."

BYU is equipped with such an "electronic brain" which serves all departments of the university and which also will be an important tool in the statistics Dept.

**Howard C. Nielsen . . . gets post as Statistics Dept. head**

**Daily Universe**  
 "Voice of Brigham Young University Community"  
 Vol. 12, No. 119 Friday, April 1, 1960 Provo, Utah

FIGURE 2. Notice announcing the formation of the Department of Statistics (*Daily Universe*, April 1, 1960). The article describes the new department as an amalgamation of existing statistics courses taught in other departments unified under a common umbrella provided by the new Department of Statistics. The incorporation of existing statistics courses with new advanced courses made it possible for the first five students to graduate from the department within a year.

1954 report *America's Demand for Wood* was a careful projection of future demand for wood based on assumptions about increasing demand, competition, technological changes, and shifts in home design.<sup>19</sup> The forecast received wide acclaim, and various sectors of the economy, including education, grasped the utility of such forecasts amid the rapid growth of the time. Wilkinson desired a similar projection for Church membership from 1957 to 2000.

The 1957 Church membership study identified six regions expected to have more than 5,000 LDS members of college age by 1975 and at least 10,000 by 2000. It identified twenty additional regions that were expected to have at least 2,000 members of college age by 1975. Based on these projections, Wilkinson proposed capping enrollment at BYU in Provo at 12,000–15,000 and building up to ten additional colleges in the Church system. The executive board supported Wilkinson's vision of BYU campuses

## Howard C. Nielson

Born in Richfield, Utah, in 1924, Howard Nielson obtained a bachelor's degree in mathematics from the University of Utah, a master's degree from the University of Oregon in mathematics with a concentration in theoretical statistics, an MBA from Stanford, and a PhD in business with a minor in statistics from Stanford. After founding the Department of Statistics at BYU in 1960, Nielson became known among students for his quantitative abilities. John Lawson, a current member of the Statistics Department, recalled that Nielson could mentally do complicated arithmetic operations faster than students could do them with paper and pencil or the crude calculators of the time.

Nielson was able early on to establish a broad curriculum for the BYU department by, for example, staying a page or two ahead of the students in an operations research class and spending a summer term at the University of Wyoming learning design of experiments so that he could teach it the next fall. After leading the department for three years, Nielson was ready for new challenges. He took a sabbatical and turned the reigns of the department over to Mel Carter.

Although Nielson remained on the statistics faculty for nineteen more years, he was never again the dominant figure in the department. He returned from sabbatical to teach regular classes for two more years. In 1967, he won a seat in the Utah State Legislature, so he scheduled all of his classes for 6:00 and 7:00 a.m. His quantitative abilities landed him on the state budget committee as a freshman legislator. In 1970, he took a two-year leave from BYU to work for the Ford Foundation on Economic Development in Jordan. After the stint in Jordan, he returned to BYU and the state legislature, where he rose to the position of Speaker of the House.

In 1974, Nielson announced that he was running for the vacant United States Senate seat for Utah and again took leave from BYU. His wife's health forced him to withdraw from the race, but by then the Department of Statistics had hired a replacement for him. He worked full time for Hercules Powder for a year and then, in a somewhat ironic shuffle, returned to BYU for a two-year position in the Economics Department as a temporary replacement for Merrill Bateman. He then spent four years as Utah's Associate Commissioner of Higher Education, after which he successfully ran for a seat in the

United States Congress in 1982. He served four terms as Congressman for Utah's third district. At Nielson's retirement party from the Statistics Department in 1982, Al Rencher made an only slightly exaggerated statement that Nielson had been a member of the department for twenty-two years, but had been on leave for twenty-four of them.

Nielson has 14 children from two marriages, 74 grandchildren, and 106 great grandchildren, at last count; a recent two-month window included two weddings, four births, and three baptisms. Since he retired, Nielson and his wife have served missions in Hungary and Australia.

servicing LDS youth in areas of membership concentration throughout the western United States.

In the first step to implement the concept, plans were announced to move Ricks College from Rexburg to Idaho Falls.<sup>20</sup> By 1960, President David O. McKay had changed Wilkinson's title in the Church Unified School System from Administrator<sup>21</sup> to Chancellor—reflecting Wilkinson's position as head of a university system, not just a single university—and eight million dollars had been spent to purchase 1,650 acres for Church colleges in Anaheim, San Fernando, Hayward (San Francisco area), Phoenix, Portland, Idaho Falls, and Salt Lake City. Almost as quickly as it began, however, the expansion concept stalled. A concerted campaign in Rexburg led to a reversal of the decision to move Ricks College,<sup>22</sup> and financial hesitation on the part of the First Presidency at the expenses of constructing the other new campuses (fortunate, as it turned out) led to the abandonment of the whole expansion project.<sup>23</sup>

The membership projection, however, is interesting in its own right. The report was daring. Even now, few statisticians would feel comfortable predicting values forty-three years in the future. Those who would dare to make such a prediction might hope that they would not be around when someone inevitably compares their predictions to actual realizations as we do here.<sup>24</sup> Some long-range predictions were amazingly accurate, while some were off by orders of magnitude. The accurate predictions attest to the validity and robustness of the modeling methods and assumptions implemented via hand computations. The wildly inaccurate predictions give a glimpse into unexpected changes in migration patterns within the United States and, much more importantly, unexpected Church expansion outside of the United States and Canada.<sup>25</sup>

The membership projection was not simply an extrapolation of the overall trend. It took into account the age structure of the Church in 1957, age-specific birth and death rates, conversion rates, geographical differences, and immigration patterns (see fig. 3). It made conservative assumptions about how these demographic characteristics would change in the future. The report divided the Church into forty-five regions, most in the western United States and Canada, producing a separate projection for each region.

Interesting facts brought out in the study include the following: all but two of the forty-five regions had contributed to the growth of the Church in the previous fifteen years; Church membership in twenty-eight of the regions had more than doubled; overall Church membership grew by a healthy 27.4 percent between 1950 and 1957; and, amazingly, the San Francisco, Phoenix, and Los Angeles regions each had a membership growth rate of around 80 percent in that seven-year period.

Not only was membership growing, but it was growing at a faster rate than the rapidly growing general population. Only southern Utah and Las Vegas had a smaller percentage of Latter-day Saints in 1957 than in 1910. Of interest to statisticians is a paradoxical finding that Arizona was the only western state in which LDS membership did not grow as a percentage of total population in the state—despite the fact that the LDS percentage increased in *every* area within the state.<sup>26</sup>

Overall, the membership prediction for 2000 was off by almost 80 percent; it predicted total Church membership in 2000 would be 6.7 million, while in actuality it reached 11.1 million (see fig. 4). At the time, even a projection of 6.7 million seemed unrealistically optimistic. Nielson compared this projection to an earlier forecast of 3.6 million<sup>27</sup> for the year 2000 and felt compelled to comment that even though his projection seemed unrealistic, it was justified by assumptions that were, if anything, conservative.

While the accuracy of the overall projection is not impressive, many of the regional projections for the United States and Canada were remarkably accurate (see fig. 5). There were two large but offsetting exceptions to accuracy for the U.S. and Canadian projections: membership in California was overestimated by around one million members, and membership in the nonwestern states and provinces was underestimated by almost one million members. Thus, the Church grew in the United States as a whole as predicted, but migration (Church members and otherwise) to the southern states was much greater than expected, while migration to California was much lower than expected.

Census Bureau statistics indicate that between 1940 and 1950, population growth rates for California, Utah, and the southern states were 53 percent, 25 percent, and 13 percent, respectively.<sup>28</sup> Between 1990 and



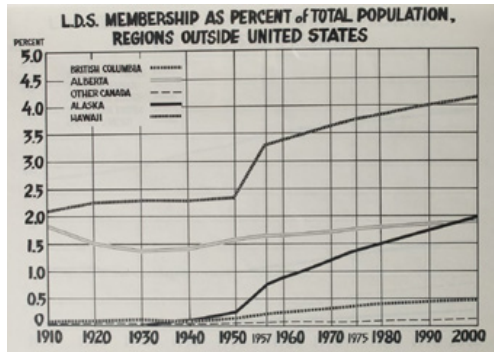
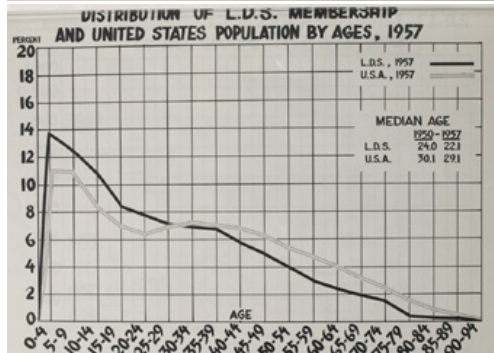
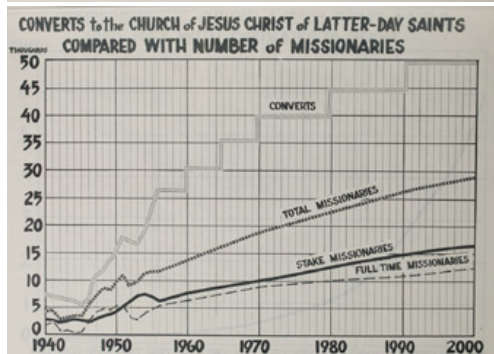
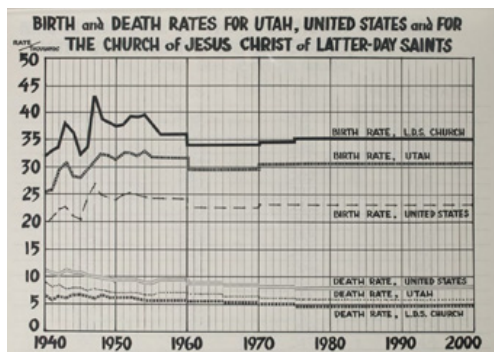
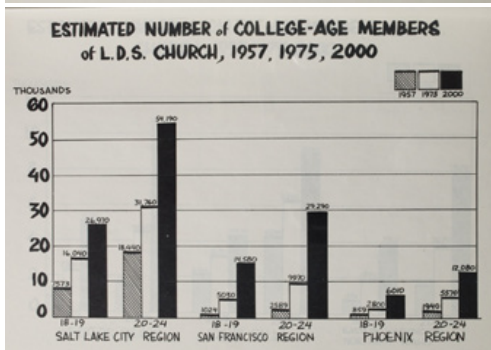
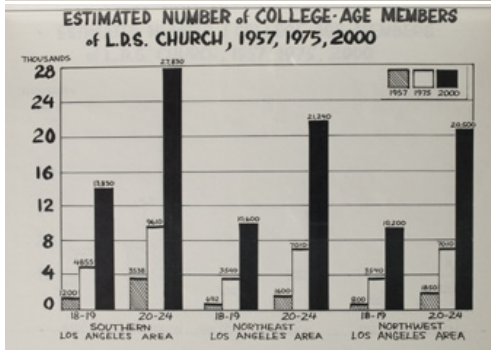
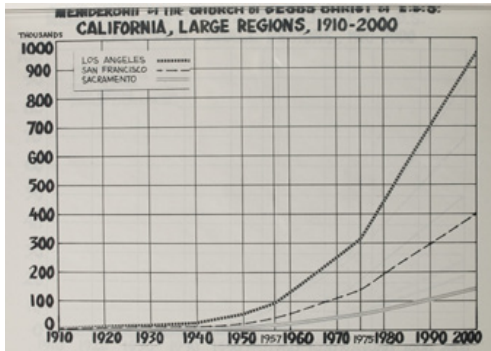
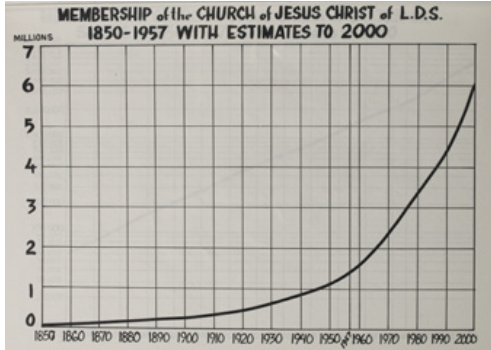
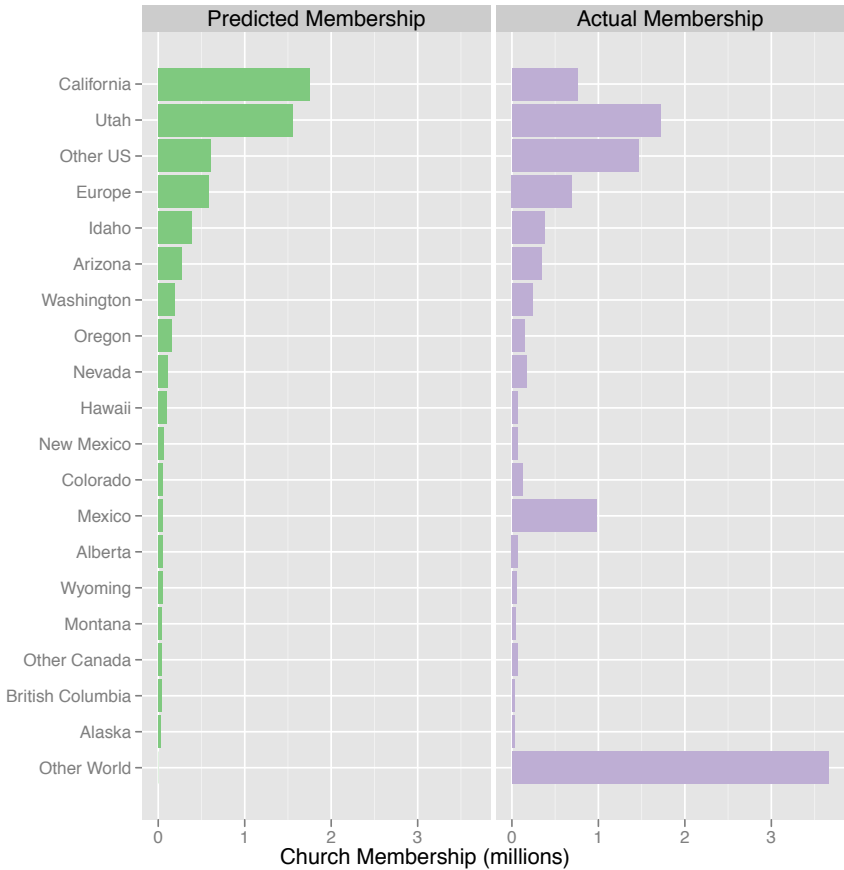


FIGURE 3. Samples of the hand-rendered graphs of birth, death, and conversion rates as well as age-structure and membership percentages used in the 1957 Church membership projection. In calculating membership-specific rates, the study found higher birth rates and lower death rates among members of the Church compared to the general U.S. population. Also, the results showed relatively more women of childbearing age among members of the Church than in the general population of women.

FIGURE 4. Church membership projections through 2000 from the 1957 report. Based on Church growth through 1957, Nielson believed Los Angeles would overtake Salt Lake City by 1985 as the largest membership region in the Church. The increasing number of college-age members in the Los Angeles area expected between 1957 and 2000 led to a recommendation for three Church-sponsored junior colleges in the Los Angeles area alone.





**FIGURE 5.** Regional Church membership projections from the 1957 report (left panel) compared to actual regional membership for 2000 (right panel). The regions are sorted by *predicted* membership. Discrepancies between the predicted and actual membership highlight the unanticipated growth in the worldwide Church. “Other World” comprises Asia, Africa, Spain, Eastern Europe, and Latin America. “Other Canada” includes all Canadian provinces except Alberta and British Columbia. “Europe” consists of Europe, Australia, New Zealand, and Polynesia. “Other US” includes all nonwestern states.

2000, the comparable figures were 15 percent, 30 percent, and 18 percent. Nielson's model assumed that extensive migration to California would persist. Based on that assumption, the 1957 report projected that by 1985 Los Angeles would surpass Salt Lake City as the largest membership region in the Church; San Francisco would be third largest, followed by the southern states, Ogden, and Provo.

The most glaringly inaccurate projections in the 1957 report involved Mexico, Latin America, Asia, Africa, and eastern Europe. The model obviously could not have anticipated the 1978 declaration extending the priesthood to all worthy male members<sup>29</sup> or the demise of the Soviet Empire. But even adjusting for those events, Church growth in most of these regions could not have been predicted from past trends in 1957. The projection is therefore a staggering commentary on the miraculous and statistically unexpected growth of the Church in these areas.

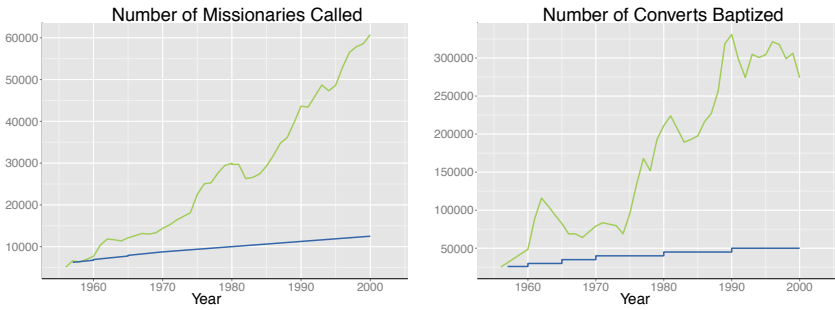
The 1957 model assumed the number of new converts would increase by 1,000 per year until 1975, with half that annual increase after 1975. In actuality, the missionary force grew at a much faster rate than predicted, as did the number of converts baptized (see fig. 6).<sup>30</sup>

### **The End of the Junior College Proposal**

In March 1963, the executive committee of the Church Unified School System voted to abandon the expanded college proposal.<sup>31</sup> Wilkinson later revised his proposal, reducing the number of junior colleges from ten to four: a school in Mexico City to train CES teachers for Mexico, Ricks College, a junior college in Anaheim, and a junior college in Phoenix with special emphasis on Native American students. He suggested that these schools would more than pay for themselves because of the increased tithing the Church would ultimately receive from students acquiring complete religious education at junior colleges. Even so, the proposal was shelved and many of the properties were sold at several times the acquisition price.<sup>32</sup>

Wilkinson said he spent more time on the junior college proposal than on anything else in his first twelve years at BYU. His eleven-month absence from BYU after resigning in 1964 to run for U.S. Senate proscribed any return to the junior college proposal. While his vision of a constellation of BYU campuses was never realized, Wilkinson's tenure at BYU saw an increase in enrollment from 4,004 students in February 1951 to 25,116 students in September 1971, one month after his retirement; this 527 percent growth dwarfed the national average among universities of 75 percent in the same period.<sup>33</sup>

The hesitation of the First Presidency to build the satellite campuses indicates that they were not comfortable with Nielson's careful statistical



**FIGURE 6.** Assumed and actual missionary force and numbers of converts from 1957 to 2000. The 1957 assumptions are represented by the darker line; the actual number of missionaries and convert baptisms are depicted by the lighter line. The 1957 assumptions for growth of the missionary force and number of converts did not anticipate President Kimball's compelling call for more missionaries in the 1970s or the remarkable growth that occurred outside the United States and Canada.

projection. Their lack of confidence in the projection was well justified. The Church did not grow as dramatically as expected in California, and it grew much more dramatically than expected outside of the United States and Canada. Had the campuses been built as suggested by the 1957 projection, they would not have been located where they would have best served the youth of the Church. Also, needed resources for churches and temples outside of the United States and Canada would have been reduced. In retrospect, a central large BYU fits the needs of the international Church better than satellite campuses based on a very careful 1957 projection. One unintended benefit of President Wilkinson's attempt to project Church growth, however, is that BYU now has a thriving Department of Statistics, the only one in the state of Utah.

### **Fifty Years of the BYU Department of Statistics**

In addition to its remarkable origin connected with Howard Nielson's statistical projections, many things about the new Statistics Department at BYU in 1960 were unique. The department initially offered only a bachelor's degree even though most existing departments exclusively offered graduate degrees. As late as 1986, the president of the American Statistical Association (ASA), possibly as a result of a recent visit to BYU, was urging statistics departments to develop bachelor's programs.

The founder of the department, Howard Nielson, had a PhD in business with a minor in statistics. The next two faculty members hired into the department also had minors in statistics, both from North Carolina State

College.<sup>34</sup> Mel Carter, who had been working as a statistical consultant at Purdue and North Carolina State College, had a PhD in animal nutrition, and Gill Hilton had a PhD in soil science.

Carter brought with him rough-hewn qualities that defined the Statistics Department in its early years. Carter had intended to work at his family dairy farm for life, but after a disagreement with his older brother about who was doing more work, he left for graduate study. His laboratory experiences taught him that influences as subtle as alfalfa dust could completely disrupt a nutrition experiment, but statistical design and analysis tools were available to adjust for these subtle effects. So he learned as much about statistics as possible from pioneers in the field, including Gertrude Cox. Carter jumped at the invitation to join the BYU department even though he suspected that Nielson “probably didn’t know that he wasn’t a statistician.” Carter’s unique combination of humility, rough edges, and respect for statistical models drew students to him and the major.

Gill Hilton brought with him a similar respect for the power of statistics in applied science combined with a strong administrative ability. Hilton later served as department chairman for twelve years, which proved critical to the growth of the department. After his service, he continued his administrative career as a mission president in Virginia.

By 1963, Nielson had built the department up to five faculty members by hiring Earl Faulkner, a biostatistics PhD from the University of Minnesota, and Dale Richards, an operations research PhD from the Department of Industrial Engineering at Iowa State.<sup>35</sup> A graduate program for the department was approved and the curriculum was stable when Carter became department chair. Under Carter’s leadership (1963–66), the new graduate program was developed and a tradition begun of consulting with faculty in other departments. Also, a charter was granted for the Utah Chapter of the ASA. Under Dale Richards’s chairmanship (1966–69), the faculty expanded from five to eight members. Gill Hilton, chair from 1969 to 1980, facilitated greater faculty research productivity and capitalized on this productivity by assisting the faculty in vending the state-of-the-art statistical software they developed.<sup>36</sup>

Al Rencher’s chairmanship (1980–84) helped the department acquire more physical space, additional faculty positions, and recognition for the consulting center. Under Lee Hendrix (1985–94) the undergraduate program expanded to join the largest in the nation and added actuarial science and quality science emphases. While Gale Rex Bryce was chair (1994–2000), enrollment in the introductory statistics class more than doubled to over four thousand per year; development of the introductory class along with additional positions to handle the increase became priorities.

Under Howard Christensen, chair from 2000 to 2006, the use of multimedia and online technology was pioneered. The current chair (as of January 2012), Del Scott, has developed computing facilities and physical space, and both graduate and undergraduate curricula have undergone radical improvements.

All of the faculty now have PhDs in statistics or biostatistics, but in addition to developing statistical methodology, the faculty carry out research on a wide variety of applied problems, including air pollution monitoring, television ratings, improvement of sports teams, rating of sports teams, DNA analysis, health-care systems, evolutionary ecology, chemical thermodynamics, educational methods, industrial improvement, wildlife management, authorship styles in literature, paleontology, election prediction, and weapons systems reliability—just to name a few. The diversity has enriched each member of the department and led to beneficial cross-fertilization and collaboration.

A unique characteristic of the Statistics Department (at least among the physical and mathematical sciences) has been the relatively extensive involvement of women in the department almost from the start. Although the first graduating class consisted of five male students, most subsequent classes have included several female students. Among the first master's students were several women.<sup>37</sup> Even when there were no female faculty members in the department, a female graduate student was teaching introductory statistics in the department.<sup>38</sup> As of 2012, the department has seventeen full-time faculty, four of whom are female (24 percent).

Fifty years after the Statistics Department slipped into existence, the department is strong and well poised for the future. The Jobs Rated Almanac has consistently rated both statistician and actuary among the top five careers for about twenty years.<sup>39</sup> A 2009 editorial in the *New York Times* even reported the claim by the chief economist at Google that, given the staggering amount of data currently collected by business, government, and academia, “the sexy job in the next 10 years will be statisticians.”<sup>40</sup> Fortunately, BYU is positioned advantageously to prepare LDS statisticians for these important future careers—all because of a whimsical comment by Howard Nielson more than fifty years ago and the dedication of those who followed him.

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Natalie J. Blades is Assistant Professor of Statistics at BYU. She received her bachelor's degree in mathematics from Wellesley College, her master's in mathematical sciences from the Johns Hopkins School of Engineering, and her PhD in biostatistics from the Johns Hopkins School of Hygiene and Public Health. She conducted

postdoctoral research at the Jackson Laboratory in Bar Harbor, Maine. She has been at BYU since 2005.

G. Bruce Schaalje is Professor of Statistics at BYU. He received his bachelor's degree in mathematics at BYU, a master's in zoology at BYU, a master's in biostatistics at the University of Washington, and his PhD in statistics and biomathematics at North Carolina State University. He worked as a research scientist for Agriculture Canada in Alberta for twelve years. Since 1992, he has been at BYU and has served as both undergraduate and graduate coordinator in the Statistics Department. He has coauthored over 140 articles in a wide variety of scholarly journals and coauthored a graduate textbook on statistical modeling.

1. John W. Welch, "Off on the Right Foot," *BYU Studies* 38, no. 1 (1999): 18–19.
2. The next year, Tony Butala, Jim Pike, and Bob Engemann recorded two singles, "The Way You Look Tonight" and "When I Fall in Love," which shot to number 13 and 7, respectively, on the Billboard chart. *Billboard Music Week*, October 23, 1961, and January 27, 1962.
3. "County Hails BYU Campus: Four-Year College to Go on 135 Acres in Anaheim," *Los Angeles Times*, August 7, 1960.
4. "Mormon Church Buys Phoenix Campus Site," *Los Angeles Times*, July 24, 1960.
5. Ernest L. Wilkinson, ed., *Brigham Young University: The First One Hundred Years*, 4 vols. (Provo: Brigham Young University Press, 1975–76), 3:149, 153, 607–8.
6. At the opening of the 1960–61 academic year, Howard Nielson was installed as chair of the Statistics Department. Three other faculty members from the College of Business also taught courses for the department in the fall term: B. Delworth Gardner, assistant professor of economics; M. Lyman Wilson, assistant professor of industrial management; and Brent L. Eager, instructor in economics. During the winter term, Bliss Crandall, dean of admissions and former professor of applied statistics at Utah State Agricultural College and Ed Dean from mathematics also taught statistics courses. *Daily Universe*, June 17, 1955. One of the classes had twelve students; five students graduated in statistics in 1961: Dave Batchelor, Ronald Duncan, Ed Huband, Wayne Larsen, and Karl Smith.
7. Brigham Young University, Bureau of Church Studies, [https://lib.byu.edu/byuorg/index.php/Brigham\\_Young\\_University\\_Bureau\\_of\\_Church\\_Studies#Description](https://lib.byu.edu/byuorg/index.php/Brigham_Young_University_Bureau_of_Church_Studies#Description).
8. Nielson is better known as a politician. He was a member of the Utah House of Representatives (1967–74), Speaker of the Utah House of Representatives (1973–74), and four-term Congressman for Utah's third district (1983–91). He also served as Associate Commissioner of Higher Education for the state of Utah (1976–78).
9. Stanford Research Institute, *America's Demand for Wood 1929–1975* (Tacoma, Wa.: Weyerhaeuser Timber Company, 1954). The report was commented on both by *Business Week* ("Outlook for Wood Products: Fight against a Trend," October 2, 1954, 84–88) and *U.S. News and World Report* ("The Next 20 Years—a Business Forecast," October 8, 1954, 91–94). Presumably, Wilkinson had read about the projection in one of these news magazines.
10. Howard Nielson, interview with the authors, April 15, 2010.
11. The study was updated in 1967 and also 1977. The Church used Nielson to carry out several other projections. In the general priesthood meeting of the October 1967 semiannual general conference, Elder Harold B. Lee mentioned Howard



Nielson by name. He referred to Nielson's projections indicating that the anticipated one million members in Utah by 1985 would make up only 21 percent of Church membership. In response to these projections, sixty-nine Regional Representatives were called.

12. Across the four departments, Nielson taught ten courses in the 1957–58 academic year.

13. Nielson, interview.

14. Weldon Taylor was dean of the College of Business. The Statistics Department was located in the College of Business until 1966, when it was transferred to the College of Engineering and Physical Sciences; however, the department awarded majors in both colleges until 1980.

15. Hercules Powder, which changed its name in 1968 to Hercules Inc., worked on the Minuteman Missile project. Several statistics students worked for the company. Hercules hired Boyd Harshbarger as its primary statistical consultant. Harshbarger was the founder and chairman of the Department of Statistics at Virginia Polytechnic Institute. As a result of this connection, BYU graduates Wayne Larsen, Al Rencher, and Gary Beus obtained their PhDs at VPI.

16. Nielson, interview.

17. While the American Statistical Association (ASA) was founded in 1839, academic departments of statistics did not emerge until much later. It is unclear which department was the first department of statistics—each time a department claims to have been first, another school pops up with an earlier claim—but departments of statistics were remarkably rare in this era. Departments of biostatistics had been attached to public health schools for much longer—the ASA documents that the Johns Hopkins Department of Biostatistics, founded in 1918, was the first academic department with statistics in the departmental title. R. L. Mason, J. D. McKenzie Jr., and S. J. Ruberg, “A Brief History of the American Statistical Association 1839–1989,” *American Statistician* 44 (1990): 68–73. In 1927, Iowa State established a statistical laboratory; however, their department was not created until 1933. “First Statistical Laboratory,” [www.fpm.iastate.edu/maps/memorials/marker.asp?id=23-01](http://www.fpm.iastate.edu/maps/memorials/marker.asp?id=23-01).

18. Several statisticians are faculty members of various departments at the University of Utah. For about the last ten years, Utah has offered an interdepartmental professional MStat degree. Utah State University actually had a Department of Statistics by 1967. Around 1985, the Statistics Department was amalgamated with the Mathematics Department to form the current Department of Mathematics and Statistics. Ten of twenty-eight faculty members are statisticians.

19. Despite the coming of age of a small Depression-era birth cohort, cultural trends luring singles from the family home while encouraging retirees to remain in the empty nest made 1953 the ninth consecutive year of record-setting spending on new construction. In anticipation of continuing growth driven by the postwar baby boom, the Weyerhaeuser Timber Company commissioned the Stanford Research Institute to predict future demand in the forest products industry. The research team identified production segments in the U.S. economy with a demand for wood: lumber for construction; pulp for paper, cardboard, rayon, and acetate; and plywood for construction and shipping. Additionally, the study accounted for technological changes like the electrification of farms and the popularity of oil and gas heat, which decrease demand for wood fuel, and shifts in taste from wood-hungry Victorian homes with wooden porches, ornate trim, and steep pitched roofs to

more conservative (and less resource-demanding) ranch houses. Stanford Research Institute, *America's Demand for Wood*.

20. Actually re-announced. A similar decision had been announced in 1954 but was shelved due to local resistance. See David L. Crowder, *The Spirit of Ricks: A History of Ricks College, 1888–1997* (Rexburg, Idaho: Ricks College, 1997), chapter 11, available online at <http://www.byui.edu/pr/thespiritofricks/ch11.htm>.

21. “In July 1953, the Church announced that Wilkinson would thereafter act as both the ‘Administrator’ (later Chancellor) of the Church Unified School System and also as president of BYU.” Gregory A. Prince and Wm. Robert Wright, *David O. McKay and the Rise of Modern Mormonism* (Salt Lake City: University of Utah Press, 2005), 165.

22. The decision involved lobbying by Ernest L. Wilkinson for a move to Idaho Falls, a meeting of the First Presidency with thirteen stake presidents of eastern Idaho (fifteen were invited), a telegraph and letter-writing campaign fueled by a local radio station, a fund-raising campaign by the local Chamber of Commerce, and a visit to Rexburg by President David O. McKay. See Crowder, *Spirit of Ricks*, chapter 11.

23. After purchasing land in five states, construction was sidelined after concerns that construction and maintenance could not be undertaken without incurring debt. In 1960, the board decided institutes of religion could provide religious instruction for LDS students. The board acknowledged this religious training might not be as thorough but would be accomplished at a much lower price. Wilkinson, *First One Hundred Years*, 3:153.

24. As of this writing (January 2012), Nielson is eighty-seven years old, in good health, and comfortable with these comparisons.

25. “Statistical Information on L.D.S. Church and L.D.S. Church University Needs,” presented at the Development Program for the National Advisory Committee of Brigham Young University, April 1958, copy in L. Tom Perry Special Collections, Harold B. Lee Library, Brigham Young University, Provo, Utah.

26. The areas of fastest overall growth in Arizona (Phoenix and Tucson) had the smallest percentage LDS population; thus, the overall LDS percentage in the state decreased even though it increased in every region in the state. This is an example of Simpson’s Paradox.

27. H. Nielson, Bureau of Church Studies, Perry Special Collections. The previous prediction was made by Howard Barker.

28. F. Hobbs and N. Stoops, *Demographic Trends in the 20th Century: Census 2000 Special Reports*, U.S. Census Bureau, Census 2000 Special Reports, Series CENSR-4 (Washington, D.C.: U.S. Government Printing Office, 2002), table A-1.

29. Official Declaration given on September 30, 1978, at the 148th semiannual general conference.

30. Number of converts and missionaries serving extracted from conference reports and supplemented by information from the Missionary Department. “Statistical Report,” *Conference Report*, April 1957–April 2000.

31. The institute program has grown to accommodate the need for religious instruction of college-age members. In 1959, there were sixty institutes with sites purchased for nineteen more. The Church committed to building an institute with a full-time instructor for any school with at least one hundred LDS students. Wilkinson, *First One Hundred Years*, 3:164. As of 2012, about 350,000 students are involved in institute programs worldwide. See “Frequently Asked Questions—Institute,” [institute.lds.org/faq](http://institute.lds.org/faq).

32. Wilkinson, *First One Hundred Years*, 3:170–74.

33. Wilkinson, *First One Hundred Years*, 3:755.

34. The fact that both men had only minors is not as shocking as it seems. Statistics departments were new; most pioneers of this new discipline had degrees in other areas. As an extreme example, Jerry Cornfield, a pioneer of biostatistics in the U.S., had a BA in history.

35. “News and Notices,” *Annals of Mathematical Statistics* 36, no. 2 (1965): 740. Faulkner’s dissertation, “A Stochastic Model for Immunological Experimentation on Spontaneous Mammary Tumors in Inbred Mice,” was the first written in statistics among the faculty at BYU. Dale Owen Richards’s doctoral dissertation, “Incompletely Specified Models in Life Testing,” in 1963, was the fifth submitted to the Department of Industrial Engineering at Iowa State University.

36. Based on the abbreviated Doolittle method and the cell means model, Del Scott and Gale Bryce developed a program for general linear models called RUMMAGE. It was unique in that it allowed the user to specify the design matrix. In its day, it was a serious competitor with SAS’s flagship program GLM. SAS is just now incorporating the design matrix capability. Royalties from the sale of RUMMAGE have provided the department with an endowed chair, a multiyear faculty fellowship, and several student fellowships. The fund has provided bridge money for new faculty hires and other academic flexibility. For a comparison to three major software products, see D. W. Garton and K. L. Koonce, “Two-Way Analysis of Variance in Computer Statistical Packages: A Comparison of SPSS, BMDP, and RUMMAGE to SAS GLM,” *Proceedings of the SAS Users Group International Conference* 6 (1981): 185–90.

37. Grace Yeh (1969) and Nancy Covino Ellison (1971) were the first two women to graduate with an MS in statistics from BYU.

38. Patti Burton (who is still teaching in the department and is now married to faculty member Bruce Collings) remembered when she was finally allowed to wear a pant suit; she said the department chairman told her she looked like she was wearing pajamas.

39. L. Krantz, *Jobs Rated Almanac: The Best and Worst Jobs* (New York: Baricade Books, 2002).

40. Steve Lohr, “For Today’s Graduate, Just One Word: Statistics,” *New York Times*, August 5, 2009.