#2.38

Figure 2.16. MEASUREMENT ERROR: Measuring Large Sales Volumes Approximately

EM9011: Toronto Star, January 22, 1990, page B3

How does McDonald's know it's sold 70 billion?

By Rode DeWolf
SPECIAL TO THE STAR

How do they know?

Just recently, Campbell Soup Co. had a big celebration in honour of the "20 billionth" can of tomato soup shipped off to market. Last year, Disney World in Florida honoured its "300 millionth visitor." And those McDonald's Golden Arches, which still adhere to the company's tradition of reporting on hamburger sales, now proclaim "over 70 billion served."

Are we expected to believe these companies can actually pinpoint the day, the hour, the very minute when numerical history is made?

The answer is no. It turns out that this is not a very exact science.

□ About the number of McDonald's hamburgers sold:

"It's an estimate," says Anne Tolle, spokeswoman for McDonald's. "We know the exact number sold at the 25 per cent of McDonald's that are owned and operated by the company, because we keep a running count by computer.

"For the number sold by the 75 per cent of our restaurants owned by franchisees, we conduct a telephone sampling of a percentage of them to get an idea of their sales volume."

□ About the 300th million visitor to Disney World:

"There is a certain ceremonial aspect to it," admits Disney World spokesman Dave Herbst. "After all there are three different gates here – at the Magic Kingdom, Epcot Center and Disney MGM studio – and there are many turnstiles at each gate. So we couldn't know exactly which visitor was the 300 millionth. But each turnstile contains a counter that keeps track of the people arriving, so we can estimate about when a record is about to occur. Then we pick a date to celebrate and pick a family coming through one of the gates to help us with the ceremony."

□ And finally, that 20 billionth can of soup:

"We never claimed we knew exactly which can was the 20 billionth," said Campbell spokesman David Hackney. "After all, tomato soup is now made at four different plants in the U.S. and at one time was made at six. There would be no way of knowing which can at which plant was number 20 billion. What we did know was that, given normal production rate at our plants, the 20 billionth can would be produced sometime in January ..... which just happens to be National Soup Month.

"So we planned a celebration in January. Instead of holding it at one of the plants – how could we possibly pick which one? – we chose to hold it in Minneapolis because it is among the top cities in the nation in tomato soup consumption per capita. Then we picked the date by determining when the various celebrities we invited to help us celebrate could make it.

"It could be that the 20 billionth can actually was produced the day before or a couple of days after. But we know it was around that time. We have production records going back to the founding of the company.'

"We could never simply make up a number out of the air, you can be sure of that. One time when we wanted to say something light-hearted about the number of stars in our chicken and stars soup, our legal department made us actually open several cans and count them."

KNIGHT-RIDDER NEWSPAPERS

1️⃣ The three population attributes discussed in the article EM9011 are all a *size*; briefly describe the three (target) populations.
- Compare and contrast the attribute discussed in the article EM9011 above and the attributes investigated in Statistical Highlights #15, #35 and on page HL36.2 in Highlight #36?

2️⃣ Which of the three Answers given in the article EM9011 – 20 billion cans, 300 million visitors, 70 billion hamburgers – would you expect to have, in relation to its magnitude:
- the *smallest* overall error;   ● the *largest* overall error?   Justify your choices briefly.

3️⃣ In the left-hand column of the article EM9011, in its *sixth* paragraph, a McDonald's spokeswoman calls the 70 billion hamburgers sold an *estimate*. Compare and contrast this useage with our defintions of 'estimate' and 'estimator' on, for example, pages HL6.2 and HL6.3 in Statistical Highlight #6; explain briefly in your discussion how *sampling* is involved in obtaining the 70 billion Answer.
- In the same paragraph, the spokeswoman is quoted as saying: *We know the exact number (of hamburgers) sold at ..... because we keep a running count by computer.* Assess (in order of *de*creasing importance), to the extent possible from the limited information in the article EM9011, the limitations imposed on the 70 billion Answer by study error, non-response error, sample error and (attribute) measurement error.

4️⃣ In the *last* paragraph at the end of the right-hand column of the article EM9011, a process is described for estimating the (average) number of stars per can in Campbell's chicken and stars soup.
- What factor(s) affect the *precision* of the corresponding estimator of the population average;
  - What matter of statistical concern do you infer from the word 'several' in the last sentence of the article EM9011?
- What factor(s) affect the *accuracy* of this estimator?
Explain briefly the importance of each factor you mention.

The article EM9011 reprinted above in this Figure 2.16 is also used, together with the article EM1601, in Statistical Highlight #34.