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Difficulties Reading Bar Graphs in USA Today

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GAISE: "Emphasize statistical literacy"

GAISE: Statistical literacy includes "being able to read statistical graphs"

GAISE: Assess students "interpreting ... articles in the news and graphs in media."

USA Today is the leading newspaper in the US. USA Today is well-known for its use of graphs. We will use 'graph' and 'chart' interchangeably.

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Non-Percentage Graphs (~30% of all)

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Percentage Graphs

Pies (29%): Automatically the components are parts with a 100% sum and are exclusive and exhaustive.

Bars (70%): Need not sum to 100%; need not be exclusive or exhaustive; can be either parts or wholes.

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Percentage Bar Graphs by Sum and Composition

We first investigate bars that are parts:
 * 100%, ~100%, < 100% and > 100%.

We then investigate bars that are wholes.

% Bar Graphs	ALL	Parts	Wholes
%Sum \ ALL	87	76	11
= 100%	11	11	
~100%	11	10	1
< 95%	36	31	5
> 105%	29	24	5

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Percentage Bars Sum = 100%

These are ~15% of all percentage bar charts.

100% bar charts are ~25% of all 100% charts

Percentage Bars
Sum ~ 100%

These are ~15% of all percentage bar charts.
If the bars are parts, exclusive and exhaustive, one explanation is that either rounding or that some answers were not helpful (No response).
Note that the sum of the right graph is 101%.

Luck at casino gambling

Lost more than won	43%
Came out even	33%
Won more than lost	20%

Back-to-school buying

Store with best sales	67%
Store with every-thing I need every year	22%
Other	10%
Other	2%

Percentage Bars
Sum < 95%

These are ~40% of all percentage bar charts.
If the bars are parts and exclusive, then one explanation is that the bars are not exhaustive.
Note that the bars may not be exclusive (right)

Favorite ice cream flavors

Vanilla	33%
Chocolate	19%

Types of bumper stickers we have

Promotional	6%
University-related	6%
Political	6%
Humorous	8%

Percentage Bars
Sum > 105%

These are ~30% of all percentage bar charts.
If the bars are parts then one explanation is that they are non-exclusive: respondents can select multiple answers.
Superlatives may not force exclusivity.

Free-time choices

Watch TV daily	96%
Drive movies	60%
Exercise	55%
Gardening	47%
Read	47%

Favorite Peeps shapes

Bunny	60%
Chick	59%
Snowman	35%
Hears	24%

Percentage Bars
Bars are Wholes

These are ~10% of all percentage bar charts.
Bars are wholes if they are exclusive:

- exhaustive and add to less than 95%
- and add to more than 105%

Fighting among teens

Male	41%
Female	25%

People who eat healthily

18-24	50%
25-34	57%
35-44	63%
45+	70%

Percentage Bars
Parts or Wholes???

Top age groups for DUI

21-25	29%
26-29	24%
18-20	20%
30-34	19%

Guests who bring gifts (by household income)

\$35,000 or less	15%
\$35,001-\$50,000	18%
\$50,001-\$75,000	24%
Over \$75,000	41%

Exclusive bars
Sum: 92%
Age 35+ omitted
Non-exhaustive
Could sum to 100%

Exclusive bars
Sum: 98%
No group omitted
Rounding error?
Could sum to 100%

Conclusions

Journalists need *guidelines* on how to make percentage bar charts that are unambiguous.
Students need *training* in reading percentage bar charts: in forming descriptions and comparisons using ordinary English.
To meet the GAISE challenge, statistical educators must *focus more on statistical literacy*: helping students read and understand the stories and graphs that use statistics in the every day media.