Human-Computer Interaction

# Reporting & Writing HCI Papers

Professor Bilge Mutlu

# Today's Agenda

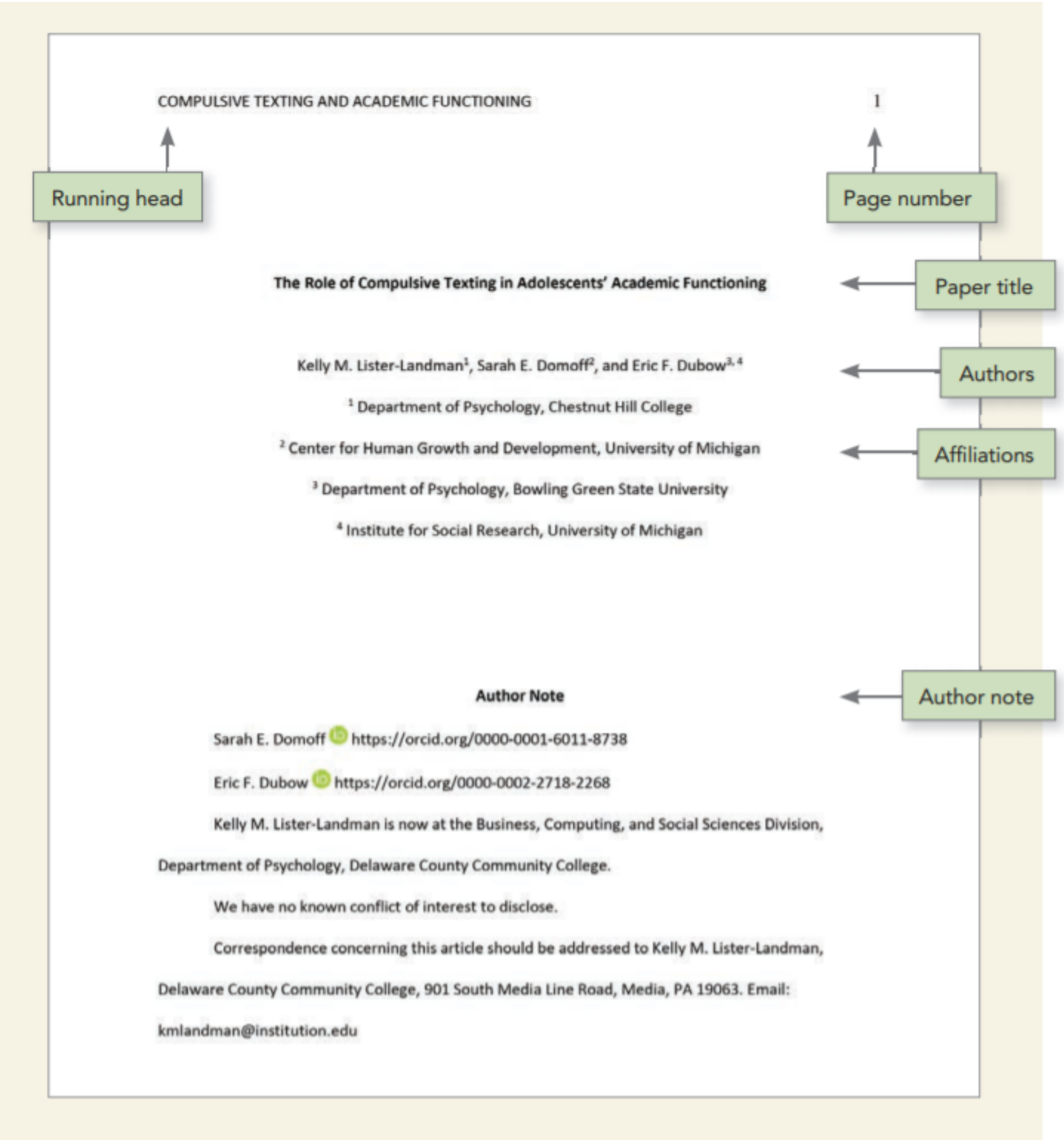
» Overview: *Reporting Statistics, Writing*

*What are reporting norms in HCI research?*

Because HCI is a rather eclectic field, the reporting norms are adopted from different fields, roughly as follows:

| **Aspect** | **Norm** |
|---|---|
| Paper structure | APA (loosely) |
| Results of statistical analyses | APA (strictly) |
| Tables, figures | APA (very loosely) |
| Citations | Depends on the publisher (ACM, IEEE, etc.) |
| Formulas | AMS (loosely) |
| Style | APA (loosely), generally high standards in writing |

# *APA Publication Manual: Print, Web; AMS Style Guide: Web*[1]


COMPULSIVE TEXTING AND ACADEMIC FUNCTIONING 1

**The Role of Compulsive Texting in Adolescents' Academic Functioning**

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We have no known conflict of interest to disclose.

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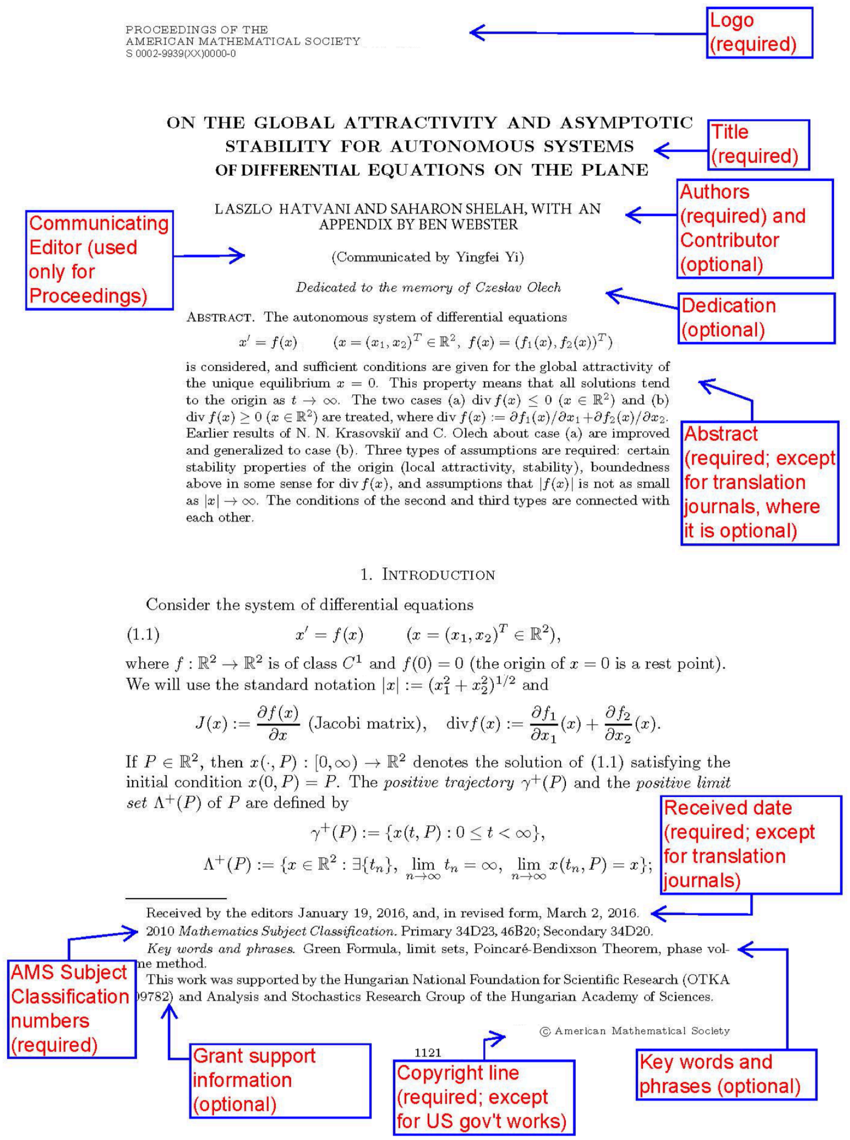
PROCEEDINGS OF THE AMERICAN MATHEMATICAL SOCIETY
S 0002-9939(XX)0000-0

ON THE GLOBAL ATTRACTIVITY AND ASYMPTOTIC STABILITY FOR AUTONOMOUS SYSTEMS OF DIFFERENTIAL EQUATIONS ON THE PLANE

LASZLO HATVANI AND SAHARON SHELAH, WITH AN APPENDIX BY BEN WEBSTER

(Communicated by Yingfei Yi)

*Dedicated to the memory of Czesław Olech*

ABSTRACT. The autonomous system of differential equations

$$x' = f(x) \qquad (x = (x_1, x_2)^T \in \mathbb{R}^2,\ f(x) = (f_1(x), f_2(x))^T)$$

is considered, and sufficient conditions are given for the global attractivity of the unique equilibrium $x = 0$. This property means that all solutions tend to the origin as $t \to \infty$. The two cases (a) $\operatorname{div} f(x) \le 0$ ($x \in \mathbb{R}^2$) and (b) $\operatorname{div} f(x) \ge 0$ ($x \in \mathbb{R}^2$) are treated, where $\operatorname{div} f(x) := \partial f_1(x)/\partial x_1 + \partial f_2(x)/\partial x_2$. Earlier results of N. N. Krasovskiĭ and C. Olech about case (a) are improved and generalized to case (b). Three types of assumptions are required: certain stability properties of the origin (local attractivity, stability), boundedness above in some sense for $\operatorname{div} f(x)$, and assumptions that $|f(x)|$ is not as small as $|x| \to \infty$. The conditions of the second and third types are connected with each other.

1. INTRODUCTION

Consider the system of differential equations

$$x' = f(x) \qquad (x = (x_1, x_2)^T \in \mathbb{R}^2), \tag{1.1}$$

where $f : \mathbb{R}^2 \to \mathbb{R}^2$ is of class $C^1$ and $f(0) = 0$ (the origin of $x = 0$ is a rest point). We will use the standard notation $|x| := (x_1^2 + x_2^2)^{1/2}$ and

$$J(x) := \frac{\partial f(x)}{\partial x} \text{ (Jacobi matrix)}, \quad \operatorname{div} f(x) := \frac{\partial f_1}{\partial x_1}(x) + \frac{\partial f_2}{\partial x_2}(x).$$

If $P \in \mathbb{R}^2$, then $x(\cdot, P) : [0, \infty) \to \mathbb{R}^2$ denotes the solution of (1.1) satisfying the initial condition $x(0, P) = P$. The *positive trajectory* $\gamma^+(P)$ and the *positive limit set* $\Lambda^+(P)$ of $P$ are defined by

$$\gamma^+(P) := \{x(t, P) : 0 \le t < \infty\},$$
$$\Lambda^+(P) := \{x \in \mathbb{R}^2 : \exists\{t_n\},\ \lim_{n\to\infty} t_n = \infty,\ \lim_{n\to\infty} x(t_n, P) = x\};$$

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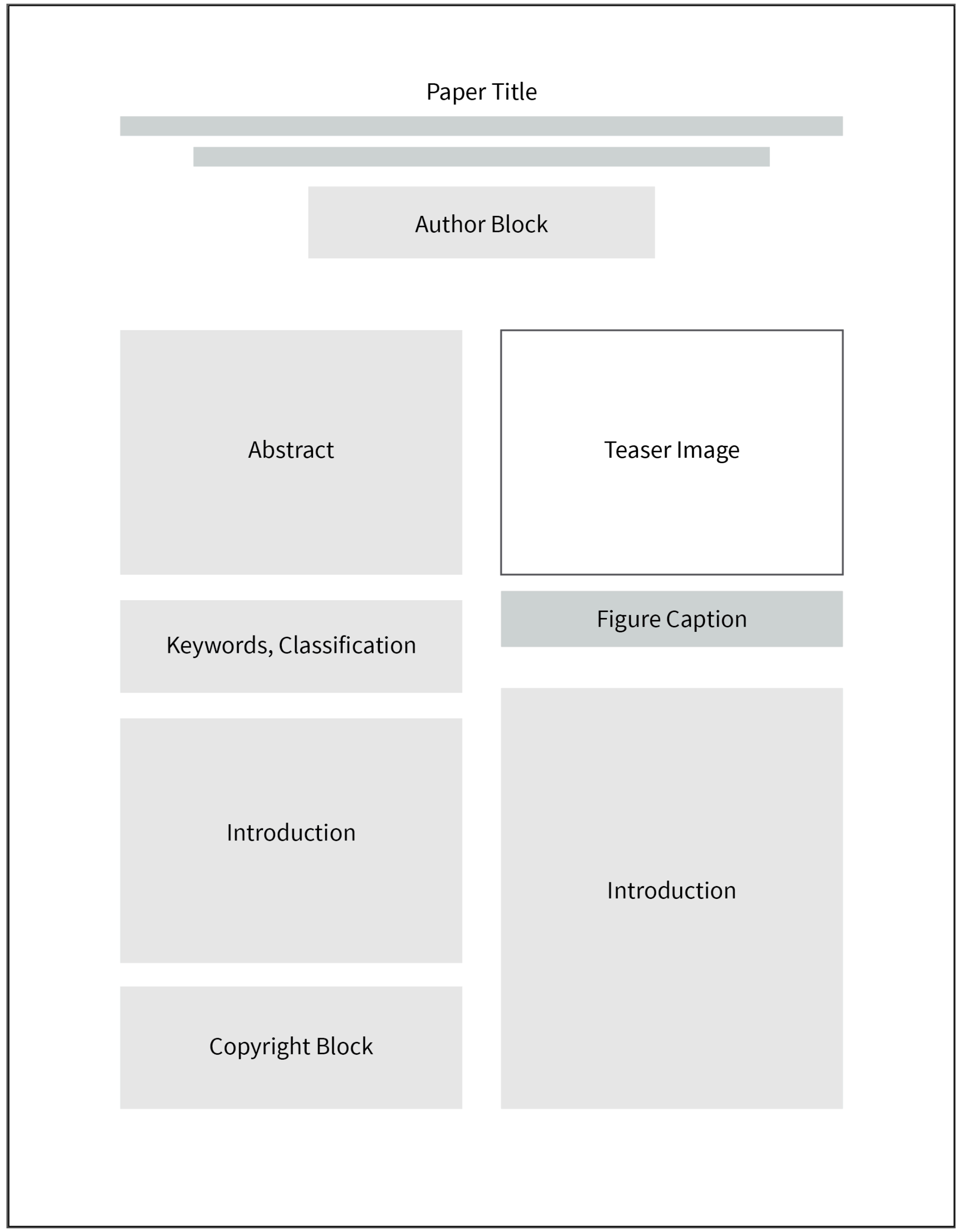
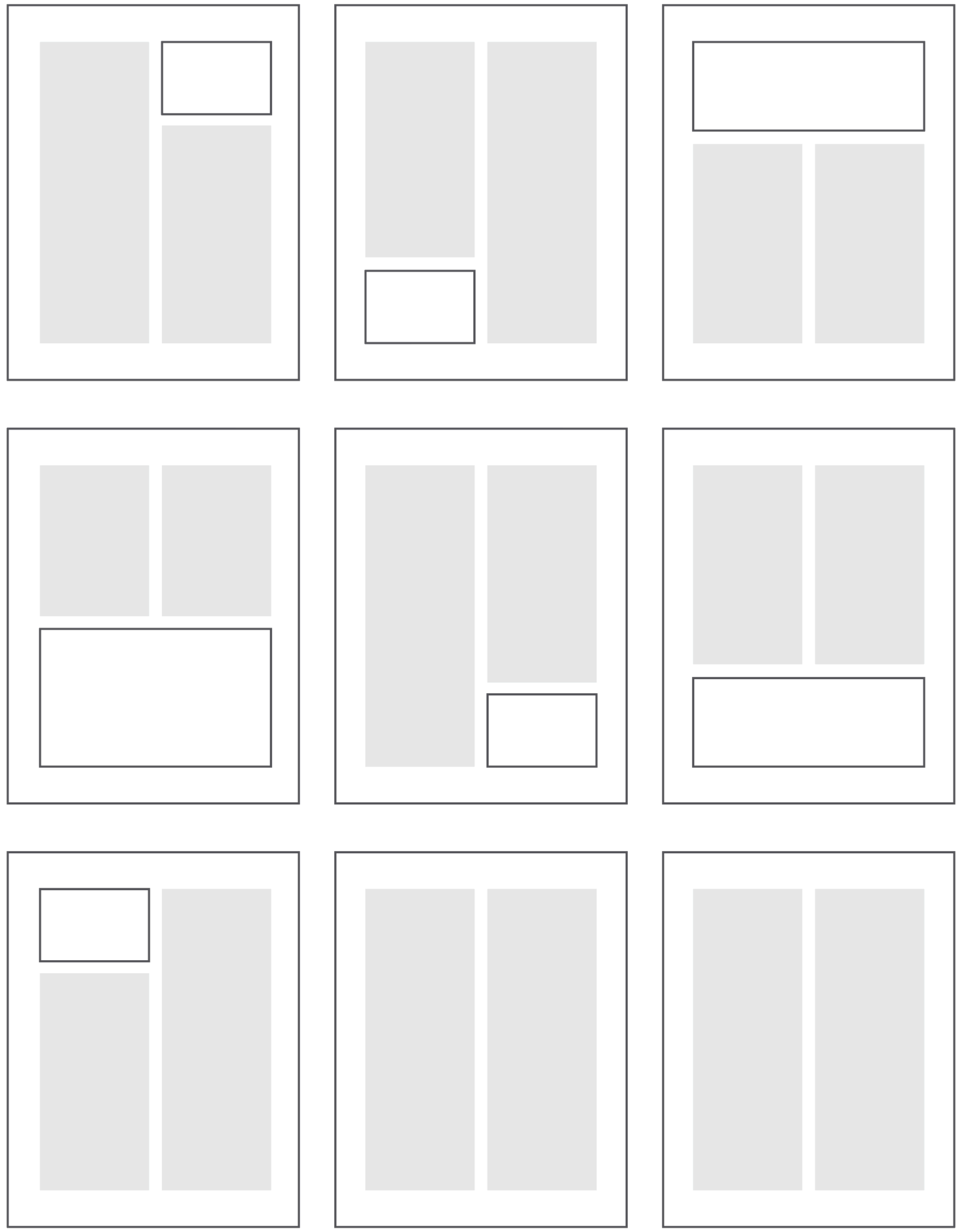
[1] Sources: Left, Right

# *What does an HCI paper look like?*



*How is an HCI paper structured?*

HCI papers commonly follow the structure below:

- » Abstract
- » Introduction
- » Related Work/Background
- » *Hypotheses (quant. empirical)*
- » *System/Design (design-based)*
- » Method
- » Results
- » Discussion
- » Conclusion
- » Acknowledgements
- » References
- » Appendices

*What is an abstract?*[2]

The abstract provides a brief but comprehensive summary of the contents of the paper. It gives readers an overview of the paper and helps them decide whether to read the full text. Usually *150 words* max.

The abstract usually includes (1–2 sentences each):

- Summary of literature review
- Problem investigated/RQs
- Hypotheses
- Methods used
- Study results
- Implications

[2] APA

*How do I choose a title?*

There is no formula or requirement, but a few things to consider:

- It should be as short as it can be, but not too broad.
  - E.g., *Bodystorming Human-Robot Interactions*
- A common format in HCI:
  - Catchy headline/System name: Technical title
  - E.g., *Pay attention!: Designing adaptive agents that monitor and improve user engagement*
  - E.g., *Reading socially: Transforming the in-home reading experience with a learning-companion robot*

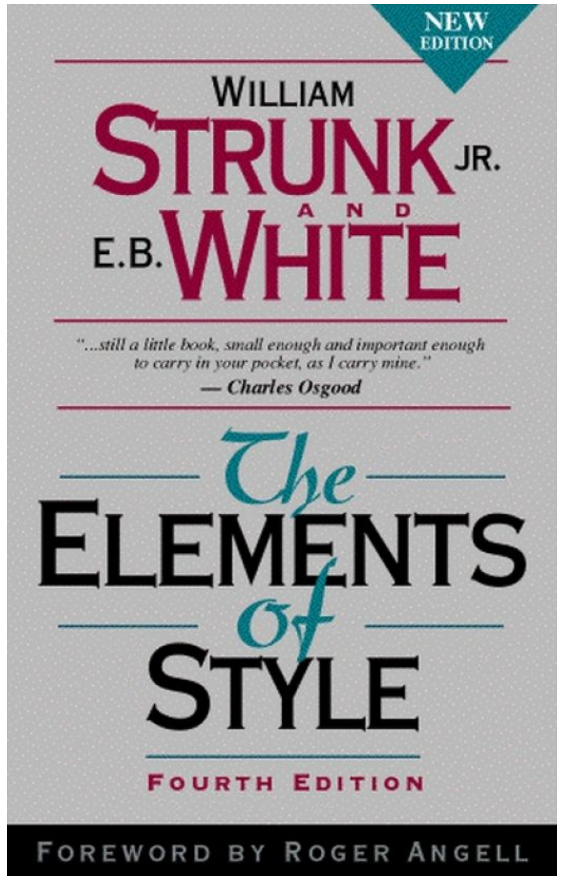
*What are other things I should pay attention to?*

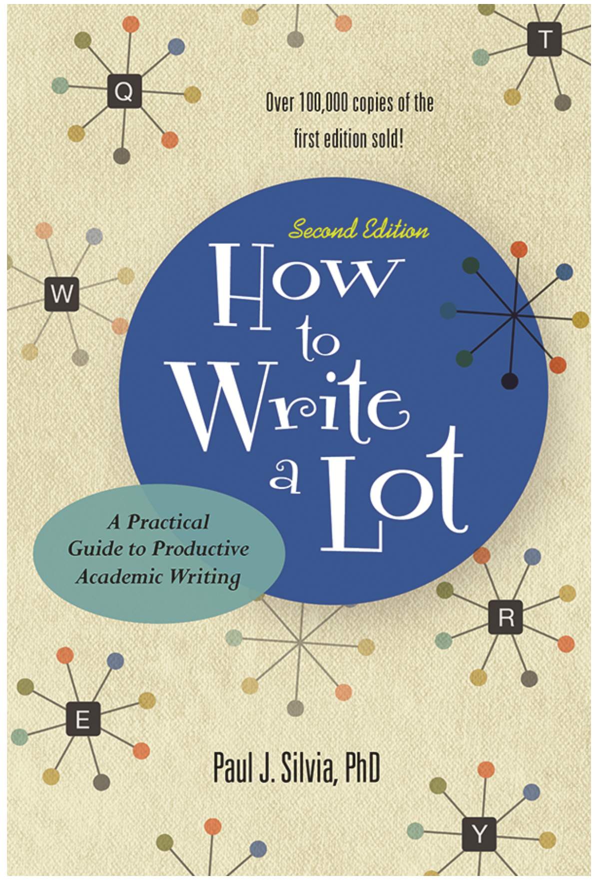
1. Writing
2. Formatting
3. Presentation

## *Writing*[3]

The HCI community pays more attention to writing than most other CS communities, so writing is very important, in particular:

1. Reporting as *storytelling*
2. Flow among parts
3. "Cut deadwood"
4. Avoid any deviation from rules (syntax, grammar, punctuation, etc.)

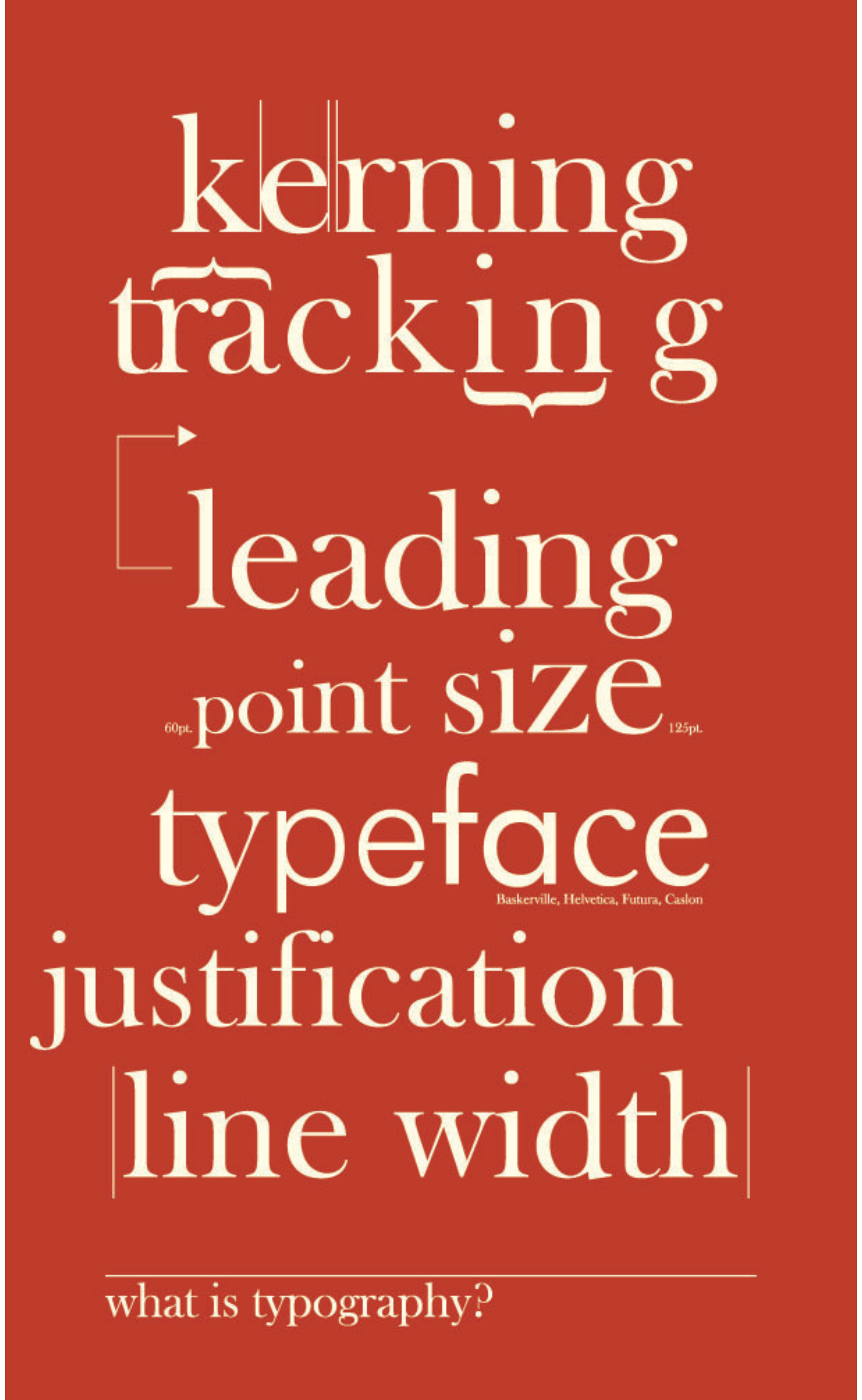



[3] Image sources: Left, Right

*Formatting*[4]

For good *typography*, become familiar with *leading*, *tracking*, *kerning*, *widows*, *orphans*, *runts*, *rags*, *rivers*.


[4] Image source: Left, Right

# *Presentation*[5]

The overall organization and visual appearance, using informative figures (e.g., a "teaser"), will improve accessibility and appeal.

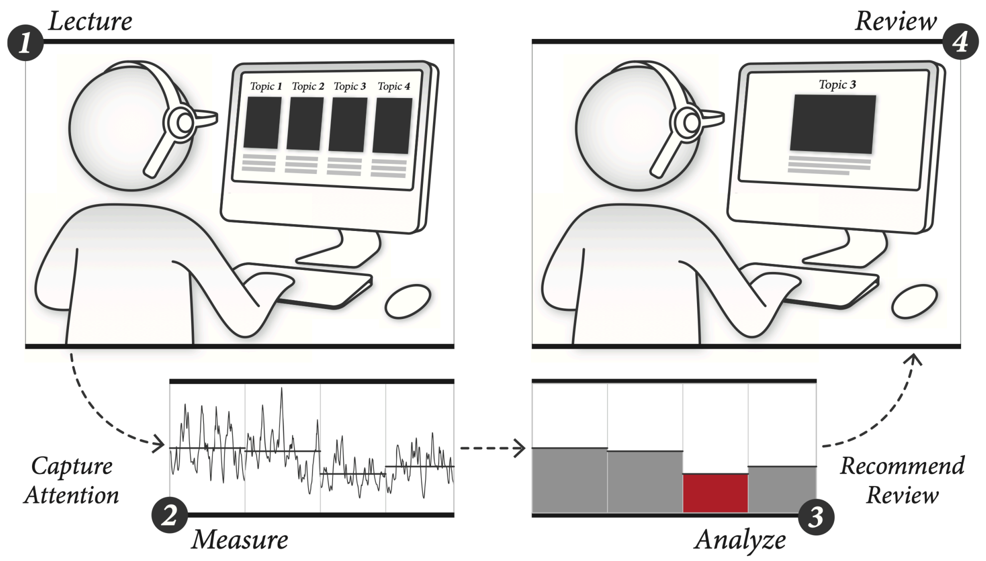



**Figure 1.** This work presents a novel educational system that (1) instructs users while (2) measuring attention across predefined lesson modules. Following the lesson, the system (3) analyzes the attention measurements to (4) adaptively determine review content that might best improve learning.

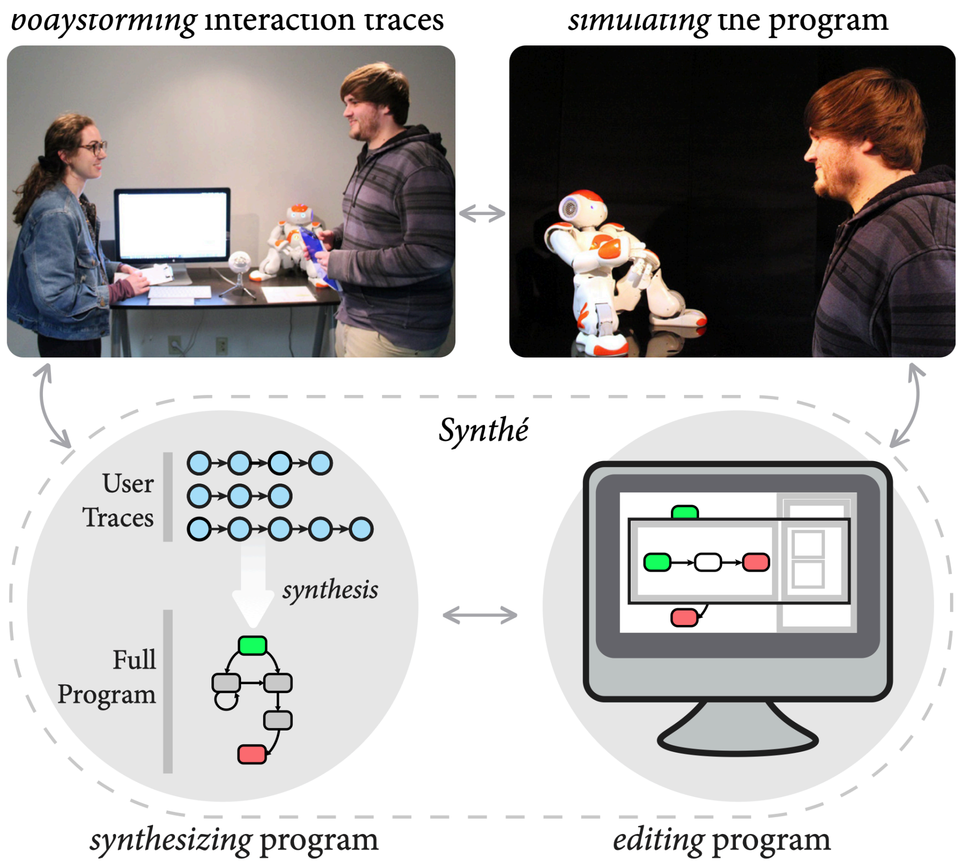
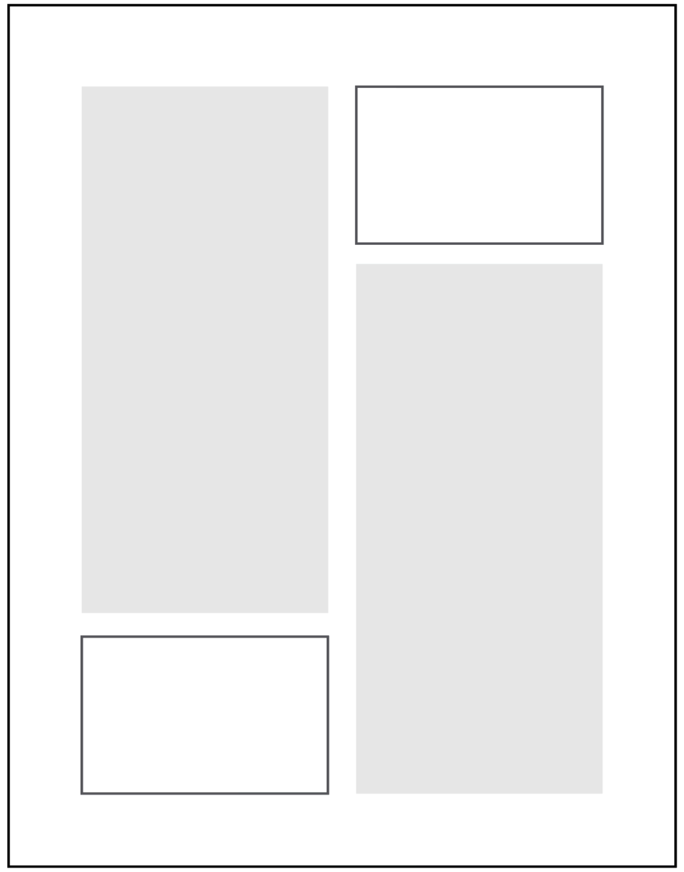



**Figure 1.** ***Synthé*** **captures designers' demonstrations, synthesizes an interaction, and allows designers to edit and simulate the interaction.**



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[5] **Left:** Szafir & Mutlu, 2014; **Center:** Porfirio et al., 2019

*How do we report statistics?*

**Descriptive statistics:** Distribution characteristics using summary statistics in text, tables, or graphs.

**Inferential statistics:** Test parameters and results in text or tables and highlighting of significance in graphs.

In *text*, APA guidelines are strictly followed; in *graphs*, you can be creative.

## *Descriptive statistics*[6]

```
> describeBy(data$Guesses, list(data$Leakage,data$TBI))

 Descriptive statistics by group
: Leakage
: HC
   vars   n mean   sd median trimmed  mad min max range skew kurtosis   se
X1    1 291 3.87 1.91      4    3.68 1.48   1  13    12 1.08     1.95 0.11
------------------------------------------------------------------------------------
: No Leakage
: HC
   vars   n mean   sd median trimmed  mad min max range skew kurtosis  se
X1    1 367 4.02 1.85      4    3.86 1.48   1  11    10 0.82     0.83 0.1
------------------------------------------------------------------------------------
: Leakage
: TBI
   vars   n mean   sd median trimmed  mad min max range skew kurtosis   se
X1    1 282 3.92 2.24      4    3.63 1.48   1  17    16 2.11     7.83 0.13
------------------------------------------------------------------------------------
: No Leakage
: TBI
   vars   n mean   sd median trimmed  mad min max range skew kurtosis   se
X1    1 353 4.37 2.46      4    4.05 1.48   1  19    18 1.55     4.24 0.13
```

The healthy controls guessed the item that the robot picked in 3.97 guesses (*SD*=1.91) when the robot gazed toward the item and in 4.02 guesses (*SD*=1.85) when the robot did not gaze toward it. Participants with TBI guessed the robot's pick in 3.92 guesses (*SD*=2.24) when the robot gazed toward it and in 4.37 guesses (*SD*=2.46) when the robot did not.

[6] Data from Mutlu et al., 2018, Social-cue perception

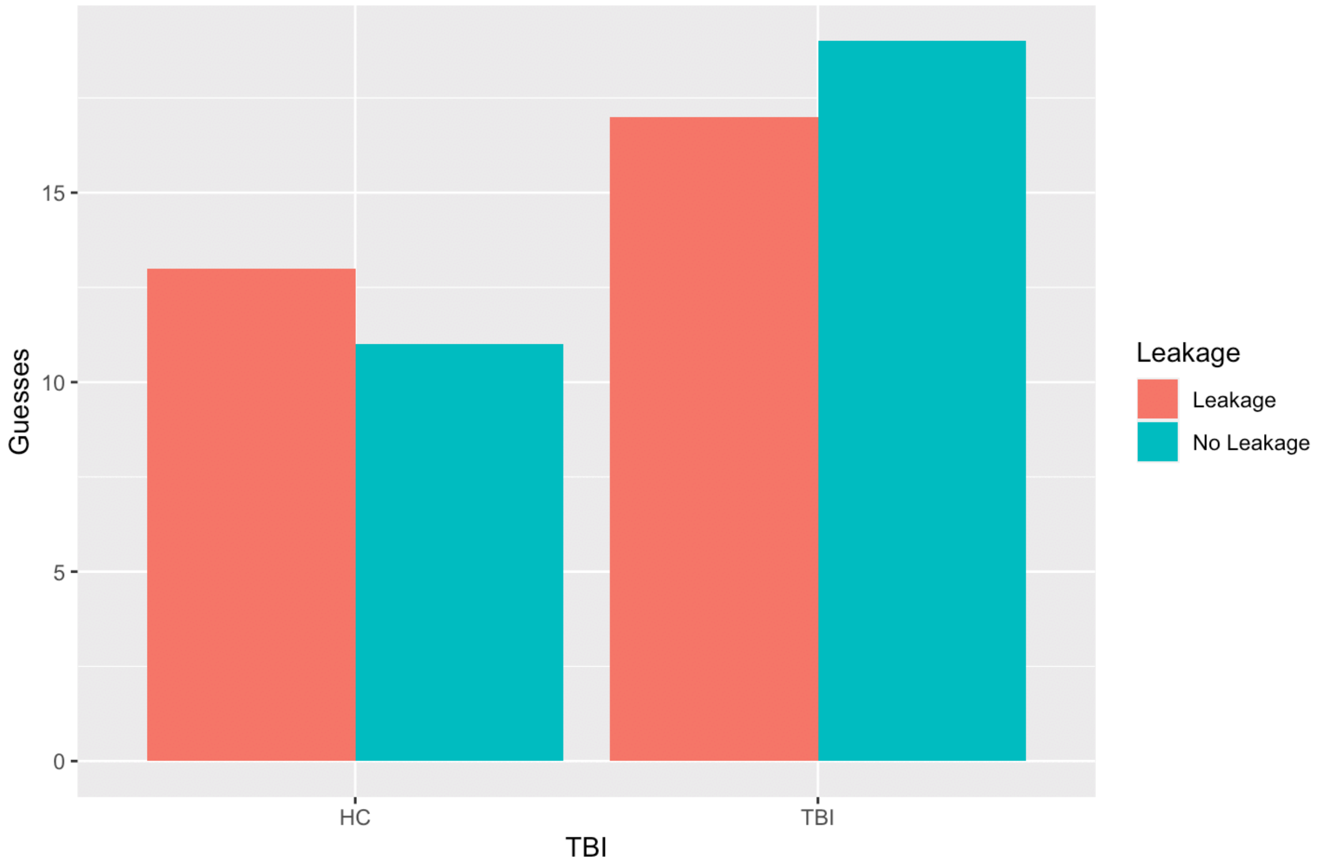
*How do we deal with decimals?*[7]

| For numbers... | Round to... | SPSS | Report |
|---|---|---|---|
| Greater than 100 | Whole number | 1034.963 | 1035 |
| 10 - 100 | 1 decimal place | 11.4378 | 11.4 |
| 0.10 - 10 | 2 decimal places | 4.3682 | 4.37 |
| 0.001 - 0.10 | 3 decimal places | 0.0352 | 0.035 |
| Less than 0.001 | As many digits as needed for non-zero | 0.00038 | 0.0004 |

[7] Source

# *Descriptive statistics (visual)*[8]

```
library(ggplot2)
ggplot(data, aes(fill=Leakage, y=Guesses, x=TBI)) +
    geom_bar(position="dodge", stat="identity")
```




[8] More information on using `ggplot2`

## *Inferential statistics*[9]

```
> summary(aov(Guesses~(TBI*Leakage)+Error(ID/Leakage)+TBI,data=data))

Error: ID
             Df Sum Sq Mean Sq F value Pr(>F)
TBI           1   15.2  15.236   2.360  0.127
Leakage       1    4.0   4.012   0.621  0.432
TBI:Leakage   1    7.5   7.467   1.157  0.284
Residuals   142  916.6   6.455

Error: ID:Leakage
             Df Sum Sq Mean Sq F value Pr(>F)
Leakage       1   27.3  27.268   6.680 0.0107 *
TBI:Leakage   1    7.1   7.131   1.747 0.1884
Residuals   144  587.8   4.082
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Error: Within
            Df Sum Sq Mean Sq F value Pr(>F)
Residuals 1001   4325   4.321
```

A mixed-model analysis of variance (ANOVA) revealed a significant effect of the leakage cue, $F(1,144) = 6.68$, $p = .011$.

Participants correctly identified the robot’s pick on an average of 3.89 questions (*SD* = 2.08) when the robot displayed the gaze cue and 4.19 (*SD* = 2.17) when it did not.

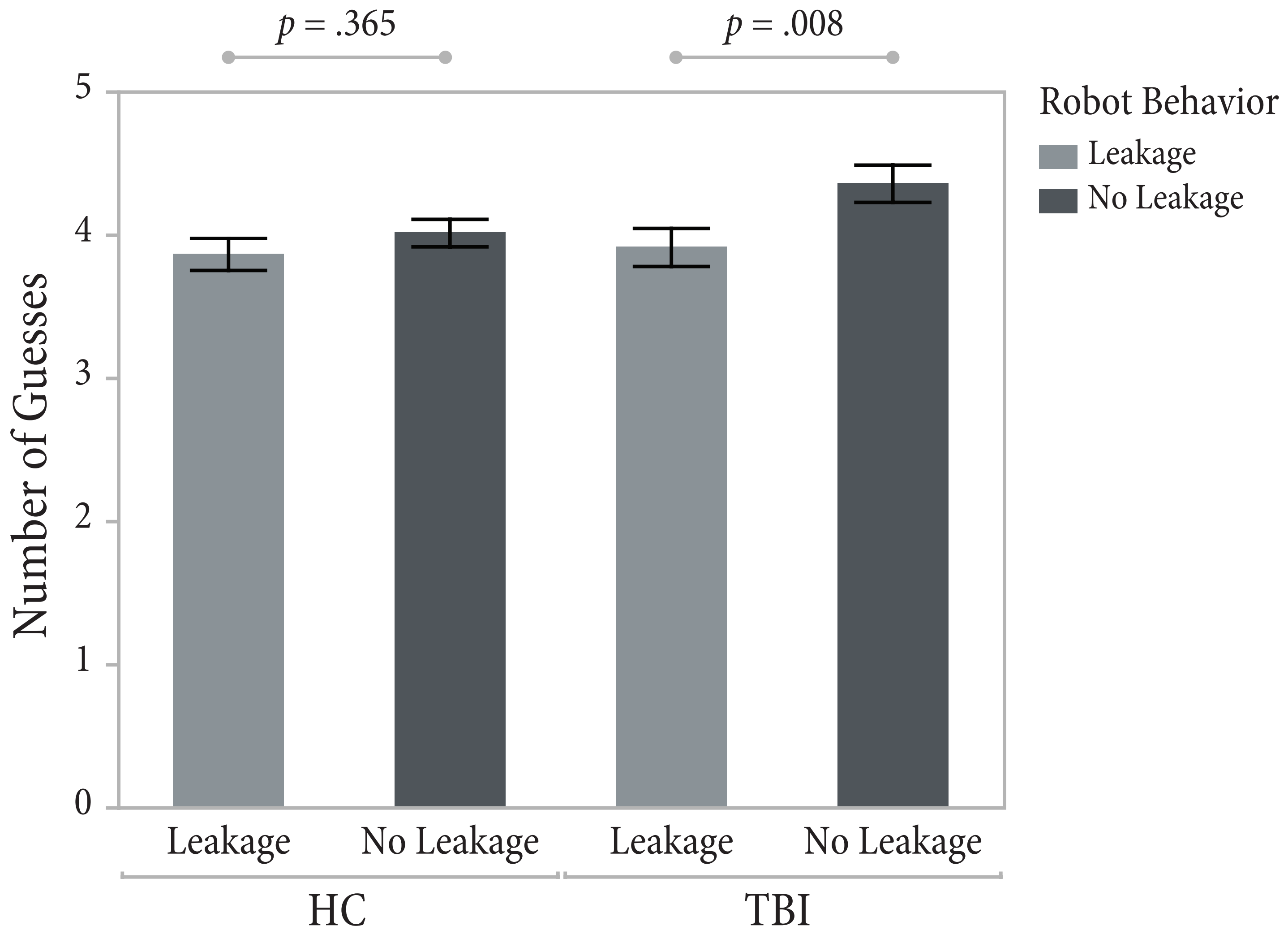
[9] Shown is a simplified model using data from Mutlu et al., 2018

## *How do I report different tests?*[7]

| Statistic | Example |
|---|---|
| Mean and standard deviation | $M$ = 3.45, $SD$ = 1.21 |
| Mann-Whitney | $U$ = 67.5, $p$ = .034, $r$ = .38 |
| Wilcoxon signed-ranks | $Z$ = 4.21, $p$ < .001 |
| Sign test | $Z$ = 3.47, $p$ = .001 |
| t-test | $t(19) = 2.45$, $p$ = .031, $d$ = 0.54 |
| ANOVA | $F(2, 1279) = 6.15$, $p$ = .002, $\eta_p^2 = 0.010$ |
| Pearson's correlation | $r(1282) = .13$, $p$ < .001 |

[7] Source

Test results can also be mapped on graphs either manually (e.g., using Adobe Illustrator) or automatically using advanced scripting (e.g., `ggplot2`, `matplotlib`).



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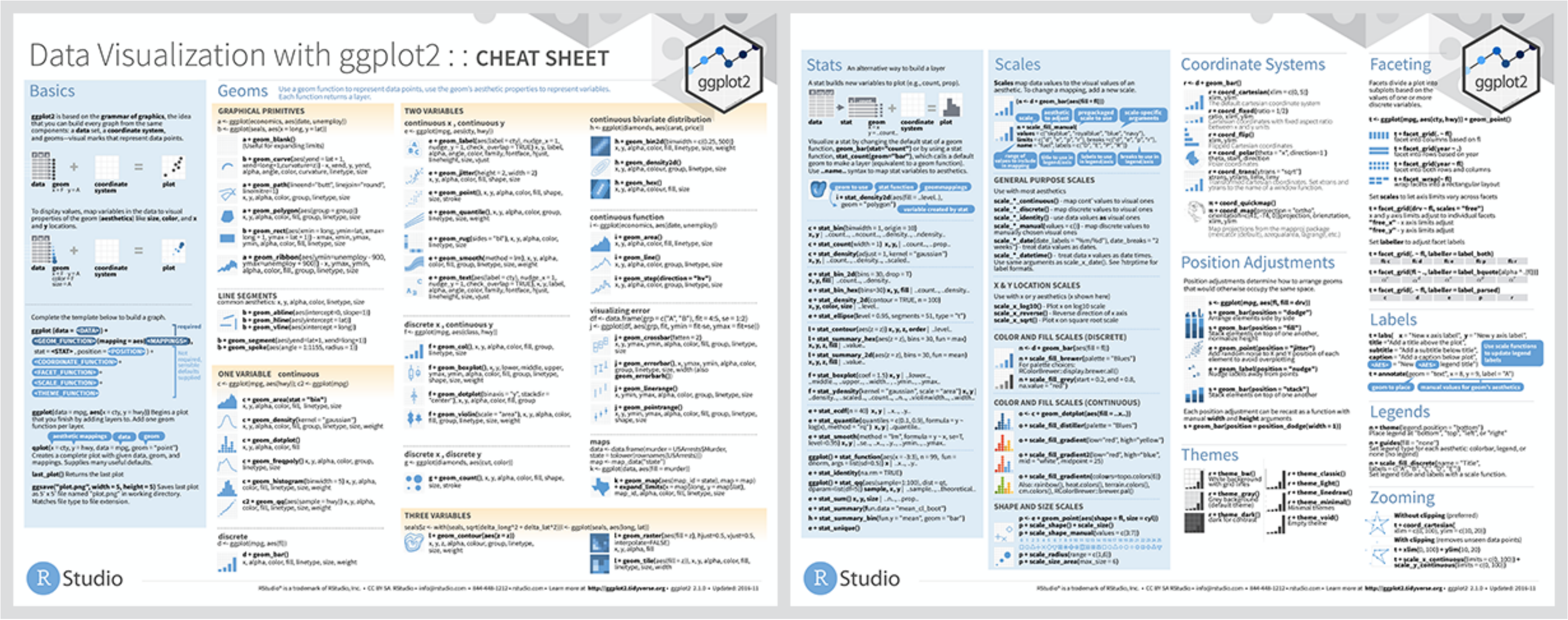


[10] `ggplot2` cheat sheet

*Questions?*