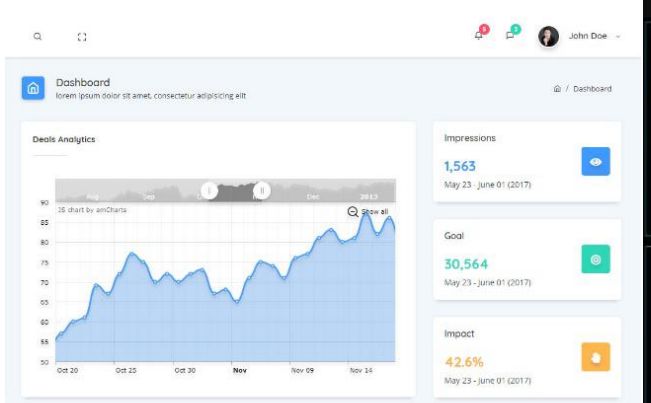
DEGGENDORF INSTITUTE OF TECHNOLOGY

Human Factors and Human-Machine Interaction

Information Dashboards

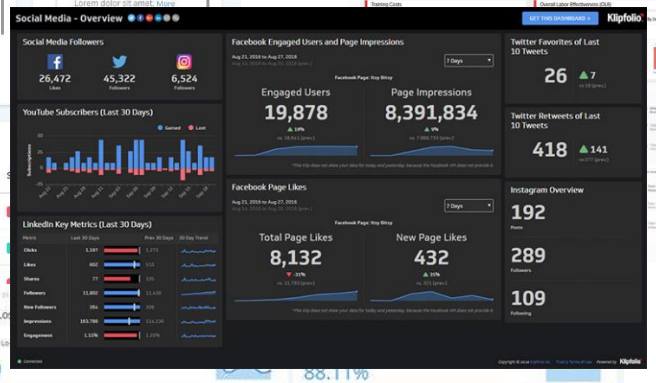
FACULTY

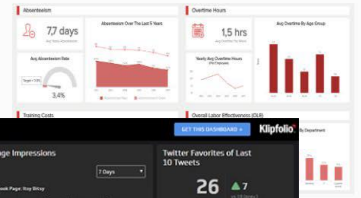
OF COMPUTER SCIENCE


Dashboard
Deals Analytics
Impressions
1,563
Goal
30,564
Impact
42.6%
Published Project
532 +1.69%
Completed Task
4,569 -0.5%
Successfull Task
89% +0.99%
Ongoing Project
365 +0.35%
Sales In July
$2665.00
Direct Sale
$1768
Referal
$897
What's New
Your Manager Posted.
You have 3 pending Task.
New Order Received.
Your Manager Posted.
Latest Activity
Devlopment & Update
Showcases
New Products
Name
Product Code
Customer
Sofa
#PHD001
Computer
#PHD002


Total Transactions
Errors Rate
Server Utilization (%)
Active Processes
Servers Location
Server Log
Network Latency (sec)
Deployment Progress
Throughput (bits/sec)


FUSION SMART
Energy Dashboard
October 2018
COST PREDICTED
CHANGE IN COST
USAGE ESTIMATE
ACTIVE APPLIANCES
ENERGY INTENSITY
47
kWh/Sqft
CARBON FOOTPRINT
Green Energy Generated


Social Media - Overview
Social Media Followers
26,472
45,322
6,524
Facebook Engaged Users and Page Impressions
Engaged Users
19,878
Page Impressions
8,391,834
Twitter Favorites of Last 10 Tweets
26
Twitter Retweets of Last 10 Tweets
418
YouTube Subscribers (Last 30 Days)
LinkedIn Key Metrics (Last 30 Days)
Facebook Page Likes
Total Page Likes
8,132
New Page Likes
432
Instagram Overview
192
289
109

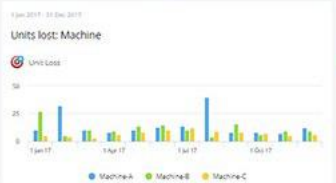


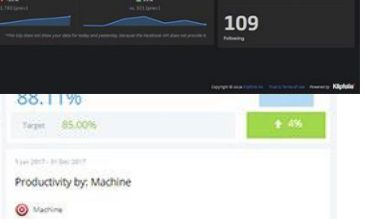

Production rate: Machine
Units Produced

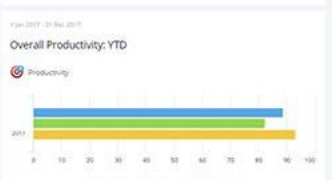

Units YTD
339,194.00
360,000.00
-6%


Operators Available


Lost Units: Causes
389


Units lost: Machine


Productivity by: Machine


Overall Productivity: YTD


Lead Conversion Ratio
15:1
Unqualified Leads turned into Customers
Leads
1,459
Opportunities
454
Negotiation
355
Proposal
212
Wins
97


Converted Leads - last 30 Days


Daniel
Sales Meneger 1
3 %
CONVERSION RATE

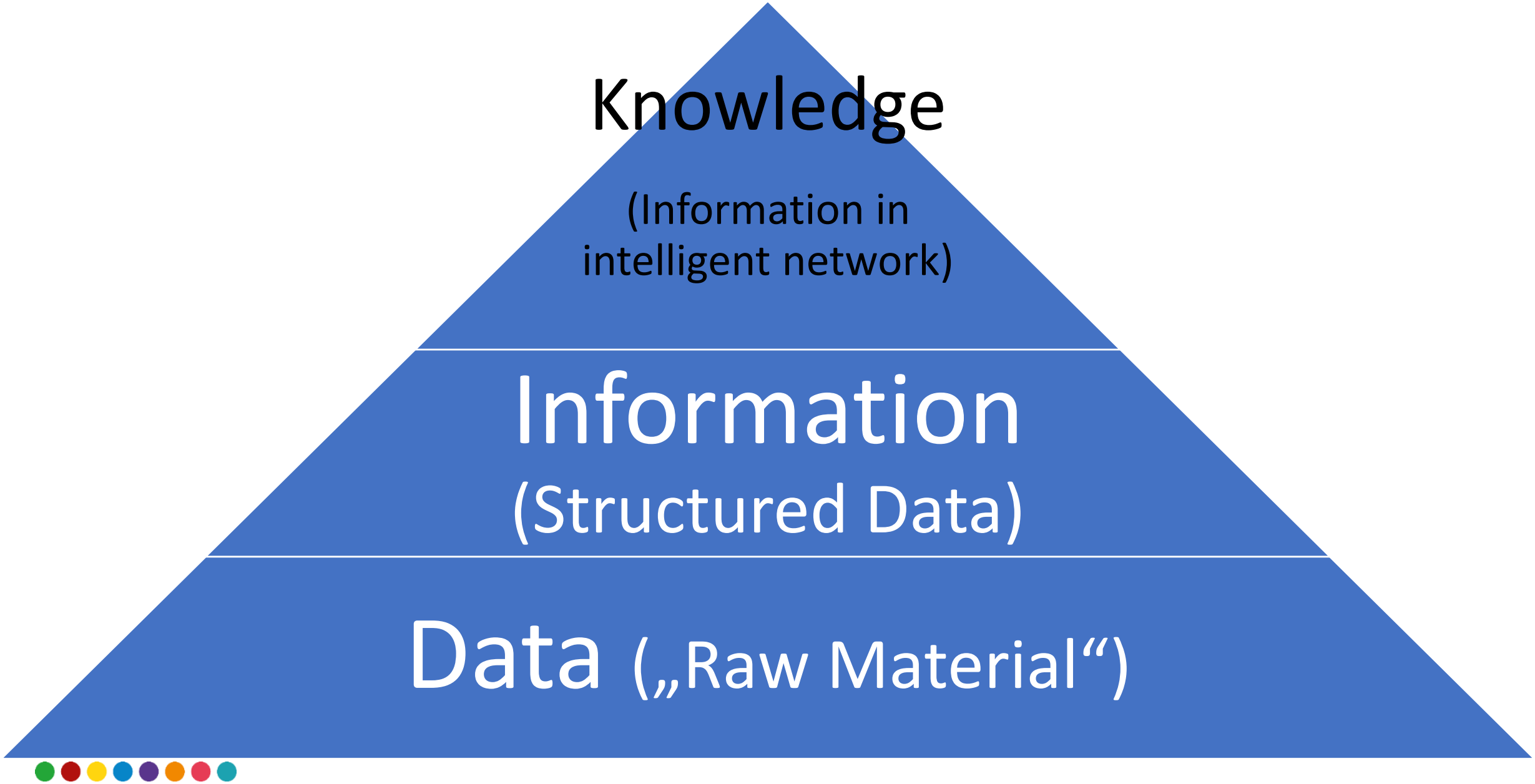

Anna
Sales Meneger 2
11 %
CONVERSION RATE

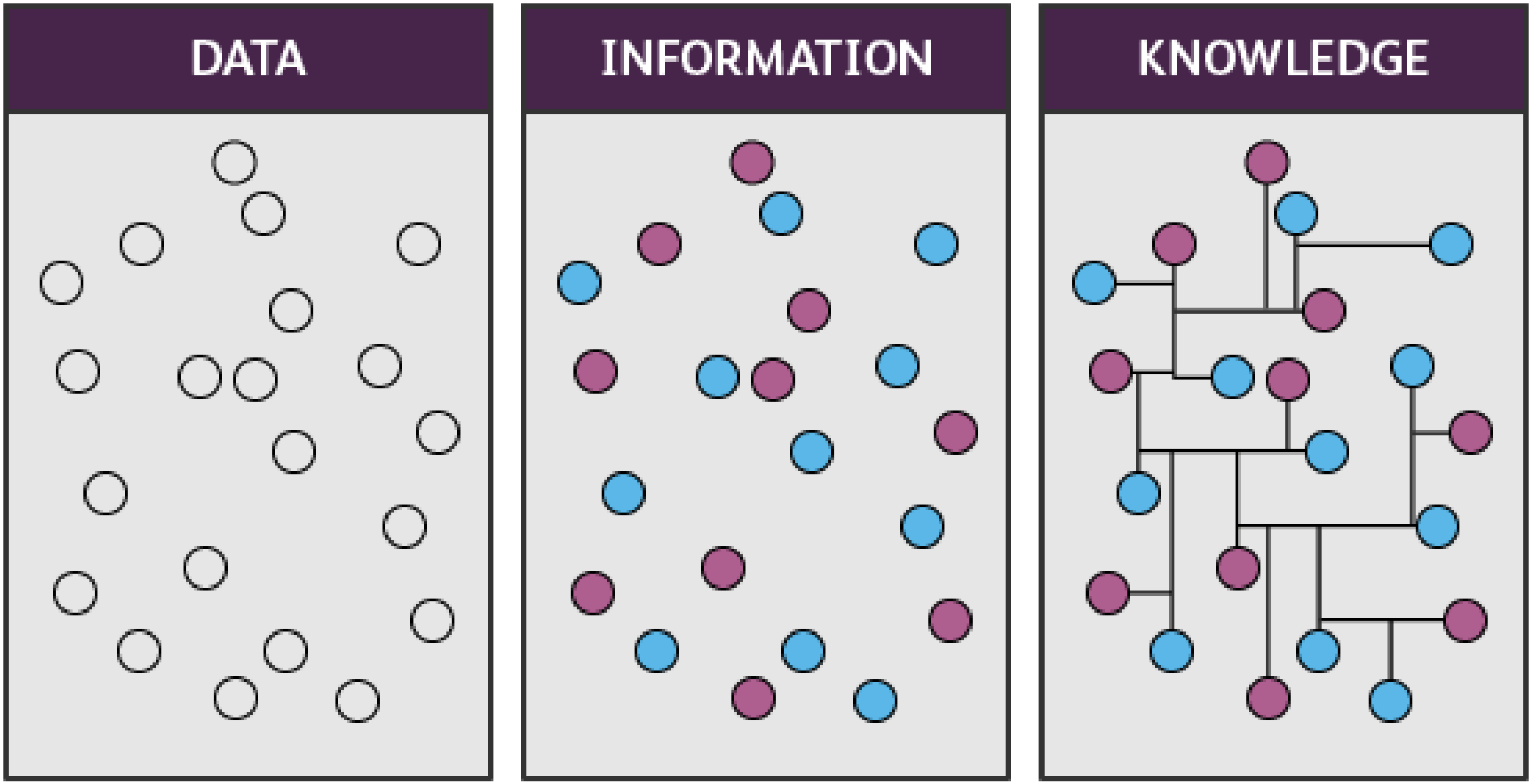

Max
Sales Meneger 3
7 %
CONVERSION RATE


35 %
Lead-to-Opportunity Ratio

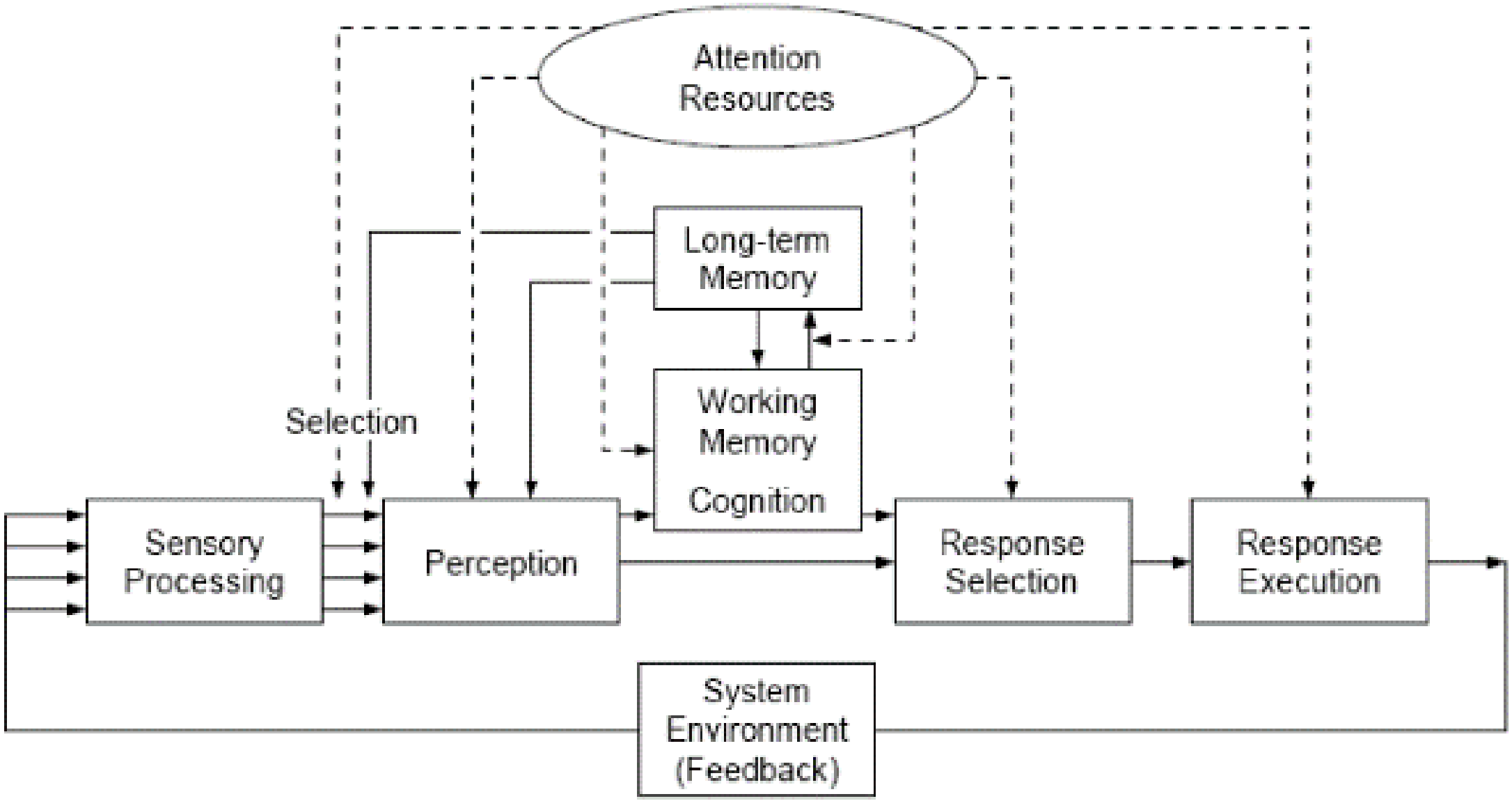

22 %
Opportunity-to-Win Ratio

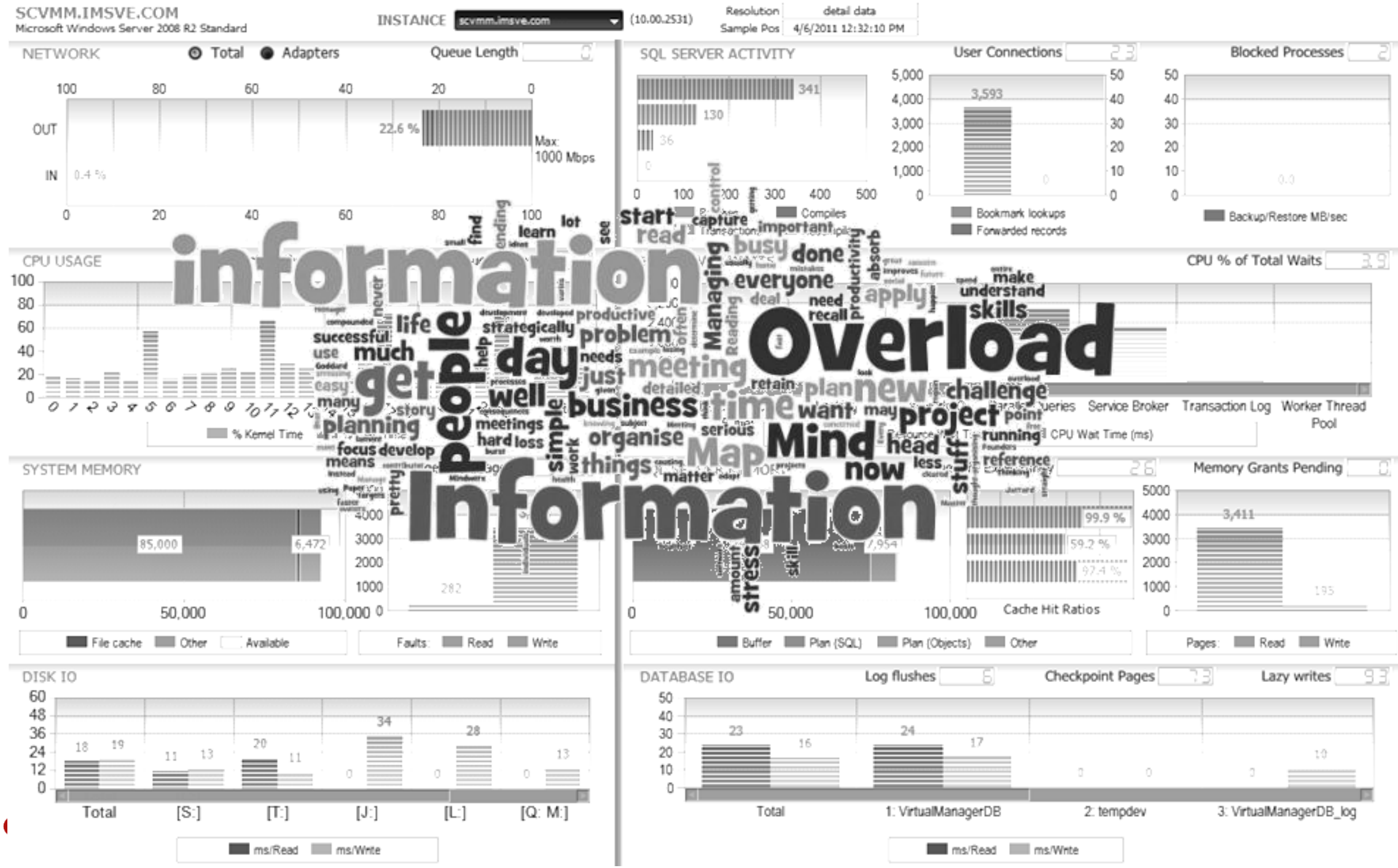
Why should computer science become cognitive?


Knowledge
(Information in intelligent network)
Information
(Structured Data)
Data („Raw Material“)



https://www.evalueserve.com/blog/making-the-leap-from-insights-to-wisdom-a-collaborative-approach/


Attention
Resources
Long-term
Memory
Working
Memory
Cognition
Selection
Sensory
Processing
Perception
Response
Selection
Response
Execution
System
Environment
(Feedback)


SCVMM.IMSVE.COM
Microsoft Windows Server 2008 R2 Standard
INSTANCE
scvmm.imsve.com
(10.00.2531)
Resolution
detail data
Sample Pos
4/6/2011 12:32:10 PM
NETWORK
Total
Adapters
Queue Length
OUT
IN
22.6 %
0.4 %
Max:
1000 Mbps
SQL SERVER ACTIVITY
User Connections
Blocked Processes
Compiles
Bookmark lookups
Forwarded records
Backup/Restore MB/sec
CPU USAGE
% Kernel Time
CPU % of Total Waits
Service Broker
Transaction Log
Worker Thread Pool
SYSTEM MEMORY
85,000
6,472
File cache
Other
Available
Faults:
Read
Wrte
Memory Grants Pending
99.9 %
59.2 %
97.4 %
Cache Hit Ratios
Buffer
Plan (SQL)
Plan (Objects)
Other
Pages:
DISK IO
Total
[S:]
[T:]
[J:]
[L:]
[Q: M:]
ms/Read
ms/Wrte
DATABASE IO
Log flushes
Checkpoint Pages
Lazy writes
1: VirtualManagerDB
2: tempdev
3: VirtualManagerDB_log

HERBERT A. SIMON

„The design of systems must encompass far more than hardware and software; it must consider with equal care the information processing capabilities of the human members of organizations who form the other half of the system.“ (1968)

HERBERT A. SIMON

„In the post-industrial society, the central problem is (…) how to organize information to make decisions.“

Simon, H.A. (1973). Administrative Behavior. A Study of Decision Making Processes in Administrative Organization, New York, London.


Meldung
Ticketplanung
Einsatz
Ticketübersicht
Meine Aufgaben
Plantafel
Multiprojektplan-Erstellung
Projektbewertung
Projekt-Rechnungslauf
Ressourcenplan-Erstellung
Archiv
Berichte
Einrichten
Mein Menü
Management & Controlling
Einkauf
Lager & Logistik
Verkauf & Marketing
Service & Werkstatt
Projektmanagement
Personalwesen
01BG-0025 Sales Media Research Calls (2,00 Calls Juni)
01BG-0025 Sales Media Research Calls (3,00 Calls Juli)
01BG-0025 Sales Media Research Entwicklungen (comp. tires)
P00105 Bau Analyse München DE Recherche
P00105 Bau Analyse München DE Recherche
P00109 Twinning 3200:0 32:0 3168:0
P00113 Sicherheitsberatu... 4:0 4:0 0:0
01BG-0025 Sales Media Res... 6502:0 128:4 6373:56
P00105 Bau Analyse Mün... 69:0 12:0 57:0
P00114 Analyse 98:0 0:0 98:0
Projektmanagement : Projektergebnisse
Projektnummer Projekt Umsatz Kosten
P00114 Analyse 780,00 500,0
P00105 Bau Analyse Münch... 1.200,00 20.566,0
P00127 Photovoltaikanlage ... 2.400,00 0,0
Projektmanagement : Budgetstunden-Überwachung
Projektnummer Projekt Verbleibend Budget Ist
P00113 Sicherheitsberatung 1:0 1:0 0:0
P00105 Bau Analyse München DE 28:0 40:0 12:0
01BG-0025 Sales Media Research 2871:56 3000:0 128:4
P00109 Twinning 3168:0 3200:0 32:0
5. Hot Lead
4. Interesse
3. On Hold
2. In Kontakt
1. Neuer Lead
11/2012
12/2012
1/2013
2/2013
3/2013
4/2013
Jan Feb Mrz Apr Mai Jun Jul Aug Sep Okt Nov Dez
2012
2013
Monatsumsatz:
Aktuelle OPOS-Bestände:
Forderungen: 3.806.345,07 €
Verbindlichkeiten: 2.882.179,43 €
Lagerwert:
Monatsumsatz:
Anzahl Re / Gt: 5 0
Volumen netto: 23.720,00 €
Rohertrag: 12.341,00 €
Bestell-Bestand:
Aktuelle OPOS-Bestände:
Lagerwert:
Fakturierung:

Big Data

STATUS QUO

- More and **more data**
- Bottleneck: human information **processing**
- Increasing **challenges for the design** of information-dense displays
- Design must know, take into account and exploit **principles** and **mechanisms** of perception and information processing.
- Daniel Kahneman: „Whatever else it produces, an organization is a factory that manufactures judgments and decisions“ (p. 418)

STATUS QUO

- History & Kewords:
  - Executive Information Systems
  - Decision Support Systems
  - Data Warehousing
  - OLAP
  - Business Intelligence, Business Analytics
  - Key Performance Indicators
- Flashy Dashboards

DASHBOARD DEFINITION

*A dashboard is a **visual** display of the **most important information** needed to achieve one or more **objectives**; consolidated and arranged on a **single screen** so the information can be monitored at a glance.* (Few, 2013; p. 26)

GENERAL REMARKS

- Dashboards ≠ display for **data analysis**/exploration, **scorecard**, report to look up **facts**
- Use **skeuomorphism** purposefully - rather avoid/don't overuse metaphors
- Dashboards are **customized** solutions; *not one-size-fits-all*
- Dashboards support formation and maintenance of **situational awareness**
  - Perception
  - Understanding
  - Anticipation

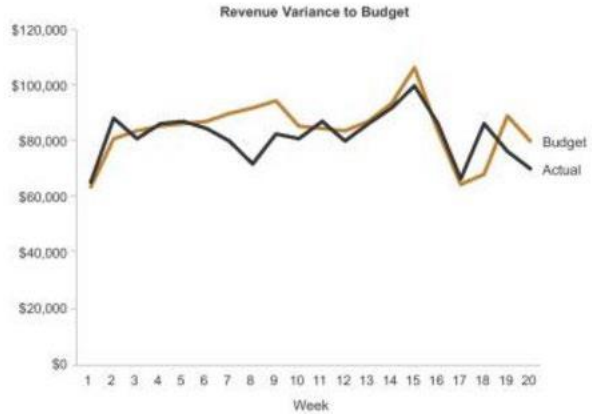
EXERCISE: SKETCH A DIT STUDENT DASHBOARD

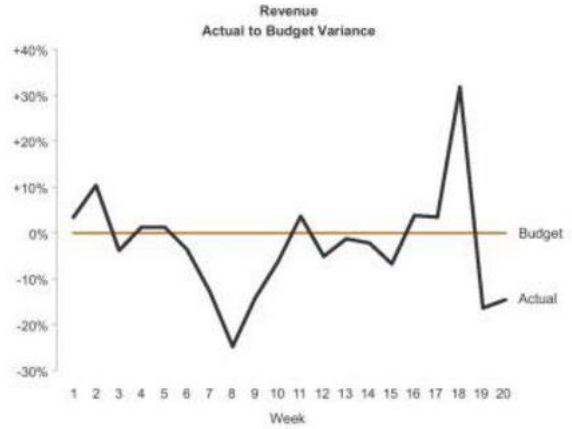
Part 1: Requirements Engineering

1. What information should be displayed on a dashboard? **Write user stories** (a user story is an informal, general explanation of a software feature written from the end user's perspective).
2. Create an **initial sketch** of your dashboard having the following questions in mind:
   - Which questions/information have the highest priority? How can these priorities be weighted visually?
   - Is attention appropriately directed (SEEV model)? Which contrasts can be used appropriately?
   - How can you use which gestalt laws appropriately?
   - Are there certain states, events, particularities to which attention must be drawn as soon as they occur?

COMMON MISTAKES

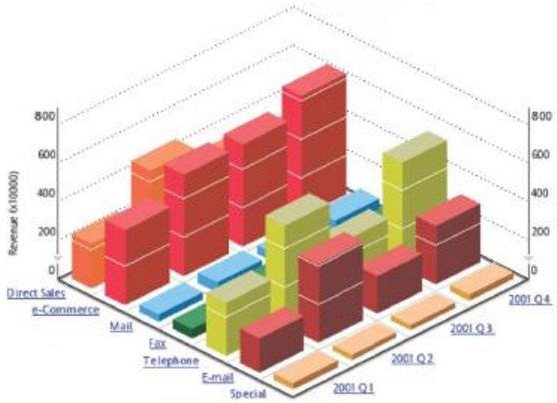
- Exceeding the boundaries of a **single screen**
  - Scrolling/fragmented screens: Information Access Costs
  - No overview, no relationships
- Supplying inadequate **context** for the data
  - Comparison biases (baseline, min/max, mean, SD, …)
  - Measures
  - Evaluations
- Displaying excessive **detail** or precision
  - Suitable rounding (3,301,654.93 EUR vs. 3.3 million EUR)
  - Avoid clutters
- Expressing **measures** indirectly (choosing a deficient measure)
  - Task orientation
  - Absolute values or relative developments?
  - Deviation from reference measure?



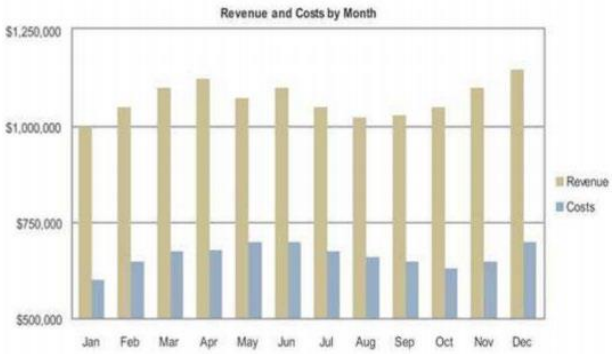


COMMON MISTAKES

- Choosing <u>inappropriate</u> **display media**
  - Diagram instead of table or vice versa
  - Circle diagrams
  - Areas, volumes for exact quantities

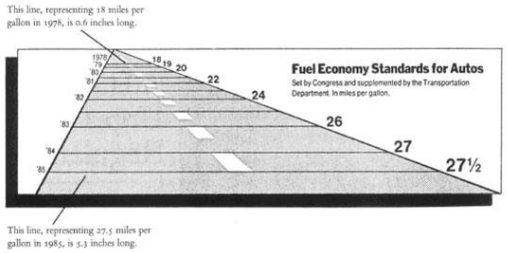


- Using <u>poorly designed</u> **display media**
  - Unnecessary legends with colour areas that are too small
  - Structures in the data are not used (e.g., sorting by size)
  - Contrasts are too strong
  - Chart junk, 3-D, ...
- Introducing meaningless **variety**
  - Visual differences should reflect differences in content
  - No different diagrams for similar sizes just for the sake of variety



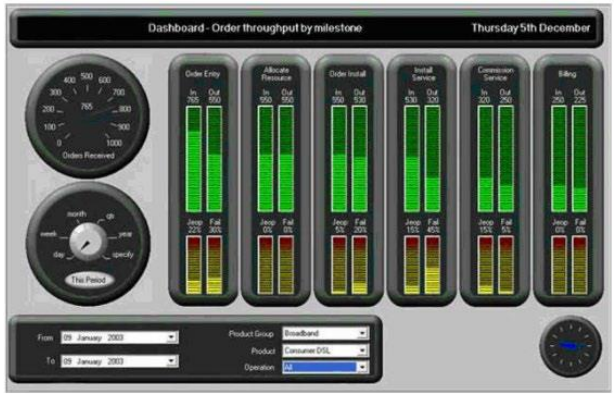
COMMON MISTAKES

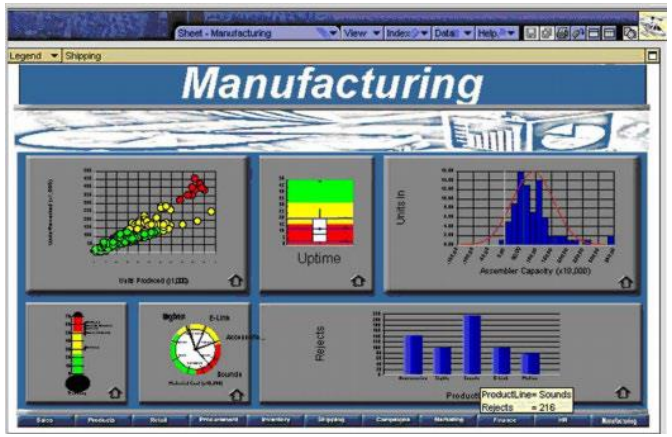
- Encoding **quantitative data** inaccurately
  - Visual Lies→ Lie Factor = depicted effect size/actual effect size
- **Arranging** the data poorly
  - Ignoring the direction of reading
  - Wasting prominent placements
- **Highlighting** important data ineffectively or not at all
  - Drawing attention to wrong content
  - Too much contrast; if everything is prominently designed, nothing stands out.



COMMON MISTAKES

- **Cluttering** the display with visual effects
  - Decoration
  - Metaphors, skeuomorphism
- **Misusing** or overusing **color**
  - Economical use
  - Generation of references: (un)intentional
  - Use for attention control
- Designing an **unattractive** visual display
  - Aesthetics are not created through decoration
  - Reduced colour saturation
  - White space important
  - C.R.A.P.



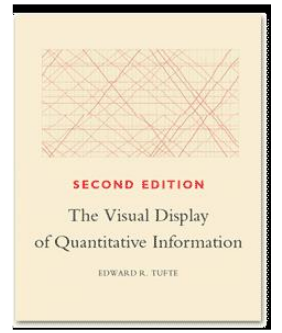


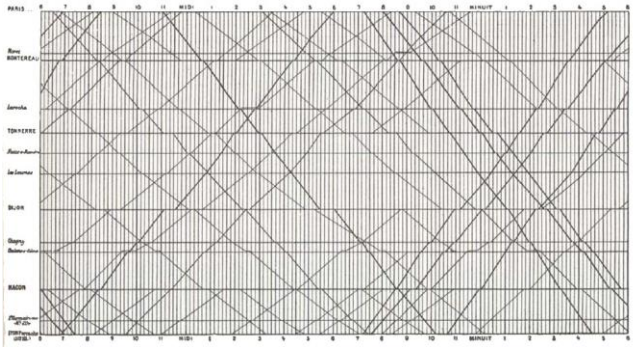
REQUIREMENTS ANALYSIS

- Focus on the **goals** not the means/methods
- Identify **mental models** of users:
  - Structures, processes, dependencies
  - Mapping via simple sketches
- Identify **requirements** through questions
  - How often is information/dashboard used?
  - Who is/are the user(s) (expert, novice, layperson)?
  - What objectives does the dashboard need to support?
  - What questions should the dashboard answer?
  - What information in what level of detail; what data types?
  - Which information is important for the goals and how?
  - Which logical groupings exist?
  - What comparisons, benchmarks, assessments are useful and necessary?
  - …

DATA-INK RATIO

- Data-ink (or data-**pixel**) = "*the ink changing as the data change*" (Tufte, 1983; p. 93)
- Representation of quantitative information should consist mainly of data (data-ink) and as little non-data as possible.
- **Design principle**: *Maximize the data-inkratio, within reason. Every bit of ink on a graphic requires a reason. And nearly always that reason should be that the ink presents new information*. (p. 96)
- **In short**: reduction of unnecessary (non-data) pixels, reduction of unnecessary variability (cf. right o. linear colour gradients), improvement of data pixels.





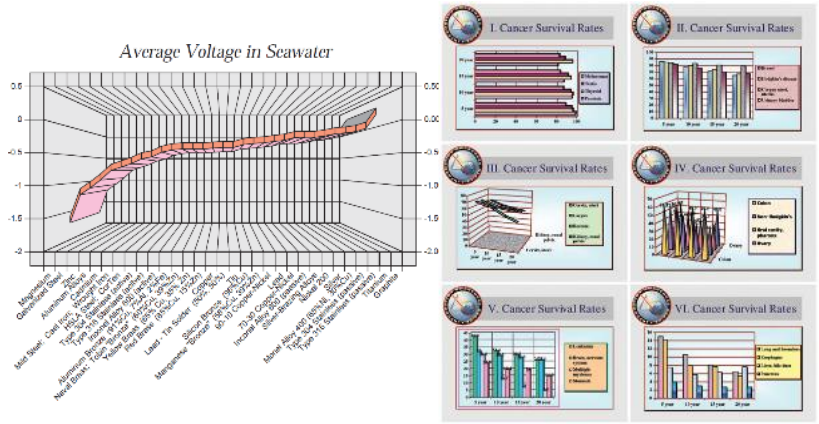
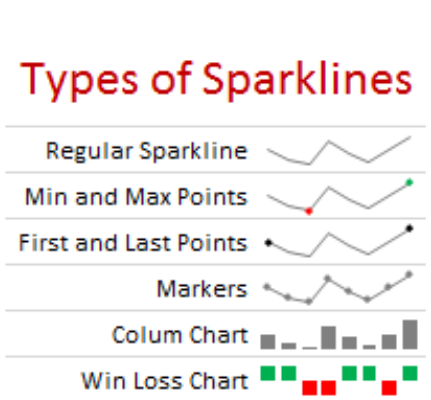
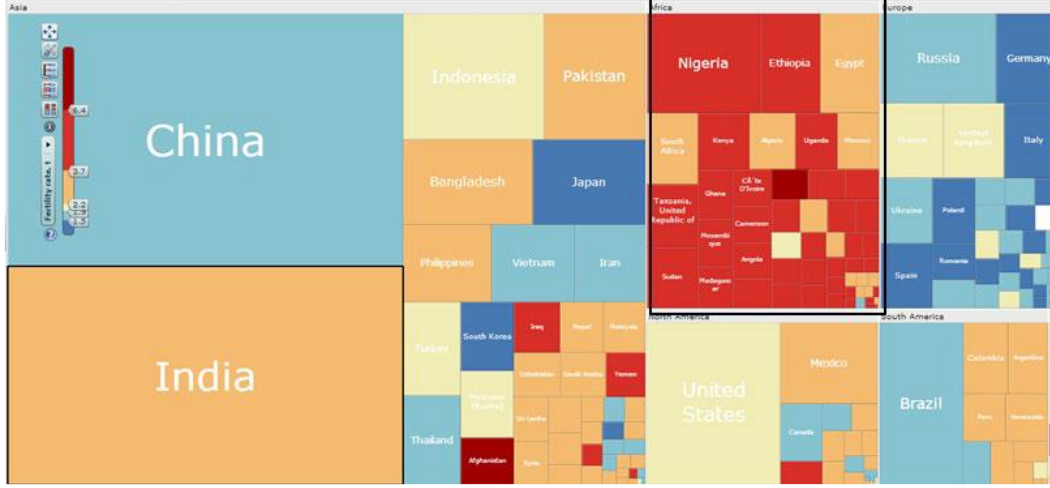
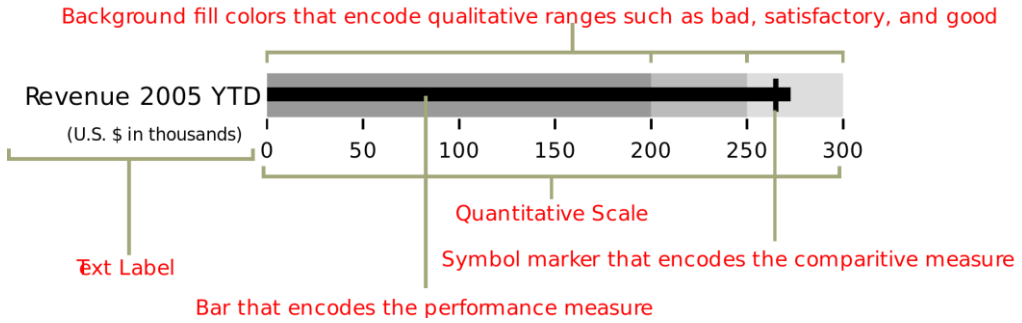


DIAGRAM TYPES







- Diagram types:
  - Bar charts
  - Scatter plots
  - Line charts
  - Sparklines
  - Box Plot
  - Spatial maps
  - Heatmaps
  - Treemaps
  - Bullet graphic

- Recommended reading:
  - Evergreen, S. D. H. (2019). Effective Data Visualization. London: Sage.
  - Kirk, A. (2019). Data Visualization. London: Sage.

BEST PRACTICES

- **Organize** information to support its meaning and use.
  - Reading flow
  - Grouping
  - Gestalt laws
  - Enable or prevent comparisons

- Maintain **consistency** to enable quick and accurate interpretation
  - Top-down processing: use prior knowledge/experience and expectations
  - Differences generate attention

- Put **supplementary information** within reach
  - Outsource details
  - → interaction

- Expose **lower-level** conditions
  - For issues below the granularity level
  - Yes/No prompt is often sufficient, with the possibility for interaction
  - Exercise restraint!

BEST PRACTICES

- Make the experience **aesthetically** pleasing
  - Subtle color saturation
  - Few, deliberate contrasts
  - High resolution, readability
  - C.R.A.P.
- Prevent excessive **alerts**
  - Crying wolf
- Keep viewers **in the loop**
  - Maintain situational awareness
  - Don't rely solely on red/green traffic lights when comprehension is important
- Accomodate **real-time monitoring**
  - Update frequency; consider stopping if necessary
  - Consider audio alerts
  - Timestamp alerts

EXERCISE: SKETCH A DASHBOARD

Step 1: Select one of the following applications:

Corporate Performance Monitoring:

An information dashboard can be used to monitor the performance of a company in real-time. Various metrics such as revenue, expenses, profit margins, inventory levels, customer satisfaction, etc., can be visualized. This allows executives to quickly respond to trends, identify bottlenecks, and make strategic decisions.

Healthcare Analysis:

In healthcare, dashboards can be employed to track various aspects of patient care. This could include analyzing hospital occupancy, patient flows, treatment outcomes, medication availability, and more. Physicians and hospital administrators could use this information to make efficiency improvements and enhance the quality of care.

Traffic Monitoring and Management:

In urban areas, dashboards can be used to monitor and manage traffic. By integrating data from traffic cameras, sensors, and GPS systems, traffic flows can be analyzed, congestion can be detected, and alternative routes can be suggested. This enables traffic authorities to quickly respond to events, improve traffic efficiency, and enhance traffic safety.

EXERCISE: SKETCH A DASHBOARD

Step 2: Sketching your dashboard

Use sketching software or pen and paper to sketch your dashboard.

Think about the following questions:

- What level of detail should be offered? In case of doubt, it is better to offer too much detail than too little. Edward Tufte clearly recommends this: To clarify show detail!
- Do you consider the common mistakes in dashboard design mentioned by Stephen Few?