

# FRAMEWORK FOR MULTI-AGENT SIMULATION OF USER BEHAVIOUR IN E-COMMERCE SITES

DISSERTATION PRESENTATION

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# CONTEXT & MOTIVATION

- Customers interact with e-commerce websites in different ways
- Companies want to optimize success metrics for profit
- Changing what, how and when content is displayed influences customers' actions
- Summarizing and analysing this behaviour is expensive, hard, tricky, ...
- Data scientists need to resort to online techniques with a high operational cost



Roll over image to zoom in

[View More Compatibility Details](#)

- Unlocked cell phones are compatible with GSM carriers like AT&T and T-Mobile as well as with GSM SIM cards (e.g. H2O, Straight) will not work with CDMA Carriers like Sprint, Verizon, Boost or Virgin.

10 new from \$509.99   13 used from \$409.99   7 refurbished from \$412.00



### Frequently Bought Together



Total price: **\$581.84**

[Add all three to Cart](#)

[Add all three to List](#)

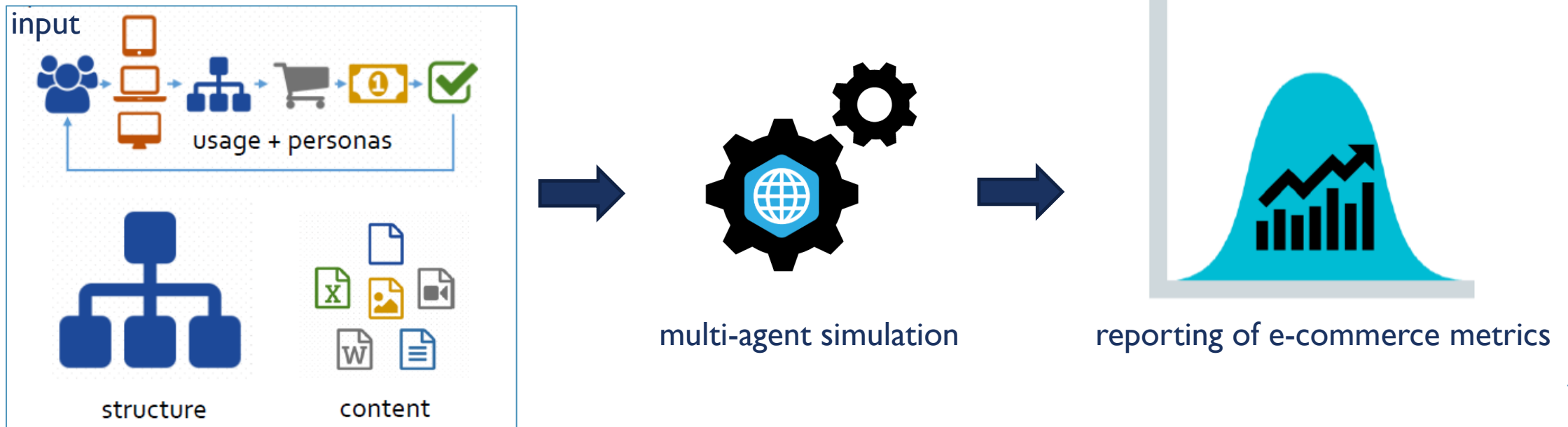
- ✓ **This item:** Apple iPhone 6 16GB Factory Unlocked GSM 4G LTE Cell Phone - Space Grey **\$555.49**
- ✓ iPhone 6 Screen Protector, Maxboost® [Tempered Glass] 0.2mm Ballistic Glass iPhone 6 Glass Screen... **\$7.99**
- ✓ iPhone 6 Case, Spigen® [Tough Armor] Heavy Duty [Gunmetal] Dual Layer EXTREME Protection Cover Heavy... **\$18.36**

### Customers Who Bought This Item Also Bought



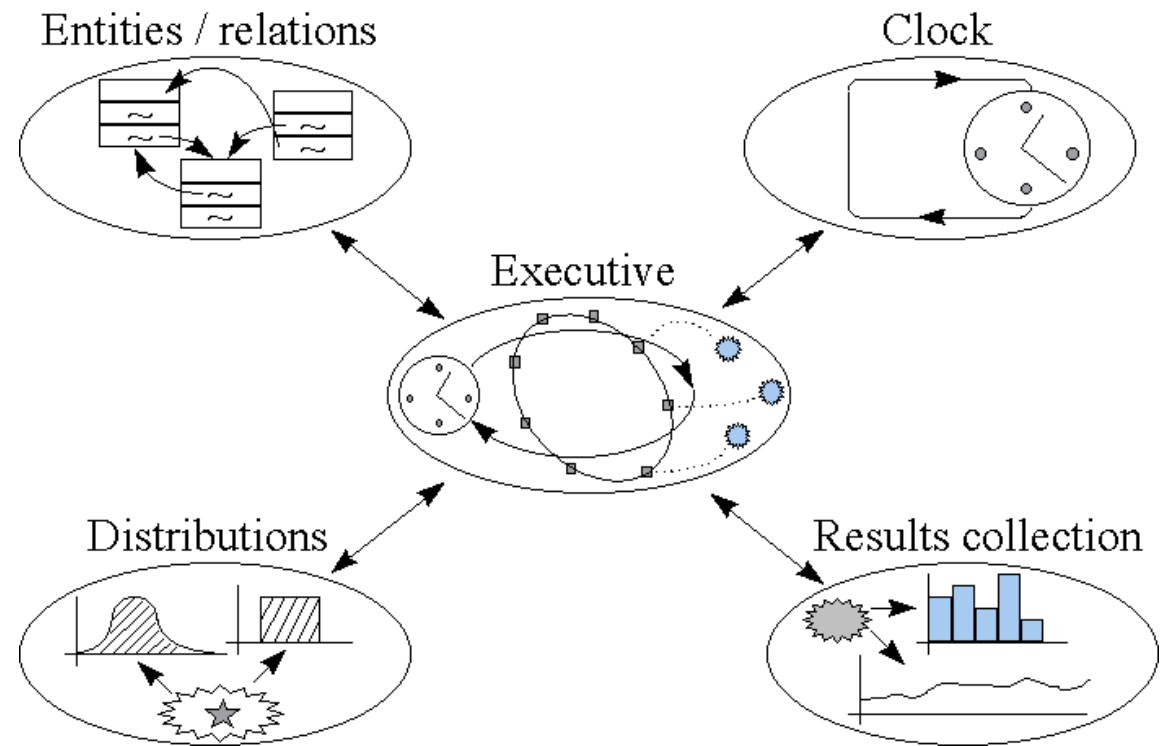
# OBJECTIVES

- Design and develop a simulation framework
- Given data from website structure and content, usage and user profiles, run a simulation where each entity represents a person interacting with the website



# IMPLEMENTATION – SIMULATION ENGINE

- Discrete Event Simulation – **DES**
- State changes at precise points in time

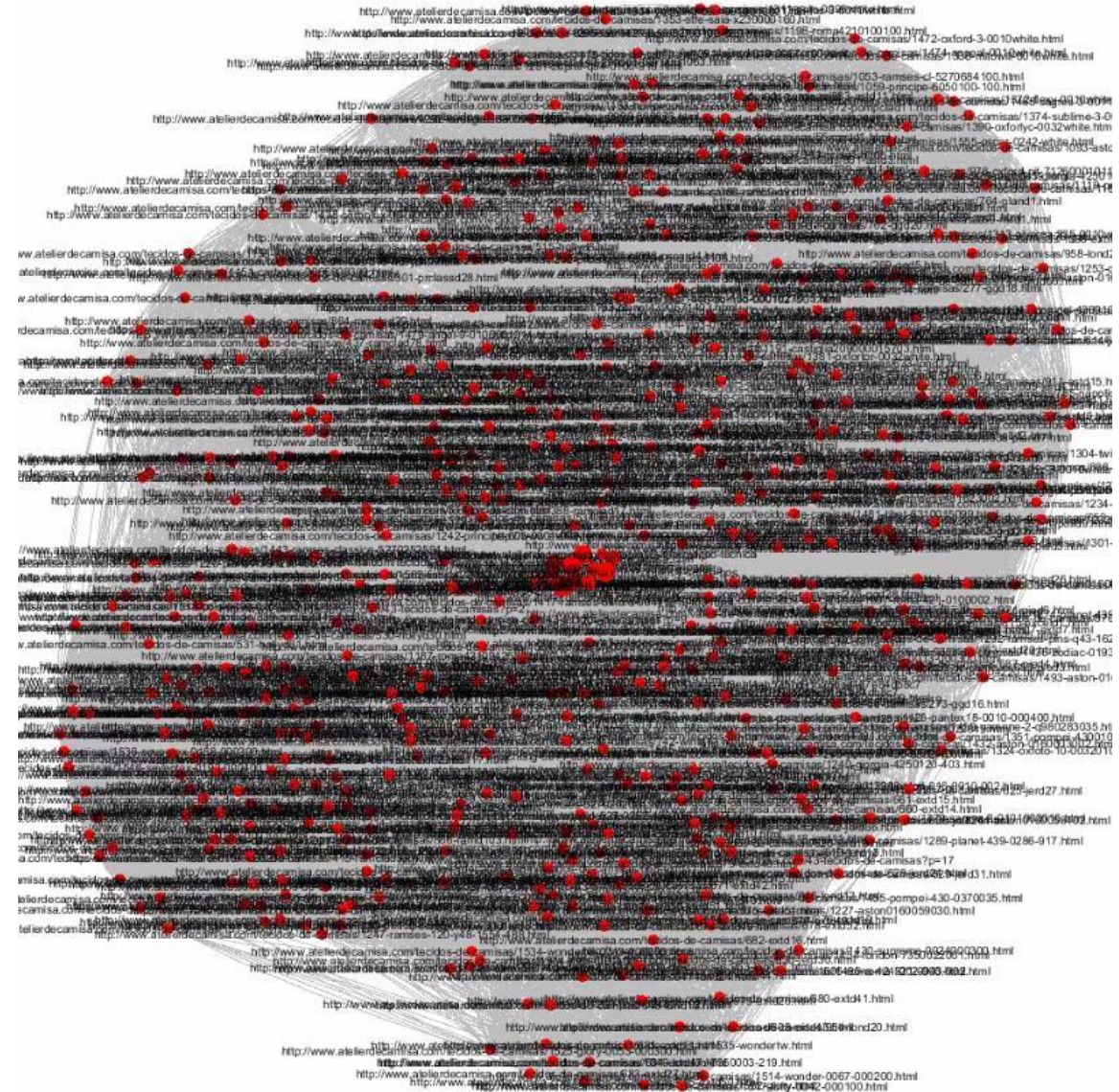


Kreutzer, 1986



# IMPLEMENTATION - WEBSITE

- Collection of webpages
- Each page has:
  - Type
  - Tags (categories, ...)
  - Outbound links



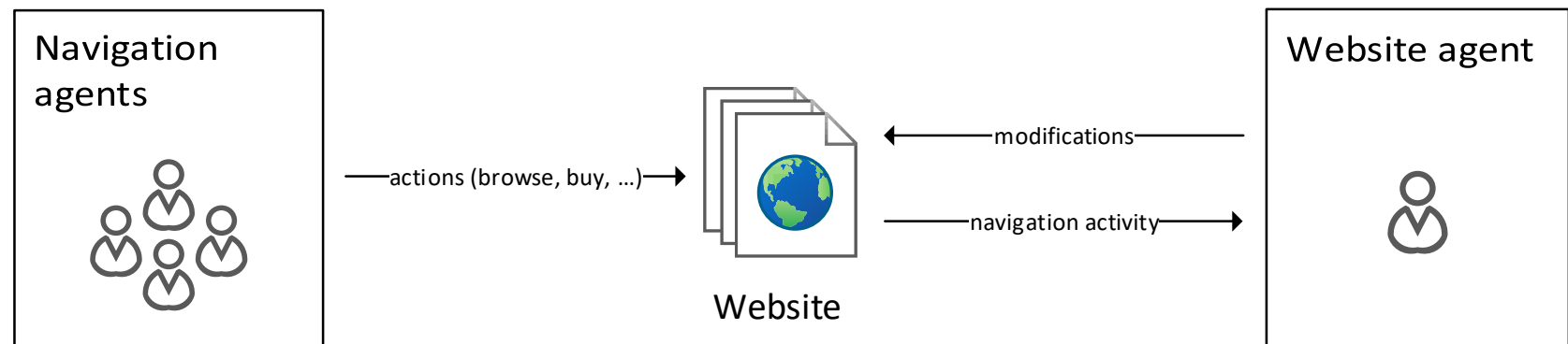
# IMPLEMENTATION - AGENTS

## Navigation agents

- Represent users interacting with the website
- Emit actions:
  - Browse
  - Buy
  - Add to cart
  - Checkout
  - ...

## Website agents

- Modify pages
- Receive navigation agents activity



# IMPLEMENTATION - REPORTING

- Analyse results, metrics, statistics
- Compare two simulation runs side by side
- Metrics:
  - Bounce rate
  - Conversion rate
  - Visits per page
  - Purchases per product
  - ...

Simulation 573afc7c365c0e0611d3fd38 vs Simulation 573afc80365c0e0611d3fd39

## General

Field	A	B
Name	Simulation Simulation	
Types	AffinityFactory [ AffinityUser ] / DummyWebsiteAgent AffinityFactory [ AffinityUser ] / DummyWebsiteAgent	
Start time	Tue May 17 12:11:55 BST 2016 Tue May 17 12:11:59 BST 2016	
End time	Tue May 17 12:11:59 BST 2016 Tue May 17 12:12:00 BST 2016	
Unique users	352 340	
Bounce rate	49.72% 47.65%	

## Visits

Show 10 entries

Page	Count A	Count B
homepage	367	358
electronics	134	111
cloth	52	59
sports	48	69
computers	28	29
lingerie	12	8
tshirts	10	15
football	6	14
cart	2	2

Showing 1 to 9 of 9 entries

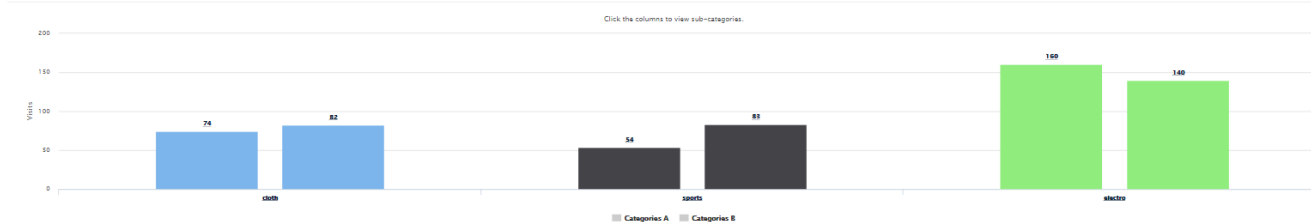
## Purchases

Show 10 entries

Product	Count A	Total Price A	Total Price B	Count B
Computer A	1	499.9	0.0	0
Football A	1	49.9	49.9	1

Showing 1 to 2 of 2 entries

## Visits per Category





# VALIDATION

- Fabricated test cases with clear expected results
- Real data from actual online stores
- *How to validate the framework/simulator itself and not the implementation of the agents?*

# CONCLUSIONS

- Implementation of the framework capable of running simulation in the presented context
- Open source, available at <https://github.com/DDuarte/Manchester>
- Appealing to both academic community and the industry:
  - Validate and test recommendation engines/algorithms
  - Run *what if* scenarios
  - A/B testing

# FUTURE WORK

- Parallel simulator
  - More metrics and actions
  - Metrics for website agents
  - Visual aspects
- 
- Submission to the 15th International Conference on Practical Applications of Agents and Multi-Agent Systems (PAAMS 17 @ Porto)

# THANK YOU

