

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**

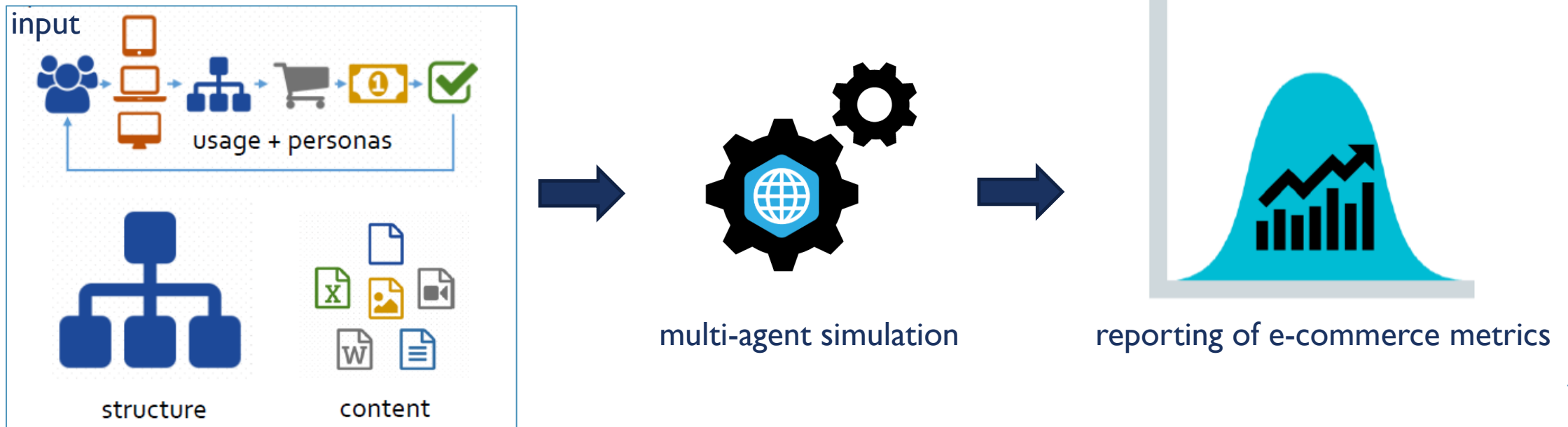
Customers Who Bought This Item Also Bought



3 of 11

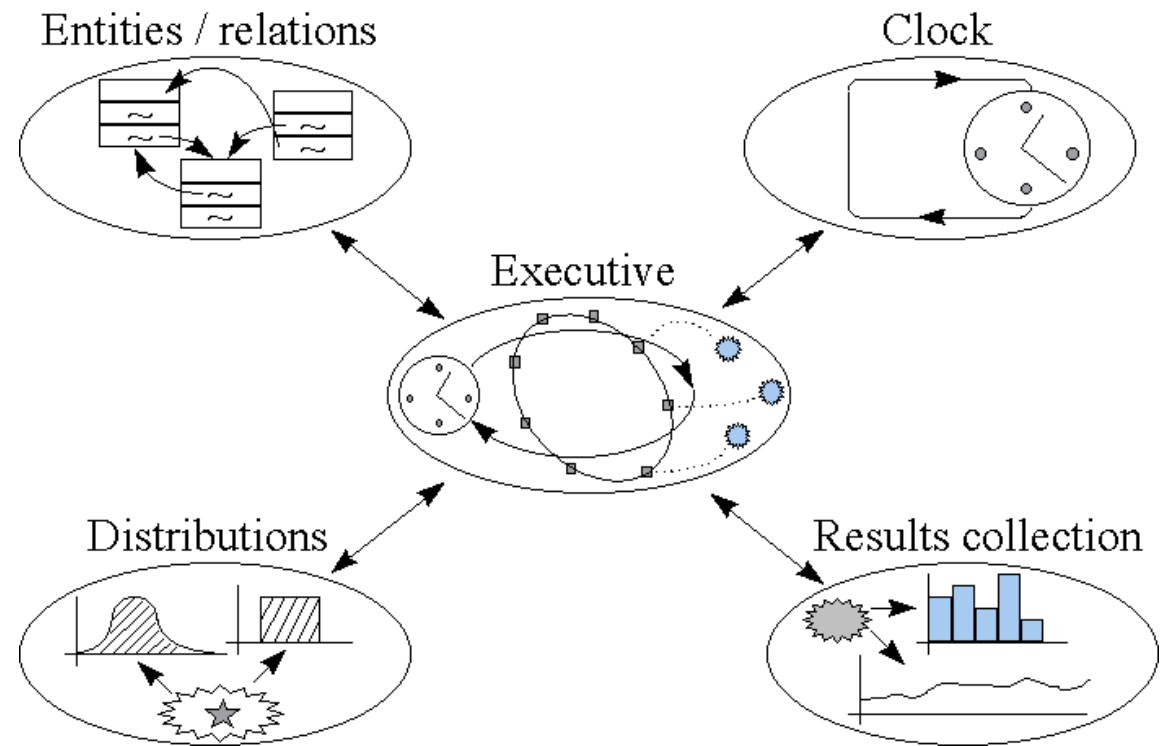
OBJECTIVES

- 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

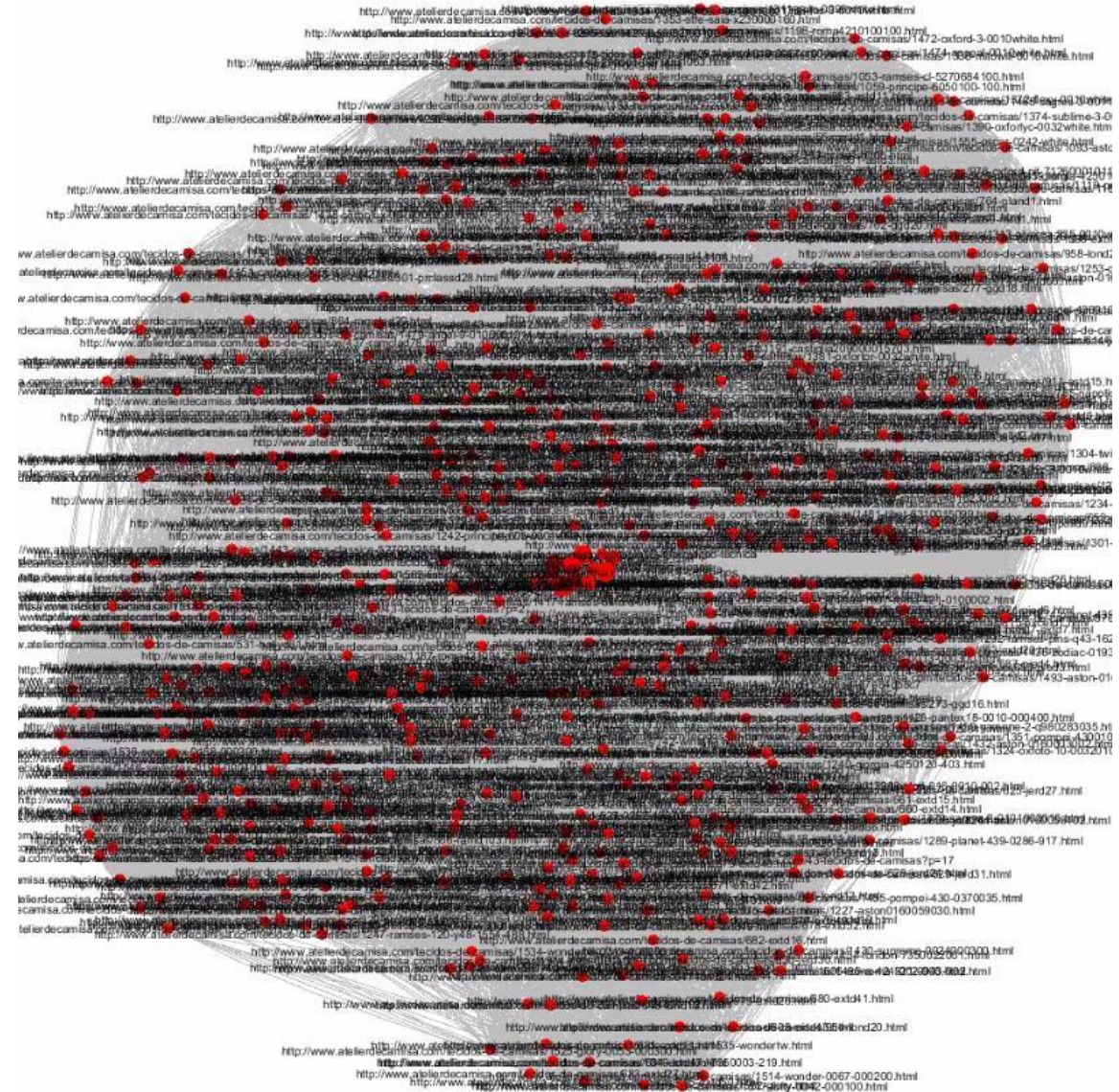
- Discrete Event Simulation – **DES**
- State changes at precise points in time



Kreutzer, 1986

IMPLEMENTATION - WEBSITE

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



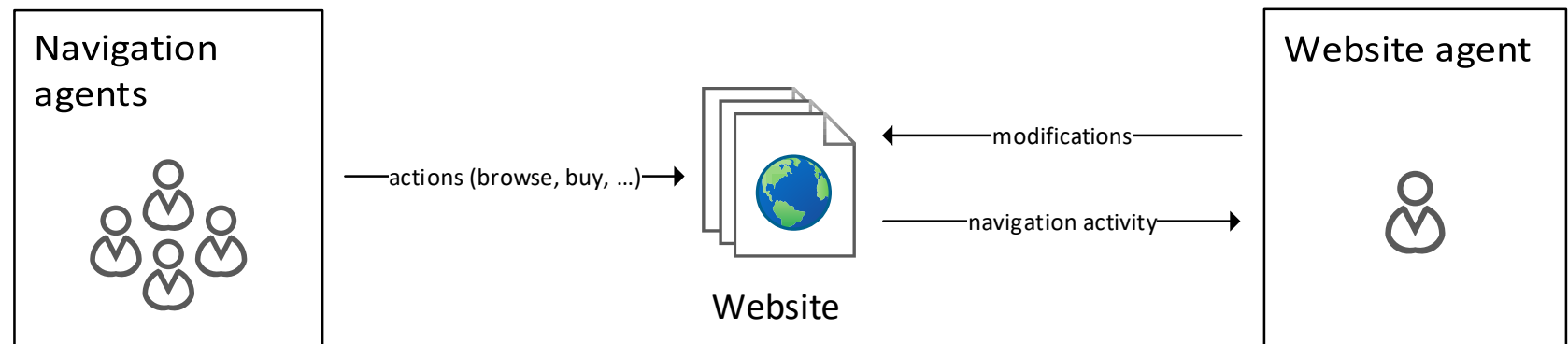
IMPLEMENTATION - AGENTS

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

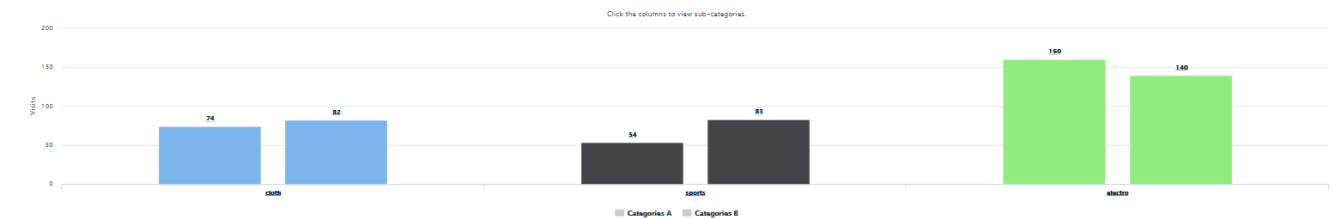
Purchases

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
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- Submission to the 15th International Conference on Practical Applications of Agents and Multi-Agent Systems (PAAMS 17 @ Porto)

THANK YOU

