

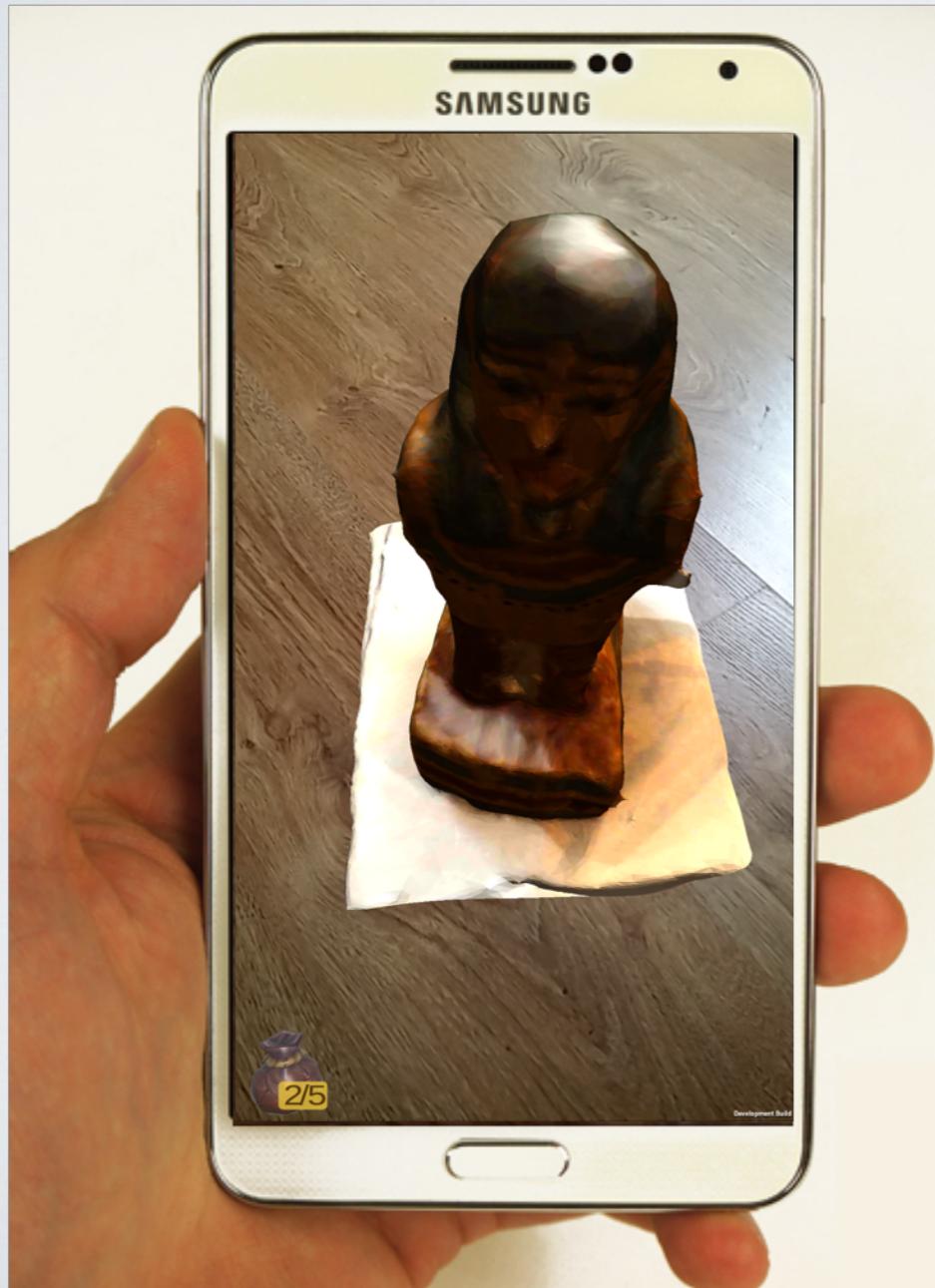
USER DEFINED GESTURES FOR AUGMENTED REALITY WITH SMARTPHONES

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AN AUGMENTED REALITY (AR) GAME



- An **AR** game for **smartphones** in a **museum** context
- How are **users** going to **interact** with **AR**?
- New interactions for new technologies

DEFINING A SET OF GESTURES FOR AR

- **Guessability Study**
(Wobbrock) to elicit end-user gestures from seeing the resultant effect



STUDY DESIGN

- 15 participants
- Custom application to show AR layer and record surface interaction
- Smartphone 151x79x8mm
- Target object to improve manipulation affordance
- Four tasks: **selection, rotation, zoom** and **free exploration**



PROCEDURE

1. Questionnaire to gather ethnographic information and technological skills
2. Introduction to the AR concept
3. Execution of the 4 tasks (talk aloud)
4. Final interview to discuss the performed gestures

TASKS

1. Putting AR object
into the bag

2. See the AR object
close up

3. See the other side
of the AR object



RESULTS FOR SELECTION

		1st	2nd	3rd
Surface	One finger drag&drop from Anubis to Bag	14		1
	One finger drag&drop from Bag to Anubis		2	
	Single tap on Anubis		2	
	Double tap on Anubis		1	
	Single tap on the Bag			2
	Single tap on background		1	
Motion	Move the Phone laterally from Anubis to Bag		1	
	Shake the Phone		2	

“It was easy, it’s like simulate what we are doing when we use a computer when you put a file into a folder and you drag one into each other”

RESULTS FOR ZOOM

		1st	2nd	3rd
Surface	Pinch to Zoom	8	2	
	Double Tap	1	1	1
Motion	Move the Phone close to Anubis	4	1	
Mix	Move the Phone + Grab Anubis to get them closer to each other	1	2	
	Pinch to Zoom + Move the Phone	1		

“The zoom is something we use every day, with the pinch to zoom with the camera for example”

RESULTS FOR ROTATION

		1st	2nd	3rd
Surface	One finger circle rotation	2		
	Two finger circle rotation	2	1	2
	One finger straight line	1		
Motion	Move the Phone around Anubis	4	1	1
Direct Manipulation	Rotate Anubis	6	2	

“The rotation is not so common so maybe other people will try different gestures”

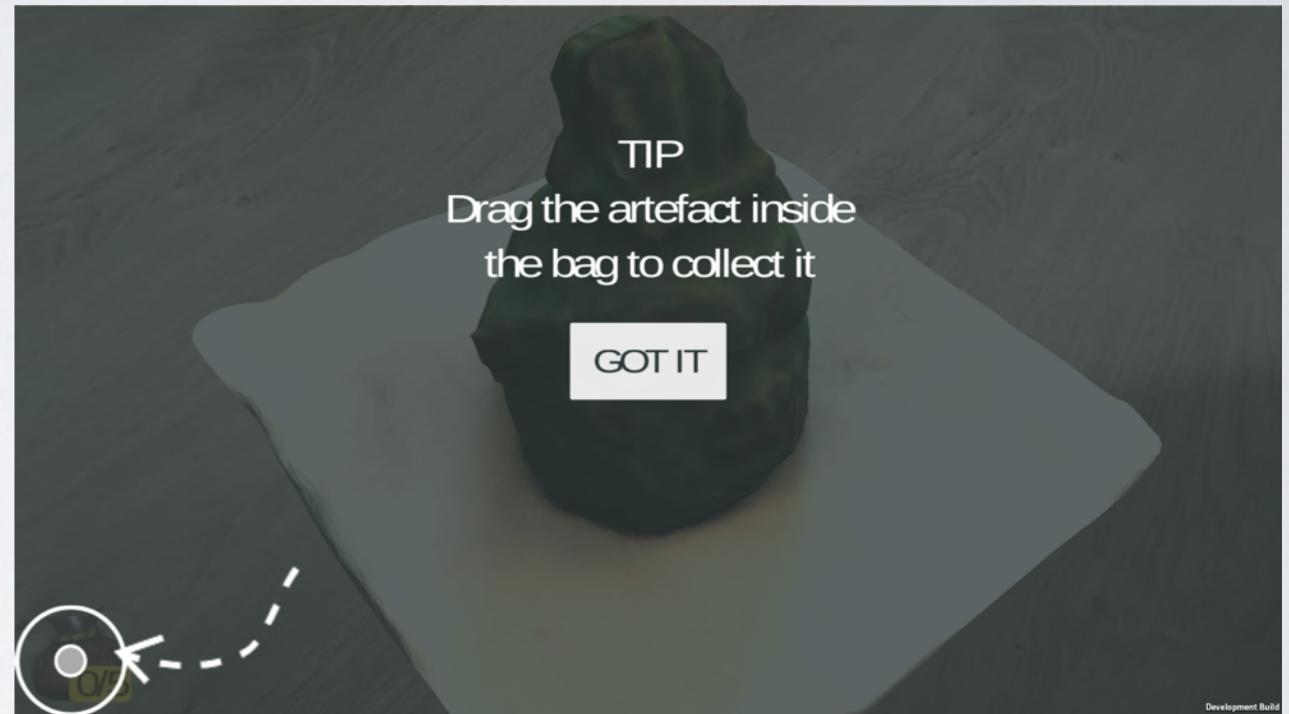
“It’s strange, you have a 2D gesture but a 3D effect”

RESULTS

- 18 gestures elicited
- Interaction mostly **natural** and **intuitive**
- Preference over **simple interaction** (surface gesture)
- Interaction highly affected by
 - **previous experience**
 - **environment settings**

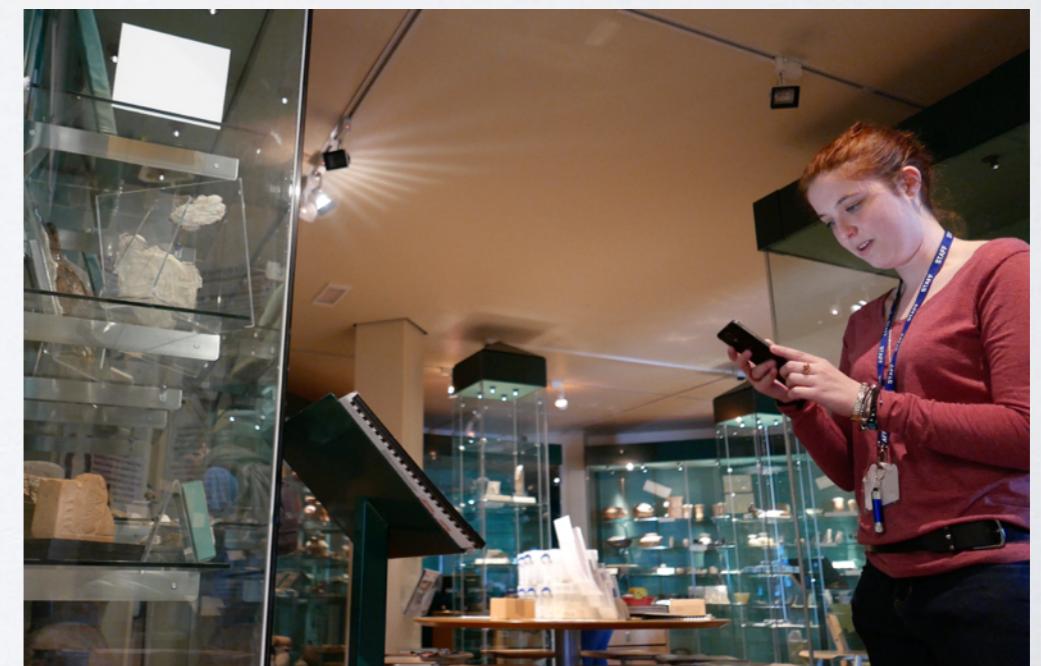
STUDY IMPLICATIONS

- Support **simple standard gestures**
- **Encourage** higher **interactivity** acting on the **environments**
 - Target object affordance and location
 - *Tip* for interaction
 - AR content to encourage exploration



FUTURE WORK

- Field study with visitors at the Egypt centre
- Verify that lab findings hold



CONCLUSION

- Development of a **AR** game for **smartphones** in a **museum** context
- A **guessability** study to understand **user interaction** in **AR**:
 - **selection**: Drag and drop (*surface gesture*)
 - **zoom**: Pinch to zoom (*surface gesture*)
 - **rotation**: Moving the target object (*direct manipulation*)
 - Simple interaction, affected by previous learnt metaphors
- Evaluation in the field

THANKS

A GESTURE TAXONOMY

- Interaction categories:
 - **Surface, motion, direct manipulation, mix**
- User preferences:
 - **First attempt, Standard, Preferred**

RESULTS FOR FREE EXPLORATION

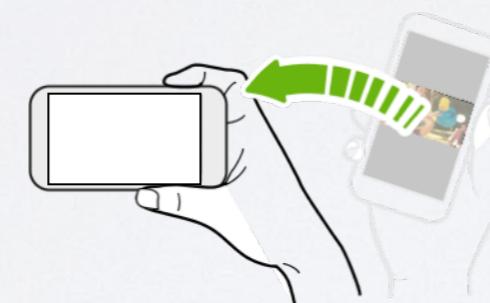
- **Widgets**
 - Single tap on the screen to show hidden menus
 - x/y axis to manage rotation
 - +/- buttons to manage zoom
- **Vocal instructions**

A GESTURE TAXONOMY

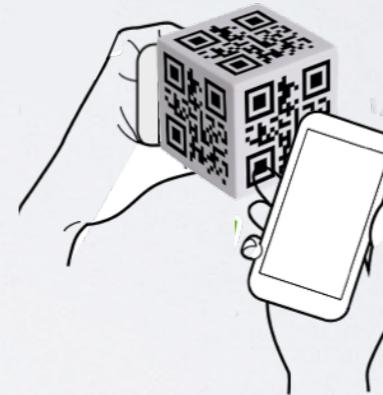
Surface



Motion



Direct
manipulation

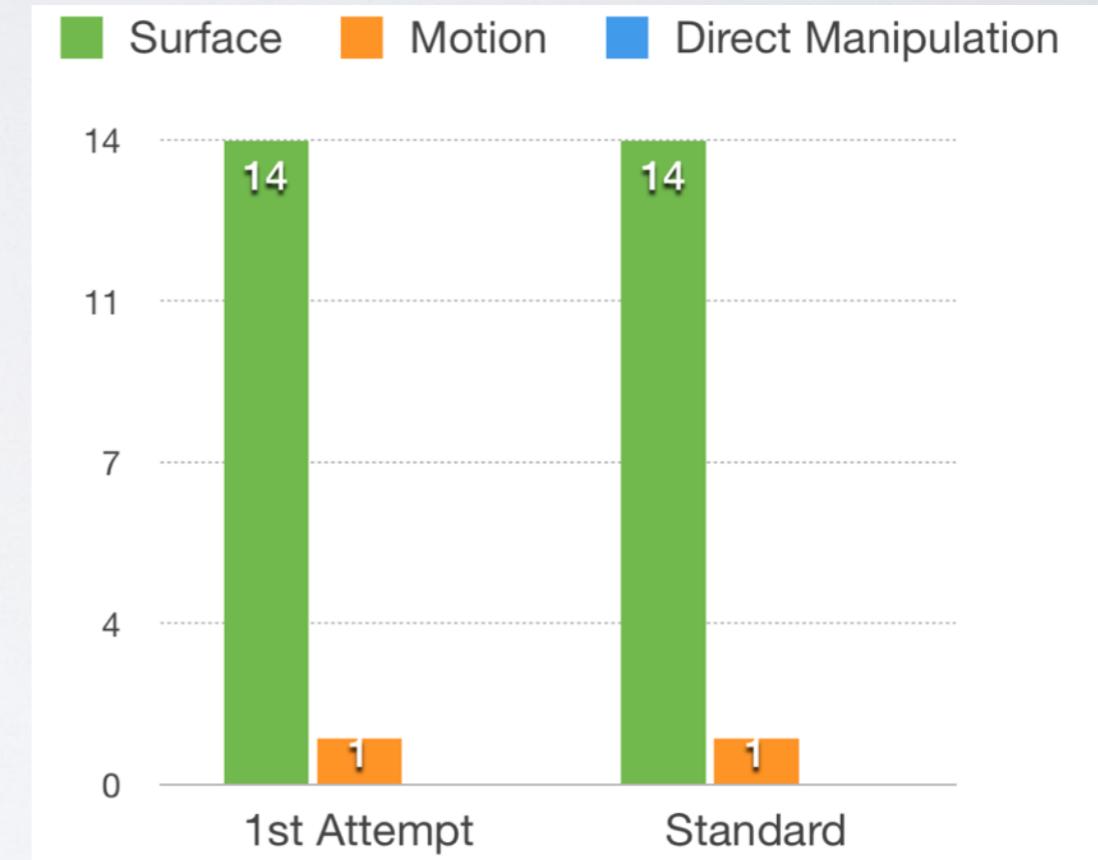


Mix



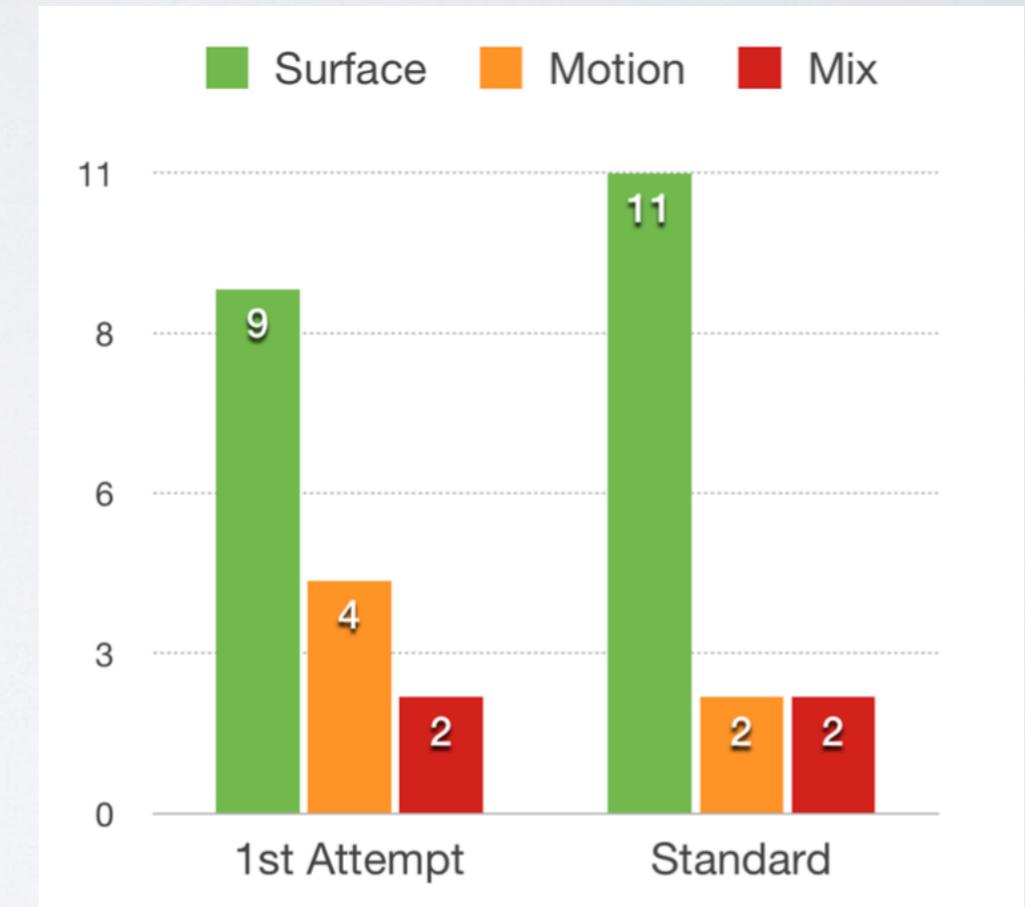
RESULTS FOR SELECTION

		1st	2nd	3rd	Std
Surface	One finger drag&drop from Anubis to Bag	14	1	14	
	One finger drag&drop from Bag to Anubis		2		
	Single tap on Anubis		2		
	Double tap on Anubis		1		
	Single tap on the Bag			2	
	Single tap on background		1		
Motion	Move the Phone laterally from Anubis to Bag	1			
	Shake the Phone	2		1	



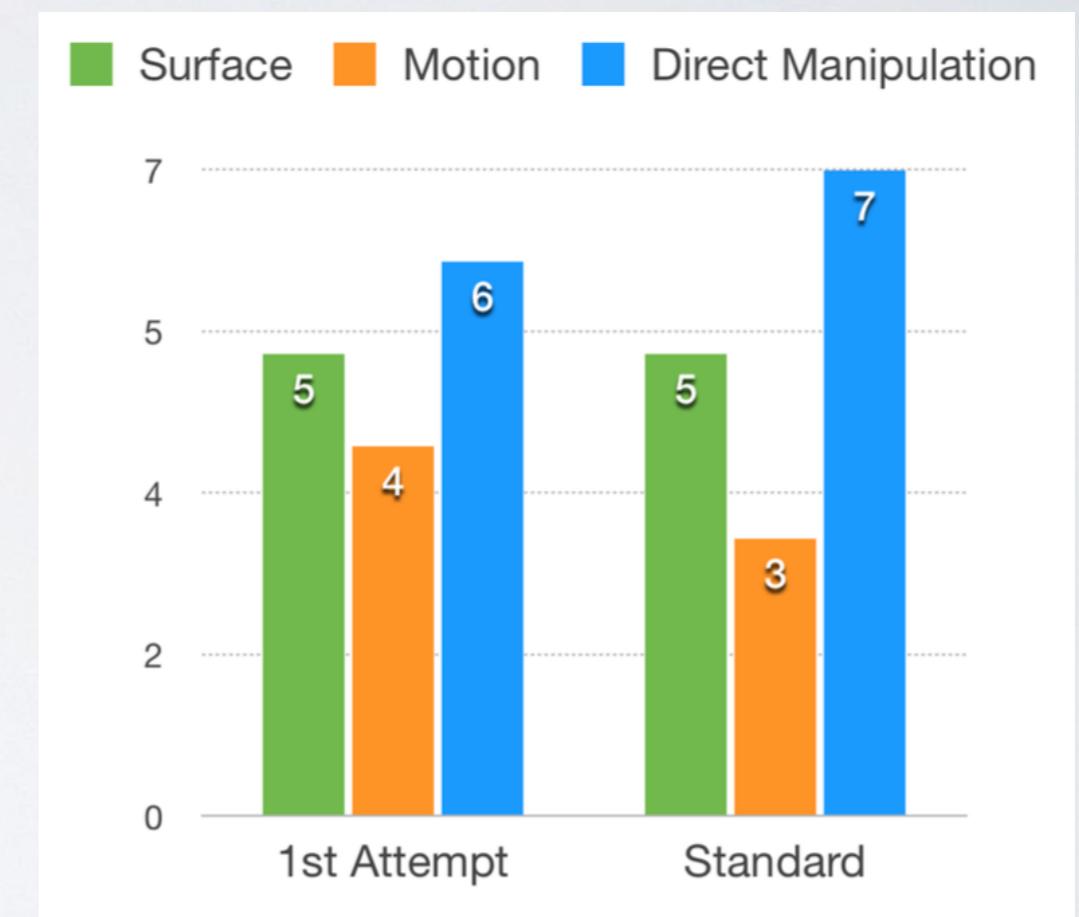
RESULTS FOR ZOOM

		1st	2nd	3rd	Std
Surface	Pinch to Zoom	8	2		11
	Double Tap	1	1	1	
Motion	Move the Phone close to Anubis	4	1		2
Mix	Move the Phone + Grab Anubis to get them closer to each other	1	2		1
	Pinch to Zoom + Move the Phone	1		1	

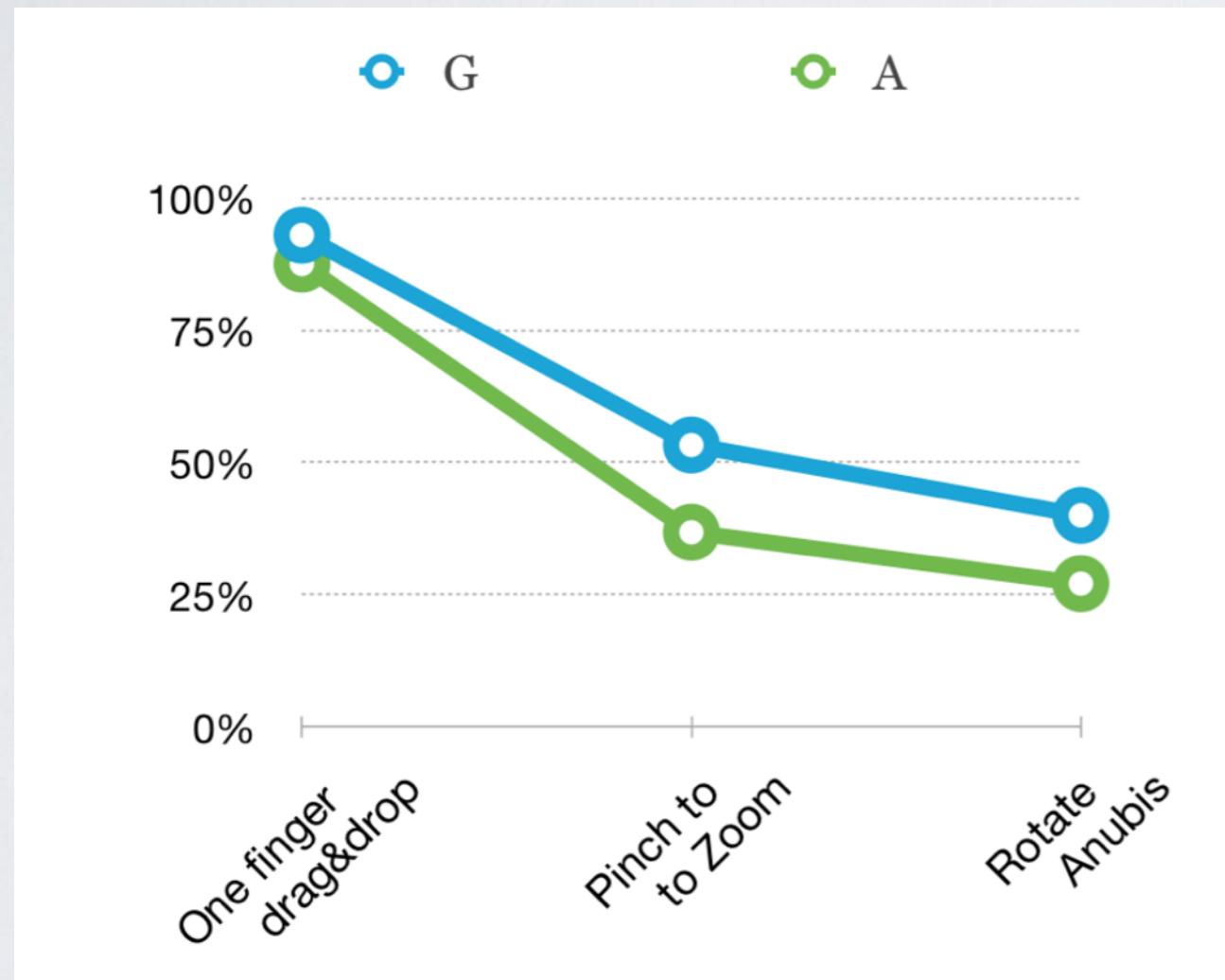


RESULTS FOR ROTATION

		1st	2nd	3rd	Std
Surface	One finger circle rotation	2		1	
	Two finger circle rotation	2	1	2	2
	One finger straight line	1		1	
Motion	Move the Phone around Anubis	4	1	1	4
Direct Manipulation	Rotate Anubis	6	2	7	



GUESSABILITY AND AGREEMENT



- **Selection**
 - surface gesture
- **Zoom**
 - surface gesture
- **Rotation**
 - direct manipulation gesture

AR RESEARCH AREAS (ISMAR)

Year	98	99	00	01	02	03	04	05	06	07		
Category											To-tal	%
Tracking	6	6	2	7	7	5	9	5	8	9	63	20.1
Interaction	2	9	2	6	3	1	3	8	9	7	46	14.7
Calibration	5	6	4	5	6	3	2	1	3	6	44	14.1
AR App.	6	7	2	9	5	8	2	2	1	4	45	14.4
Display	0	4	5	7	2	3	3	4	1	8	37	11.8
Evaluations	0	4	1	3	2	2	0	3	5	4	18	5.8
Mobile AR	1	0	1	1	0	1	1	1	3	4	19	6.1
Authoring	0	0	0	1	2	3	3	2	0	1	12	3.8
Visualiza-tion	0	0	0	2	1	3	0	2	3	5	15	4.8
Multimodal AR	0	2	0	0	0	0	1	0	3	2	8	2.6
Rendering	0	2	1	2	0	1	0	0	0	0	6	1.9
Total	20	40	18	43	28	30	24	28	35	47	313	100