

Exploratory Investigations of Multimedia Human Computer Interfaces for Autism

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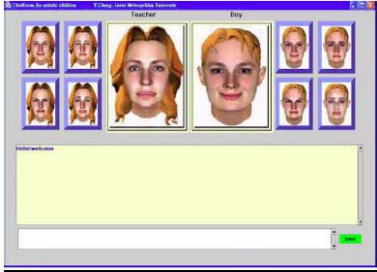
RESEARCH GOAL


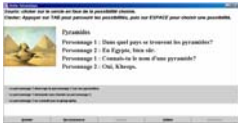




- Computerized education for autism
- Software design issues?
- Lack of experimental framework
- **Goal:** derive guidelines to design educational software for autism


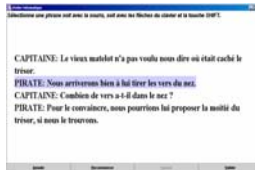
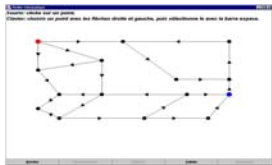
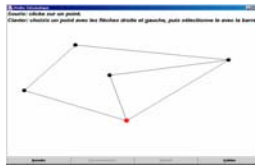
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Introduction	Method	Software Design	Results	Discussion	Conclusion
<h1>AUTISM SYNDROME</h1>					
<ul style="list-style-type: none"> • Triad of impairments <i>DSM IV (APA, 94) ICD-10 (WHO, 92)</i> • Low / High functioning autism • Pragmatic deficiencies: <ul style="list-style-type: none"> – Relation to context <i>(Paul, 87)</i> – Difficulties in local coherence tasks <i>(Jolliffe & Baron-Cohen, 99)</i> • Asymmetric profile in favor of visuospatial skills <i>(Mottron, 05) (Blair et al., 02)</i> 					
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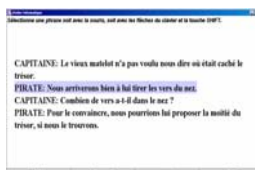



Introduction	Method	Software Design	Results	Discussion	Conclusion
<h1>EXECUTIVE FUNCTIONS</h1>					
<ul style="list-style-type: none"> • Controlling behavior • Planning, anticipating • Inhibiting • Working memory • Dysfunction in autism: <i>(Russell, 96) (Hughes et al., 94)</i> <ul style="list-style-type: none"> – “open” tasks – Inhibiting prepotent response – Inhibiting a natural response in favor of an arbitrary rule 					
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POTENTIALITY OF COMPUTERS					
<ul style="list-style-type: none"> • Claimed advantages (Panyan, 84) (Higgins & Boone, 96) • Suspected problem (Moore & Taylor, 00) (Bernard-Optiz et al., 01) • Existing projects: <ul style="list-style-type: none"> – Multimedia (Tjus et al., 03) – Virtual Environments (Leonard et al., 02) (Bosseler & Massaro, 03) • Experimental evaluations <ul style="list-style-type: none"> – Social training (Bernard-Optiz et al., 01) – Executive test (WCST) (Ozonoff, 95) 					
			 <p>Moore et al., 05</p>		
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Introduction	Method	Software Design	Results	Discussion	Conclusion		
EVALUATION PROTOCOL							
Evaluation before (1 session)		Training (11 sessions)		Evaluation after (1 session)			
Dialogue understanding							
Spatial planning							
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Introduction	Method	Software Design	Results	Discussion	Conclusion
EXERCICES DESIGNED					
		Training		Evaluation	
Dialogue understanding		WHAT TO CHOOSE? 		INTRUDER 	
Spatial planning		LABYRINTH 		POSTMAN 	

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Introduction	Method	Software Design	Results	Discussion	Conclusion
COMPARING EVALUATION INTERFACES					
		Minimalist output		Multimodal output (image & speech)	
Dialogue understanding					
Spatial planning					

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BEFORE-AFTER EVALUATION					
Clinical group			Control group		
10 boys, high functioning autism (DSM IV)			8 boys and 2 girls		
Average IQ=80.5 (NV=95.9 V=89.1)			Average Chron. Age = 9 yrs 7 mths		
Average Chron. Age = 12 yrs 10 mths			Matched on school level		
Performance progression between before & after					
Control group		Clinical group			
Intruder Both Interfaces		Intruder Minimalist Interface			
Postman Multimodal Interface					
Group comparison for Postman exercise					
Before			After		
Performances: Control > Clinical			Performances: Control > Clinical		
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DISCUSSION					
<ul style="list-style-type: none"> • Learning domain: <ul style="list-style-type: none"> – Starting assumption: groups differ on Intruder, not on Postman – Results: groups differ on Postman, not on Intruder – Intruder task: social complexity reduced – Postman task: executive complexity <u>not</u> reduced • Interface modalities: <ul style="list-style-type: none"> – No positive impact of tested multimodal interfaces – Multimodality may induce cognitive overload 					
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CONCLUSION & FUTURE WORK

- Recommendations:
 - Include interface modalities that support executive functions
 - Cautious use of multimodality
- Further analysis of logs and video
- Test learning transfer to real life
- From exploratory to focused studies

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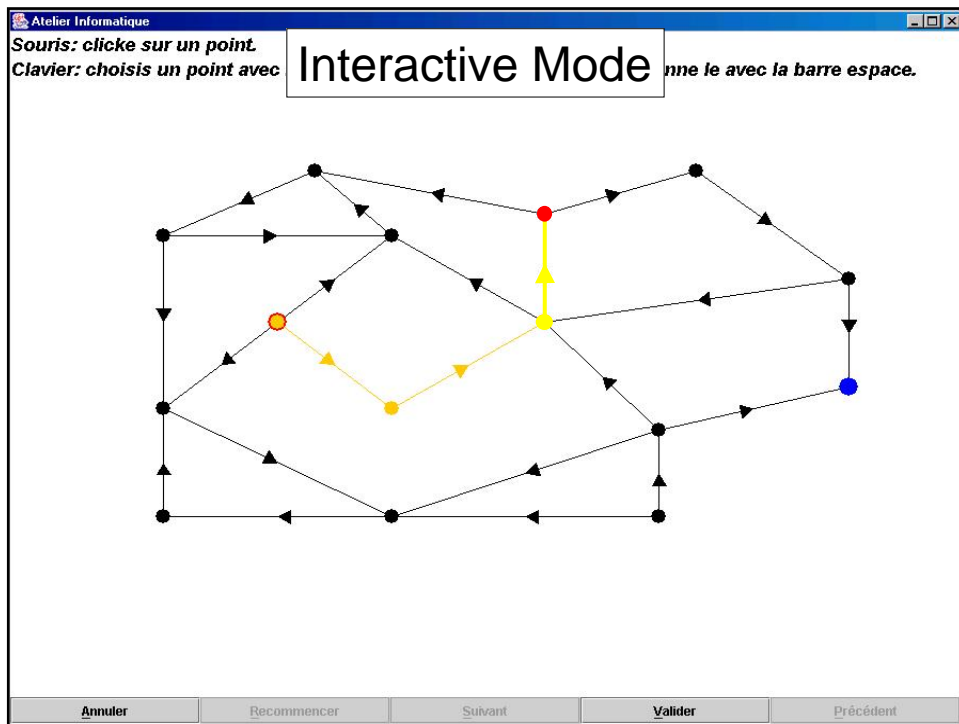
Souris: cliquer sur le cercle
Clavier: Appuyer sur TAB p

Non-interactive Mode

...sir une possibilité.

Les rues sont à sens unique. Le sens d'une rue est indiqué par une fleche. Quelle direction faut-il prendre pour partir du point rouge et arriver au point bleu?

Direction 1.
 Direction 2.
 Direction 3.



Introduction	Method	Software Design	Measures	Results	Discussion	Conclusion
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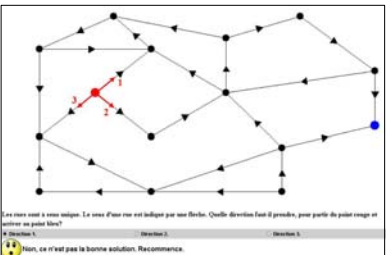
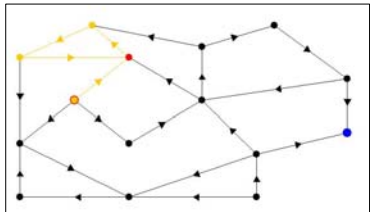
LABYRINTH INTERACTIVE MODE

- Performances of control group higher than clinical group in non-interactive mode
- Number of Move Backwards for clinical group higher than for control group
- Gaze is more directed to screen with 'Labyrinth' than with 'What to choose?'

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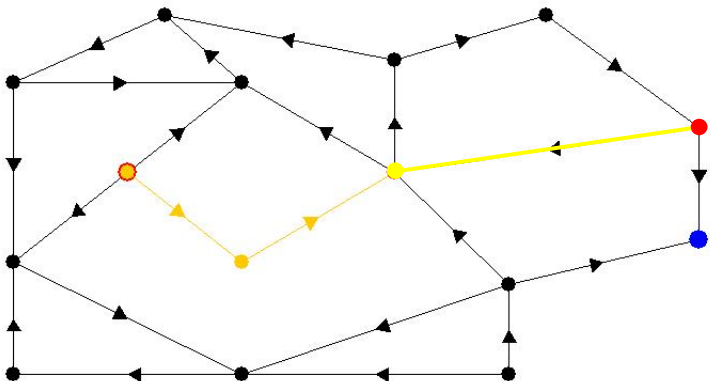
EXECUTIVE FUNCTIONS (1/2)

- Executive dysfunction in 'Labyrinth'

Non-interactive mode	Interactive mode
<p>Orientation rule is "arbitrary"</p>  <p>Les cases sont à sens unique. Le sens d'une case est indiqué par une flèche. Quelle direction faut-il prendre, pour partir du point rouge et atteindre un point bleu?</p> <p>Si direction 1... direction 2... direction 3...</p> <p>Non, ce n'est pas la bonne solution. Recommencez.</p>	<p>Orientation rule is "natural"</p> <p>Path is visually represented</p> 

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Souris: clique sur un point.
Clavier: choisis un point avec les flèches droite et gauche, puis sélectionne le avec la barre espace.



Annuler Recommencer Quitter Valider Drapeau

EXECUTIVE FUNCTIONS (2/2)

- Recommendation: Include modalities supporting executive functions in HCI
- Delayed learning for executive functions
- Trial and error strategy in spatial planning
- Another possible interpretation for Ozonoff (1995) experiment on WCST

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Sélectionne une possibilité

Image designed with poser 5 according to (Ekman, 2003)



Contrôle annulé

Carole : Le professeur de français est absent toute la journée.

Nicolas : Ah bon! J'avais peur qu'il nous donne un contrôle aujourd'hui.

Carole : Le contrôle est annulé.

Nicolas : Quel dommage!

Reply associated with the image

Nicolas regrette qu'il n'y ait pas de contrôle.

Nicolas préférerait que le professeur soit présent.

Nicolas est bien content qu'il n'y ait pas de contrôle.

Annuler Recommencer Suivant Valider Précédent

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neutral anger happy

fear sad surprise


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FACIAL EXPRESSION TEST

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Souris: cliquer sur le cercle à gauche de la possibilité choisie.
Clavier: Appuyer sur TAB pour parcourir les possibilités, puis sur ESPACE pour choisir une possibilité.



Photos provided by the
« Développement et
Psychopathologie » team,
CNRS UMR 7593

Comment est le personnage?

content surpris en colère triste effrayé sans émotion

Annuler	Recommencer	Suivant	Valider	Précédent
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FACIAL EXPRESSION MODALITY

- Better performances of control group with facial expressions than without
- Performances of clinical group inferior to control group with facial expressions
- Facial expression recognition for clinical group:
 - Better than random answers
 - Higher with photos than with virtual human

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MULTIMODALITY

- Multimodal integration disorder:
 - No positive impact of tested multimodal HCIs
 - Multimodality may induce cognitive overload
- Impaired ability to link emotional facial expressions with speech context

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CONCLUSION

- For what type of learning?
 - Training pragmatics
 - Training executive functions
 - Training to link emotional information to social context
- With which media and modalities?
 - Cautious use of multimodality
 - Support executive functions
- How to evaluate software?
 - Detailed information from logs & video
 - Learning transfer to more complex tasks

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