Virtual Environments to Address Autistic Social Deficits

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Overview

- Background and rationale
- Face Gaze Studies
- Virtual Buddy
- Virtual Social Environment
- Virtual Social Interaction

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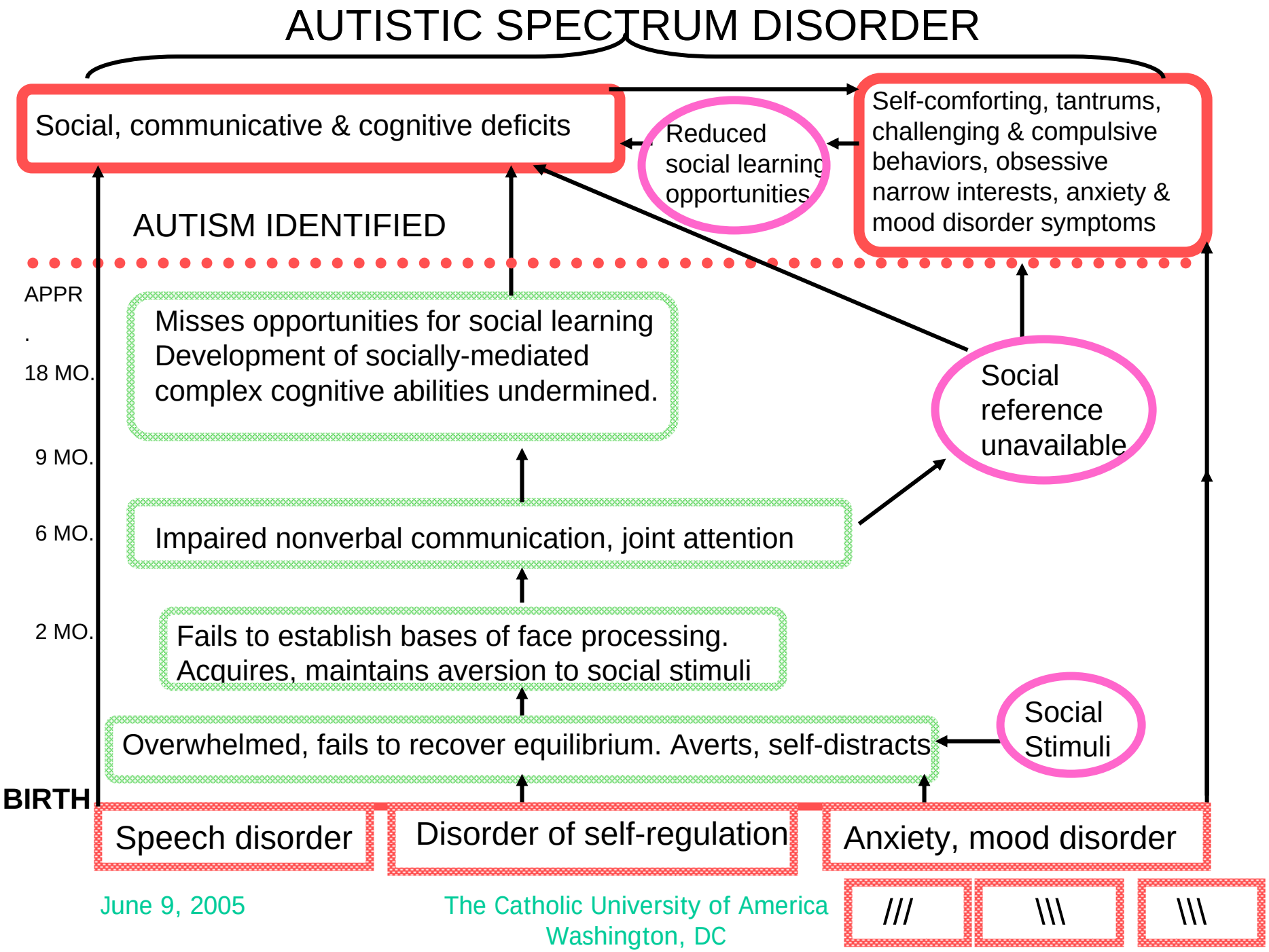
AUTISTIC SPECTRUM DISORDER
Social, communicative & cognitive deficits
Reduced social learning opportunities
Self-comforting, tantrums, challenging & compulsive behaviors, obsessive narrow interests, anxiety & mood disorder symptoms
AUTISM IDENTIFIED
APPR.
18 MO.
9 MO.
6 MO.
2 MO.
BIRTH
Misses opportunities for social learning
Development of socially-mediated complex cognitive abilities undermined.
Social reference unavailable
Impaired nonverbal communication, joint attention
Fails to establish bases of face processing.
Acquires, maintains aversion to social stimuli
Overwhelmed, fails to recover equilibrium. Averts, self-distracts
Social Stimuli
Speech disorder
Disorder of self-regulation
Anxiety, mood disorder

Summary

- A ‘perfect storm’ of genetic conditions combine to block social input to development
- Sparks a cascade of developmental failures
- The underlying genetic conditions, the developmental failures resulting from them, plus the tertiary effects of living asocially in a social environment – constitute the syndrome

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Face gaze

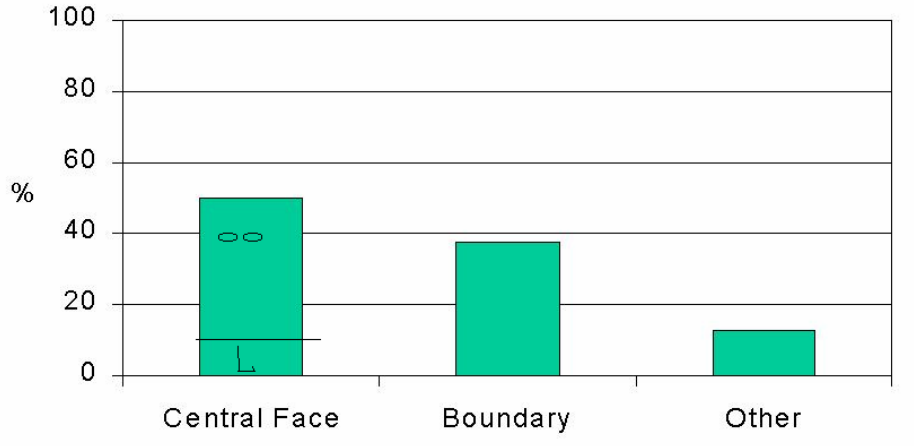
during learning and recognition

- Will impaired face-processing – apparently universal in autism - also involve inexpert face gaze?

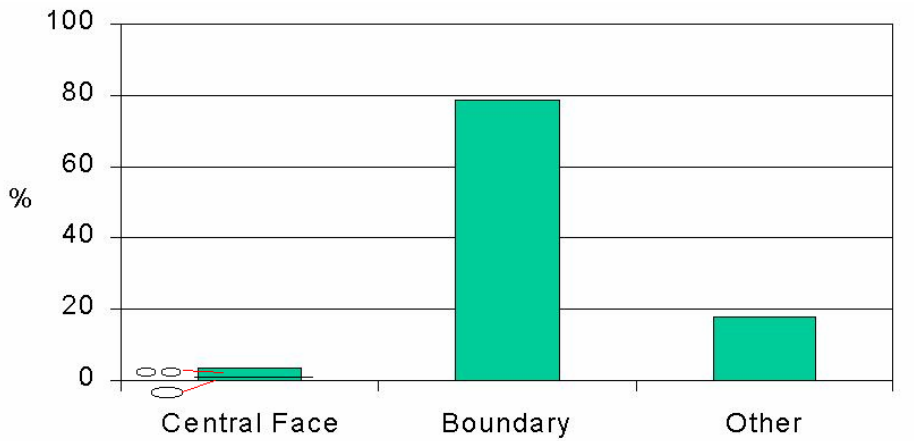
- Is there a relationship between face gaze and social skills?

Study 1 Gaze locus

During initial second …

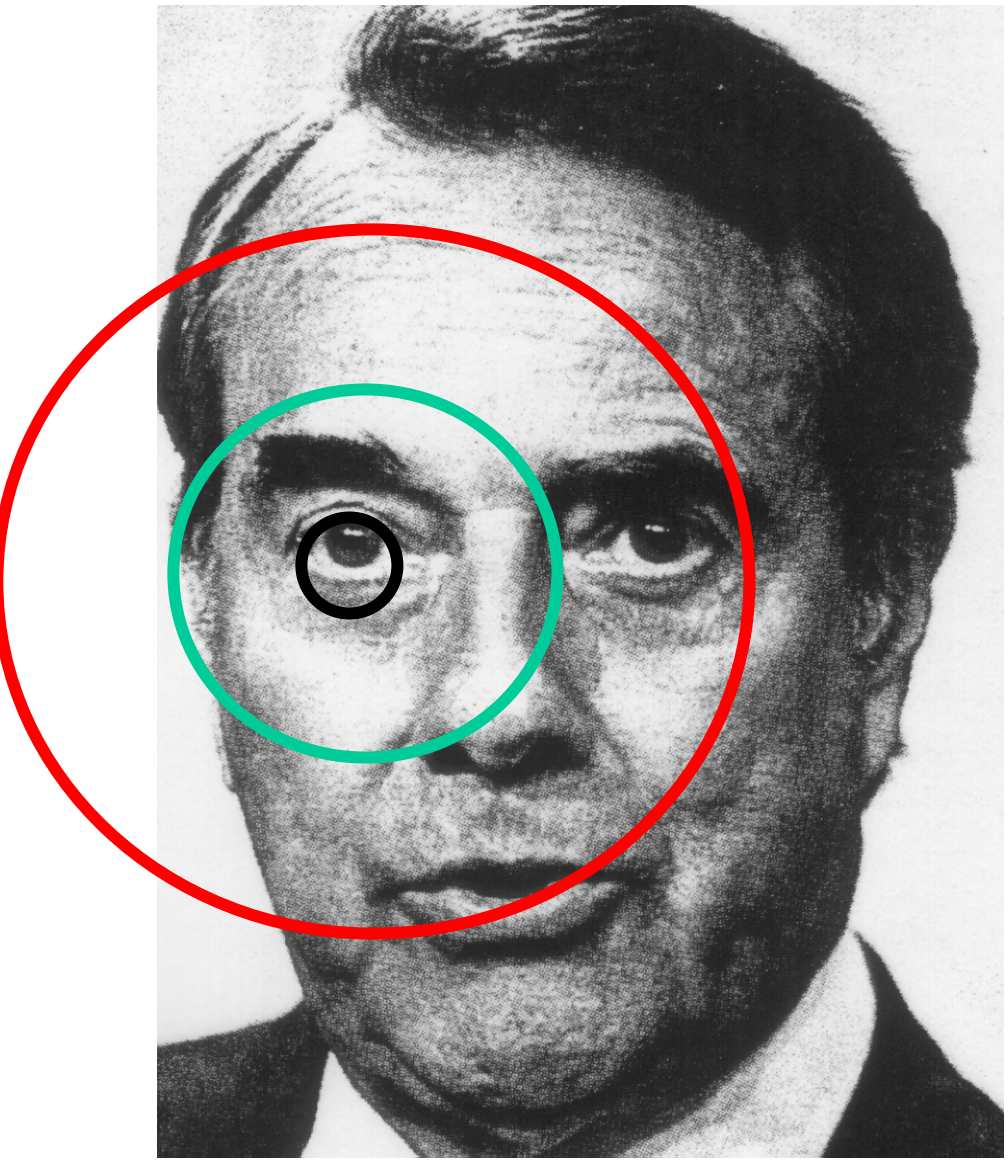


Control group looked mostly at central face



Experimental group looked elsewhere

Typical gaze, at conversational distance

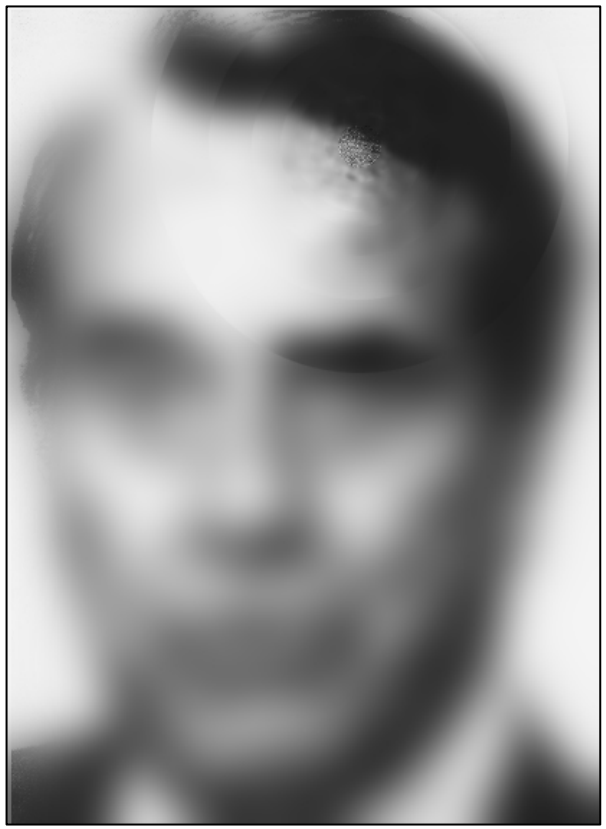


Foveal	2°
Parafoveal	5°
Extrafoveal	10°
Face	11°

Approximation of effect of acuity curve

Gaze at eye area

Gaze at hairline



Failure to look at eye area severely limits access to information needed for face processing

Study 2 Gaze locus (prelim. results)

Between-group differences in recognition task for

- Duration of gaze at background (ASD)*
- Initial fixation on mouth (ASD)*
- Duration of gaze at mouth (ASD)#

- Initial fixation on eyes (Con)#
- Duration of gaze at eyes (Con)#

* p<.05

Trending towards significance

Initial fixation after saccade away from between-trial gaze-fixation target

Gaze locus & social reciprocity

Clinical participants were assessed with Autism Diagnostic Interview-Revised (ADI-R). ADI-R is primarily a look back at childhood (5^{th} year of life).

Clinical participants' ADI-R social (impairment) score correlated inversely ($p<.05$) with

- initial gaze at eyes ($r = -.832$), and
- duration of gaze at eyes ($r = -.747$).

Face Gaze -- Discussion

- Individuals with ASD spend more time than Controls looking at background, periphery, or mouth; less time looking at eye area
- Initial fixation for ASD tends to be on mouth; for Controls, on eyes
- Strategy of looking at eye area to determine familiarity of face correlates with
-- typicality of social skills at age 4
- Children with ASD may not be looking at faces in a way that can be effective

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Early Intervention – The Virtual Buddy

Piloting an experimental intervention to nudge children to develop face processing skills

Car seat

Monitor

Eye-tracker

Virtual Buddy

- Eye-tracking studies suggest it may be beneficial to teach effective face gaze
- Child's experience: voluntarily watching video
- Training: provide video rewards when child's gaze behavior progresses
- Goal: induce child to attend to eye area of faces and teach face interpretation
- Evaluation by assessing change in social interaction during structured play sessions

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Social Navigation -- The Virtual Mall

Design of an environment to elicit assess and practice social skills

The Virtual Mall

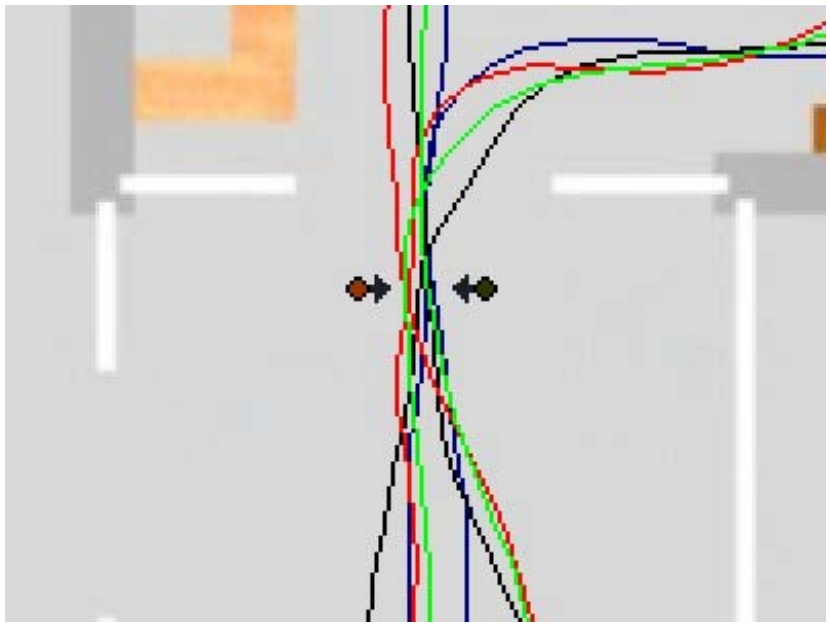
Iterative design of environment in which to offer social challenges

- Mall with moving, non-interactive humans
- Joystick navigation
- Tasks assigned to assure that participants are faced with decisions to move around or through obstacles
- Obstacles have identical spatial, different social characteristics

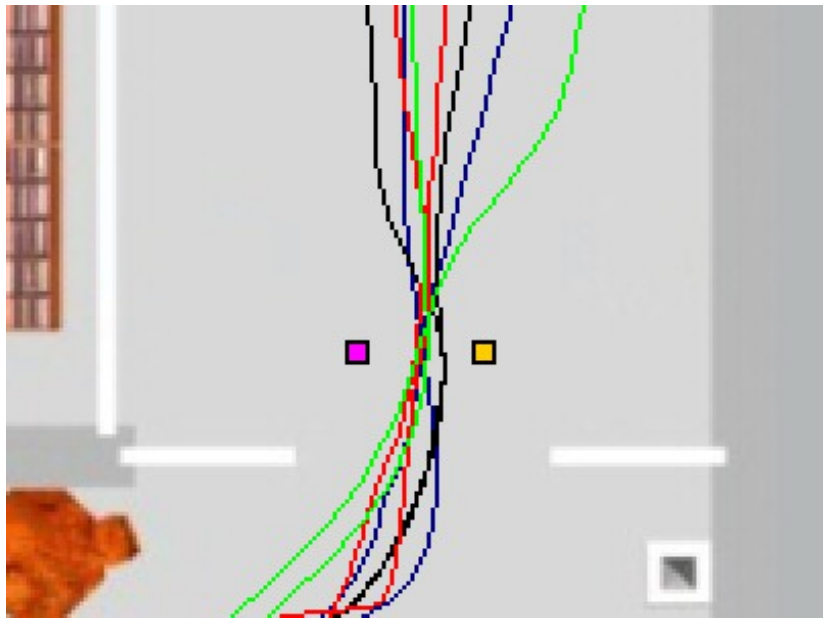
Virtual Mall -- Participants' Verbalizations

- Described avatar's behavior in first person
- Talked of virtual humans in ways that assigned them agency
- One excused herself verbally when passing near virtual humans

‘Social’ and ‘Non-Social’ Obstacles –



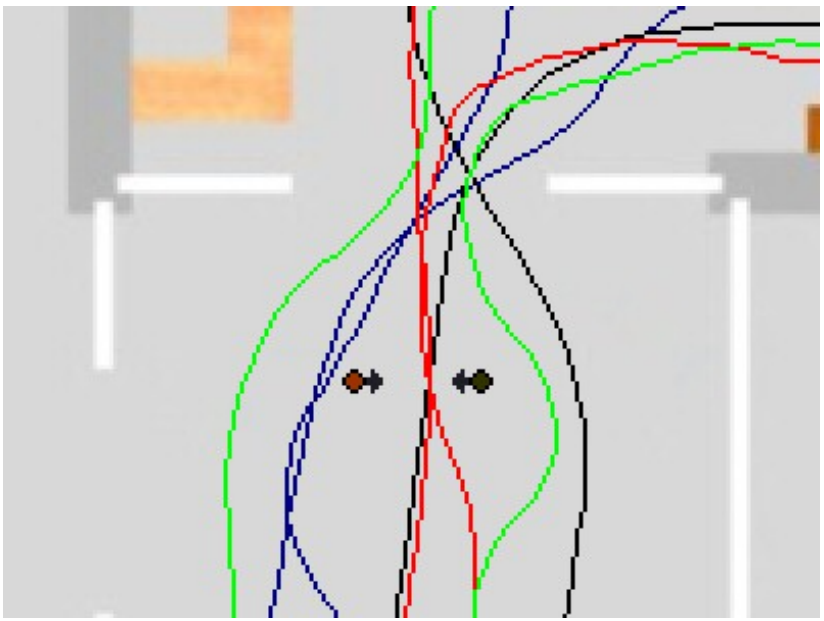
Virtual people



Advertising signs

All participants chose to go between the obstacles, in both directions

Modifications: + Conversational sound
+ More room for going around
+ More room for going between



Increase in choice of paths around people

Same participants mostly went between advertising signposts

Virtual Mall -- Discussion

- Adding non-interactive conversation between virtual humans appears to enhance the Mall's social validity
- Participants' responses to date are encouraging for use of a virtual environment as a tool for evaluation and rehabilitation

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Social Conversation Environment

Development and evaluation of a simulation to provide guided experience in conversational interaction

"Life hardly seems long enough to give the autistic child all the detailed instruction he needs to learn the rules of social conduct.“*

* Lorna Wing (1976) psychiatrist, mother of individual with autism

Virtual Social Interaction using SIMMersion™ Technology

Bank of videoclips recorded by an actor

Learner selects from among questions and statements, speaks them to character

Character model includes emotional levels. At highest levels of user skill, character displays most amenable emotional state

Illustration – detection of suicidal intent

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