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# A systematic review of Theory of Mind based Interventions for Autism Spectrum Disorder.

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# A Systematic Review of Theory of Mind Based Interventions for Autism Spectrum Disorder

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**THE COCHRANE COLLABORATION®**

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@SueReviews
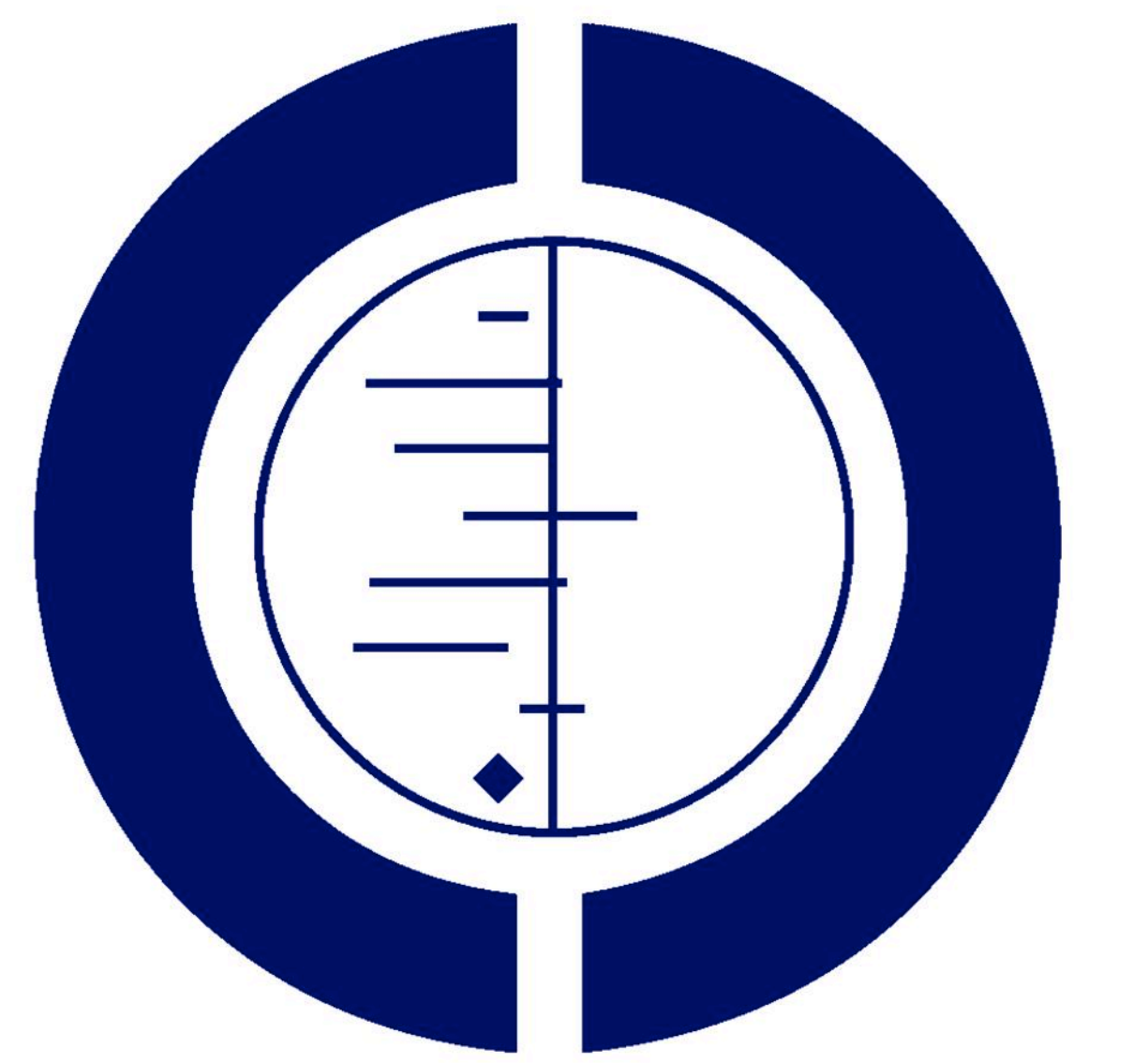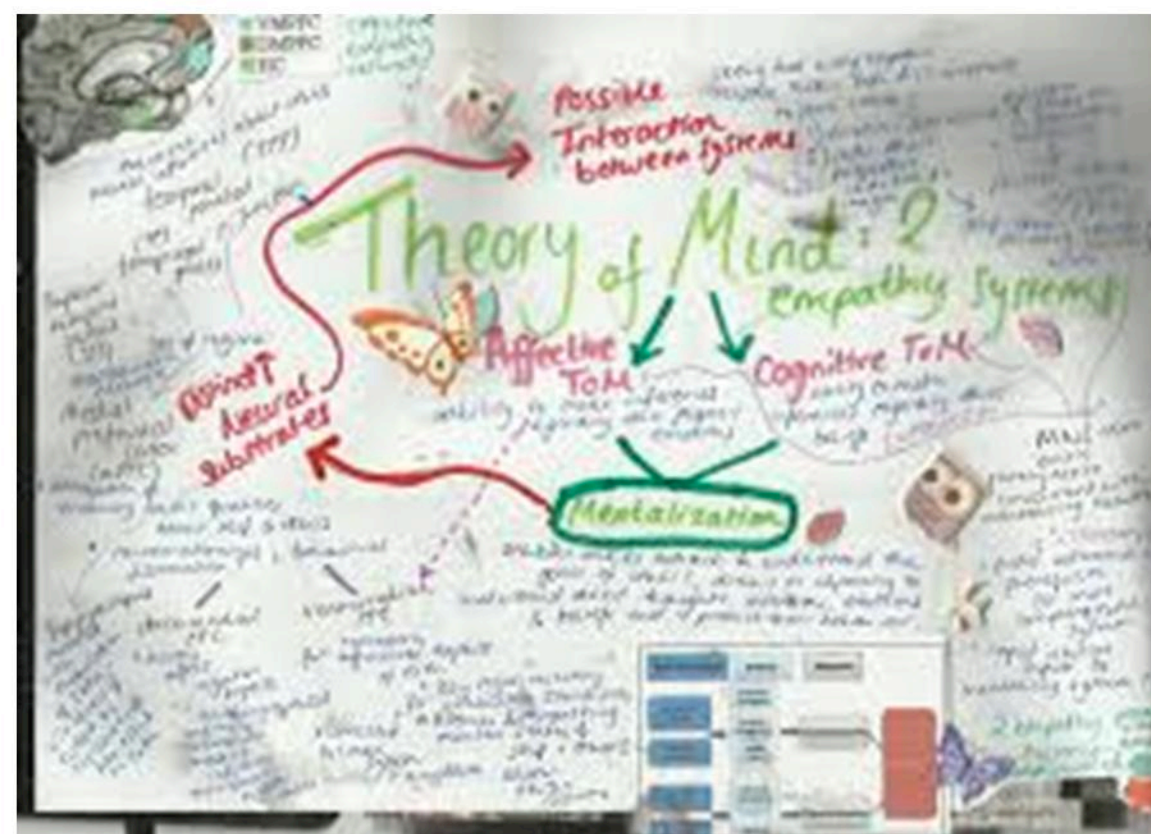www.dart.ed.ac.uk

## Background

- Theory of Mind (ToM) is a highly influential concept which has shaped autism research over the past 30 years [1,2]
- The model suggests that most people with autism spectrum disorder (ASD) have a profound difficulty understanding the minds of other people, including their emotions, feelings, beliefs and thoughts [3]
- Theory of Mind has had a significant influence on research and, to a lesser extent, clinical and educational practice [4]
- The model implies that successful interventions to teach ToM could have far-reaching effects on behaviours and outcome

### The goal of this review is to evaluate the efficacy of interventions based on the ToM model for individuals with ASD and thus test its validity and relevance to clinical and educational practice
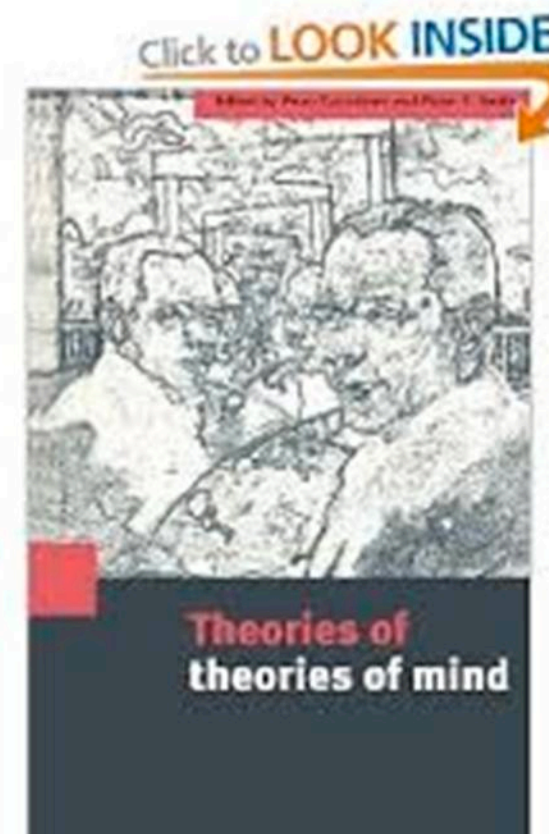
*As these images illustrate, Theory of Mind is a shifting concept, developmentally and theoretically linked to a range of associated skills and neural underpinnings*

## Methods

Searches
- Eight international databases including MEDLINE and PsycINFO
- Hand searches of relevant journals, conference proceedings
- Direct contact with authors in the field to source unpublished or very new data

Types of studies: randomised and quasi-randomised controlled trials
Participants: All ASD, based on clinical best estimate, usually confirmed by an appropriate diagnostic tool

Types of Interventions:
- designed to teach ToM
- designed to teach a precursor of ToM (e.g. imitation, joint attention)
- based on or inspired by ToM models of autism
- aim to test the ToM model of autism

Study selection and data extraction:
- All studies selected independently by two authors
- All data extracted independently by two authors
- Risk of bias evaluated independently by two authors
- In each case a third author arbitrated as needed

Studies combined based on similarity in….
- intervention delivery type
- target skill
- participant group
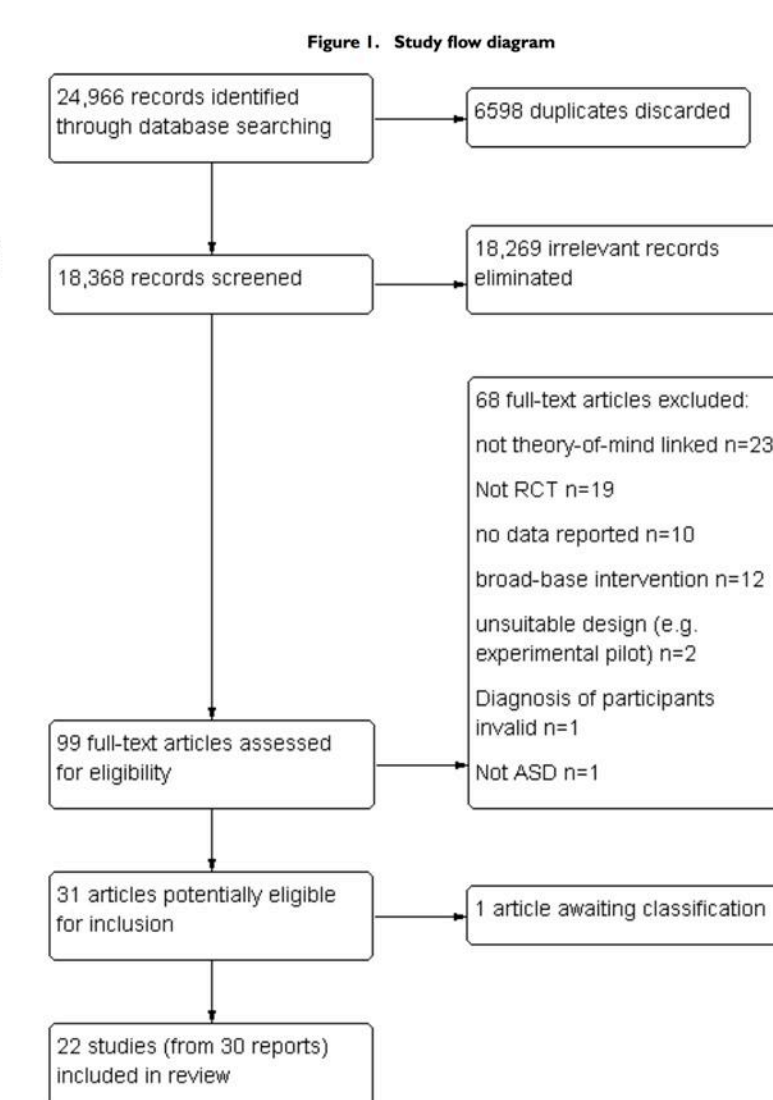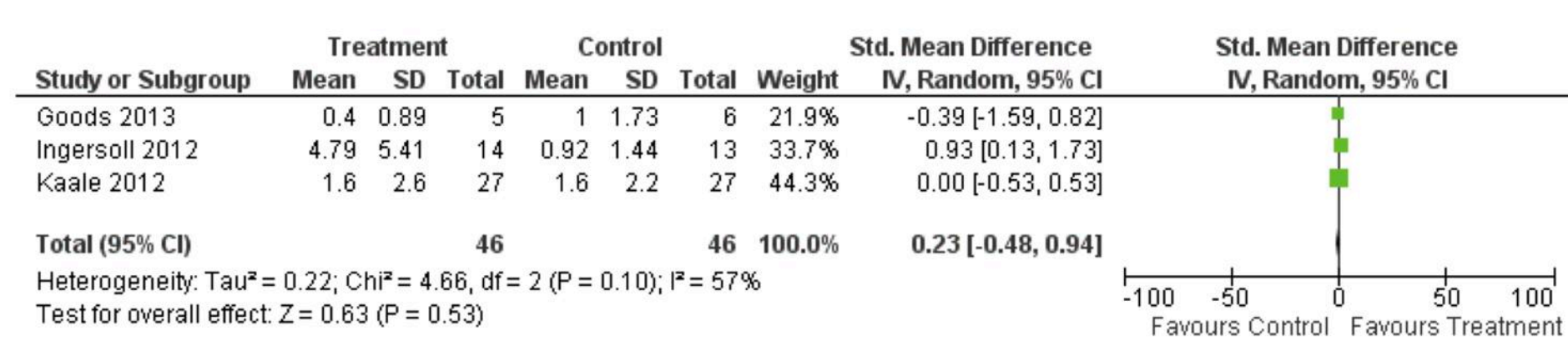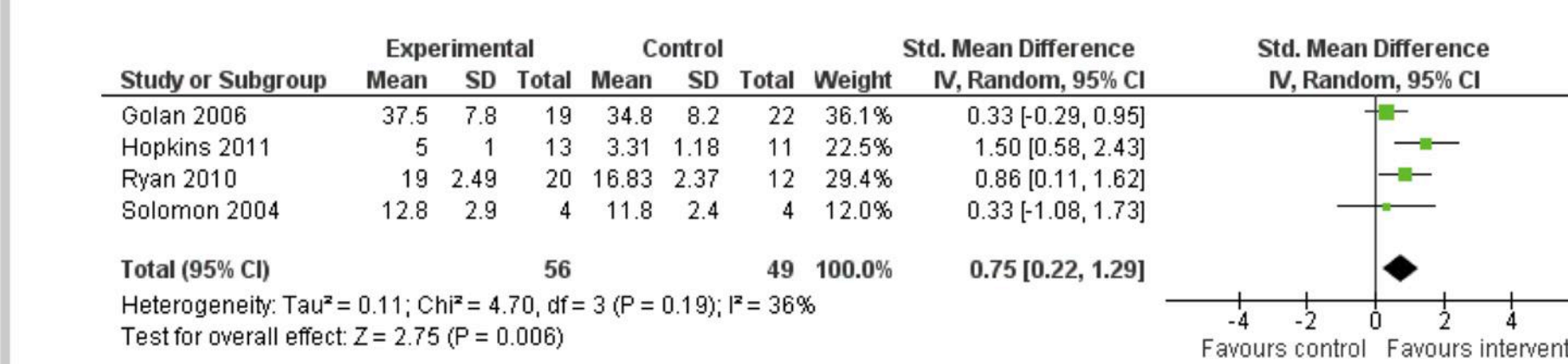- primary outcome skill and measure
- comparison group status

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Included studies: Baghdadli 2013; Begeer 2011; Bolte 2002; Fisher 2005; Golan 2006; Golan 2010; Goods 2013; Hadwin 1998; Hopkins 2011; Ingersoll 2012; Kaale 2012; Kasari 2006; Kim 2009; Landa 2011; Ryan 2010; Schertz 2013; Solomon 2004; Williams 2012; Wong 2010; Wong 2013; Young 2012.
**Please email sue.fletcher-watson@ed.ac.uk for a copy of the published review which details all included studies, and exclusions:**
Fletcher-Watson, S., McConnell, F., Manola, I. & McConachie, H.R.M. (2014). Interventions based on the theory of mind cognitive model for autism spectrum disorder. *Cochrane Database of Systematic Reviews.*

1. Baron-Cohen, S., Leslie, A.M. & Frith, U. (1985). Does the autistic child have a 'theory of mind'? *Cognition* 21: 37-46.
2. Baron-Cohen, S. (2000). Theory of mind and autism: A fifteen year review. *Understanding other minds*: 3-20.
3. Garfield, J., Peterson, C. & Perry, T. (2001). Social cognition, language acquisition and the development of theory of mind. *Mind and Language* 16(5):494-541.

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**Figure 4.** Forest plot of comparison: I test, outcome: I.3 Joint attention initiations in standardised assessment.

| Study or Subgroup | Treatment Mean | SD | Total | Control Mean | SD | Total | Weight | Std. Mean Difference IV, Random, 95% CI |
|---|---|---|---|---|---|---|---|---|
| Goods 2013 | 0.4 | 0.89 | 5 | 1 | 1.73 | 6 | 21.9% | -0.39 [-1.59, 0.82] |
| Ingersoll 2012 | 4.79 | 5.41 | 14 | 0.92 | 1.44 | 13 | 33.7% | 0.93 [0.13, 1.73] |
| Kaale 2012 | 1.6 | 2.6 | 27 | 1.6 | 2.2 | 27 | 44.3% | 0.00 [-0.53, 0.53] |
| Total (95% CI) | | | 46 | | | 46 | 100.0% | 0.23 [-0.48, 0.94] |

Heterogeneity: Tau² = 0.22; Chi² = 4.66, df = 2 (P = 0.10); I² = 57%
Test for overall effect: Z = 0.63 (P = 0.53)

Figure 4 interpretation:
- Meta-analysis indicates no significant effect on social behaviour measured by a standardised tool (Early Social Communication Scales)
- Studies all reported on individual therapist-led treatments; two targeting social communication and one imitation intervention.
- Linked studies not included in this meta-analysis did report treatment gains in social communication behaviours
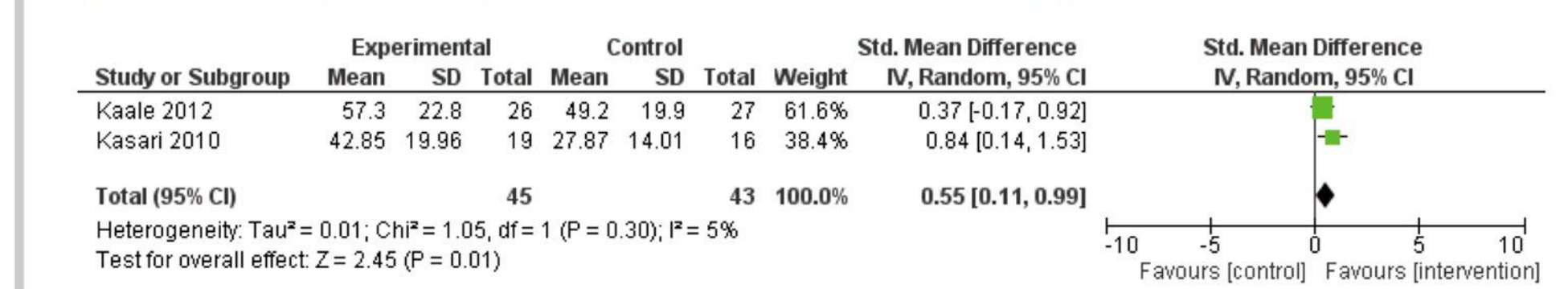
**Figure 5.** Forest plot of comparison: I test, outcome: I.2 Emotion recognition from face photographs, TAU control.

| Study or Subgroup | Experimental Mean | SD | Total | Control Mean | SD | Total | Weight | Std. Mean Difference IV, Random, 95% CI |
|---|---|---|---|---|---|---|---|---|
| Golan 2006 | 37.5 | 7.8 | 19 | 34.8 | 8.2 | 22 | 36.1% | 0.33 [-0.29, 0.95] |
| Hopkins 2011 | 5 | 1 | 13 | 3.31 | 1.18 | 11 | 22.5% | 1.50 [0.58, 2.43] |
| Ryan 2010 | 19 | 2.49 | 20 | 16.83 | 2.37 | 12 | 29.4% | 0.86 [0.11, 1.62] |
| Solomon 2004 | 12.8 | 2.9 | 4 | 11.9 | 2.4 | 4 | 12.0% | 0.33 [-1.08, 1.73] |
| Total (95% CI) | | | 56 | | | 49 | 100.0% | 0.75 [0.22, 1.29] |

Heterogeneity: Tau² = 0.11; Chi² = 4.70, df = 3 (P = 0.19); I² = 36%
Test for overall effect: Z = 2.75 (P = 0.006)

Figure 5 interpretation:
- Meta-analysis indicates a significant effect on emotion recognition skills measured using static photographs of faces
- Studies reported on technology-based or group-based therapeutic intervention types
- Linked studies not included in this meta-analysis also revealed treatment gains in close-generalisation tasks

**Figure 6.** Forest plot of comparison: I test, outcome: I.1 Joint engagement in mother-child interaction.

| Study or Subgroup | Experimental Mean | SD | Total | Control Mean | SD | Total | Weight | Std. Mean Difference IV, Random, 95% CI |
|---|---|---|---|---|---|---|---|---|
| Kaale 2012 | 57.3 | 22.8 | 26 | 49.2 | 19.9 | 27 | 61.6% | 0.37 [-0.17, 0.92] |
| Kasari 2010 | 42.85 | 19.96 | 19 | 27.87 | 14.01 | 16 | 38.4% | 0.84 [0.14, 1.53] |
| Total (95% CI) | | | 45 | | | 43 | 100.0% | 0.55 [0.11, 0.99] |

Heterogeneity: Tau² = 0.01; Chi² = 1.05, df = 1 (P = 0.30); I² = 5%
Test for overall effect: Z = 2.45 (P = 0.01)

Figure 6 interpretation:
- Meta-analysis indicates a significant effect on social behaviours during mother-child interaction
- Studies reported on one therapist-led and one parent-mediated intervention for social communication behaviours
- Studies also showed some limited evidence of generalisation to new interaction partners or settings

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## Included papers...

22 studies from 30 reports
n=695 participants
Samples n=10 to n=61
Preschool to adult
9 HFA samples

## Intervention targets...

5 Theory of Mind
7 emotion recognition
9 social attention
1 imitation

## Intervention methods...

6 technology based
8 therapist-led
4 group treatment
4 parent-training

## Summary of Results

- Positive treatment effects on the target skill were reported widely
  ⇒ Studies found improvement in imitation and false-belief abilities
  ⇒ There was mixed evidence of impact of social communication intervention on play
  ⇒ Parent-report measures of general social skills were usually positive across a range of studies, but rarely blind
- Otherwise, there was little evidence of 'knock-on' effects on abilities
- Treatment gains rarely generalized to new settings (e.g. play with parent instead of therapist) or new evaluation materials (e.g. emotion recognition using novel stimuli)
- Social communication interventions (joint attention and other fundamental of social interaction) were most successful at producing generalized and extended effects
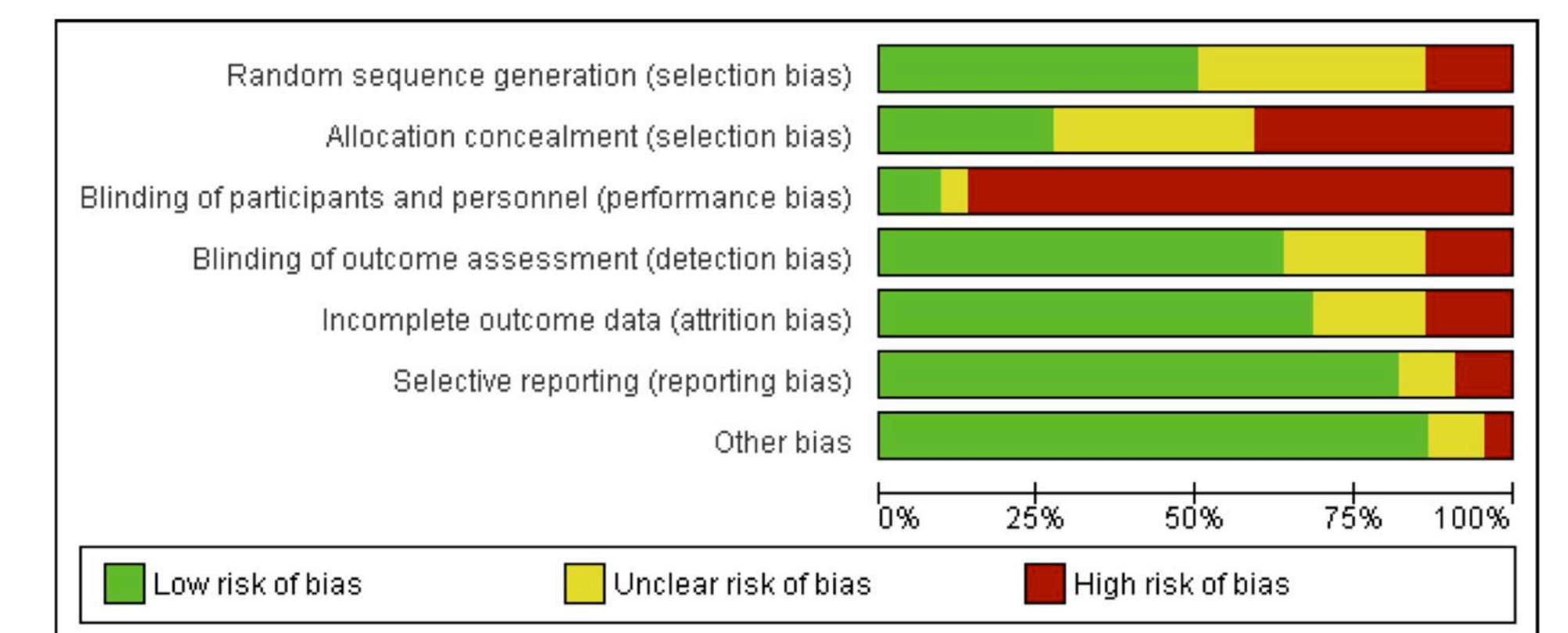
## Quality of the Evidence

- Risk of bias was high in some categories
- Lack of detailed reporting often hampered accurate evaluation of risk of bias
- This review was also challenged by the wide variety of measures used to evaluate outcome
  - Most studies employed multiple measures and did not always identify a primary outcome *a priori*
  - Measures selected rarely corresponded to the core diagnostic domains of autism
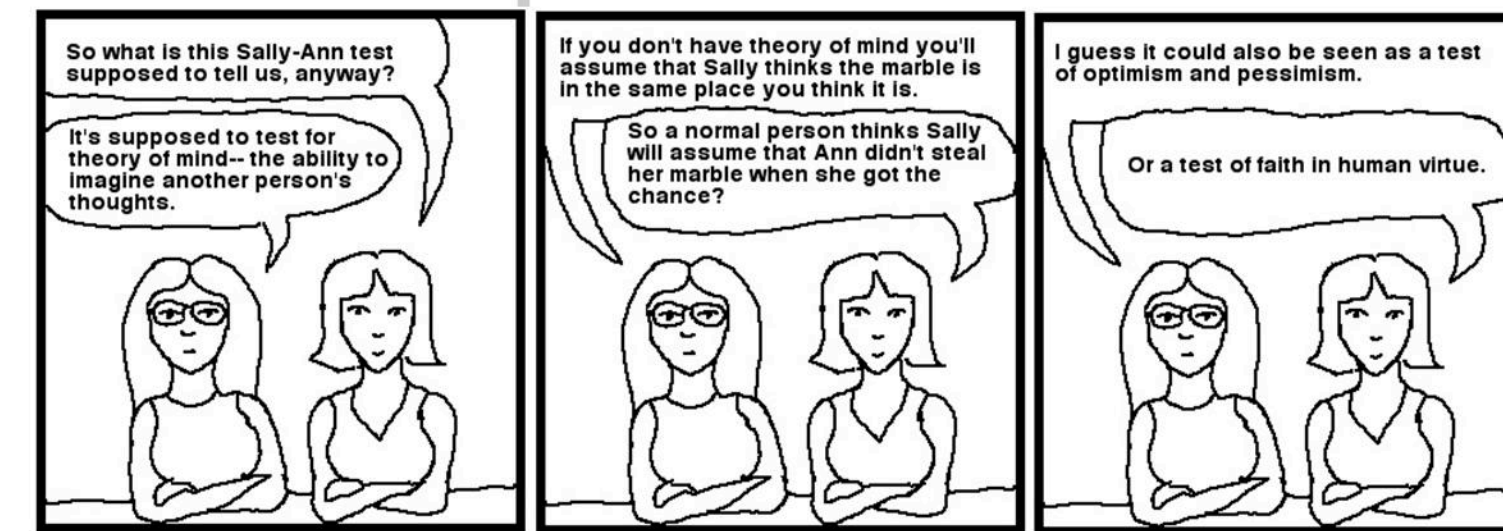- No intervention studies were explicitly designed to test the ToM model

## Conclusions

- Intervention studies were successful in improving the target skill but rarely produced generalised effects.
- Social communication interventions, usually with young children with core autism, had the strongest evidence base and showed the best signs of generalisation and maintenance in the long-term
- The skills targeted in the reviewed interventions are theoretically and developmentally linked but it is rare for an intervention to trigger this developmental chain
- The quality of evidence in the field on the whole is low and researchers need to continue to strive for high standards in intervention trial design, especially robust, relevant and consistent outcome measurement.
- There is currently very limited evidence for the relevance of Theory of Mind to clinical and educational practice

**Figure 2.** 'Risk of bias' graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

- Random sequence generation (selection bias)
- Allocation concealment (selection bias)
- Blinding of participants and personnel (performance bias)
- Blinding of outcome assessment (detection bias)
- Incomplete outcome data (attrition bias)
- Selective reporting (reporting bias)
- Other bias

0%  25%  50%  75%  100%

Low risk of bias    Unclear risk of bias    High risk of bias