EARLY START DENVER MODEL

**A NATURALISTIC DEVELOPMENTAL BEHAVIORAL INTERVENTION
DESIGNED FOR PRESCHOOLERS WITH AUTISM SPECTRUM DISORDER**

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Journal of Autism and Developmental Disorders

AJ DREXEL AUTISM INSTITUTE

http://drexel.edu/autisminstitute/

Prof. Craig Newschaffer,
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Associate Prof. Diana Robins
*Early Detection and Intervention
Program Leader*

Associate Prof. Paul Shattuck
*Life Course Outcomes
Program Leader*

EARLY DETECTION AND INTERVENTION PROGRAM

Goal: understanding how **early detection** and **early intervention** practices **improve outcomes** in ASD
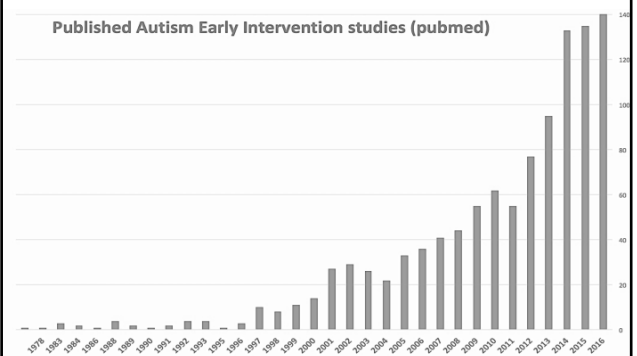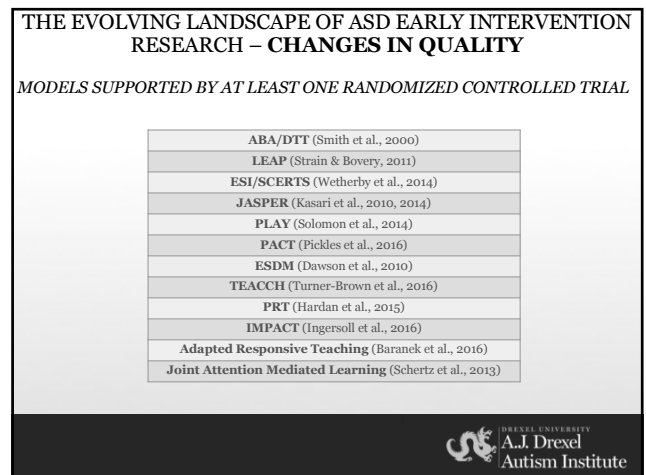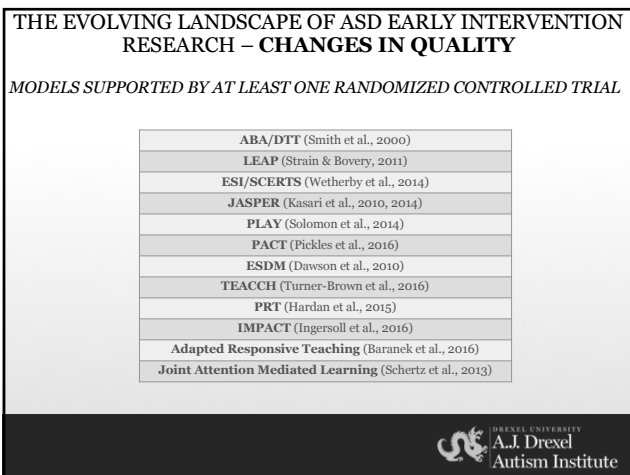
Focus on characteristics of the:
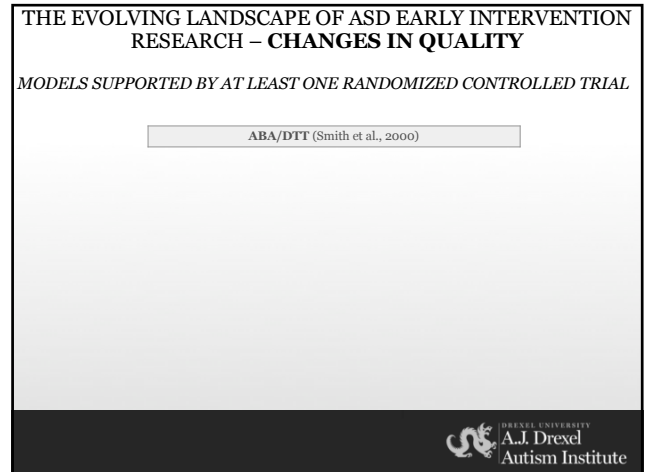
Child   Program   Context

THE EVOLVING LANDSCAPE OF ASD EARLY INTERVENTION RESEARCH – **CHANGES IN QUANTITY**
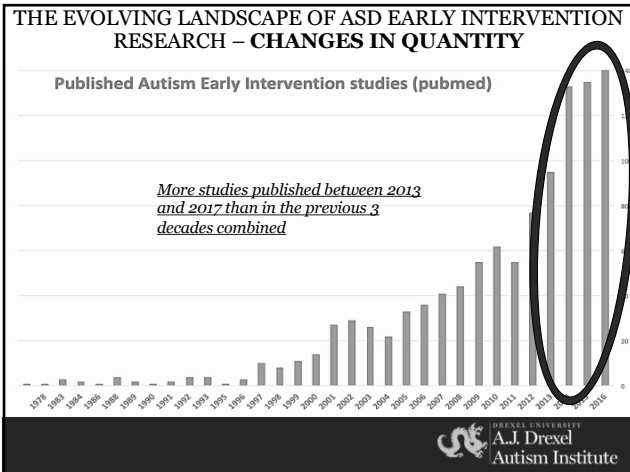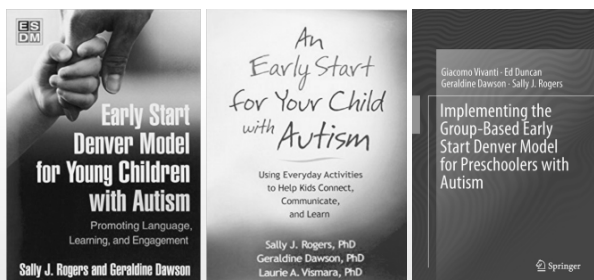
Published Autism Early Intervention studies (pubmed)

THE EVOLVING LANDSCAPE OF ASD EARLY INTERVENTION RESEARCH – **CHANGES IN QUANTITY**

Published Autism Early Intervention studies (pubmed)

More studies published between 2013 and 2017 than in the previous 3 decades combined

THE EVOLVING LANDSCAPE OF ASD EARLY INTERVENTION RESEARCH – **CHANGES IN QUALITY**

MODELS SUPPORTED BY AT LEAST ONE RANDOMIZED CONTROLLED TRIAL

ABA/DTT (Smith et al., 2000)

THE EVOLVING LANDSCAPE OF ASD EARLY INTERVENTION RESEARCH – **CHANGES IN QUALITY**

MODELS SUPPORTED BY AT LEAST ONE RANDOMIZED CONTROLLED TRIAL

ABA/DTT (Smith et al., 2000)
LEAP (Strain & Bovery, 2011)
ESI/SCERTS (Wetherby et al., 2014)
JASPER (Kasari et al., 2010, 2014)
PLAY (Solomon et al., 2014)
PACT (Pickles et al., 2016)
ESDM (Dawson et al., 2010)
TEACCH (Turner-Brown et al., 2016)
PRT (Hardan et al., 2015)
IMPACT (Ingersoll et al., 2016)
Adapted Responsive Teaching (Baranek et al., 2016)
Joint Attention Mediated Learning (Schertz et al., 2013)

THE EVOLVING LANDSCAPE OF ASD EARLY INTERVENTION RESEARCH – **CHANGES IN QUALITY**

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EARLY START DENVER MODEL (ROGERS AND COLLEAGUES)

Those who fall in love with practice without science are like a sailor who enters a ship without a helm or a compass, and who never can be certain whither he is going (Leonardo Da Vinci, circa 1490)

- RESEARCH INFORMING ESDM

- ESDM PRACTICES

- ESDM OUTCOME RESEARCH

- ***RESEARCH INFORMING ESDM***

- ESDM PRACTICES

- ESDM OUTCOME RESEARCH

NEED TO EXPAND RESEARCH KNOWLEDGE TO INFORM EFFECTIVE INTERVENTIONS

❖ Early intervention focuses on facilitating the acquisition (learning) of novel skills in children with ASD

❖ Therefore, interventions should evolve when our knowledge on how children with ASD learn changes

❖ Lack of cross-fertilization between research and practice – 80% of applied research in ASD fails to cite basic science research, and viceversa

(Kazdin, 1999; Vivanti, 2017, Curr Dir Psychol Sci; Vivanti & Nuske, 2016, Behav Brain Res; Critchfield et al., 2015)

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RESEARCH ON THE SELECTIVE NATURE OF EARLY LEARNING

• Early learning driven by <u>selective</u> responsivity to:

1. <u>Ostensive pedagogical cues,</u> including:
   • Verbal Labels *(Baldwin & Markman, 1989; Bloom, 2002)*
   • Eye-Contact and gaze cues *(Csibra & Gergely, 2011; Wang et al., 2010)*
   • Affect *(Nielsen et al, 2008; Brand & Shallcross, 2008)*
   • Goals *(Over & Carpenter, 2012)*

2. <u>Novelty versus repetition</u> *(Stahl & Feigenson, 2015; Mather, 2013)*

(Vivanti & Rogers, 2014, Phil Trans R Soc B; Vivanti et al., 2017, Cognition)

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EARLY LEARNING IN AUTISM SPECTRUM DISORDER

Children with ASD can and do learn – not a learning disability

• Intact ability to learn from own actions via trial & error *(Vivanti et al 2016, Mol Aut)*

• Intact implicit learning *(Foti, Vivanti et al 2015, Psych Med)*

However difficulties in **social learning** – learning from (and about) actions and communication of other people

(Vivanti & Rogers, 2014; Vivanti, Dawson & Rogers, 2017)

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However difficulties in **social learning** – learning from (and about) actions and communication of other people

Early differences in early emerging preferences and responses that support social learning

'System preferences' facilitating learning in typical development are reversed

More independent as children, but in most cases more dependent as adults

(Vivanti & Rogers, 2014; Vivanti, Dawson & Rogers, 2017)

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PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B

rstb.royalsocietypublishing.org

Autism and the mirror neuron system: insights from learning and teaching

Giacomo Vivanti[1,2] and Sally J. Rogers[3]

[1]Olga Tennison Autism Research Centre, School of Psychological Science, and [2]Victorian Autism Specific Early Learning and Care Centre, La Trobe University, Melbourne, Victoria, Australia
[3]The MIND Institute, University of California, Davis Medical Center, Sacramento, CA, USA

Ability for Social Learning

Motivation for Social Learning

Social Modulation of Learning

Journal of Abnormal Child Psychology

Mechanisms of Imitation Impairment in Autism Spectrum Disorder

Giacomo Vivanti · David Trembath · Cheryl Dissanayake

Attention to the demonstration

$F_{(2, 54)}=4.55$; p=0.01, $\eta2= 0.15$

Frequency

$F_{(2,60)}=12.89$; $p <0.001$, $\eta2=0.30$

Style

$F_{(2,58)}=10.68$, $p <0.001$, $\eta2=0.49$
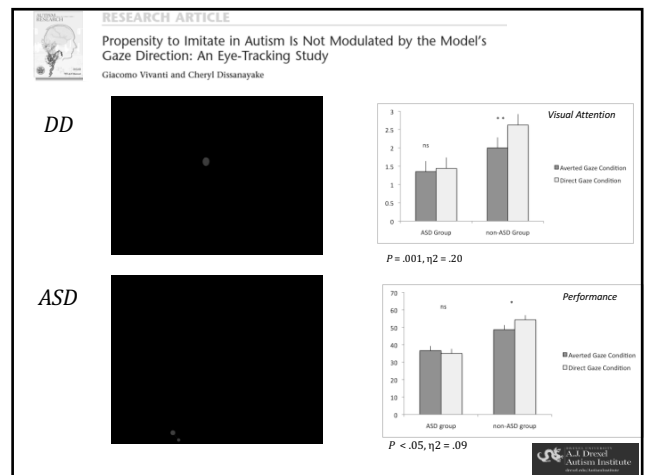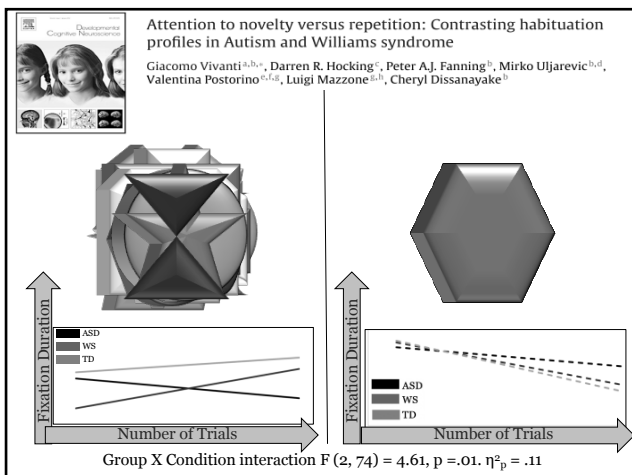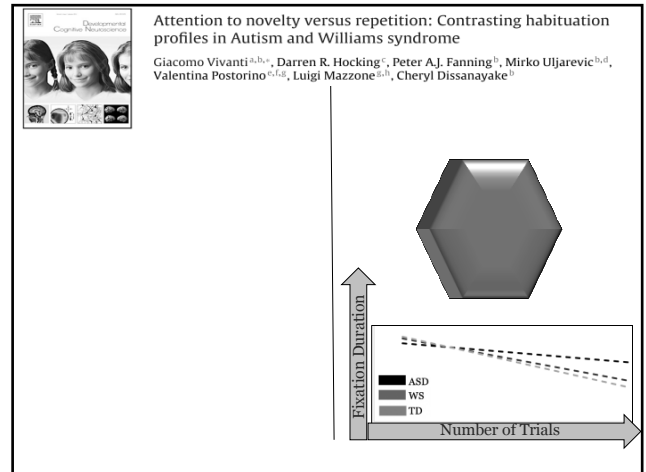
No Evidence of Emotional Dysregulation or Aversion to Mutual Gaze in Preschoolers with Autism Spectrum Disorder: An Eye-Tracking Pupillometry Study

Heather J. Nuske[1,2] · Giacomo Vivanti[1,3] · Cheryl Dissanayake[1]
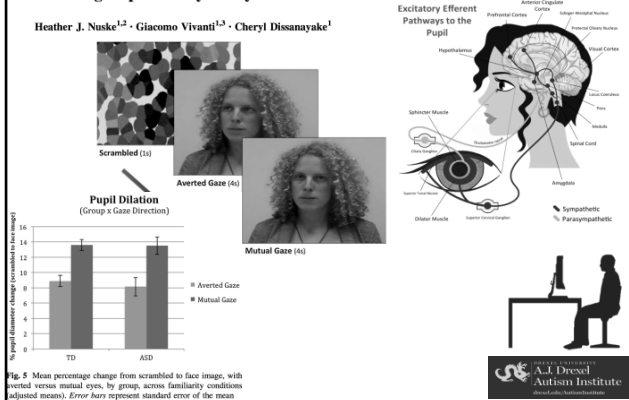
Others' emotions teach, but not in autism: an eye-tracking pupillometry study

Heather J. Nuske[1,2], Giacomo Vivanti[2,3] and Cheryl Dissanayake[2]

Group X Condition interaction
$(F(1,38) = 9.42, p = .004, \eta^2 = .20)$
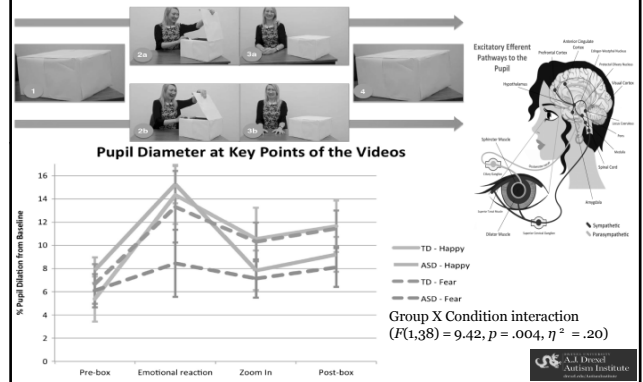
Social affiliation motives modulate spontaneous learning in Williams syndrome but not in autism

Giacomo Vivanti[1,2*], Darren R. Hocking[3], Peter Fanning[2] and Cheryl Dissanayake[2]

Playful vs Neutral Model - WS

Social vs Instrumental Imitation

Group X Condition Interaction –
F (2, 52)=5.5; p<0.05, η2= .09
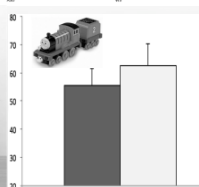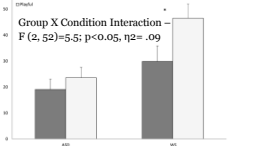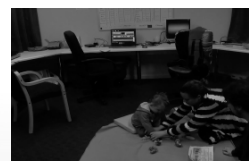
(Vivanti et al., 2016, Mol Aut)

Learning by watching *vs* learning by doing

Number of errors in the first, second, and third object presentation in experiment
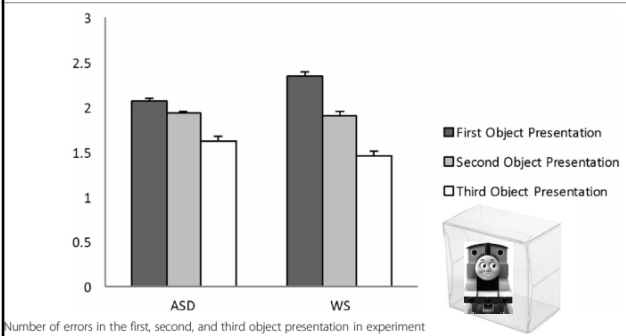
- No group differences between ASD and WS
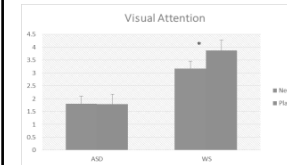- TD at ceiling

Playful vs Non-Playful Imitation

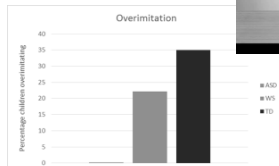Playful model   Non-playful model

Group
$F_{(2, 52)} = 12.61; p < 0.001, \eta^2 = .2$

Group X Condition Interaction –
$F_{(2, 52)} = 5.5; p = 0.02, \eta^2 = .1$

The social nature of overimitation: Insights from Autism and Williams syndrome

Giacomo Vivanti [a,b,*], Darren R. Hocking [c], Peter Fanning [b], Cheryl Dissanayake [b]

Verbal labels increase the salience of novel objects for preschoolers with typical development and Williams syndrome, but not in autism

Journal of Neurodevelopmental Disorders

Giacomo Vivanti [1,2*], Darren R. Hocking [3], Peter Fanning [2] and Cheryl Dissanayake [2]

Visual attention
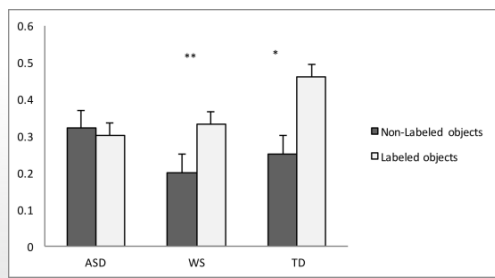
Group X Condition Interaction - F (2, 60)=4.23; p=0.01, $\eta_p^2 = 0.13$
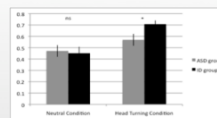
Importance of individual differences

Exp Brain Res (2014) 232:695–701

Atypical monitoring and responsiveness to goal-directed gaze in autism spectrum disorder

Giacomo Vivanti · David Trembath · Cheryl Dissanayake

Goal understanding

$P = .001, \eta2 = .29$

RESEARCH ARTICLE

The Action Observation System when Observing Hand Actions in Autism and Typical Development

Jennifer J. Pokorny, Naomi V. Hatt, Costanza Colombi, Giacomo Vivanti, Sally J. Rogers, and Susan M. Rivera
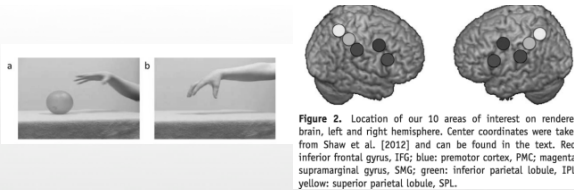
Figure 2. Location of our 10 areas of interest on rendered brain, left and right hemisphere. Center coordinates were taken from Shaw et al. [2012] and can be found in the text. Red: inferior frontal gyrus, IFG; blue: premotor cortex, PMC; magenta: supramarginal gyrus, SMG; green: inferior parietal lobule, IPL; yellow: superior parietal lobule, SPL.

Same response to goal-directed and non goal-directed actions (in TD $p <.001$)

Implications for teaching practices

❖ Visual attention and learning less modulated by pedagogical cues and novelty

❖ Relevance of goals

❖ Individual differences

❖ Implication for teaching

- RESEARCH INFORMING ESDM

- **_ESDM PRACTICES_**

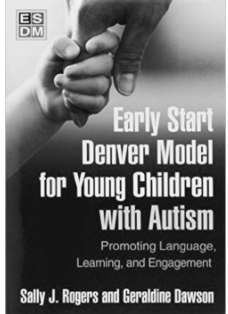- ESDM OUTCOME RESEARCH

Early Start Denver Model

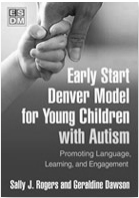Comprehensive comprehensive early intervention for toddlers with autism ages 12–48 months.

"Denver Model"
Sally Rogers and colleagues, 1984

"Early Start Denver Model"
Rogers & Dawson, 2010

CRITICAL TREATMENT TARGETS

Behaviors that enable social learning and engagement in naturalistic social interaction and cooperative activities

Imitation
Social Orientation
Joint Attention
Emotion Sharing
Communication

Social Learning Infrastructure

ESDM - DEVELOPMENTAL APPROACH

Curriculum follows Developmental Sequences

Scaffolding, shared control, use of child-preferred activities for meaning, motivation and reward

ESDM PRINCIPLES

❖ Teaching episodes are embedded in daily routines and playful social interaction (Joint Activity Routines)

❖ Active experiential learning promoted by following children's preferences and motivation

❖ Social-pragmatic view of language development

❖ ABA strategies (ABC, fading, prompting etc..)

❖ Data-driven (including, individualized goals, fidelity, decision tree)

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ESDM – TREATMENT PRACTICES

Table 1 – Commonalities and differences between ABA/DTT and ESDM instructional approaches

Shared Principles and Strategies	Differences in Teaching Procedures	
	DTT	ESDM
Individualization of treatment goals Comprehensive Intensity Manualized teaching practices and fidelity systems Data-based monitoring of progress Three-part contingency structure (Antecedent, Behavior, Consequence) Use of behavioral techniques (e.g. prompting, fading, shaping)	Adult-directed	Shared control
	adult selects teaching materials, settings, activity and reinforcers	*adult builds learning opportunities on child's spontaneous interest*
	Extrinsic Reinforcers	Intrinsic Reinforcers
	consequence of the desired behavior is an external reward, (e.g. token, edible)	*desired behavior occurs in the context of inherently rewarding social interactions*
	Discrete Trial format	Joint Activity Routine format
	adult delivers stripped-down, concise, and unambiguous instructional cues	*adult displays animated/playful facial emotions and body language when delivering instructional cues*

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THE STARTING POINT – EVALUATION: ESDM CURRICULUM CHECKLIST

• ESDM Curriculum Checklist: Criterion-referenced tool which provides developmental sequences of skills in 8 domains

• 480 items organized in 4 levels:
   • 9-12 up to 48 month period

• Placement of items across levels reflects typical child development research and clinical experience


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FRAMEWORK FOR TEACHING: JOINT ACTIVITY ROUTINES

• Follows child choice or interest

• Both partners engage in activity

• Targets multiple objectives from different domains

• Brief, 2-4 minutes in length

❑ **Step 1:** Set Up (Develop a theme)

❑ **Step 2:** Theme (Take turns, collaborate)

❑ **Step 3:** Add variations (increase play complexity, expand child repertoire, target multiple objectives, build up flexibility)

❑ **Step 4:** Close the activity and transition to new one

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EARLY START DENVER MODEL (ROGERS AND COLLEAGUES)
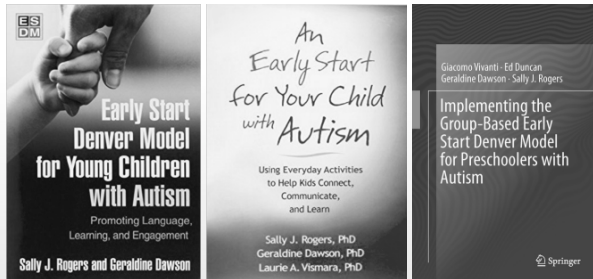
GROUP-BASED EARLY START DENVER MODEL
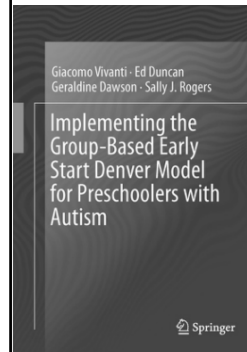
Focused on facilitating learning within small groups through guided peer interaction (1:3/1:4)

Target: community childcare/preschool programs

Rationale

- ❖ Small group environments more consistent with common cultural practices
- ❖ Peers and childcare teachers - untapped resources
- ❖ Concerns with sustainability of 1:1
- ❖ Concerns with parent-implemented programs
- ❖ More opportunities to target goals needed in the next learning environment, including:
  - ❖ Following shared daily routines
  - ❖ Participating in group activities
  - ❖ Social engagement and play with peers
  - ❖ Daily living and safety skills (e.g., hat!)

(Rogers & Lewis 1989; Rogers, 1998; Rogers & Dawson, 2010)

Fostering peer interactions

Set Up:
- Physical positioning
- Parallel play with double toy sets
- Materials as magnets
- Adults as "invisible supports"

Circle games

Goals:
- Giving materials to peers
- Taking materials from peers
- Showing objects
- Asking for a turn
- Asking for an object
- Saying "no", "mine", "not yet" or "in a minute"
- Responding to peer greetings

FROM ESDM TO G-ESDM - KEY ADAPTATIONS

- ❖ Low staff-to-child ratios (1:3 – 1:4)
- ❖ Individual goals are targeted within small group activities
- ❖ Activity centers
- ❖ Different levels of training in the team

Slide 1

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- RESEARCH INFORMING ESDM

- ESDM PRACTICES

- ***ESDM OUTCOME RESEARCH***

Slide 2

Randomized, Controlled Trial of an Intervention for Toddlers With Autism: The Early Start Denver Model
Geraldine Dawson, Sally Rogers, Jeffrey Munson, Milani Smith, Jamie Winter, Jessica Greenson, Amy Donaldson and Jennifer Varley

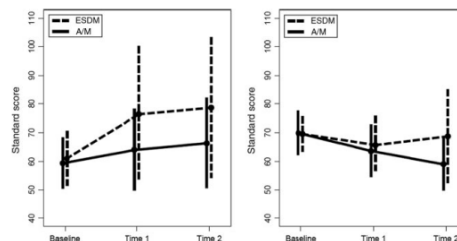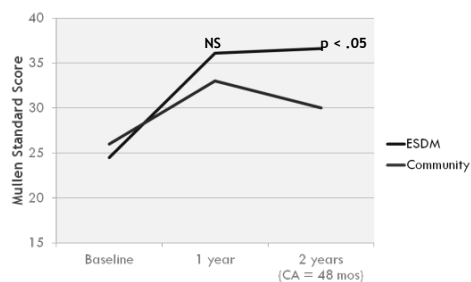48 Children < 2.5 years of age

ESDM vs. Community, 2 year intervention – 25 hr/week

FIGURE 2
Mean scores on the MSEL (left) and the VABS composite (right) for children in the ESDM and A/M groups 1 and 2 years after entering study. Error bars indicate ±1 SD.
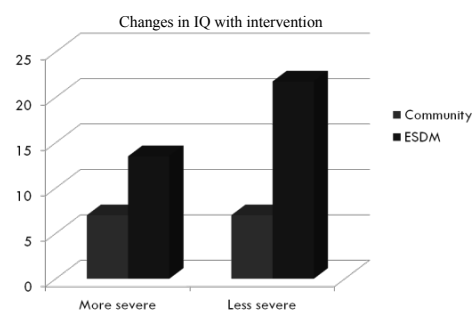
Slide 3

Effects of Intervention on Expressive Language
Dawson, et al., Pediatrics 2010

Slide 4

**Severity of ASD moderates outcomes, but those with more severe ASD improve in ESDM**
Dawson, et al., Pediatrics, 2010

Changes in IQ with intervention

Long-Term Outcomes of Early Intervention in 6-Year-Old Children With Autism Spectrum Disorder

Annette Estes, PhD, Jeffrey Munson, PhD, Sally J. Rogers, PhD, Jessica Greenson, PhD, Jamie Winter, PhD, Geraldine Dawson, PhD

- Follow-up of the same children, two years after
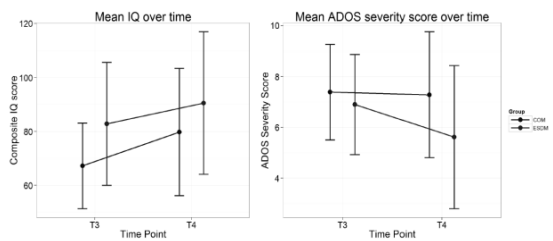
Cost Offset Associated With Early Start Denver Model for Children With Autism

Zuleyha Cidav PhD [1], Jeff Munson PhD [2], Annette Estes PhD [2], Geraldine Dawson PhD [3], Sally Rogers PhD [4], David Mandell ScD [1]

During treatment, costs for children in the ESDM group was higher by about $14,000 than those of children who received community-based treatment.

In the post-intervention period, compared with children who had earlier

received treatment as usual in community settings, children in the ESDM group needed less services, resulting in cost savings of about $19,000 per year per child.

Costs associated with ESDM treatment were fully offset within a few years after the intervention due to reductions in other service use and associated costs.

Early Behavioral Intervention Is Associated With Normalized Brain Activity in Young Children With Autism

Geraldine Dawson, Ph.D., Emily J.H. Jones, Ph.D., Kristen Merkle, B.S., Kaitlin Venema, B.S., Rachel Lowy, B.S., Susan Faja, Ph.D., Dana Kamara, B.S., Michael Murias, Ph.D., Jessica Greenson, Ph.D., Jamie Winter, Ph.D., Milani Smith, Ph.D., Sally J. Rogers, Ph.D., and Sara J. Webb, Ph.D.

Outcome study
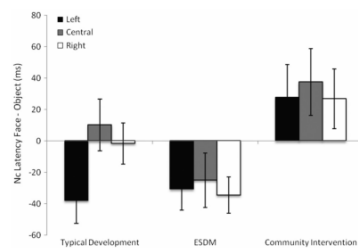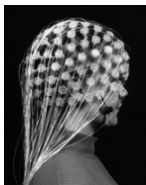
TD=17

ESDM=24

Comm=24

Figure 3.
Differences in peak latency of component (Nc) responses to faces and objects for children with typical development, Early Start Denver Model (ESDM) intervention, and community intervention. Note: Negative scores represent faster responses to faces than to objects.

Effects of a Brief Early Start Denver Model (ESDM)–Based Parent Intervention on Toddlers at Risk for Autism Spectrum Disorders: A Randomized Controlled Trial

12 wks, 1 hr clinic sessions involving collaborative parent coaching

Change in Parent Fidelity Scores
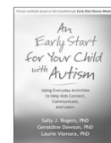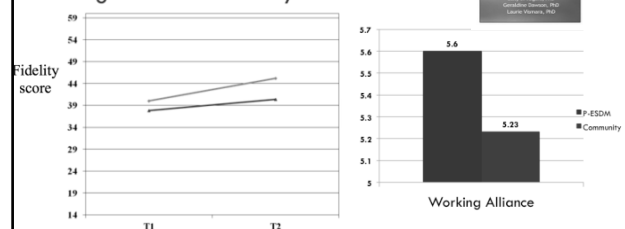
Autism Treatment in the First Year of Life: A Pilot Study of Infant Start, a Parent-Implemented Intervention for Symptomatic Infants

S. J. Rogers · L. Vismara · A. L. Wagner ·
C. McCormick · G. Young · S. Ozonoff

7 infants (7-15 month olds) symptomatic of ASD: sibs, clinical referrals

Consistently elevated scores and parent and expert clinician concerns

Parent coaching model

12 weeks, 1 session per week

Post-treatment fewer ASD symptoms compared to controls,

But more than typical children

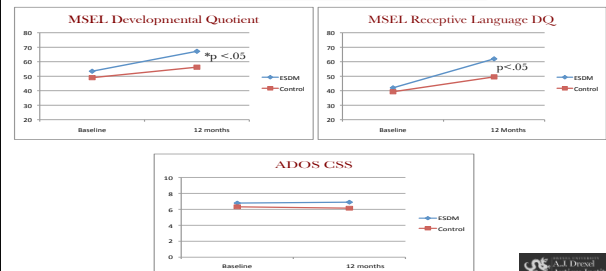All children except for 1 in the typical cognitive range

Effectiveness and Feasibility of the Early Start Denver Model Implemented in a Group-Based Community Childcare Setting
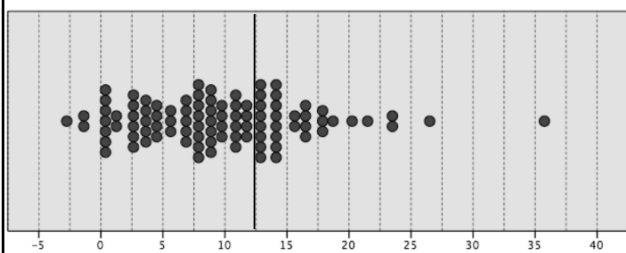
Giacomo Vivanti · Jessica Paynter ·
Ed Duncan · Hannah Fothergill · Cheryl Dissanayake ·
Sally J. Rogers · the Victorian ASELCC Team

Developmental Rate:
Individual Gains in Mullen Overall AE (n=96)

Developmental Rate:
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10 % Limited gains

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38 % Significant progress but developmental rate not in keeping with typical dev. norms

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10% Limited gains

38 % Significant progress but developmental rate not in keeping with typical dev. norms
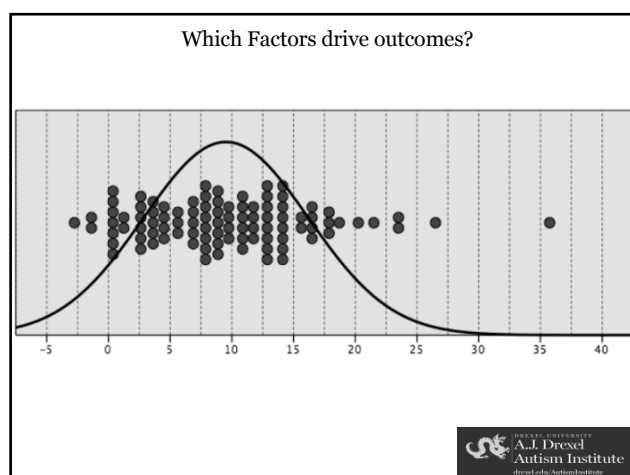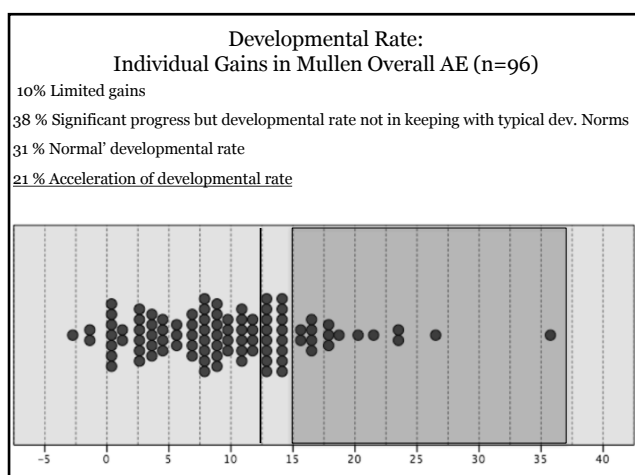
31 % 'Normal' developmental rate

Developmental Rate:
Individual Gains in Mullen Overall AE (n=96)

10% Limited gains

38 % Significant progress but developmental rate not in keeping with typical dev. Norms

31 % Normal' developmental rate

21 % Acceleration of developmental rate


Which Factors drive outcomes?

ARISTOTLE (340 BC)
"IT IS EASY TO KNOW THE EFFECTS OF HONEY, WINE AND OTHER REMEDIES. BUT TO KNOW HOW, FOR WHOM, AND WHEN WE SHOULD APPLY THESE AS REMEDIES IS NO LESS AN UNDERTAKING THAN BEING A PHYSICIAN"

DREXEL UNIVERSITY
A.J. Drexel
Autism Institute

Outcome for Children Receiving the Early Start Denver Model Before and After 48 Months

Giacomo Vivanti[1,2] · Cheryl Dissanayake[2] · The Victorian ASELCC Team[3]

Verbal Children (N=29)
$r = .02$, $p = .45$

Minimally Verbal Children (N=31)
$r = -.56$, $p = .001$
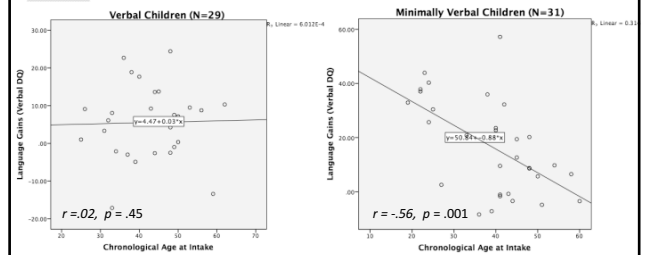
Language gains predicted by the combined effect of age and initial language level
(R square increase due to interaction $F=4.52$, $p<.05$)

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Autism Institute

Brief Report: Predictors of Outcomes in the Early Start Denver Model Delivered in a Group Setting
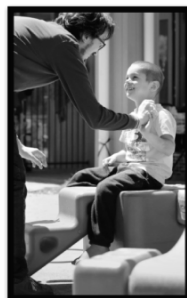
Giacomo Vivanti · Cheryl Dissanayake · Cynthia Zierhut · Sally J. Rogers · Victorian ASELCC Team

Children who benefit most from the ESDM are those who display:

- ⇧ Spontaneous functional play
- ⇧ Spontaneous imitation,
- ⇧ Gaze following/goal understanding,
- ⇩ Severity of autism symptoms
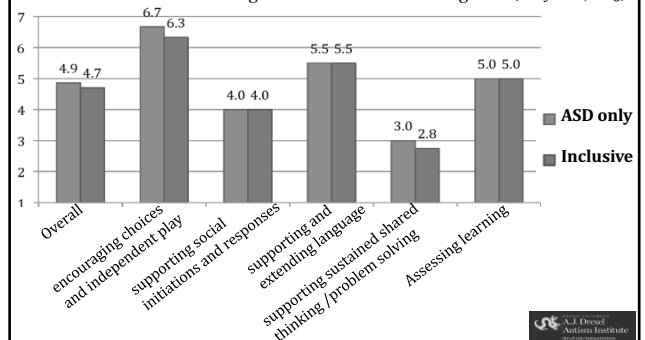
No significant role:

Overall cognitive level; RRB, social attention

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Impact of setting – inclusive vs segregated

- Pilot RCT - 16 children receiving Group-ESDM in a mainstream (inclusive) setting and 16 in an ASD-only (segregated) setting

- Sustained Shared Thinking and Emotional Well-Being scale *(Siraj et al., 2015)*

Category	ASD only	Inclusive
Overall	4.9	4.7
encouraging choices and independent play	6.7	6.3
supporting social initiations and responses	4.0	4.0
supporting and extending language	5.5	5.5
supporting sustained shared thinking /problem solving	3.0	2.8
Assessing learning	5.0	5.0

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Thank you for your attention!

The Victorian ASELCC team, OTARC team and Drexel EDI team

Sally J Rogers

Cheryl Dissanayake

Tristram Smith

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David Mandell

Connie Kasari

Heather Nuske

Darren Hocking

Peter Fanning

All the children who took part in their research and their families !

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