“JUST-IN-TIME” PROGRAMMING: DEVELOPMENTAL APPROPRIATENESS AND IMPLICATIONS FOR BEGINNING COMMUNICATORS

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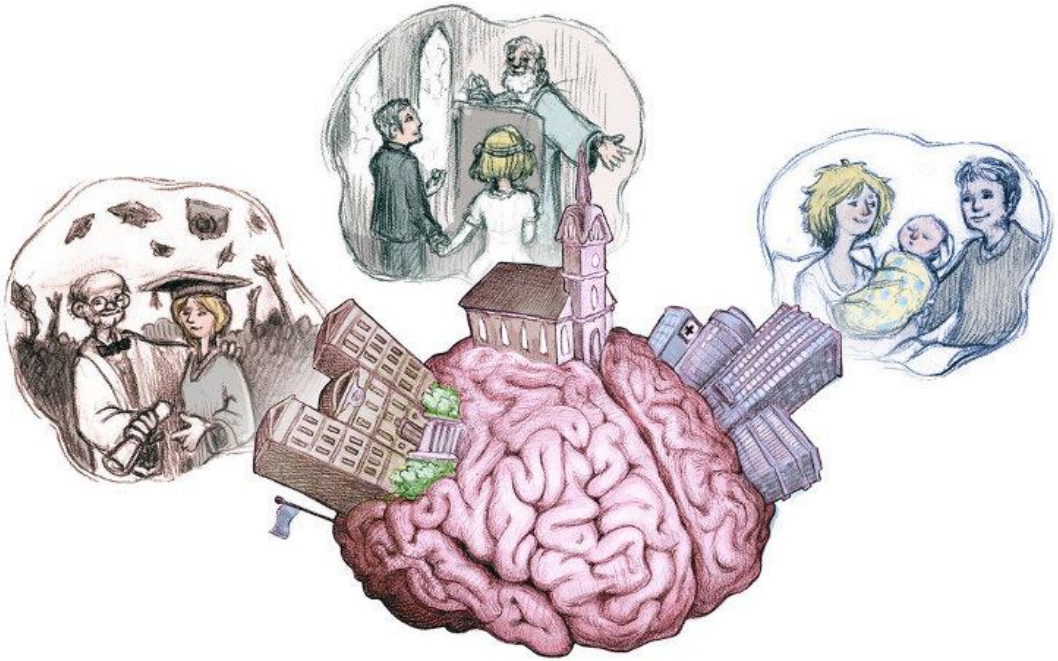
JIT PROGRAMMING AND LANGUAGE DEVELOPMENT FOR BEGINNING COMMUNICATORS

EARLY LANGUAGE ACQUISITION

- **Early spoken language acquisition centers largely on the development of a receptive and expressive lexicon representing single concepts (e.g., mom, bath, car)**
- **This acquisition largely occurs within the context of events in which concepts occur[1]**
  - Language representing a concept is extracted from the environment (i.e., from more sophisticated communicators' input), used within that environment, and then subjected to feedback[2]
    - "Dog!"
    - "You're right! That's a dog! A brown dog!"

EARLY LANGUAGE ACQUISITION, CONT'D

- **Language learners, then, rely heavily on episodic memory to retrieve the concepts they've learned within previous contexts/events for use at a later date[3]**



EARLY LANGUAGE / EARLY AAC PROGRAMMING

- **When mapping early language development onto AAC intervention for early language learners (or beginning communicators), there has sometimes been a disconnect[4]**
  - AAC programming often happened away from the early learner and the communication context[4]
  - Concepts (words) were often chosen and represented via adult-driven conceptualizations[4]
  - Word representations often did not capitalize on contextual knowledge or episodic memory[3]

VISUAL SCENE DISPLAYS (VSD)

- **Visual scene displays, (photographic or pictorial scenes of events with concepts embedded), address one aspect of disconnect: representation[3,5,6]**
  - They represent concepts (words) within the contexts in which they frequently occur; this may make them:
    - More recognizable
    - More accessible via episodic memory[3]

PROBLEMS REMAINED…

- **Although VSDs allowed for symbiosis between early language development and AAC in regards to representation, not all of the disconnect was resolved**
- **Programming and concept (word) choices were usually made by adults**
- **In fact, programming VSDs could be even more time-consuming and complex than programming traditional grids**

TECHNOLOGICAL ADVANCEMENTS TO ADDRESS LOGISTICS

- **With older renditions of AAC devices, programming had to be done away from learner's prior to interactions**
- **Thankfully, with the advent of mobile technology with onboard cameras now a standard feature as well as the complimentary evolution of AAC apps, programming has been streamlined**
- **Popular apps utilizing VSDs (e.g., GoTalkNow, Autismate) can be programmed quickly by adults who do not have experience or training with these apps[7]**
- **So quickly, in fact, that they can be used to program concepts within communication events/contexts, in response to interests demonstrated by language learners**
  - That is, content can be programmed "Just-in-time"[8]

SUMMARY OF AAC INTERVENTION FOR BEGINNING COMMUNICATORS, JIT, AND LANGUAGE DEVELOPMENT

- **Concepts (words) can now be programmed in the moment, Just-in-Time (JIT)**
- **This allows for them to be programmed based on the current context, particularly in response to interest demonstrated by the language learner[2]**
- **The learner can, in turn, express the newly acquired concept immediately within the context, and get feedback based on this expression[1,2]**

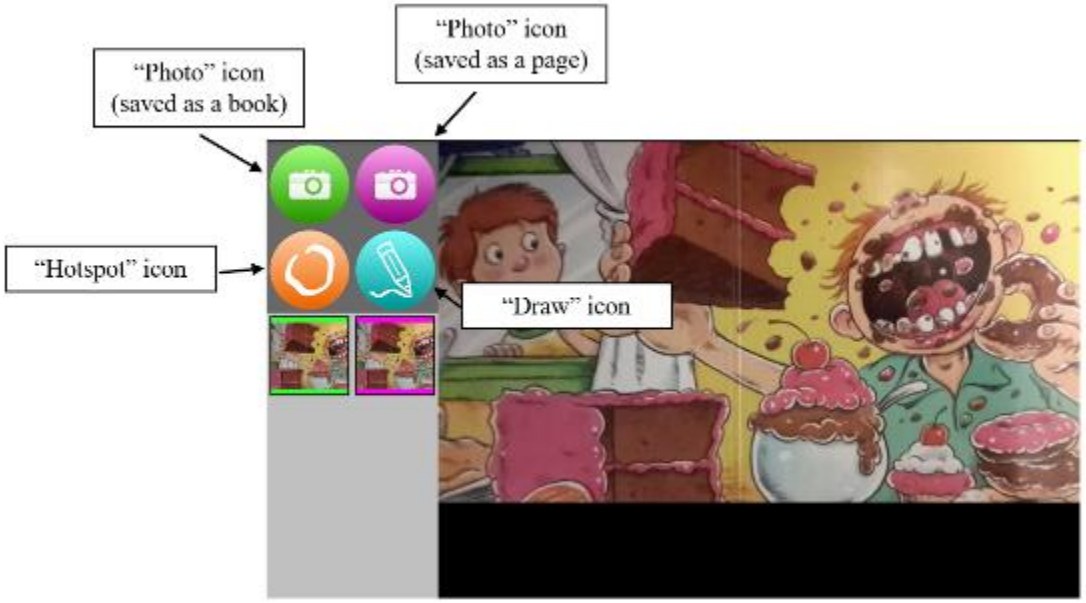
CONTINUING ADVANCEMENT

- **Simplifying the complexity of AAC programming is one way to lesson the time and attention required for programming to allow for it to occur JIT[3,9]**
- **BUT, can we make it SO straight-forward and lessen demands SO much that it is accessible to all people, including people with beginning linguistic, motor, and cognitive profiles?**

TWO STUDIES

EASYVSD

- **EasyVSD (under development at Invotek) was designed to build off the strengths of people who are beginning communicators and minimize demands by simplifying the programming process**



STEPS IN PROGRAMMING A VSD WITH ONE CONCEPT VIA EASYVSD

1. **Select “photo” icon**
   - Activating screen within ¾ in icon diameter
2. **Touch anywhere on screen to take a photo**
   - Timing activation with desired environmental content
3. **Select “hotspot” icon**
   - Interpreting the representation’s meaning
4. **Trace around area of photo to make a hotspot (does not have to be a closed shape)**
   - Identifying desired area
5. **Select “record” icon**
   - Use of an isolated point
6. **Speak to record the hotspot output**
   - Producing speech

Optionally:

1. **Select “draw” icon**
   - Discriminating between icon functions
2. **Trace with finger anywhere to draw on the VSD**
   - Activating screen within VSD boundaries

STUDY 1: DESCRIPTION

- **A descriptive study involving 10 toddlers who were typically developing ranging in age from 10 months to 22 months (mean=16 months)**
- **Described the toddlers' successful participation in programming storybook pages into EasyVSD during a shared storybook interaction, defined by their completion of a step in the programming process with or without visual/verbal prompting or modeling from the investigator**

STUDY 1: THE TODDLERS' PROFILES

- All toddlers demonstrated an isolated point
- All toddlers coordinated their gaze with their movement
- All toddlers demonstrated evidence of joint attention skills
- All toddlers demonstrated use of symbolic expressive communication
- 8 of the 10 toddlers used spoken words

STUDY 1: RESULTS

- **All 10 toddlers were able to participate in programming in some capacity, with overall rates of successful participation at 41%, out of an average of 80 opportunities**
- **However, there was a great deal of variation in participation success across the toddlers who participated and the steps of the programming process**

STUDY 1: RESULTS, CONTINUED

Percentage of successful participation for each toddler out of total opportunities for participation in each programming step

Participant; age in months	Selecting photo icon	Taking a photo	Selecting hotspot icon	Creating a hotspot	Selecting record icon	Recording message	Selecting draw icon	Drawing on photo	*Mean* (SD)
1; 10 months	11	67	0	11	0	0	0	67	*20*(30)
2; 11 months	0	50	0	0	0	0	0	80	*16*(31)
3; 12 months	10	70	0	10	0	10	0	50	*19*(26)
4; 13 months	0	80	0	0	0	0	0	70	*19*(35)
5; 14 months	27	100	18	0	0	0	18	82	*31*(39)
6; 18 months	100	90	80	30	70	0	80	90	*68*(35)
7; 19 months	30	40	10	10	20	0	30	90	*29*(28)
8; 20 months	82	91	45	45	18	9	91	100	*60*(35)
9; 21 months	80	100	70	80	30	10	90	100	*70*(32)
10; 22 months	90	100	70	70	60	0	100	90	*73*(33)
Mean (SD)	*43*(40)	*79*(22)	*29*(33)	*27*(29)	*20*(26)	*3*(5)	*41*(44)	*82*(16)	*41*(28)

STUDY 1: IMPLICATIONS

- **Although the study was not completed by people who are beginning communicators who require AAC, it suggests that programming can be simplified to allow more people to participate in the process**
- **However, some aspects of programming may be more demanding than others**
- **AAC technology for people who are beginning communicators can be designed in a way that builds off the strengths of its users**
- **There is likely room for future technology to continue to simplify the programming process and cater to people who are beginning communicators**

STUDY 2: DESCRIPTION

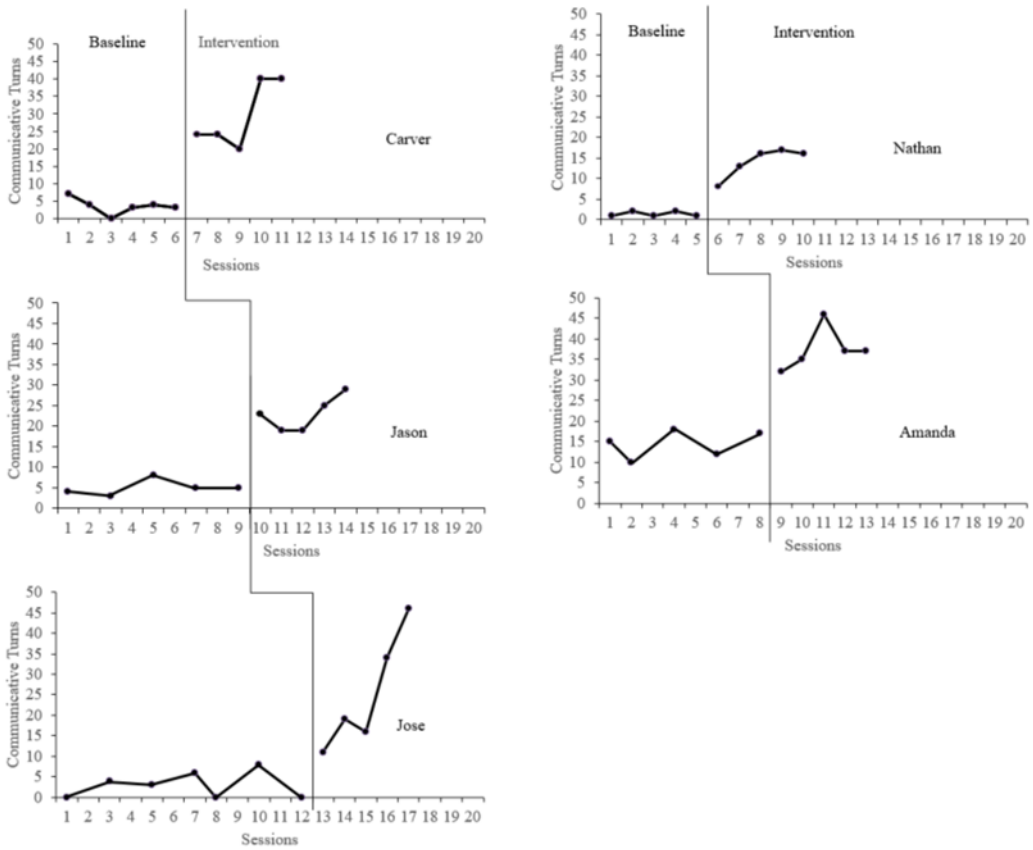
- **An intervention study determining the benefits of interventionists' JIT programming using EasyVSD**
- **5 adolescents participated in the study**
  - All adolescents were early language learners, or beginning communicators (i.e., they used less than 50 concepts expressively)
  - All of the adolescents had intellectual and developmental disabilities such as autism spectrum disorder, cerebral palsy, and fetal alcohol syndrome; 4 of the 5 adolescents had multiple disabilities
  - Those same 4 adolescents also had major physical limitations and were in wheelchairs, often making physical participation in programming difficult

STUDY 2: DESCRIPTION

- **The study used a multiple baseline, across participants design to address the following question:**
  - What is the effect of a communication application on mobile technology featuring visual scene displays and just-in-time programming on the number of communication turns taken by pre-adolescents and adolescents who are beginning communicators during 15-minute interactions?

STUDY 2: RESULTS

- **Participants demonstrated an average increase of 20 turns per 15 minute session from baseline to intervention**



STUDY 2: IMPLICATIONS

- **Just in time programming of VSDs benefits not only young kids who are learning language, but also adolescents who are also early language learners**
  - Although they both have limited expressive vocabularies and other limitations (e.g., motor, working memory), young kids and adolescent beginning communicators are very different populations
  - This study suggests that JIT programming benefits early language learners across ages
- **The study also provides preliminary evidence that this group may also participate in programming meaningfully, but also that physical participation shouldn't come at the cost of communication or frustration**

SYNTHESIZING THE FINDINGS

- **Taken together, these and other studies suggest that technology has been made largely more accessible, both in regards to:**

  1. Communication, and

  2. Programming

- **Clinicians and family members can use existing technology to program concepts JIT to support beginning communicators' access to relevant expressive language and subsequent language development**

FINAL SUMMARY

- **Consider the demands AAC technology imparts relative to:**
  - Communication
  - Programming
- **Recognize that less demanding options are available for beginning communicators across ages that may:**
  - Allow for JIT (i.e., in the moment) programming of concepts
  - Allow AAC concepts to be made available in response to interest demonstrated by language learners (paralleling typical language development)
  - Allow beginning communicators to participate in some capacity in the programming process, regardless of motor, language, or cognitive profiles

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