Online early-childhood development tracker in which parents, caregivers, and child health/development professionals document children’s developmental milestones:

- Parents create developmental diary
- Based on crowd-sourced milestones
- Provide parents with visual, objective, non-parametrized statistical feedback on their children’s development:
  - Aggregate percentiles
  - Future projection

Crowd-based percentiles extracted from Baby CROINC are consistent with established research:

Correlations between major milestones’ median ages reported in our system and those published by the U.S. Centers for Disease Control and Prevention1. Spearman correlations were high ($0.72 \leq r \leq 0.95$) and significant ($p < 0.001$).

The Baby CROINC dataset has a non-rigid structure:
- Milestone descriptions are given as free text.
- Users of different cultures and languages.
- Data sparse due to wide variety of possible milestones.

Automated methods (NLP) can help cluster similar milestones into canonical milestone concepts:
- “Started walking” = “Began to walk”
- Some of the tasks require domain-specific knowledge:
  - “Started to say ‘am am’ when she wants to eat” = “Is now verbally able to let one know if hungry or thirsty”

High quality standard from need to avoid misleading developmental conclusions.

Baby CROINC relies on Crowd Curated Intelligence (CCI):
- Human experts curate personalized inputs to enable aggregated, crowd-based data.
- CCI led to a dramatic increase in users’ ability to view crowd-based statistics, indicating that CCI is critical for enabling objectivity while maintaining personalization.

Saturation curve shows exploratory knowledge accumulation:
- Average slope does not significantly decrease or plateau over time. This indicates that the system has not yet reached a “saturation” point.

Towards an Abstract Model of User-Expert Interaction (WIP)

Goal: Algorithmic tools that mediate interactions between laypeople and experts in a joint effort to explain a complex phenomenon, and enable the design of retention-aware mechanisms and learning algorithms.

Layperson

- Has good understanding of his particular situation and aims to understand “his corner of the world”, to predict his future and to understand whether he belongs to particular groups of people that are similar to him and different from others.

Wishes to help, and by doing so to increase both her expertise and her reputation. Does so by passing “meaningful information”, in the form of predictions and identification of similar sub-groups.

The Collaborative Discovery Model

- Layperson is characterized by type $u \in X^T$, and retention parameter $r \in \mathbb{R}^+$.

- Expert is characterized by a forecasting function:
  - $f_t: X_T \times \mathbb{R}^T \rightarrow \Delta(X_T)$, and reputation score $x \in \mathbb{R}$.

- Localized Belief:
  - $p_t(x|u_i) = p_t(x|u_i) \times \text{t} \quad i \subseteq \Gamma$, $|i| \leq \ell$

- Rational Prediction Scoring:
  - $r_a \leftarrow r_t + S_t(p_t, Q_t, y_t) - \varepsilon$
  - $s_{a+1} = r_t + S_t(p_{t+1}, Q_{t+1}, y_t)$

Main Results

Characterization of Bi-Propriety Scoring Rules:
- $S_t(p_t, Q_t, y_t) \leq S_t(p_t, Q_t, y_t)$
- $S_t(p_t, Q_t, y_t) \leq S_t(p_t, Q_t, y_t)$

Monotonicity (“More knowledge is better”):
- $I \subseteq J \Rightarrow \delta(p_t(x|u_i), T) \leq \delta(p_t(x|u_j), T)$

Collaborative Clustering Mechanisms

Find out more at baby.croinc.org!

1. Disease Control and Prevention. "Established research milestones for healthy child development". Available at: www.cdc.gov/ncbddd/actearly/milestones


从基于群体的儿童发展监测系统

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1. www.cdc.gov/ncbddd/actearly/milestones, adapted from [Shelov1993] [Hagan2007]