Developmental and Cross-Cultural Evidence for Intuitive Dualism

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Abstract

Humans may intuitively be dualists, imagining physical bodies and non-physical minds as distinct and separable. Intuitive dualism has been invoked to explain diverse phenomena, including the spread and distribution of religious beliefs and our intuitions about psychological illnesses. Alternatively, dualism may be learned gradually by participation in cultures with a Cartesian intellectual tradition. To compare these two explanations we collected data about which they make different predictions: the developmental trajectories and cultural variability of people's proclivity to offer dualist interpretations of ambiguous stimuli. 180 Canadian children (aged 2-10 years), 42 Fijian children (aged 5-13) and 38 Fijian adults (aged 27-79) from a small village on a remote Fijian island, interpreted an ambiguous animation which may have depicted a mind switching bodies. Agency cues—proximity between the bodies and the transfer of salient eyes—shifted the proportion of participants offering dualist interpretations of the animation from 10% to 70%. Participants' age and sex had no significant effect. Fijians with more Western education actually offered fewer dualist interpretations. Statistical models which assume that dualist interpretations 'emerge early and everywhere' fit our data far better than those which assume that dualism 'develops gradually with exposure to Western cultural traditions'.

Adult humans behave in peculiarly "dualist" ways. Adults everywhere profess beliefs in souls and the afterlife (Atran & Norenzayan, 2004; Boyer, 2001), mindless bodies (zombies), bodiless minds (ghosts, spirits) and minds entering new bodies (Cohen, 2007; Cohen & Barrett, 2008) and place unusual value on "genuine" artifacts (Bloom, 2005) as though they'd become infused with their owners' non-physical essence. Even medical professionals show reasoning biases when thinking about 'psychological' versus 'physical' disorders(Ahn et al., 2009). Cross-cultural research suggests that adults' intuitions about disembodied minds are strikingly similar across societies (Cohen et al., 2011). Young children sometimes expect minds to persist after their body dies (Astuti & Harris, 2008; Bering & Bjorklund, 2004). Both children (Notaro et al., 2001; Schulz et al., 2007) and adults (Ahn et al., 2009) struggle to draw causal connections between mind- and body-related phenomena. Recent cognitive-historical work even indicates dualist thinking in ancient Chinese texts (Slingerland & Chudek, 2011).

Since minds are not actually separable from bodies, the ubiquity of dualist beliefs is a scientific puzzle. Here we empirically arbitrate between two plausible explanations: intuitive and culturally acquired dualism.

Intuitive Dualism (ID):

> Perhaps something about human minds causes them to reliably, with minimal cultural input, parse the world into two separate (and potentially separable) kinds of stuff: mental and physical

(Bloom, 2005). Many plausible explanations could generate this prediction. For instance, perhaps our cognitive aptitude for reasoning about intentional agents is a recent evolutionary acquisition, partially encapsulated from more ancient mechanisms for identifying and tracking physical objects (Scholl, 2001). The weak prior instantiated by this encapsulation could lead developing minds to reliably converge on dualist 'overhypotheses' (Kemp et al., 2007).

Culturally Acquired Dualism (CAD):

Alternatively, dualist thinking may stem from culture-specific social learning. Culture evolves (Richerson & Boyd, 2004; Gray et al., 2007) and the concepts that people use to make sense of their own and other's minds have changed during recorded history (Danziger, 1997). A strict conceptual divide between mind and body may be a culturally evolved reasoning tool, or even an historical accident. It may be peculiar to analytically inclined (Nisbett et al., 2001) European societies, whose intellectual pedigree includes the prototypical dualist thinker René Descartes. Culture-relative views of dualism are particularly common among anthropologists (see Cohen et al., 2011, for recent citations). Some psychologists' investigations also imply some degree of culturally acquired dualism, for instance those that emphasise the role of specific religious traditions in shaping dualist thinking (e.g., Astuti & Harris, 2008; Richert & Harris, 2008).

Here we test the relative fit of ID's and CAD's predictions about people's readiness to offer dualist interpretations of ambiguous stimuli. Our participants watched ambiguous animations which could have depicted a mind switching bodies—an interpretation easily accessible to dualists, who consider minds and bodies separate and separable, but far-fetched to non-dualists.

CAD—with it's emphasis on cultural acquisition—predicts that people more inculcated into 'dualist cultures' should more readily provide dualist interpretations. That is, Westerners should more readily infer body-switching as they get older, and non-Westerners as they have more contact with Western, Cartesian thinking.

To measure the covariance of dualist-cultural-inculcation with dualist-interpretations we showed our stimuli to 2- to 10-year-old Canadian children, and both children and adults from two villages on Yasawa Island—a small, remote island in the northwestern corner of the Fijian archipelago. Yasawan villages have no computers and had no televisions until recently (with little reception and used almost exclusively by men to watch rugby), no children's books, and no reliable electricity. Few villagers speak any world languages,

so movies and other programs provide little entertainment. Adults vary substantially in their Western-style schooling, from zero to 12 years.

Meanwhile ID—with its emphasis on reliably developing cognitive mechanisms interacting with environmental cues—predicts that people's readiness to make dualist interpretations should hinge on whether the ambiguous cues in our stimuli evoke their cognitive representations of 'minds' vis-à-vis 'bodies', and that these patterns of variation should be consistent across cultures and ages.

To manipulate the degree to which our ambiguous stimuli cued participants' representations of minds we drew on developmental research into three key cues that children and infants use to identify intentional agency: self-propelled motion (Luo & Baillargeon, 2005; Premack, 1990), equifinality and efficiency of behavior (Csibra et al., 2003, 1999; Gergely et al., 1995), and the presence of facial features, especially eyes (Beier & Spelke, 2012; Farroni et al., 2002; Hamlin et al., 2007; Johnson et al., 1998; Phillips et al., 2002; Woodward, 2003).

Methods

Our animations consistent of four scenes.

Participants initially saw a pentagon and a cake in opposite corners of a computer screen (First Scene, Figure 1). 'This is Penny, she really likes cake', we told participants. We then payed an animation depicting the pentagon gazing towards, then moving towards and then seeming to take a bite out of the cake. Here we paused the animation and asked participants to 'point to Penny'. We repeated this question at the end of each animation.

In the second scene, the pentagon overcomes an obstacle, a maze, to reach the cake (Maze Scene, Figure 1). All participants pointed to the Pentagon in these two scenes.

In our third scene, the River Scene (Figure 1) the pentagon's path to the cake is blocked by a river. A large square with eyes is motionless beside the cake on the other side, while Penny moves back and forth beside the river and eventually moves away. A few participants (4.4%) identifed the square or cake as 'Penny' in this scene.

In our crucial fourth scene, the Testing Scene, the pentagon's path to the cake is blocked by a wall with a gap smaller than its body. It tries to fit through the gap while a small triangle is motionless nearby. The pentagon eventually moves away from the gap, stops moving, and stops gazing towards the cake. A moment

later the small triangle becomes animate, gazes towards the cake and proceeds through the gap to the cake. Our key dependent measure was whether participants identified the triangle or pentagon as 'Penny' at the end of this scene. For brevity we call this 'switch-perceiving'.

Across five treatments we manipulated the contextual cues that mental agency had transferred between the shapes (Figure 1).

In the Far and Near Conditions, we manipulated whether the pentagon moved away from (Far) or towards (Near) the triangle before becoming motionless. We suspected that 'movement towards' would cue body-switching inferences by (1) suggesting that Penny represents the triangular body as a proximate goal and (2) possibly satisfying participants' intuitions that switching bodies requires close physical proximity.

In the Near-Eyes and Far-Eyes conditions we facilitated body-switching interpretations using salient eye shapes, a cue that even very young infants use to identify agency. In these conditions the pentagon initially has eyes while the triangle does not. When the pentagon becomes motionless her eyes disappear and a few moments later a pair of eyes appears on the triangle. In 'non-Eyes' conditions, both shapes always have eyes.

To establish that the agency-rich cue of eyes in particular mattered, we created a fifth condition where, instead of eyes, a bow-tie shape is transferred between the shapes (Near-Bowtie condition, Figure 1E).

Participants

In Vancouver we tested 180 children at a science museum. In Fiji we tested 42 children and 38 adults from two villages using identical materials and back-translated scripts. Full demographic details are presented in Table 1. We were only able to test a subset of our conditions among our small Fijian population.

Results

Did participants make any dualist inferences? Yes.

There are three ways to ask this question statistically. First, we could test the null hypothesis that participants never switch-perceive. Since there were some instances of switch-perceiving, this hypothesis is false. Of course, participants might point to the triangle for many reasons unrelated to dualism (e.g., inattention, confusion, an disinclination to repeatedly point to the pentagon). We have one source of information about the base rate at which such dualism-irrelevant other-shape-pointing occurs: how many participants

pointed to the square (or, in two cases, the cake) in the River Scene (12/272 = 4.4%; this rate did not differ significantly between Canada and Fiji, p = 0.5).

Second, we can compare switch-perceiving rates to this River Scene 'noise' (or non-dualist pointing) estimate. In all but one condition (Far), switch-perceiving rates significantly differed from the noise estimate given binomial expectation. Details are presented in Table 1 and Figure 2. Switch-perceiving in the Far condition occurred at over twice the noise estimate rate, while other conditions ranged from 5.2 to 15.9 times greater.

A third, conservative though *prima facie* implausible possibility is to imagine that in the absence of dualist intuitions, participants would choose between the triangle and pentagon at random. Table 1 and Figure 2 show that switch-perceiving rates were both above (Near-Eyes condition, $p < 0.01$) and below (Far Condition, $p < 0.001$; Near condition, $p < 0.01$; Near-Bowtie condition, $p < 0.05$) binomial expectation of such random guessing.

We provide these null-hypothesis tests to better describe our data to readers more comfortable with this form of scientific inference. However we wish to emphasize that these null models neither fit the data well, nor do they discriminate between the two substantive, non-null hypotheses we are considering (ID and CAD).

To formalize a critical test of the substantive hypotheses we logistically regressed switch-perceiving on agency cues, participant age, culture and exposure to Western education. Table 2 summarizes these predictions and their fit to our data; tables 3 and 4 present regression details. In no instance did participants' sex have significant effects on switch-perceiving.

Did agency cues cause participants to make more dualist inferences? Yes.

We regressed switch-perceiving rates on both eye- and proximity-cues controlling for age and sex. In Vancouver, proximity-cues increased the odds of switch-perceiving 2.85 times ($p < 0.001$), while eye-cues increased them 8.16 times ($p < 0.001$). In contrast to the large effect of eye-cues, the Near-Bowtie condition did not significantly differ from the Near condition ($p = 0.77$). We found no significant differences between our two Fijian conditions (Near and Near-Eyes) for children ($p = 0.39$), adults ($p = 0.63$) or both combined ($p = 0.37$); though in all cases eye cues had positive effects.

Though, as predicted by ID, our participants' proclivity to make body-switch inference did vary with the strength of agency cues, this is not inconsistent with CAD. Rather, these hypotheses make conflicting predictions about the variability of body-switch inferences with participants' age and exposure to Western

culture.

Did older participants make more dualist inferences? No, they made (non-significantly) fewer.

ID expects dualist intuitions to emerge early and persist throughout development. CAD expects them to increase with age and enculturation.

Older participants reported fewer body-switches, but not fewer than expected by sampling error alone. Regressing switch-perception on participants' age and sex yielded small, negative, non-significant effects (Table 3).

A more intuitive metric makes this easier to interpret. How many years of exposure to a dualist culture would shift a population from our estimated non-dualist error rate (4.4%) to switch-perceiving half the time (50%)? As references points, we evaluate three plausible predictions CAD could make. It could predict an enculturation process that is relatively fast (5 years, $\beta = 0.62$[1]), medium-paced (10 years, $\beta = 0.31$) or slow (20 years; $\beta = 0.15$). The likelihood of observing our data (Figures 3 and 4) is many million times smaller under these three exemplar CAD predictions than ID's prediction of no effect.

Did Western participants make more dualist inferences? No, they made (significantly) fewer.

ID expects dualist interpretations to vary little between cultures. CAD, or at least variants of CAD which explain Westerners' dualism by emphasizing their analytic, Cartesian cultural history, should predict that Canadians will be more dualist (even as children) than Fijian villagers.

Overall, Fijians reported more body-switches than Canadians ($\beta = -0.91, p = 0.03$). In the Near-Eyes condition, controlling for age and sex, both Fijian and Canadian children switch-perceived at very similar rates ($p = 0.94$). In the more agency-cue impoverished Near condition (no eye-cues), the odds of Fijian children switch-perceiving were 2.37 times greater than their Canadian counterparts ($p < 0.01$). These patterns of results are visually apparent in Figure 2, and in Table 3 where effect estimates control for sex and age.

For an intuition into the relative fit of CAD and ID, consider three possible variants of CAD. Membership in a Western, Cartesian-influenced culture could cause the odds of switch perceiving to increase by a small amount ($OddsRatio = 1.2$). The likelihood of this CAD model, given our data, is three times smaller that ID's prediction of no difference. Strong variants of CAD fare even worse. A medium ($OR = 2$) cultural effect is 180 times less likely, a large one (OR=3) is about fifteen thousand times less likely.

[1] An increase from a 4.4% pointing rate to a 50% rate is about a 22-fold increase in the odds of pointing. Dividing the natural logarithm of this odds ratio over the number of years over which the change occurs yields the predicted logistic regression coefficient.

Did Fijians with more exposure to Western education make more dualist inferences? No, they made fewer.

Again, ID predicts that Western enculturation should have little or no effect on switch-perceiving while 'Westnern Cartesian' variants of CAD predict an increase with exposure to Western education.

Across our whole Fijian sample, the odds of switch-perceiving (controlling for age and sex) were 20% smaller for each year of formal education an individual had received ($p = 0.02$); that is, more Western-educated Fijians were less likely to point to Penny in the new triangular body. This effect was slightly more pronounced in the Near-Eyes condition ($OR = .72, p < .01$) than the Near condition ($OR = .83, p = .07$). This interaction was significant for adults ($p = .04$), as was the three-way interaction ($adulthood * condition * education, p = 0.05$). Put simply: more educated Fijians were less disposed to switch-perceive, particularly adults in the absence of eye-cues.

For a more intuitive metric, consider how much formal education would be required to shift the switch-perceiving rate from the baseline noise estimate (4.4%) to just 50%. This could happen relatively slowly (15 years), at a medium pace (7 years) or quickly (3 years). The data we observed are many thousands of times less likely under any of these modes than ID's prediction (Figures 3 and 4).

Our data suggest that Western education may lead to, if anything, somewhat fewer dualist interpretations. This may be because it conveys an increasing understanding of the dependence of the mind on the brain.

Discussion

Our participants offered more dualist interpretations of ambiguous stimuli (pointing to a named individual—'Penny'—in a new body) when our cues encouraged representation of Penny as an intentional agent who deliberately switched bodies: deliberate movement of the old body towards the new one, and the transfer of eyes (but not a bow-tie) between the bodies. Their proclivity to offer this interpretation did not vary between sexes, did not increase with age and, if anything, decreased with contact with Western culture.

We claim that these data substantially favor 'Intuitive Dualism' (ID) over 'Culturally Acquired Dualism' (CAD) as an explanation of why dualist thinking is common among adults. One might have several concerns with this conclusion.

To demonstrate that ID explanations fit our data better than CAD's, we formalised CAD's predictions by using the rate of non-dualist pointing we had observed in previous scenes. There are other ways one could

formalise CAD's predictions, which could yield weaker predictions (i.e., smaller β coefficients).

These formalised predictions were purely illustrative; our conclusion does not hinge on them. Since we observed fewer dualist interpretations among older Westerners, and non-Westerners more exposed to Western culture (i.e., the likelihood maximising estimates for these regression coefficients were negative), our data are strictly more likely under ID's prediction of no effect than under any CAD prediction, however weak. Also, ever weaker variants of CAD come ever closer to being indistinguishable from ID. If it takes hundreds or even tens of years of cultural exposure to substantially change how readily people entertain dualist interpretations then, for all practical purposes, adults' and children's widespread dualist thinking can be considered, as ID claims: reliably developing intuitions that require minimal cultural input.

One might also worry that our results are peculiar to animations. We believe that, cetaris parabis, the causes of real-world dualism ought to bias people's interpretation of animations too. Even so, given our Yasawan sample's minimal (or zero) exposure to cartoons, animations and movies, their interpretations are unlikely to be a byproduct of exposure to animation or other modern technologies.

Another reasonable concern is that participants may not have interpreted our abstract stimuli as a mental agent switching into a new physical body. They may have interpreted the shapes as vehicles being driven by tiny people, or interpreted the word 'Penny' to mean 'the most salient shape' rather than as a proper noun referring to a specific agent. We are confident that our conclusions are robust to such concerns for three reasons.

First, anecdotally, some children in Vancouver voluntarily made exclamations like "Penny switched bodies!"

Second, even if some people relied on such unconventional interpretations of animated characters or proper nouns, we find it implausible that the most straightforward interpretation (relied on by children's cartoons everywhere)—that animated shapes depict social agents, and that proper nouns are their names—would not have *some* influence. That is, even if these peculiar interpretations influenced our data, we would expect the patterns predicted by CAD to be ameliorated rather than entirely erased. This was not what we saw.

Third, the patterns of variability we observed in response to agency cues speak against many of these interpretations. The transfer of eye-shapes between the bodies, a well-known agency cue, but not the transfer of another arbitrary shape (a bowtie) greatly increased participants' readiness to identify the triangle as Penny. It is hard to image why this would occur if participants interpreted the shapes as vehicles or

some other non-agentic entity. Participants also pointed to the triangle more often when the pentagon had approached it rather than moved away from it, even though the timing and motion of the triangle was identical in both cases. This makes sense if the motion-towards made it seem that Penny was trying to get into the triangular body. It is harder to explain if participant's choices were merely driven by the visual salience of the triangle.

Our data demonstrate a striking developmental and cultural consistency in people's proclivity to offer dualist interpretations of ambiguous stimuli. They contribute to an emerging corpus that suggests mind-body dualism—the tendency to track, reason and think about minds and bodies as separate and potentially separable things—emerges early and reliably across cultures (see also Slingerland & Chudek, 2011; Cohen et al., 2011). Where previous work has been susceptible to concerns about how well other cultures' concepts and words map to the English word-concept 'mind' (Wierzbicka, 2006), our method depends minimally on language. We merely assume that, across cultures, people keep using a name to keep referring to the same agent.

Dualist intuitions seem to develop reliably, with minimal cultural input, at least after about three years of age. This does not mean that they could develop in the absence of cultural learning, or that culture does not shape how adults represent minds. We are, after all, a cultural species (Richerson & Boyd, 2004). However the pronounced variability that cultural transmission typically generates (e.g. Bell et al., 2009) makes the relative invariance of dualist intuitions surprising and worthy of further investigation.

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Condition	**Sample Size** (% male)	**Age (years)** Mean (Std. Dev.)[Range]	**Switch-perceiving rate** Mean (.95 CI)	**Binomial test**
		Sample: Vancouver, Canada		
Far	30 (40%)	4.4 (1.4) [2,8]	10% (2.62%, 27.68%)	$p = .37$
Far-Eyes	30 (36%)	4.9 (1.7) [2,8]	46.66% (28.80%, 65.36%)	$p < .001$
Near	30 (63%)	4.7 (1.5) [3,8]	23% (10.64%, 42.70%)	$p < .001$
Near-Bowtie	30 (63%)	4.3 (1.3) [3,8]	30% (15.41%, 49.56%)	$p < .001$
Near-Eyes	60 (50%)	5.3 (2.1) [2,11]	72% (58.36%, 82.18%)	$p < .001$
		Sample: Yasawa, Fiji		
Near (Adults)	18 (55%)	44.6 (13.6)[27,79]	44.44% (22.40%, 68.65%)	$p < .001$
Near (Children)	22 (45%)	9.6 (2.7) [5,13]	54.55% (32.67%, 74.93%)	$p < .001$
Near-Eyes (Adults)	20 (55%)	43.6 (11.5)[29,61]	55% (32.05%, 76.17%)	$p < .001$
Near-Eyes (Children)	20 (45%)	9.2 (2.6) [5,13]	70% (45.67%, 87.16%)	$p < .001$

Table 1: Sample descriptions and switch-perceiving rates per condition, including a test against the binomial distribution of whether the switch-perceiving rate in each condition differs from our noise-estimate rate

Variable	**ID Prediction**	**CAD Prediction**	**N.H.S.T.s**	**Model Comparison**	
Agency cues	Yes	No prediction	Yes ($p < 0.001$)		
Age	No	Yes	No ($p = 0.35$)	Slow: Medium: Fast:	$> 10^{14}$ $> 10^{14}$ $> 10^{14}$
Culture	No	Yes (Canada > Fiji)	Yes (Fiji > Canada) ($p = 0.03$)	Slow: Medium: Fast:	≈ 3 ≈ 180 $\approx 10^4$
Western Education	No	Yes (positive effect)	Yes (negative effect) ($p = 0.02$)	Slow: Medium: Fast:	$\approx 10^4$ $\approx 10^8$ $> 10^{14}$
Sex	No prediction	No prediction	No ($p = 0.6$)		

Table 2: Summary of the predictions made by Intuitive Dualism (ID) and Culturally Acquired Dualism (CAD), and their fit to our data. Each theory entails predictions about whether and how each variable (leftmost column) will covary with people's proclivity to offer dualist interpretations of ambiguous stimuli. Null Hypothesis Significance Tests (N.H.S.T.s) check for evidence of any covariance at all. The 'Model Comparisons' row compares the likelihood of these data given the two theories' predictions, as the ratio $\frac{\text{ID model likelihood}}{\text{CAD model likelihood}}$, for the three variants of CAD specified in the text (slow, medium and fast). Ratios greater than one favour ID's prediction.

Table 3: Coefficients and standard errors for logistic regression models used to draw inferences about the effect of age (years, centered), sex ($f = -0.5$, $m = 0.5$), culture (Fiji= -0.5, Canada= 0.5), proximity- and age-cues on switch-perceiving. The Proximity-Cues predictor is 0 in the Far and Far-eyes conditions, 1 in the Near and Far-Eyes conditions. The Eye-Cues predictor is 0 in the Far and Near conditions, 1 in the Far-Eyes and Near-Eyes conditions. Sex and culture have been coded such that their coefficient reflects the difference between the sexes and cultures, while the intercept reflects their average.

**: $p < .01$, *: $p < .05$

	Vancouver	**Fiji**		**Everyone**	**Children (2-13 y.o.)**		
		Children	Adults		All Conditions	Near Cond.	Near-Eyes Cond.
(Intercept)	−2.28 (0.45)**	0.22 (0.44)	−0.25 (0.49)	−0.77 (0.23)**	0.17 (0.21)	−0.40 (0.33)	0.93 (0.31)**
Proximity Cues	1.05 (0.40)**						
Eye Cues	2.23 (0.44)**	0.62 (0.66)	0.48 (0.67)	1.51 (0.30)**			
Age	−0.13 (0.11)	−0.14 (0.13)	0.04 (0.03)	−0.01 (0.01)	−0.05 (0.07)	−0.31 (0.17)ˆ	−0.04 (0.11)
Sex	0.27 (0.39)	0.00 (0.66)	0.02 (0.69)	0.27 (0.29)	0.14 (0.27)	0.41 (0.66)	−0.21 (0.50)
Culture				−0.91 (0.41)*	−1.07 (0.50)*	−3.17 (1.18)**	−0.08 (0.74)
N	150	42	38	230	222	52	80

Table 4: Coefficients and standard errors for logistic regression models used to draw inferences about the interaction between years of education and the effectiveness of eye-cues in the Fijian sample, and in particular its interaction with adulthood. The 'Child' predictor is 1 for Fijians in the child sample (i.e. 5-13 years old) and 0 for participants in the adult sample (i.e. 27-79 years old).

**: $p < .01$, *: $p < .05$

	Everyone	**Everyone**	**Adults**	**Kids**
(Intercept)	1.39 (0.56)*	5.99 (4.15)	6.42 (4.09)	0.55 (0.74)
Education	−0.20 (0.09)*	−0.80 (0.48)ˆ	−0.81 (0.49)ˆ	−0.17 (0.34)
Sex	0.33 (0.50)	0.24 (0.54)	0.04 (0.79)	0.38 (0.73)
Age	0.03 (0.02)	0.02 (0.04)	0.02 (0.04)	−0.04 (0.19)
Eye Cues		−9.61 (4.99)ˆ	−9.70 (5.03)ˆ	1.37 (1.13)
Child		−5.04 (4.41)		
Education * Eye Cues		1.15 (0.56)*	1.16 (0.56)*	−0.20 (0.39)
Education * Child		0.57 (0.56)		
Eye Cues * Child		10.94 (5.11)*		
Education * Eye Cues * Child		−1.32 (0.68)ˆ		
N	74	74	36	38

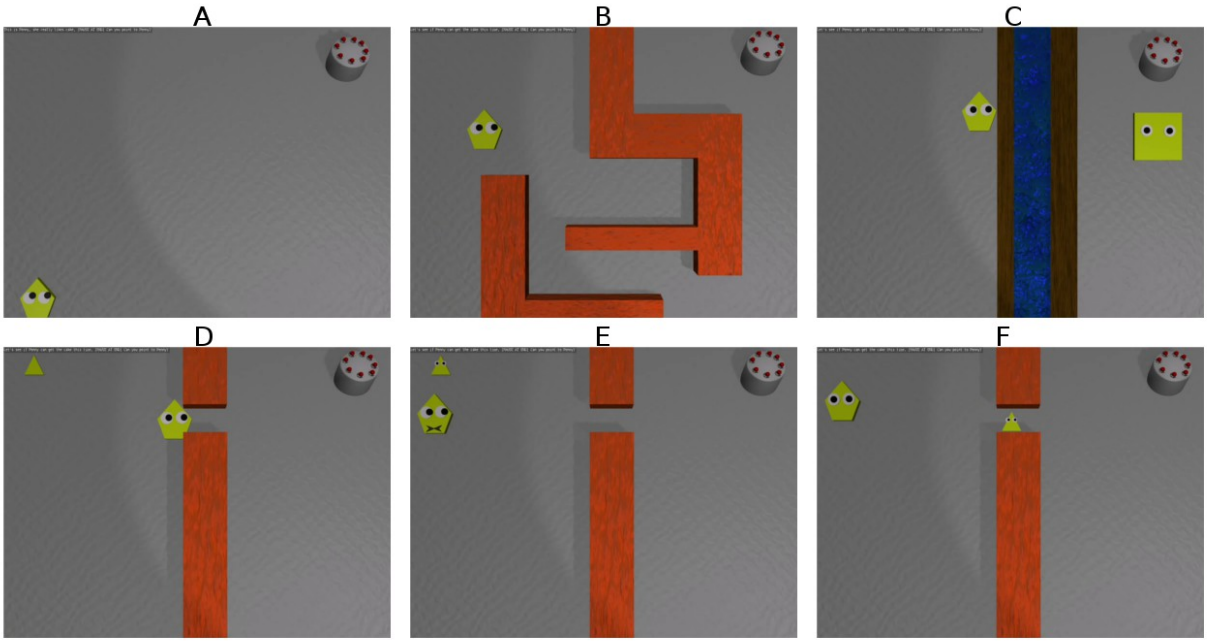

Figure 1: Still images from the videos participants saw: a) First Scenes; b) Maze Scene; c) River Scnes ; d) Testing Scene, Near/Far-Eyes Conditions; e) Testing Scene, Near-Bowtie Condition; f) Testing Scene, Near Condition

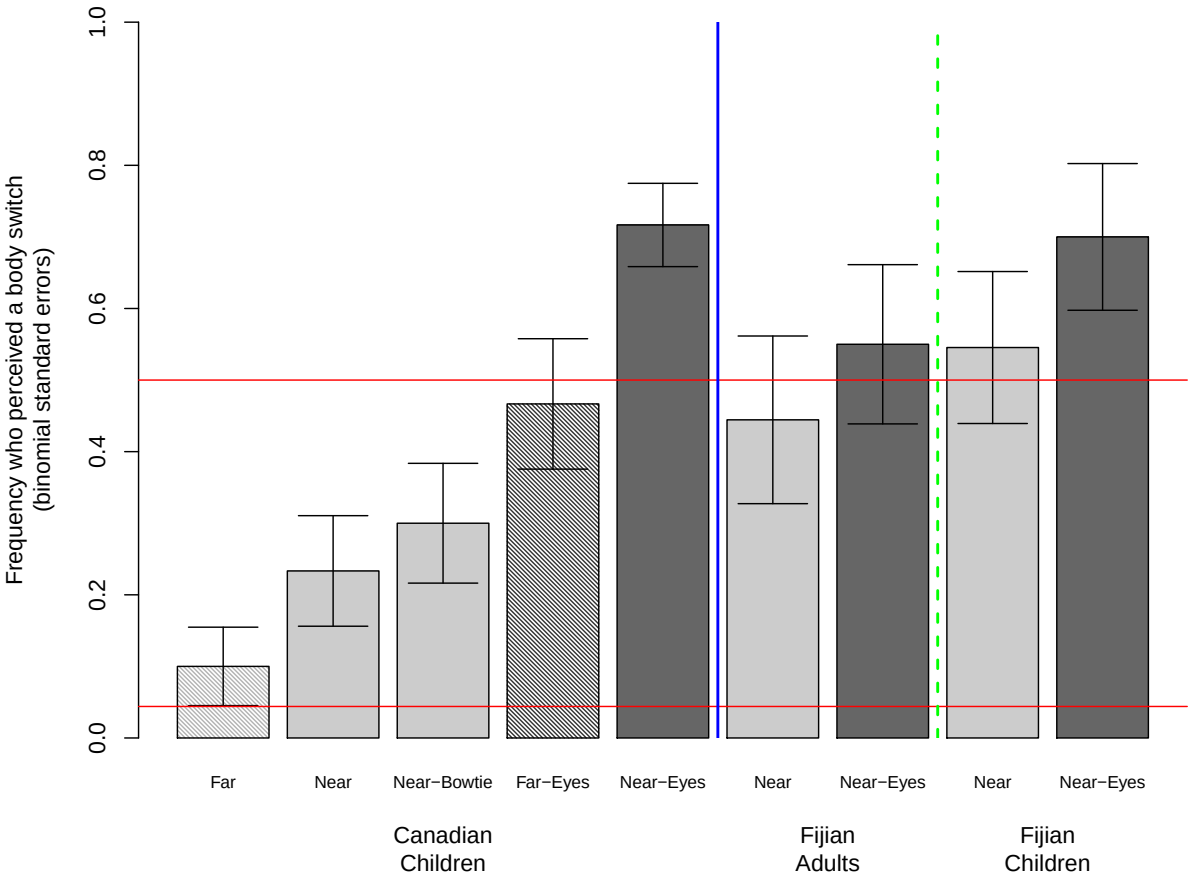

Figure 2: Frequencies of Canadian (left of the solid vertical blue line) and Fijian (right of the same line) adult (left of the dashed vertical green line) and child participants who identified the triangle as Penny in the testing scene (i.e., reported a body-switch), between conditions with 95% confidence intervals. Red horizontal lines mark the noise rate estimate (4.4%) and 50%. For visual clarity, bars representing conditions with eye-cues are shaded a darker color, bars for Far proximity-cue conditions are shaded with oblique lines

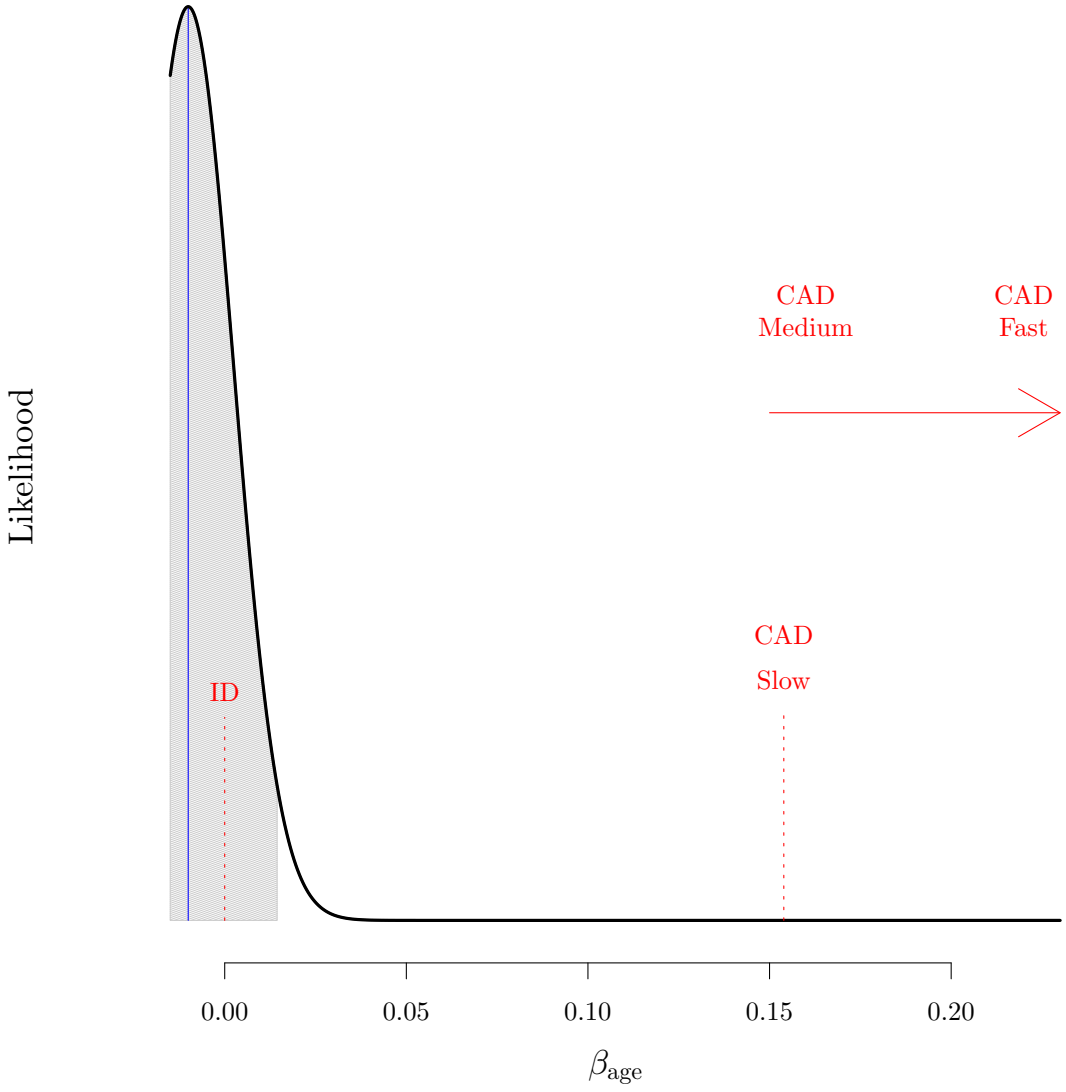

Figure 3: The likelihood of our data, given different relationships between participants' age (in years, horizontal axis) and their proclivity to offer dualist interpretations of ambiguous stimuli (formalised as a logistic regression parameter β_{age}). The likelihood maximising estimate is shown in blue and a grey region shows the 95% confidence interval around it. The predictions made by Intuitive Dualism (ID) and three variants of Culturally Acquired Dualism (CAD) are shown in red.

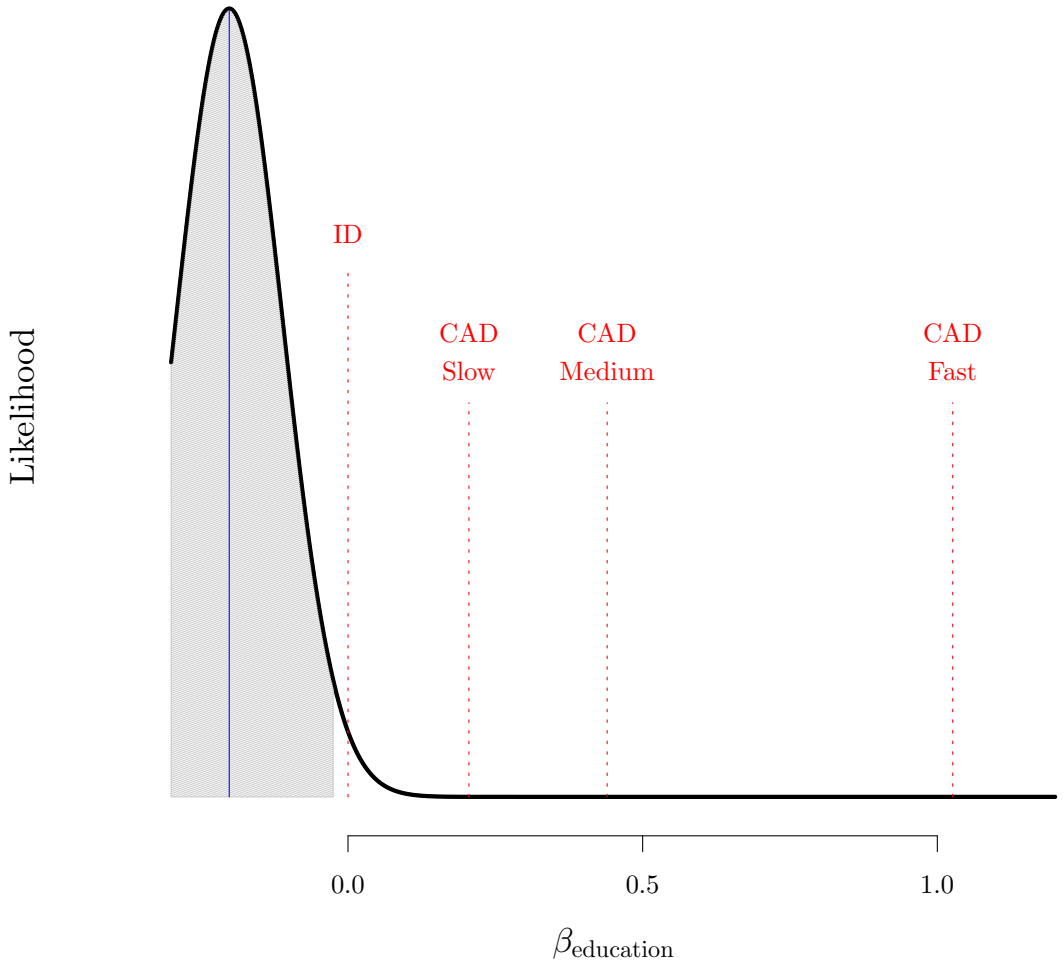

Figure 4: The likelihood of our data, given different relationships between Western-style education among Fijians (in years, horizontal axis) and their proclivity to offer dualist interpretations of ambiguous stimuli (formalised as a logistic regression parameter $\beta_{\text{education}}$). The likelihood maximising estimate is shown in blue and a grey region shows the 95% confidence interval around it. The predictions made by Intuitive Dualism (ID) and three variants of Culturally Acquired Dualism (CAD) are shown in red.