# Maths 4 Mums (+ Da

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***From day one, without noticing it, we teach our children. We sing them lullaby and they learn how to sing, we talk to them and they learn how to speak, we count their tiny fingers and they learn...mathematics. From their infancy we, often subconsciously, develop what Dr Gardiner calls "a comfortable familiarity with the world of number and elementary mathematics".***

***Dr Tony Gardiner from the School of Mathematics (University of Birmingham) is one of the leading figures in mathematics education in this country. Gwyn Gardiner was a teacher in primary school and now teaches mathematics in high school. They've got five kids of their own and for many years they've been introducing mathematics to children of various ages and abilities. In this issue they give some practical advise to M&D readers.***

We will try to restrict to things that any thoughtful parent can handle; but readers need to be willing to reconsider the way young children (and they themselves) "construct" the mathematical universe inside their heads! So view your participation as an adventure. The goal at all times should be to establish a platform, which is sufficiently stable to allow children to make their own choices in adolescence. In general, try to choose informal challenges which are "just within reach" - or, if the child enjoys being stretched, occasionally "just out of reach". These should always be in a spirit of fun, and should not be seen as "work"; nor should one engage upon these challenges in a spirit that leaves the child feeling they have "failed". As soon as the child indicates a reluctance to "play the game", back off and give things a break for a few days or weeks.

1. Simple counting games: towards robust mental imagery. To calculate reliably, we ultimately need to move beyond personal feelings and recognise that calculation requires an objective perception. Though good examples often involve the individual, personal involve-

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## By Tony and Gwyn Gardiner

ment can make it hard for the child to extract the "objective representation". In particular, we need to be aware of the need to move beyond the perception of "self" as qualitatively different from "others". (a) (In any relatively intimate setting with small numbers present) "How many people can you see in this room? So how many people are there in this room altogether?"

The first question naturally excludes the self. The second moves towards eliminating this distinction.

"How many noses are there in this room?" (Be prepared to have Teddy's nose included as well!) "How many eyes are there in this room? How many ears are there in this room?" Make sentences simple, clear and complete. Enjoy observing whether "ears" are more problematic than "eyes": even adults tend to be more aware of their own eyes than their own ears! (b) (At the supper table.) "How many feet are there under the table? (Try not to peep.)"

There is no shortage of the opportunites to count visible objects. So the goal here is for the child to construct in the imagination "two feet per person" and count the mental representations. Give plenty of time and don't "help".

However, if the timing proves unfortunate, and the task proves too hard, nothing is lost by allowing peeping and direct counting - so that the task can be left with the child having successfully answered - even if not in the anticipated way. Then take note and resist the temptation to set things that are too hard in future, and reflect on the need for more preparatory work than adults imagine is needed.

If the above proves successful, return some weeks or months later,
when you have good reason to believe that "tens" have been grasped, with the following - repeating the original question first:

"How many feet are there under the table?

How many knees are there under the table?

How many Big Toes are there under the table?

How many Little Toes are there under the table?

How many toes of all kinds are there under the table?"

Don't be scared of questions that look like repetition. Once the similarity has been grasped there is a delight in repetition - as childrens stories in all cultures indicate.

(c) (At some point between the two episodes in (b), use bath time to try this:) "How many fingers are there on your left hand?" (If the child is clearly left handed, you might try "right" in place of "left". The point being that the "counting hand" may be actively used to count the fingers of the other hand.)

Then hug the right hand so that it cannot be seen, or cover it with a flannel, and ask: "And how many fingers are there on your right hand?" Then, with both feet visible: "How many toes are there on your left foot?" The cover the right foot with a flannel, or with your hand, and ask: "How many toes are there on your right foot?" "How many toes are there on *my* left foot" Etc. And some time later, when the child's feet are enclosed in socks or shoes: "How many toes are there on your left foot? And how many toes on your right foot?" The purpose of these questions is not to prepare for some silly curriculum assessment, but to "savour" playing with numbers, and to establish the shift from "hands-on counting" to counting "in the mind".

Repetition is a pleasure and an essential component of robust understanding. And if you can embed this experience in settings which are physical and intimate, this can help to make the curious mental game that is mathematics "natural".

The most important thing is to make sure that "success" (and hence "failure") is not important to you, but rather that you are exploring together that interface between the "real" world and the more elusive - but important - "mental universe" we each need to construct for ourselves.

The pleasure for the adult lies in uncovering little by little what it takes to construct this mental universe, to move from innocence to a position where we "take things for granted" even though they are surprisingly subtle.