Bridging Games

Bridging through 10 is one of the most useful, versatile and powerful mental arithmetic strategies around.

All dyscalculic learners should be taught the bridging strategy, carefully and methodically (as I set out in great detail in *Section 2* of *The Dyscalculia Toolkit* [Sage] and in *Chapters 2, 3 and 4* of *Overcoming Difficulties with Number* [Sage]). Because the technique requires plenty of practice before a learner can be expected to develop the necessary familiarity and fluency, here is a collection of games that aims to promote mathematical understanding and provide practice in both addition and subtraction, using numbers of various magnitudes.

Work on bridging through 10 should start at the concrete level, with Cuisenaire rods. Several simple bridging games at a basic level can be found in the two print books mentioned above, and in the ebook *Exploring Numbers Through Cuisenaire Rods* [iBooks]. The first game in this collection – In The Frame – goes one stage further: its focus is on addition that involves bridging through multiples of 10. It, and the related concrete subtraction game, should be played only after exposure to plenty of practical activities to do with bridging through 10, and only once players no longer depend on counting strategies for addition and subtraction. Bridging can only be an efficient and reliable strategy if we already know how to build numbers out of – or split numbers into – smaller components. (The related Frame a Subtraction game can also be found in the Subtraction Games collection on this website, and is duplicated here simply for convenience).

Empty number lines (ENL) are an excellent way to support and record calculation methods that involve bridging. Empty number lines feature in all the bridging games in this collection. For more information about learning or teaching how to use ENL, see *Part ll* of *Overcoming Difficulties with Number* [Sage]) and watch my YouTube video (*https://www.youtube.com/watch?v=4U9BOXR7wwQ*).

Once the concept of bridging is secure, the paper & pencil games in this collection help learners become so familiar with using an ENL for bridging that they are soon able to conjure up a visualised ENL during mental calculations. When this more advanced, abstract stage is reached, I recommend card games such as Standing Aces, Over The Top, and A Close Call (see Various Card Games for Addition & Subtraction on this website) or Subtraction Equations (see the Subtraction Games collection on this website) for extra practice in mental bridging.

Concrete games:	**In The Frame**	**Frame a Subtraction**
Paper & pencil games:	**Bridging Race [through 10]**	**Bridging Race [multiples of 10]**
	Bridging for Subtraction	**Bridge Back Through Zero**

What is this game about?

This is a game about **bridging through 10** and through **multiples of 10**. The game is played at the concrete level. The variation, involving recording the bridging moves on an empty number line, helps players develop a more abstract conception of bridging.

Equipment needed

- Cuisenaire rods

- A 5 cm x 10 cm frame (made of craft foam, or kitchen sponge, or make a shallow tray out of paper by turning up the sides).

- Two 1–6 dice for the basic game; a 5–10 die/spinner for the variation.

Rules

Take turns to throw both dice and announce the total. Take one rod to match if possible (take two rods only if your throw adds up to 11 or 12). Arrange your rod(s) along the 10 cm side of your frame.
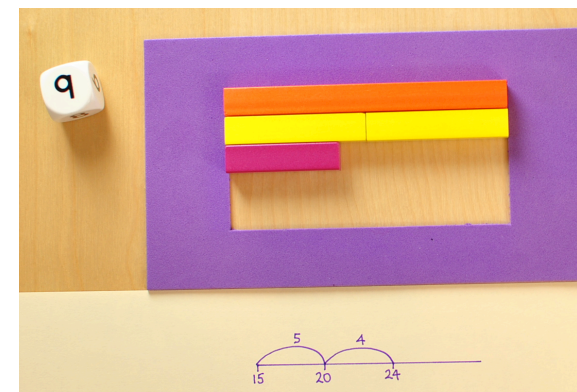
You may not start a new row until the previous row is full, so when adding an amount that is larger than the available space in a row, you must bridge: exchange your rod for two smaller rods, one being the complement of whatever is already in the frame and the other being however much there is still left to add. Be sure to make the exchanges carefully, explaining every step of the process. Each time your turn requires bridging, go on immediately to have another turn.

The winner is the first player with a frame filled with rods.
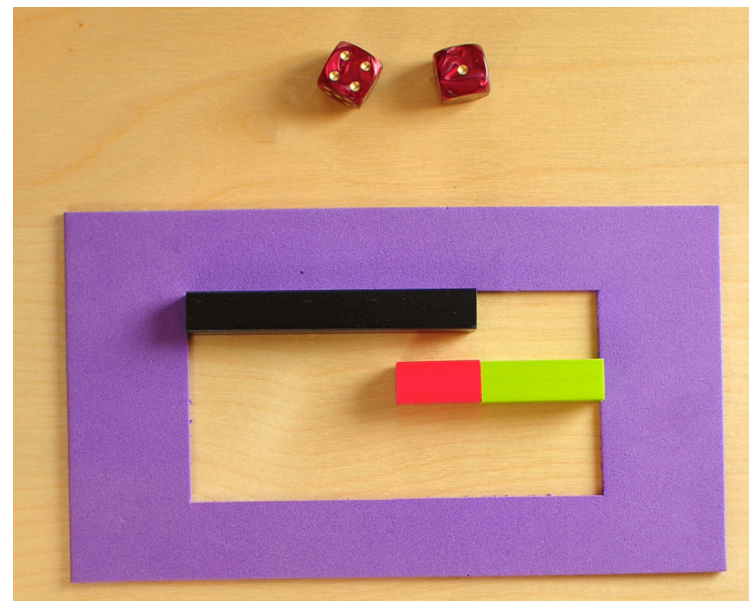
Variation

Play with a single die or spinner labelled 5–10. Whenever you bridge, record the addition on an empty number line. Do not have an extra turn. Do not record any turns on which you throw a complement, or the number 10, because no bridging is required in these cases. The game ends when one player has filled their frame. The winner is not the first player to do so, but the player with the most additions recorded on number lines at the end of the game.

What is this game about?

The game is about the kind of subtraction problem that would require decomposition if performed as column subtraction. The game provides practice in using **complementary addition** by **bridging through 10**.

Equipment needed

- Cuisenaire rods
- A frame or tray measuring 2 cm x 10 cm for each player
- A spinner with a base for numbers 11–15. A 4–9 die
- Paper and pencil.

This player has just won the game, after subtracting 7 from 11 and recording the calculation as complementary addition on his fifth empty number line.
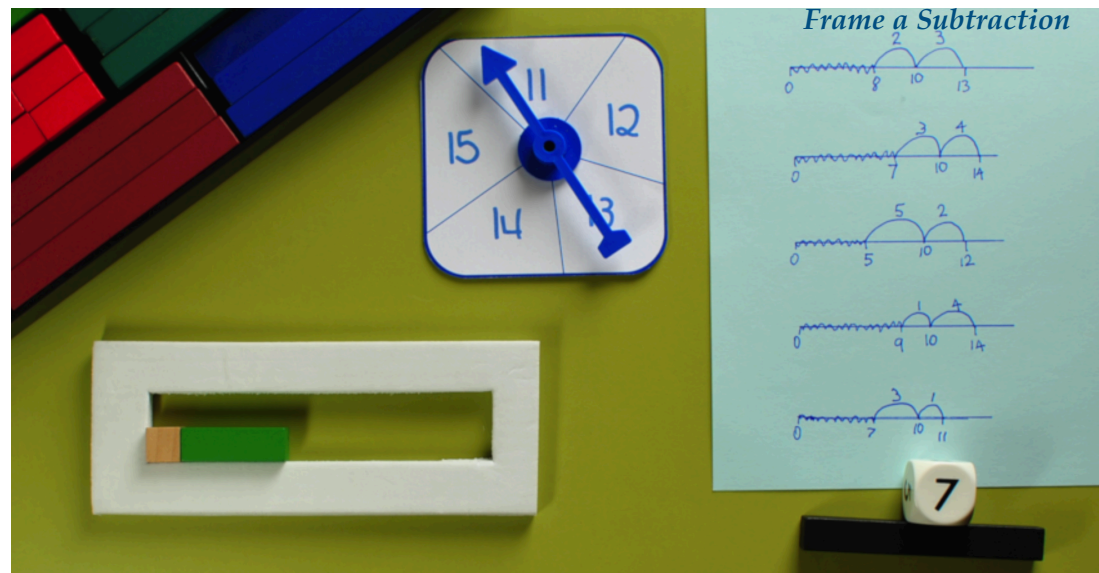
Rules

Start every turn with an empty frame. On your turn, spin the spinner and put two rods (one of which must be an orange 10-rod) to match the spin inside your frame. Now roll the die to find out how much to subtract. If you have enough units to leave the orange 10 rod whole (i.e. 15 minus 4 or 5, or 14 minus 4) that is the end of your turn. If not, you must demonstrate how to find the answer by exchanging the orange 10 rod for two smaller rods. Subtract, i.e. physically remove, one single rod to match the number on the die. As you perform the exchange and subtraction, explain aloud every step of the process. Record the bridging calculation on an empty number line as complementary addition (i.e by finding the **difference** and working **forwards** on the number line.)

The winner is the first player to perform and record 5 <u>different</u> subtraction calculations as complementary additions with bridging.

Variation

Go on to have an extra turn whenever your answer is 6 or 7 (this puts more focus on the harder calculations).

This game appears in the 3rd edition of Ronit Bird's 'The Dyscalculia Toolkit Book' [Sage].
A demonstration video of the game is posted on YouTube: https://www.youtube.com/watch?v=NXpNktY8_34

What is this game about?

This game is about adding numbers that come to a total of more than 10 (but <20), by adding the second addend in two stages: first add the complement of the first number, then add whatever is left.

During play, follow these conventions of working on an empty number line: draw arcs above the line and clearly mark the line where each jump begins and ends; label the size of each jump in or above the arc; underneath the line, label the position of the jump, i.e. at which number in the counting sequence it begins and ends.
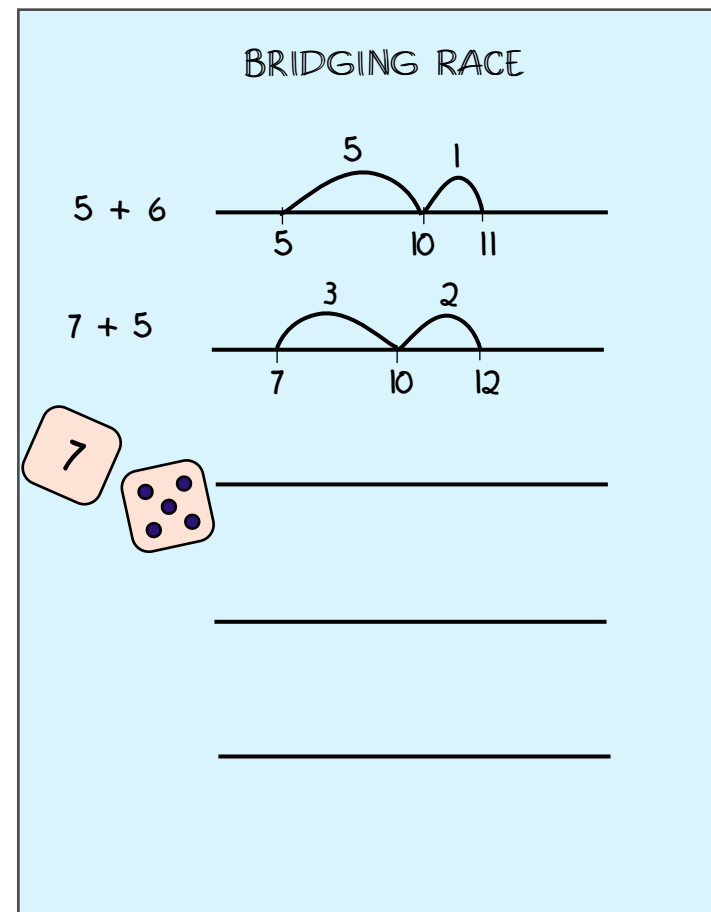
Equipment needed

- Two 6-sided dice adapted as follows: use stickers to replace the 1s and 2s with a 7 and an 8 on one die and a 7 and a 9 on the other.

- Paper and pencil. The game board consists of 5 horizontal lines.

Rules

Players take turns to throw both dice and announce whether the total is more or less than 10. If it is 10 or less, you can do nothing on this turn. If the total is more than 10, use bridging and sketch the calculation on a number line on your game board. If you throw the same pair of numbers again, you may swap the order of the numbers so as to make sure that no two of your number line sums are identical (if you throw the same pair yet again, miss the turn).

The winner is the first player to record five different bridging calculations on five number lines.

BRIDGING RACE

5 + 6

5   10   11

7 + 5

7   10   12

7

What is this game about?

This game provides practice in using an empty number line for the bridging technique when adding a single-digit number to a 2-digit number.

Because this game focuses on bridging through multiples of 10, players should play it only when they are already adept at bridging through 10.

Equipment needed

- A pack of digit cards made up of four each for the numbers 1 – 9.
- Paper and pencil. The game board consists of 5 blank horizontal lines.

Rules

Shuffle the cards. On your turn, take the top pair of cards from the pack, followed by a single card. Arrange the pair in whichever order you choose, and read it as if the card at the left represents tens and the card at the right represents units, thereby creating a 2-digit number. If adding the single card's number to this 2-digit number does not take the total beyond the next decade boundary, there is nothing more you can do on this turn.

The aim is to try to arrange your cards so that adding the number on the third card requires bridging through a multiple of 10. Record the calculation on one of the empty number lines on your paper game board.

If you happen to get the same three digit cards next time in the same order, and cannot create an opportunity for bridging by swapping the position of the first pair of cards, you will have to miss this turn.

The winner is the first player to record five different bridging calculations on five number lines.
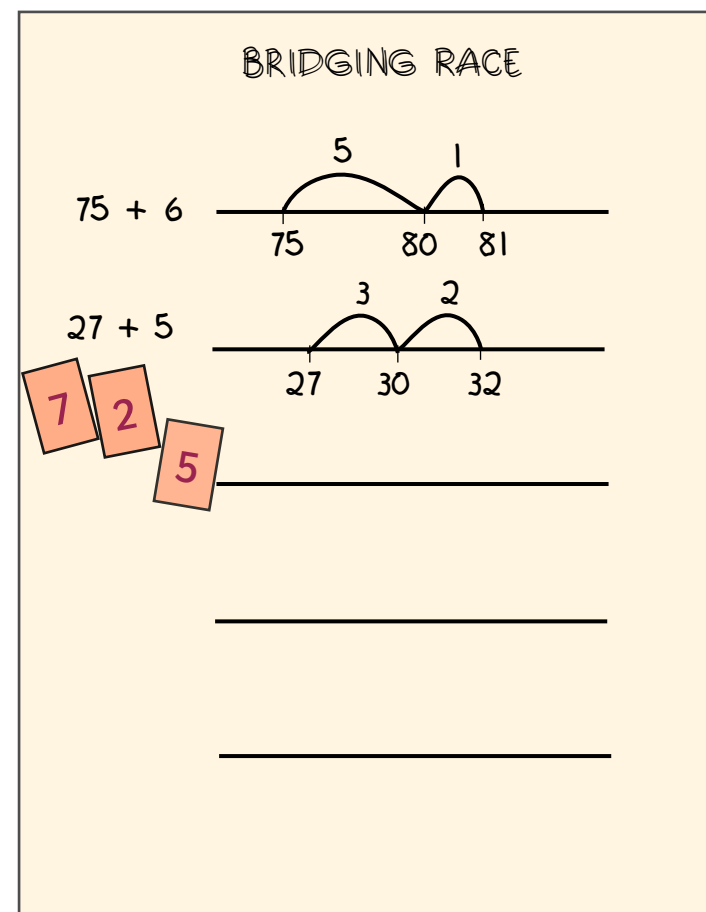
This player can arrange the 2 and 7 to create either 27 or 72, but adding 5 to 27 will provide an opportunity for bridging (through 30), whereas adding 5 to 72 would not.

What is this game about?

This challenging game assumes some understanding of place value and provides practice in complementary addition. [Complementary addition is a way of solving subtraction problems by working forwards to find the difference.] During the game, point out to players that calculations requiring decomposition if performed as column subtraction, are often more easily solved using complementary addition on an empty number line (ENL).

Equipment needed

- A pack of digit cards made up of four each for the numbers 1 – 9.

- Paper and pencil. The game board consists of 5 blank number lines.

Rules

Shuffle the cards. Players are dealt four cards each and work on them simultaneously, hiding their cards and game boards until both players are ready to compare their move for that round.

The aim is to arrange your cards into two pairs, with one card in each pair representing tens and the other units, so as to create two 2-digit numbers. Subtract one 2-digit number from the other, recording your calculation on a number line, as complementary addition, as illustrated. Exactly two jumps are allowed for each calculation: one to bridge (forwards) to a multiple of 10 and one to bridge across the remaining gap.

The winner of each round is the player who used the bridging technique, sketched on a new ENL on their board, and whose solution to their subtraction problem is less than their opponent's. A game consists of 5 rounds.
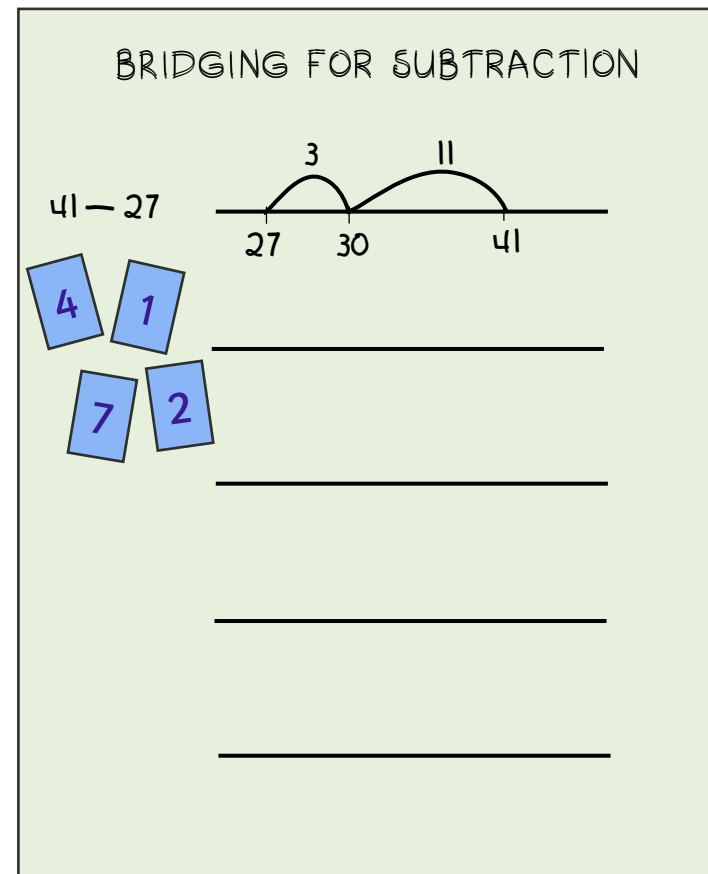
This player has chosen to subtract 27 from 41, to create a difference of 14. (An arrangement to create a subtraction such as 74 – 12, or 47 – 21, etc, has no chance of winning.)

This player would win this round if the opponent's answer is more than 14.

Tip: your numbers need to be close enough in value so that the difference is relatively small (to win the round), but far apart enough to need to use the bridging strategy to find the solution.

What is this game about?

This game is about numbers below zero. It contributes to an understanding of negative numbers as the mirror image of the sequence of positive numbers. It provides practice in mental subtraction by bridging back through zero.

Equipment needed

- A pack of digit cards made up of four each for the numbers 1 – 9.

- Paper and pencil for jottings in the early stages.

- Tokens for scoring.

Rules

Shuffle the cards. Players take 2 cards each. If both cards are for the same digit, replace one at the bottom of the pack and take another.

The number on one card is subtracted from the number on the other, before the order of the cards is swapped and the new subtraction is performed.

During a single turn, both players must demonstrate and explain their calculations. For example, if my cards are 8 and 5, I might say: *'8 minus 5 is 3. Now, for 5 minus 8, I can start at 5 and go back 5 to reach zero, then there are still 3 more to subtract. So, 8 – 5 = 3 and 5 – 8 = –3.'*
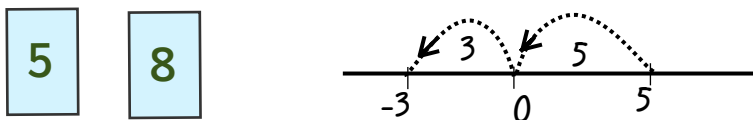
In the early stages of the game, players may sketch an empty number line on which are drawn two backward jumps, but only for the calculation that results in the negative number. As soon as possible, perform both calculations mentally, without jotting anything down.

When both players have solved and explained both their subtractions, the player who has reached the lowest negative number wins a token.

Variation

Before shuffling the pack, take out two of the cards for 1 and give one to each player, to keep for the duration of the game. This 1 represents one ten, and can be placed to the left of either of the two cards that the player picks up on each turn. The result will be a series of four possible subtractions, in two of which a single-digit number is subtracted from a teen number (giving positive answers), while in the other two related problems the teen number is subtracted from the 1-digit number (giving negative answers).
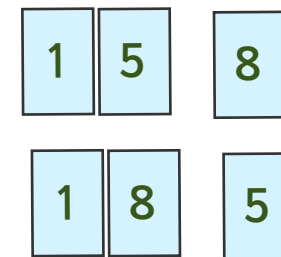
These problems may be challenging because, in order to partition the teen number, players may have to perform a mental bridging calculation in order to establish the size of the second backward jump (e.g. in the example illustrated above, when partitioning 15 into 8 and what's left, the challenge is to establish that the amount that's left is 7).