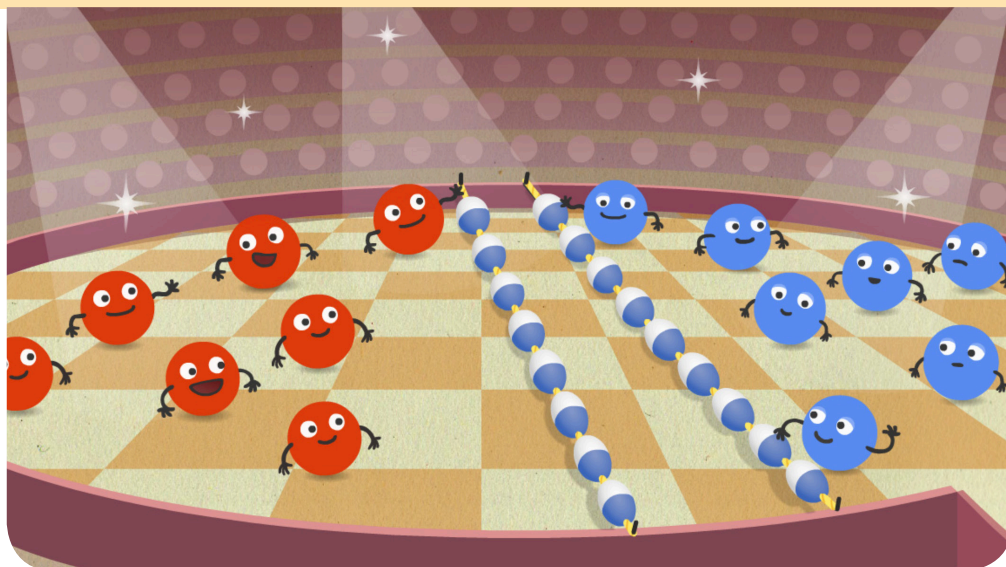


The Land of Bump

The Land of Bump is an animated story that introduces the motion of particles related to temperature and energy transfer in an accessible, interactive way. The fancifully illustrated story includes pauses that allow users to predict what will happen next.



Getting to Know the App

The Land of Bump is an interactive animation that tells the story of the Red Hots who like to dance fast and the Cool Blues who like to dance slow. All is well until they have to share the same practice floor. They bump each other and the fast ones slow down while the slow ones speed up. This story represents an analogy to hot particles colliding with cold particles. The Land of Bump contains a problem to solve, namely how to ensure that the dancers can dance on the same dance floor without affecting each other's speeds. Viewers are asked if one barrier will work to solve the problem. When one barrier fails, they are asked if two barriers with a gap between them will work.

What it Teaches

The Land of Bump animated story is a vivid demonstration that when fast and slow particles collide, the fast particles slow down and the slow particle speed up— when hot and cold substances mix, the two temperatures change to an intermediate degree (speed). The temperature of the matter is the relative speed of particles.

Navigating the App

There is a speaker button on the left and an advance to next screen button on the right. These buttons flash when it is the right time to either hear what the narrator has to say (speaker button) or to move on to the next slide (arrow button). Even young children learn to time their presses properly, but help them if their touch is slightly off center. Encourage them to answer out loud when the narrator poses a question. Even if children do not do this, the pauses should encourage them to slow down and think about why the dancers behave as they do.

How it Works

The Concord Consortium's Molecular Workbench computational model (<http://mw.concord.org/nextgen/>) is embedded in the interactive.

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Talking About Discoveries

The Land of Bump includes several embedded questions as the story unfolds. To help children consolidate the many variables that explain and solve the problem of the transfer of temperature, you may want to talk about the story with them. Use the following questions to start the conversation. Your questions should leave discoveries to the children as much as possible. A hypothetical conversation between an adult and children who have watched The Land of Bump is also included to serve as a guide to a conversation style, not as a script to follow.

T: Remember that the Red Hots wanted to dance fast and the Cool Blues wanted to dance slow. So, what happened that created a problem for the two groups of dancers? [When they bumped each other they could not dance at the speed they liked.]

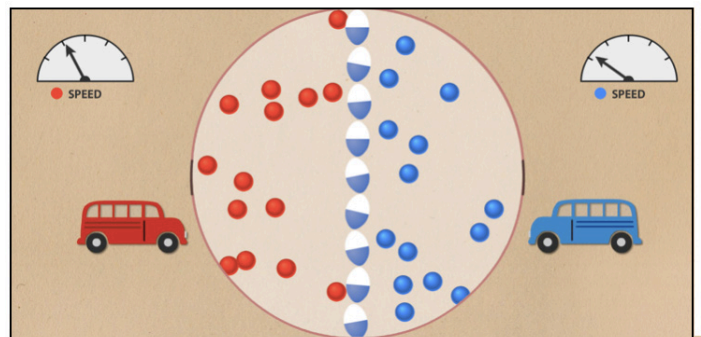
T: (Assume children talked about bumping). Okay, they did not want to be bumped. Why not? [Bumping would change their speed. The fast would move slower; the slow ones would move faster.]

T: (Assume children said bumping changed their speed). So when they bumped each other, they danced differently. Tell me about that. [Help children remember that the change of speed happened for both the fast dancers slowing down and the slow dancers speeding up.]

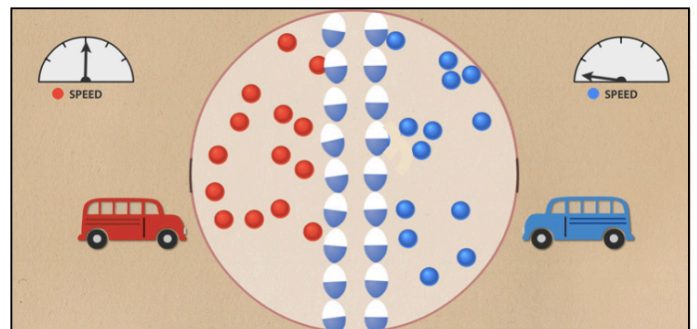
T: If bumping caused them to dance in a way they did not like, what did they do next? [They put a barrier between the Red Hots and Cool Blues.]

T: (Assume the children remember the barrier). They put a barrier between the fast dancers and the slow dancers. Did the barrier help? [This question might be answered by pure memory. Revisit both what happened in the story and the reasons things worked or did not work.]

T: Well, one barrier did not work. So, tell me why. Now tell me why putting two barriers worked. [The children may mention that there was a gap between the two barriers, but help them figure out why the gap was necessary: the barriers move but do not bump each other.]



The one barrier moves fast and slow, bumping the dancers on the other side and changing their speed.



The gap prevents the fast barrier and the slow barrier from bumping, so the dancers don't get hit by the wrong speed.

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Supplemental Activity: Buttons as Particles

What to Do

Children have ideas that are more complicated than they can put into words. But we can give them “tools of the mind,” such as moveable objects that they can use to retell the story of The Land of Bump. Give the children two sets of buttons of two different colors to represent the Cool Blues and the Red Hots. The buttons do not have to be red and blue, just different colors for each. The buttons should be at least the size of a nickel and thick enough for the children to act out bumping. Include several thick pipe cleaners to represent the barriers that separated the fast and slow particles later on in the activity. Place the buttons near but not on a sheet of white paper. Ask the children to use the buttons to retell The Land of Bump story. Prompt them now and then if they get to one section of the story, but do not get to other sections. You may even show them sections from The Land of Bump app to help them remember the problems and solutions. If they don’t see the reason for the pipe cleaner, mention that they can be the barrier(s). But give them a chance to figure this out on their own at first.

Purpose of Activity

Children may be able to relate to the cause and effect of bumping when they can physically move buttons into each other. These gestures are an important symbolic system for young children to make their thinking visible. The buttons also cause the children to think in advance about what happens in the story and what that change then sets up to happen after that. They may not notice the pipe cleaners at first, but if their work leads them to think about the need to separate the fast and slow particles, they then might pay attention to the pipe cleaners and choose to use them. It may hard for them to physically act out the relative fast and slow speeds, so help them talk about speed when you can. Look again at the hypothetical conversation in reference to the app itself. This conversation should provide guidance for how to work with the buttons.

What to Notice

Do the children act out bumping? Do they mention that the bumping has the effect of changing speed? Do they use a pipe cleaner to show that bumping it on one side causes particles on the other side to move? If they use two pipe cleaners, do they give special attention to the gap? Do they mention why the gap is important? Do they think that two barriers are better than one simply because there are two? Do children always use just two buttons, one of each color, or do they try to include multiple buttons of each color?

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Hypothetical Conversation

The hypothetical conversation is between a teacher/parent (T) and several children (C). Consider how you might engage in a similar conversation, and what to listen for as children describe their experience with The Land of Bump.

T: So, let's review what you have learned about particles. Someone tell me what the problem was in The Land of Bump. What was happening that the dancers did not like?

C: They did not like to be bumped.

T: Who did not like being bumped?

C: The red ones and the blue ones.

T: So, the blue ones did not want to bump each other.

C: No, the blues did not want to bump the reds.

T: How about the reds, what did they want?

C: Not to bump the blues.

T: So, the Red Hots did not want to bump the Cool Blues and the Cool Blues did not want to bump the Red Hots. Why not?

C: They don't like to be bumped.

T: Why not? Because it does not feel good?

C: No, because they could not do their own dance with all that bumping.

T: Why would bumping change the way they danced?

C: It made them go faster.

T: I see. What speed were they going before they were bumped?

C: Slow.

C: No, the red ones were going fast.

T: So, the Red Hots did not care if they were bumped by the Cool Blues.

C: Oh, yes they did.

T: Why did the Red Hots care if they were bumped by the Cool Blues?

C: It slowed them down.

T: I see. So bumping made the Red Hots slow down and the Cool Blues speed up. I can see where they would not want to change their speed. So what did they do to solve the problem?

C: They put up a barrier.

T: How did that help?

C: They could not bump anymore.

T: They could not bump what anymore?

C: Each other.

T: Okay, so the barrier prevented the reds from hitting the blues and the blues from hitting the reds. But, as I remember, one barrier did not work. Why is that?

C: It worked. They didn't bump.

C: She's right. It didn't work. They had to use two barriers remember. It worked with two.

T: Okay, with one barrier the reds got slow and the blues got faster. How did that happen?

C: They got bumped.

T: But you said the barrier prevented the dancers from bumping each other.

C: I know, but I guess they got bumped.

T: Actually there was no way for the dancers to move to the other side of the barrier. The dancers at all times remained on their own side of the dance floor.

C: Then something else bumped them.

C: Yeah, the barrier bumped them.

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Hypothetical Conversation *continued*

T: I think you are on to something. The reds hit the barrier fast and that part of the barrier hit the blues fast making the blues speed up. The blues hit the barrier slow and that part of the barrier hit the reds slow and that slowed the reds down. (Teacher could point to a picture of the dance floor with one barrier and red and blue dancers on either side.) So how did it help to have two barriers?

C: They could not bump.

C: With two barriers they could not get through.

T: They could not get through to the other side. Is that what you mean?

C: Yeah, two barriers make it too hard to get through to the other side.

T: But we already said that even with one barrier the dancers could not get through to the other side.

C: Oh yeah.

T: So we need to explain how two barriers worked better than one.

C: They weren't touching.

T: What was not touching?

C: The two barriers.

T: How does that help?

C: Because two is better.

T: What is about these two barriers that prevented the reds from slowing down and the blues from speeding up?

C: They are separated.

T: That is true. There is a space between the two barriers. What would happen if there were no space between the two barriers?

C: The barriers would bump the dancers.

T: I get it. If the barriers were really close it would be like just one barrier and we know that does not work because the barriers do the bumping. So just to understand how the separated barriers work, tell me what happens when the Red Hots hit the barrier on their side. (Teacher could point to this feature in a screenshot from The Land of Bump.)

C: They bounce back.

T: Well, yes they do, but they also bounce back with just one barrier. Let's look at these two separated barriers. Think about what happens when a Red Hot hits the barrier. What does that barrier do?

C: It bounces, too.

C: Yeah, it bounces around, but does not hit the other barrier.

T: Ah! That could be the key. The first barrier does not bump the second barrier.

C: And the second barrier does not bump the dancers on the other side.

T: Well done. The space between the barriers is large enough to prevent the movement of one barrier from causing a movement in the other barrier. The barrier on the Red Hot side moves fast when it is bumped and the barrier on the Cool Blues side moves slowly when it is bumped. But the dancers never change from slow to fast or from fast to slow.



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