9.1.122	T/R 1:	Can you tell me, I want you to think real hard about it, if you look at the models, do you see any relationships among them, or between them? If you look at one model and you look at another and you look at another, do you see any connections?
9.1.123	David:	Well...
9.1.124	T/R 1:	Do you understand my question?
9.1.125	David:	Yeah, I think so, on the second question, well, um, both my models were, um, like in this shape, like that.
9.1.126	T/R 1:	Ok, that's neat. I haven't seen that model. Maybe you can build that one on the overhead when we're finished.
9.1.127	David:	Cuz I think this was...
9.1.128	T/R 1:	Ok, that's interesting. Ok, so if you were comparing three quarters and two thirds, how would you do it with that model?
9.1.129	David:	Um, wait, this would be one whole, this is one half, and one of these would be one fourth.
9.1.130	T/R 1:	Ok, that's one half and one fourth. But we're doing three quarters and two thirds.
9.1.131	David:	Well, cuz this was I think was on the second question.
9.1.132	T/R 1:	Right, but now we're doing three quarters and two thirds.
9.1.133	David:	Let's see, um [starts playing with rods as he thinks]
9.1.134	T/R 1:	You know Meredith, that's very interesting what you're telling Mrs. Phillips. I couldn't help but overhearing that, and I'm also talking to David here, but I have a question for you and David to think about, Ok?
9.1.135	Meredith:	[interjecting] Mmm hmmm
9.1.136	T/R 1:	Uh, I probably want you to tell David what you just told Mrs. Phillips. I sort of was listening on the side. Because then I have another question, a challenge for both of you. Why don't you tell David what you just did so David catches up? He was doing a different problem, right, David?
9.1.137	Meredith:	[Meredith has built a model of a blue, brown, and black train, four dark green rods, and three brown rods, and has also included four red rods. As she speaks, she adds two white rods to the model] If you call all these, this one, and these fourths and these thirds, and you take twelve reds, you can call them twelfths, it would be bigger, if you take three thirds, three fourths would be bigger by one twelfth. Or it would be bigger by-
9.1.138	T/R 1:	Just listen to the rest of what she's says, David, for a minute.
9.1.139	Meredith:	Or it could be bigger by two twenty-fourths.

9.1.140	T/R 1:	By two twenty-fourths or by one twelfth. Well, David may need to think about that a little bit, but I noticed that you have a different model here, and I'm going to let you explain that to David, also, but before you do, you can share that with David. I want you to tell me, this is my question to David also, Meredith, do you see any connections between these two models, ok? And now first of all explain it to David and tell him if you see any connections, and then see if you can even imagine a third model and how that would be connected, but it's important that David understands both of these first. Ok? So I'll leave
9.1.141	David:	I think I have some, um, models,
9.1.142	T/R 1:	I think so too.
9.1.143	David:	But I just can't remember them.
9.1.144	T/R 1:	But why don't you work with these? You don't have to build new ones. You should get a little closer to Meredith here and work with these because she has them built and use these two and see if you can imagine a third one even if you can't build it. But, Meredith, can you share this with David and then I'll be back because then I'll want to hear from it in a little bit.
9.1.145	Meredith:	[Meredith has built a second model of an orange an red train, four light green rods, three purple rods, and twelve white rods] This [orange and red train] is called the one, these [light green rods] are the fourths, and these [purple rods] are the thirds, and these [white rods] are twelfths. It's, if you take, two thirds, three fourths,
9.1.146	David:	Yeah, I know, I made the same model
9.1.147	Meredith:	It's bigger by one twelfth. Easy.
9.1.148	David:	That's what I kept on doing but what I'm saying is this. I kept on making the same shape when I did my models, like that. [David has the model of a purple rod, a red rod, and three white rods on his desk]
9.1.149	Meredith:	Why don't you just work with me because we don't have really a lot of cubes?
9.1.150	David:	I had a lot of models I just can't really remember any of them. I was working on the second question.
9.1.151	Meredith:	I need ones. [laughs]. Can I use these ones? I really need ones. I need twenty-four ones.
9.1.152	David:	[points to the white rods that are on Meredith's desk. inaudible. Meredith completes her first model by placing eight more red rods and twenty-two white rods in her model.]
9.1.153	Meredith:	Do you have any more reds over there?

9.1.154	David:	Yeah.
9.1.155	Brian:	Three, those are the four, fourths
9.1.156	CT:	A'right.
9.1.157	Brian:	And these are the three thirds.
9.1.158	CT:	Right, ok. I understand that so far.
9.1.159	Brian:	And so, so, they only asked for two thirds, so I took out one third
9.1.160	CT:	Right
9.1.161	Brian:	And they only asked for three fourths, so I took out one right there. And then they said, how, how much bigger is it, and I said by one twelfth, and I put it right there, and that's how I got it.
9.1.162	CT:	You're calling this one twelfth.
9.1.163	Brian:	Well, well, it, it.takes it takes twelve of these to equal up to one, to equal up to all that. So it's one twelfth.
9.1.164	CT:	How did you know this? Did you guess it or did you,
9.1.165	Micheal	We experimented.
9.1.166	CT:	You experimented with that?
9.1.167	Brian:	Yeah, yeah.
9.1.168	CT:	And it came out to twelfths?
9.1.169	Brian:	I was just going to say that.
9.1.170	CT:	Oh, wow, you people have three models, do you not?
9.1.171	Brian:	Yeah.
9.1.172	CT:	Oh, wait a minute. Or do you? You have one, two, and this is the same one.
9.1.173	Michael:	This is the same one. Yeah.
9.1.174	CT:	So you have two models, and they're asking you for one more.
9.1.175	Michael:	We want each to have two different models.
9.1.176	CT:	Excuse me?
9.1.177	Michael:	Brian wants to have two models of his own, and I want to have two models of my own.
9.1.178	T/R 1:	Kimberly, do you have some extras...
9.1.179	David:	You don't have to fill it up, all you have to do is put it in there.
9.1.180	T/R 1:	What do you need? Ones have become precious I don't see any ones in here. Some. Alright, we'll make a mess. One, two, three, four, five, you have a friend who also... here's some more, ok? You know, a suggestion I have, Alan and Erik, if you can find another table who's solving the same problem, maybe you can combine
9.1.181	Erik:	Well, we need a lot more pieces. Well,
9.1.182	T/R 1:	[speaking to other students]... smaller model. Maybe you can all come together. Maybe, uh, Meredith and David can help you. Ok,

		what do you have here, David? [to Erik] Here! [Erik says oh good]. Ok, where are we?
9.1.183	Meredith:	If you call this a one, these fourths, these thirds, and these twelfths, and these twenty-fourths. And you take three thirds, two thirds- three fourths and two thirds, it's bigger by one twelfth or two twenty-fourths.
9.1.184	T/R 1:	Mmmm hmmm. Ok, I see that, you see that, too, David, and you showed us this one too, but now that's not my question, ok? I'm, I'm asking you a different question. You found in this model that three quarters was bigger than two thirds by
9.1.185	Meredith:	One twelfth.
9.1.186	T/R 1:	One twelfth, right? You found in this model that three quarters was bigger than two thirds by
9.1.187	Meredith:	Two twelfths, two
9.1.188	T/R 1:	Two twelfths - by one twelfth?
9.1.189	Meredith:	Yeah, one twelfth
9.1.190	T/R 1:	Or two twenty-fourths, right? Is that right? One twelfth or two twenty-fourths. So here, this was the difference, in your little model, and here this was the difference in the bigger model, correct? I'm asking you to imagine, ok, so, this is, I'm going to pull this out for a minute, this was your one twelfth, right? And this was your one twelfth or, two twenty-fourths, right? If you were to build a bigger model, can you predict, can you predict without building it, what your comparisons might look like? Can you predict it in your minds and maybe sketch it or...
9.1.191	David:	It would probably be a much, much bigger, because if the model is, say, this big, it would need more reds and more whites than these, 'cause these are small.
9.1.192	T/R 1:	Can you predict how many more reds and how many more whites? I need you to think about that.
9.1.193	Meredith:	It depends how big the, uh, model is
9.1.194	T/R 1:	Ok, that's, that's fair enough. So can you imagine one a certain size and able to predict how many reds and whites. You understand my question? That's a real good question for both of you to think about.
9.1.195	Meredith:	[inaudible, laughs]
9.1.196	T/R 1:	But, to be able to justify your answer, why don't you talk to each other about it, and see what you each think, and try to uh, convince each other first, and then you can try to convince me. Ok?
9.1.197	David:	I think that this one [holding a red rod] might be one twenty-fourth, because

9.1.198	Meredith:	No, because these are twenty fourths. These are twelfths. Well, if it was double the size of this
9.1.199	David:	Yeah, I know, then this would be one twenty-fourth, and then this would be one, one forty-eighth, or something, yeah one forty-eighth. Question, then we might be using something like this, and this would be something like one twelfth or something.
9.1.200	Kimberly:	... three quarters, and if you take one of the twelfths and you put it down here, it fits.
9.1.201	T/R 1:	Hmmm, that's really interesting.
9.1.202	Audra:	And this is the same here.
9.1.203	T/R 1:	Is that another model there, Audra?
9.1.204	Audra:	Yeah, yeah, cuz this is the same here cuz this is the same size, because there's the same purples and it will fit twelve.
9.1.205	T/R 1:	Ok, now, those models look to me the same. You have four greens and you have three purples, it's just that here you have, is it really different, though?
9.1.206	Kimberly:	Not really
9.1.207	T/R 1:	What number name is this?
9.1.208	Kimberly:	That's a whole and that's a whole.
9.1.209	T/R 1:	What number name did you give it?
9.1.210	Kimberly:	A whole, one
9.1.211	T/R 1:	What number name?
9.1.212	Kimberly:	One
9.1.213	T/R 1:	If this has the number name one and this has the number name one, uh, are they different or the same? Are the lengths the same or different?
9.1.214	Kimberly:	They're the same.
9.1.215	T/R 1:	Can you make one where the lengths, for what you pick one is going to be different? Are these models, I guess, this is my question to you, are they really different?
9.1.216	Kimberly:	No
9.1.217	T/R 1:	You see what I'm saying? Can you think of another?
9.1.218	Kimberly:	Audra, can you help me, That one?
9.1.219	Audra:	You don't need halves
9.1.220	Kimberly:	I know but it's easier for me to find it
9.1.221	T/R 1:	And, what rod would you use to represent one twelfth in that model?
9.1.222	Michael:	In this one?
9.1.223	T/R 1:	Yeah.
9.1.224	Michael:	Hmmm, probably, this one, let's see, just a second.
9.1.225	T/R 1:	Just think backward.

9.1.226	Michael:	Just a second, I'll try and measure.
9.1.227	T/R 1:	That's very interesting, Brian and Michael. That's very very interesting. It's the red.
9.1.228	Brian:	I know, I know [Michael shows that a red rod represents the difference between two thirds and three fourths.]
9.1.229	T/R 1:	So you think you're going to use red to represent one twelfth
9.1.230	Michael:	I think. I also came up, I just came up with just came up with the- oh, here it is. [Michael has a second model of an orange and yellow train, three yellow rods, and is trying to place purple rods next to this model]. Nope, I didn't get up to another model.
9.1.231	Brian:	Yes, I think I have fourths, Mike, Mike, wait, Mike, wait, I have one - I think I have one.
9.1.232	Michael:	We already tried that one [Brian groans]
9.1.233	Brian:	I'm frustrated
9.1.234	Michael:	[laughs] I never thought this problem would be this hard.
9.1.235		[conversation between T/R 1 and Erik - view not on camera]
9.1.236	T/R 1:	You might want to study Andrew's model to see what you have to do to make it bigger.
9.1.237	Erik:	We did - we did two oranges and-
9.1.238	T/R 1:	Right, but I want you to make one bigger than that.
9.1.239	Erik:	I can divide it into thirds, but I can't divide it into fourths.
9.1.240	T/R 1:	Maybe you gotta make it bigger.
9.1.241	Meredith:	Ok, let's try to go to thirty. Let's maybe try to go to thirty. This is twenty-four, we need to make it six more. What is six?
9.1.242	David:	[counting out white rods from Meredith's small model] One, two, you don't really need this anymore.
9.1.243	Meredith:	[stopping David] I do
9.1.244	David:	You don't really need that one.
9.1.245	Meredith:	Well, I have an idea.
9.1.246	T/R 1:	Yeah.
9.1.247	Meredith:	Well, say we called it thirty.
9.1.248	T/R 1:	Thirty.
9.1.249	Meredith:	Yeah, um model. Thirty of the ... thirty ones, and
9.1.250	T/R 1:	You're using thirty white ones to make your train, is that what you're telling me?
9.1.251	Meredith:	Yeah
9.1.252	T/R 1:	Using thirty white rods to call one? Will it work?
9.1.253	Meredith:	No not thirty white ones, you would add a six block, which would be, I think would be this six [a yellow rod], yeah so this is six. That would make thirty and you would call the oranges thirds

Description: Clip 2 of 4 A doubling conjecture	Transcriber(s): Yankelewitz, Dina
Description: Clip 2 of 4 A doubling conjecture **Parent Tape: Building Large Models to Show Equivalence: An Exploration (classroom view)** **Date: 1993-10-07** **Location: Colts Neck Elementary School** **Researcher: Professor Carolyn Maher**	**Transcriber(s): Yankelewitz, Dina** **Verifier(s): Yedman, Madeline** **Date Transcribed: Spring 2009** **Page: 7 of 8**

9.1.254	T/R 1:	Would that work?
9.1.255	Meredith:	And some of
9.1.256	T/R 1:	Well, try building that and tell me if that works.
9.1.257	Meredith:	Ok.
9.1.258	T/R 1:	That's, that's something to try. Why don't you try?
9.1.259	David:	I also thought of, um,
9.1.260	T/R 1:	Can you get over there to help Meredith? Are you in an awkward situation where the blocks are down there? Would it be easier for you to put your chair here, do you think?
9.1.261	David:	Well, I was also thinking about the other one. It was, um, it was, um, twice the size of that [pointing to Meredith's larger model] Then,
9.1.262	T/R 1:	Hold on, let's hear what David says.
9.1.263	David:	Then this, then the red would be, um, one twenty-fourth, the whites would be, I think that would be one forty-eighth.
9.1.264	T/R 1:	Oh, so you're saying that if it would be twice the size.
9.1.265	David:	And then this [light green] would be one twelfth.
9.1.266	T/R 1:	That's very interesting. That's an interesting theory. Why don't you test the theory with Michael and Alan, I think they would like to hear this theory. Would you like to hear - I think David has a theory - why don't you come over here. They have an interesting - David has an interesting theory, I don't know if Meredith heard it, tell them his theory, now listen carefully, Jackie, you want to hear this theory?
9.1.267	Erik:	They [pointing to Andrew's table] already had a theory, I heard it.
9.1.268	T/R 1:	Ok, let's hear David's theory.
9.1.269	David:	Well, before
9.1.270	T/R 1:	You know this model, gentlemen, don't you?
9.1.271	Alan:	Yeah.
9.1.272	T/R 1:	Ok, listen to what he's saying with this model. Meredith? Ok, I'm ready to listen.
9.1.273	David:	Well, before, we had this other one, um, where the whites were one twenty-fourth and the reds were one twelfth. But then if we double that, then the reds would be one twenty-fourth, the whites would be one forty-eighth, and then the light green would be one twelfth.
9.1.274	T/R 1:	You may have to say that again. Alan is making a face.
9.1.275	Erik:	I just I
9.1.276	Alan:	No, meaning
9.1.277	T/R 1:	You're thinking that's possible?
9.1.278	Erik:	I heard what Andrew said was
9.1.279	T/R 1:	I would suggest that all of you get your blocks together and pick a spot on the floor over there

9.1.280	Erik:	But I heard-
9.1.281	T/R 1:	And take some mats
9.1.282	Erik:	But I overheard Andrew's - Andrew's doing, what he's doin' is he's makin' a train for the wholes and he said if you could make a train for one whole, why can't you make a train for the thirds and the fourths?
9.1.283	T/R 1:	Interesting question. Let me make a suggestion. If you put floormats on the floor, over there by Chris, who's running the camera-
9.1.284	Erik:	He'll have to look straight down.
9.1.285	T/R 1:	And took all your - he'll manage - and take all your rods, all your boxes, why don't you try building David's model and see if it works.
9.1.286	David:	Um, but
9.1.287	T/R 1:	You can destroy this, because someone else has it. You will use someone else's and you help them, ok Meredith? Because you'll need the blocks.
9.1.288	David:	What was yours before? Was it like two blues... no
9.1.289	T/R 1:	Remember what this is, though.
9.1.290	David:	No, one blue, one black, and um, one
9.1.291	Meredith:	No, one blue, one brown and one black.