

## Appendix: Narratives by Session

### PRH1

Two of the villages in the *PRH1* economy, *blue-pink* and *pink-red*, are highly specialized, respectively averaging 94% and 98% of the fully specialized production over days 29-40. The *red-blue* village is only 76% specialized over the same days because *producer2* did not produce much beyond autarky (40 blues and 10 reds). *Merchant3* also did not begin to specialize until days 39 and 40. Notably, these villagers failed to build a strong social connection. While the discussion is not overtly unfriendly, it distinctly lacks the “we” mentality of a community of four. For example, *merchant3* declares on day 18, “Okay this is too busted, I’m gonna just make my own stuffs. Forget this.” Shortly thereafter, though, *merchant3* engages in an almost exclusive bilateral relationship with *producer2* trading pink for blue. *Producer1* and *merchant4* also exchange nearly exclusive with each other. Their conversations are multilateral, but the exchanges are not, as this excerpt from day 21 illustrates:

*Producer1*: who you trading with? other travelers from other groups?

*Merchant4*: yeah

*Merchant4*: person 8

*Merchant3*: Heheh.

*Merchant3*: 8 is great!

*Producer2*: i cant travel, i dont have a bucket

*Producer1*: yeah only 3 and 4 can

*Merchant4*: thats why you needed to share hgaha

*Producer2*: lool

*Merchant3*: Well then, I can give you pink if you want, #2

*Producer2*: yes plz

*Producer2*'s problem is that she is not specialized and hence has little to offer *producer1* and *merchant4*, and despite *merchant3*'s suggestion on day 37, “#2.... hey, I make all red, you do all blue, and I spiff you with pink”, she never does. She instead spends most of the session asking and sometimes begging: “can u give me pink” and regular statements of “i need pink”. Her perspective is “I just need pink”, and she does not go beyond that. She offers blue from time to time (“I can give blue” on day 28), but having produced a total of 40 units, she has little to offer others as a valuable exchange partner. This holds back the entire village from taking advantage of intervillage trade. *Merchant3* and *merchant4* both first bring back pink on day 17. *Merchant4*, however, exclusively exchanges pinks for reds with *producer1*. As part of this bilateral relationship, *producer1* moves all 130 of his red to *merchant4* to seek the best terms for the two of them:

*Producer1*: you want all my reds again?

Merchant4: yeah

Merchant3: If you have extra red or whatever....

Merchant4: ill do the splitting

Thus, *producer1* earns \$9.13 and *merchant4* \$9.75 over days 29 through 40, while *producer2* and *merchant3* only earn \$3.13 and \$2.01, respectively.

Unlike the *red-blue* village, the *blue-pink* village is a highly cohesive community of four, nearly fully specialized in production, and a large trader in the merchant area exchanging both blue and pink for red. The day 1 conversation sets an initial friendly tone for the village:

Merchant7: hey

Producer5: hi

Merchant8: sup

Producer6: whats shakin

Merchant8: so maximize

Merchant8: make more than u need

Merchant 7: who needs what

Producer5: 6, can you make pink? and i'll make blue?

Merchant8: and we can help eachother out

Merchant8: no wasting

Producer5: after this round ..

On day 4 both producers fully specialize and begin trading bilaterally with each other. The merchants take longer to specialize and also nearly exclusively trade with each other. On day 18, a bit of tension surfaces:

Merchant8: give me all ur reds and blues and we will be rich

Producer6: ha

Producer6: rright

Merchant8: Person 7 drag everything to me so it multiplies

Producer5: heh . i've been give you guys left over ...

Merchant7: what do i get/?

Merchant8: Person 5 and 6 u guys are greedy

\*\*\*\*\* Day 19 \*\*\*\*\*

Producer6: man 8 is getting greedy

Merchant8: trust me

Merchant8: too late

Producer6: he just made 6 bucks last round

Merchant8: who?

Producer5: can i get some pink now?

Producer5: hmm

Producer6: hmm

Producer5: there u go, 7

Producer6: you need to keep more blue 5

Producer5: ok

Producer5: say .. i give u 41 instead of 42

Producer6: nvm

Producer6: we are find

\*\*\*\*\* Day 20 \*\*\*\*\*

Producer6: fine

Producer5: heh :p

Producer6: ok

Producer6: someone has to be making more pink?

Producer5: nah.. it's all good  
Producer6: dude 8 is gipping 7  
Producer6: thats sucks  
Merchant8: Person 7  
Producer6: i hope its his friend  
Merchant7: ya  
Merchant8: nothing

Throughout these conversations, *merchant8* and *merchant7* are bringing back red from the merchant area, and each consumes all of it himself. But then *merchant8* offers the following proposition to *producer5* and *producer6*:

Merchant8: ok Person 5 and Person 6  
Merchant7: ill give u blue for ur reds  
Merchant8: if u want red to multiply ur stash  
Merchant8: u have to give up some blues and pinks  
Producer5: ok  
Producer6:  $12 * 7 = 84$   
Producer5: give me 20 instead, 6  
Producer6: ok  
\*\*\*\*\* Day 21 \*\*\*\*\*  
Producer5: and i'll give you 30  
Producer6: ok  
Producer5: the rest will go to 7 and 8  
Merchant8: 30 pink?  
Producer6: wo wo  
Producer6: dont give any to 8  
Merchant7: k  
Producer6: he is gipping people  
Merchant8: if u guys give Person 7 and i a lot  
Merchant8: we will give u reds  
Producer6: oh ok  
Merchant8: as many as the "others" give us  
Merchant7: i need pink  
Merchant7: haha  
Producer6: im fine with that  
Merchant8: and i need blues  
Merchant7: k  
Producer6: ok  
Producer5: ok i'll give you blue  
Producer5: and 6 will give , 7 pink  
Producer6: alright so ill have 30 pink to spare  
Producer5: from our left over.. we'll see how it goes  
Merchant8: i have only make \$4 so far  
Producer6: k  
Producer5: i should have ... 30 left over?  
Producer5: i'll give u 30 blue next round, 8  
Merchant8: make the numbrs equal

At this point, the exchange becomes multilateral with *producer5* sending blue to *producer6* and *merchant8* and *producer6* sending pink to *producer5* and *merchant7*. When the merchants

return with red, they both give both producers some of it. What is interesting is that the red is returned so as to equalize (imperfectly) earnings across the producers and merchants. Over days 29-40, the earnings for *producer5*, *producer6*, *merchant7*, and *merchant8*, respectively, are \$11.30, \$11.76, \$11.23, and \$13.33. By the end of the experiment, the wealth from the intervillage trade makes everyone happy. As *producer6* says on day 36, the merchants and their buckets are “like a ready bake oven...throw in some blue and pink and wa la you got red”.

The *pink-red* village has one feature in common with both of the other two villages. Like the *blue-pink* village, the *pink-red* village is highly specialized. Except for a few days, the producers are completely specialized. The common feature with the *red-blue* village is that the intravillage exchanges are bilateral. *Producer9* and *producer10* discover that they both speak French and conveniently converse to the exclusion of the merchants, except when they choose not to. When the merchants discover the ability to trade for blue, they return the favor and ignore the producers:

\*\*\*\*\* Day 34 \*\*\*\*\*

Producer10: and how do u travel???

Producer9: only 11 and 12 can travel

Producer9: i think

Producer9: what the hell is that bucket anyway?

\*\*\*\*\* Day 35 \*\*\*\*\*

Producer10: man this aint serious?!?!?!?!?!?

Merchant12: this it tough

Merchant11: Merchant12

Merchant11: should we keep doing what we are doing

Producer10: c'mon u guys should stop???

Producer10: hihihihih

Producer10: Person 9 this aint fair man????

Producer10: dont u think

Producer10: ???

\*\*\*\*\* Day 36 \*\*\*\*\*

Producer9: yeah, but we're making more money than them anyway

Producer10: where do u go when u guys travel

Producer10: china???

Producer9: ha

Producer9: quebec?

Producer10: hihihihih

Merchant11: hey 12

Merchant11: doesnt blue get u more money?

Merchant11: wouldnt it make sense

\*\*\*\*\* Day 37 \*\*\*\*\*

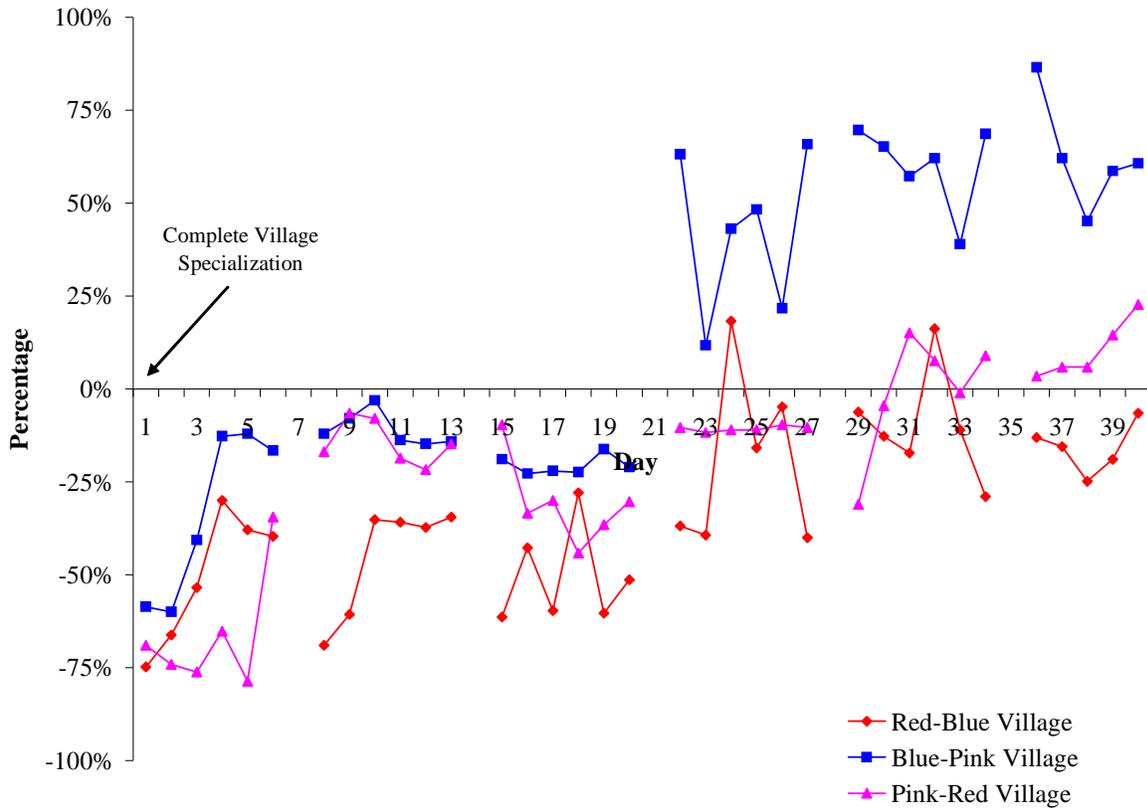
Merchant11: to do 10 each

Producer10: stop traveling guys

Merchant11: and then hustle the rets

Hence, it appears that specialization at home is necessary to take advantage of long distance trade, but it is not sufficient. A personal social community among the four members of the

village also appears necessary. If the producers and merchants do not develop personal social bonds, the merchants cannot take advantage of their ability to transport the third good and the producers cannot take advantage of their ability to produce goods to trade for the third good.



Efficiency by Village: *PRH1*

*PRH2*

All three villages in this economy fully specialized early in the session: the *red-blue* village by day 6, *blue-pink* by day 2, and *pink-red* by day 9.

In the *red-blue* village, cooperation and collective problem solving both begin on the first day. The villagers coordinate production, and after a few days of trial and error mapping of the production space, they are fully specialized by day 6. As the merchants in the village become aware of their productive disadvantages, they begin to complain:

Merchant4: they r set up to make more... look at their numbers  
 Merchant3: I kno... thats dumb.

But this all changes when they discover that they can use their buckets for intervillage trade. On the 21<sup>st</sup> day, the first day of rest after their discovery of intervillage trade, this exchange occurs:

Merchant4: they are set up to make more

Merchant3: that sucks

Producer2: not really though ... yall could be makin bank ... cuz u have buckets.

By the third day, one of the producers in the village has become curious about the use of the buckets, but intervillage trade is slow to evolve. The buckets are largely ignored until the merchants start to talk about acquiring pink on the 12<sup>th</sup> day. By day 13, *merchant3* solves the problem, “i think other people have pinks ... we can trade 4 them.” And by day 15 intervillage trade has begun. *Merchant3* returns with pinks, inspiring excitement in his fellow villagers, and he quickly explains to *merchant4* how he can get pinks as well, “press the travel button and trade reds for pinks ... trade blues for pinks.” None of this makes sense to the producers, as two and three days later, one of them still believes that pink is created by combining red and blue in the bucket. But then *producer2* has an idea, “lemme get some pinks next time 3 ill give you some blues too if u want.” Once the pattern of production, exchange, and consumption reaches a level that all agree upon, the interactions become stable. Multilateral trade continues to the end of the session, with the villagers earning \$13.34, \$9.94, \$10.87, and \$9.43 respectively over the last two weeks of production.

In the *blue-pink* village, exchange and specialization begin on the second day. One villager teaches the others how to move goods around, and they pair off into exchange groups. By day 2 this village is fully specialized. The group is generally cohesive, but on day 20, there is a flare of temper as *merchant7* reacts to the large earnings disparity between *producer5* and the other villagers. He takes on the role of distribution-police and attempts to coordinate an equitable distribution of their production. He is ignored by the rest of the villagers, and so he quickly moves on to other topics. Eventually, on the 26<sup>th</sup> day, he resigns himself to the inequity with a hint of sarcasm:

Merchant7: look at his (5's) [earnings] 93 times the multiplier

Merchant8: 5's doing good

Merchant7: that's ok though, he makes the most product too ... 8 and i are gimps we make the least product

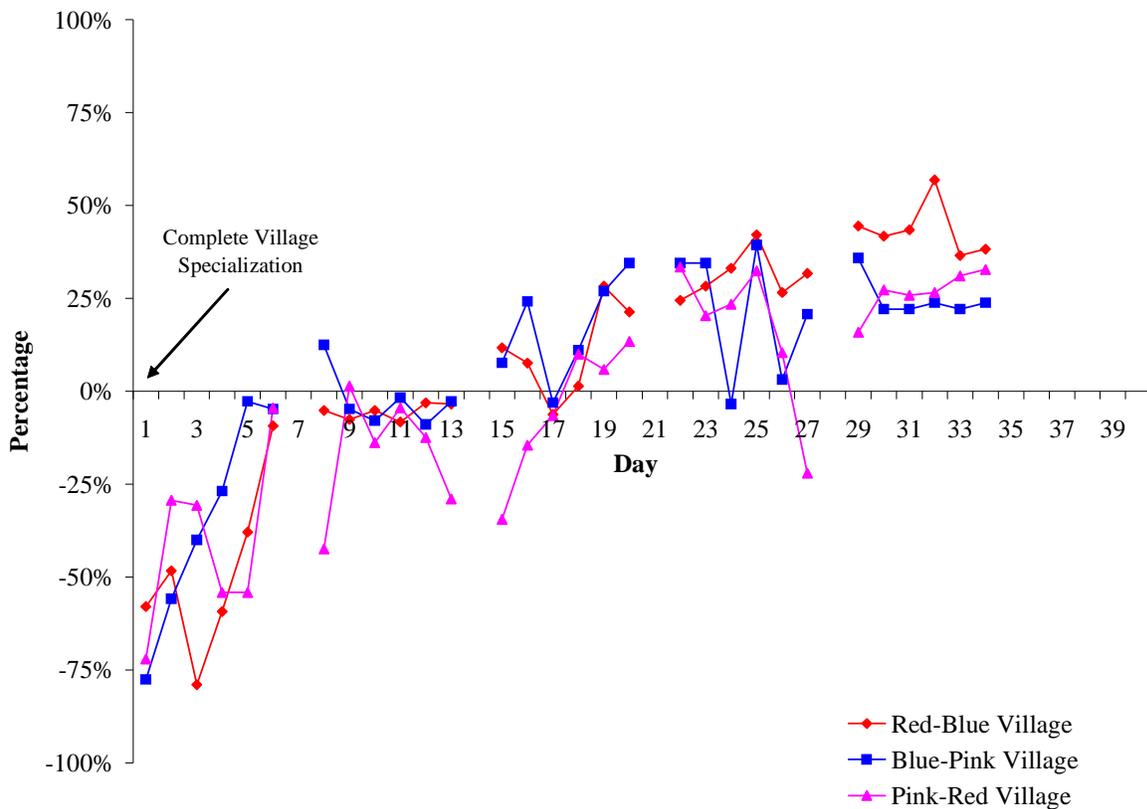
Producer5: right i make the most so dont hate guys i cant help it.

Once they get beyond this problem, the tone returns to cohesion and they chat until the end of the session.

By day 5, *merchant7* completely understands the possibility and process of intervillage trade, as is evident in this exchange:

Producer5: does anyone have reds?  
 Producer6: no  
 Producer5:thats odd  
 Merchant7: they're in the other rooms  
 Merchant8: how do you get reds?  
 Merchant7: the travelers can talk to them if they are in the travel room ...  
 Producer5: is there a way for anyone to go to the other rooms?  
 Merchant7: and then we can trade with them using our buckest  
 Producer6: 7 has the bucket.

His plan is foiled, though, because when he goes to the travel screen there are no other villagers with whom he can interact. By the 8<sup>th</sup> day *merchant7* returns with red, but on day 10 he informs his fellow villagers that he is no longer trading with the others. In his place, *merchant8* begins to trade on behalf of the other villagers, and when he returns he distributes his acquisitions evenly.



**Efficiency by Village: PRH2**

Once *merchant8* finds a stable trading partner, the production, exchange, and consumption numbers settle into a pattern that lasts until the end of the session. The villagers earn a total of \$13.84, \$11.11, \$ 7.60, and \$6.12 over the last two weeks of production.

Exchange and specialization begin on the first day in the *pink-red* village. *Producer9* directs the production decisions of his fellow villagers telling them to specialize and in what

good they ought to do so. They are skeptical of his advice at first, but by the 10<sup>th</sup> day the village is fully specialized.

The villagers discuss intervillage trade on the first day. *Producer9* tells the two merchants in his village to go trade for blue, and they take his advice. But, when *merchant11* goes to the trade screen on day 4, there is no one there with whom he can trade. The producers react angrily to his failure to acquire blue, but by the 8<sup>th</sup> day, *merchant12* brings blue back from the merchant area. They have problems with the other villages being too slow getting to the travel screen for a few days, to the extent that *merchant12* suggests they give up trying, but they persevere and work out a consistent arrangement on day 14. The merchants want goods from the producers, but the producers say they will not give them anything until they acquire blue. This boils into an argument on day 19. *Merchant12* is irritated because he is specializing in red and not receiving any pink to complement it:

\*\*\*\*\* Day 9 \*\*\*\*\*

Merchant12: ok, I am getting blue, while I'm gone get me pinks, it's not hard

\*\*\*\*\* Day 19 \*\*\*\*\*

Merchant12: you people keep on doing me wrong, you say to make reds then never give me pinks.

The others tell him, in effect, that that is not their problem. They'll help him when he helps them, "trade first...then I give you pink...im not giving you any pinks until you get blues". This continues, increasing in intensity, into the 21<sup>st</sup> day, with each side repeating their previous remarks until *merchant12* explains that he cannot acquire blue because there is only one person trading it and he is trading with *merchant11*. On the next day, *producer9* gives him some pink, but they soon begin to tell him that they can't do that each turn and that he ought to adjust his production to look out for himself. The argument continues, and on day 24 this exchange occurs:

Merchant12: there is only one person [merchant] who trades blues, and he trades with 11, what else do u want me to do? ... i will give u reds

Producer10: make what u need that's what i would do if i were you.

Thereafter, *merchant12* becomes in essence a beggar. He pleads with his fellow villagers for pink, but to very little avail. Nothing he can say will satisfy them. Finally on the 29<sup>th</sup> day he agrees to trade 10 reds for 10 pinks with *producer9*. *Producer10* also become apologetic, "that's what i dont get, it comes across as greediness like we hold out till we get what we want or no deal but with me, i want to help you guys." *Merchant12* trades a bit more with the other villagers towards the end, but he remains a social outcast. Over the last two weeks of production, the villagers earn \$11.54, \$7.92, \$14.61, and \$3.99.

The merchant area is all about making deals. They quote prices back and forth and exchange, but very little other interaction occurs. Lonely *merchant12* goes to the travel screen at one point and types his requests for trade in French, but as usual, his requests are ignored.

### PRH3

The distinctive characteristic of this economy is its high degree of specialization. By day 8, all six merchants are fully specialized. The producers, however, vary in their degree of specialization over the last 12 days: averaging 70% in the *pink-red* village, 90% in the *red-blue* village, and 100% in the *blue-pink* village.

From the beginning of the session, the villagers form “teams” in the *red-blue* village; *producer2* and *merchant3* pair off as do *producer1* and *merchant4*. By day 5, however, the producers form one team, the merchants another, and these pairs remain separated for the entire session.

The *red-blue* merchants are thinking early on (even before specializing) about long distance trade as shown by such comments as, “i don’t see anyone making pink” in period 2 and “ok how does the traveling hwo?” in day 7. In day 10, *merchant3* and *merchant8* agree in principle to trade “5 pink for 5 red”, and from day 12 on, they trade at a one-to-one ratio every day reaching a steady state volume of 25 pink for 25 red in day 19. When *merchant3* first returns with pink in day 12, *producer2* exclaims, “HEY WHOOA where are the pinks coming from?!?!”. Except for a couple rare occasions, *merchant3* only shares his pink with his partner *merchant4*. With this pink, the merchant pair earns \$1.30 on average as a team over days 29-40 as compared to the \$1.52 for the producer team. *Producer2* makes frequent requests, pleas really, to *merchant3* and *merchant4* that “we could all make bank if we worked together” and “seriously tho...if me and #1 could get some pinks, we could afford to give away some of our reds and blues to give you guys a better profit”, but *merchant4* replies that the other partnership is not interested: “it sounds complicated, I’m afraid it’ll get messed up” and *merchant3* says “uhm. Would that just be more trouble 4?”. In day 38, *producer2* makes the following interesting observation:

Producer2: i think the people running this experiment are wondering why everyone is always so anxious to get a partner first thing and then are sooo adamant about not changing their set pattern...i think it’s like people who still mail their bills instead of paying online...

Producer1: haha, could be

Producer2: it's the market!! take risks!! especially cause it's a fake market!!<sup>1</sup>

The *blue-pink* village stands out from all of the rest. First, the exchanges among the *blue-pink* villagers, nearly from the beginning, are multilateral, and by day 5 the entire village is completely specialized. From the first day on, the villagers are champing at the bit to get the third good, red, saying: “7 and 8 prolly have to travel to get reds from the other people” in day 1, “we need those reds” in day 3, “man i wish that other room would get some people” in day 4, and “you see if we can get those reds yet?” in day 6. When *merchant8* first brings red back, he asks, “what do i do with the red”, to which *producer6* replies, “pass em out”, i.e., pass them out evenly. Starting with day 25, *merchant8* gives himself 14 reds and the other three villagers each receive 12.<sup>2</sup> The personal exchange of this village is quite evident in day 25's conversation:

Merchant8: we are awesome  
Producer5: yup  
Merchant8: go team!  
Merchant8: haha  
Producer6: yup. best team i've had in these things  
Merchant8: agreed  
Producer5: lol yah  
Producer6: usually there's some idiot who just hordes his own blocks  
Producer6: so sad  
Producer5: lol  
Merchant8: very sad

The conversation in the *blue-pink* village also reveals out-group and in-group attitudes among the village members:

Merchant8: btw people are now JUST learned [day 39] what others need and how to trade  
Merchant8: i kinda wanted to laugh at them  
Producer6: heh heh  
Merchant8: listen someone needs blue on the other side  
Producer5: o ok  
Producer5: I can make mad blues

The most distinguishing feature of this village is that it is the wealthiest of all 24, notably because, in addition to being fully specialized, *merchant8* trades 25 pink and 25 blue for 50 red, 25 from each of the other two villages. *Merchant8* summarizes it this way in day 33:

Merchant8: u know whats funny  
Producer6: what's funny?  
Merchant8: i wonder if the other ppl that im trading with realize that im trading with 2 people and getting twice as much...  
Merchant8: i mean i trade 25 with both of them  
Merchant8: but i get 50 total

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<sup>1</sup> Yes, this economy is conducted within the artificial confines of the laboratory, yet it is amazing to observe different spontaneous orders across different economies and different villages within the same economy.

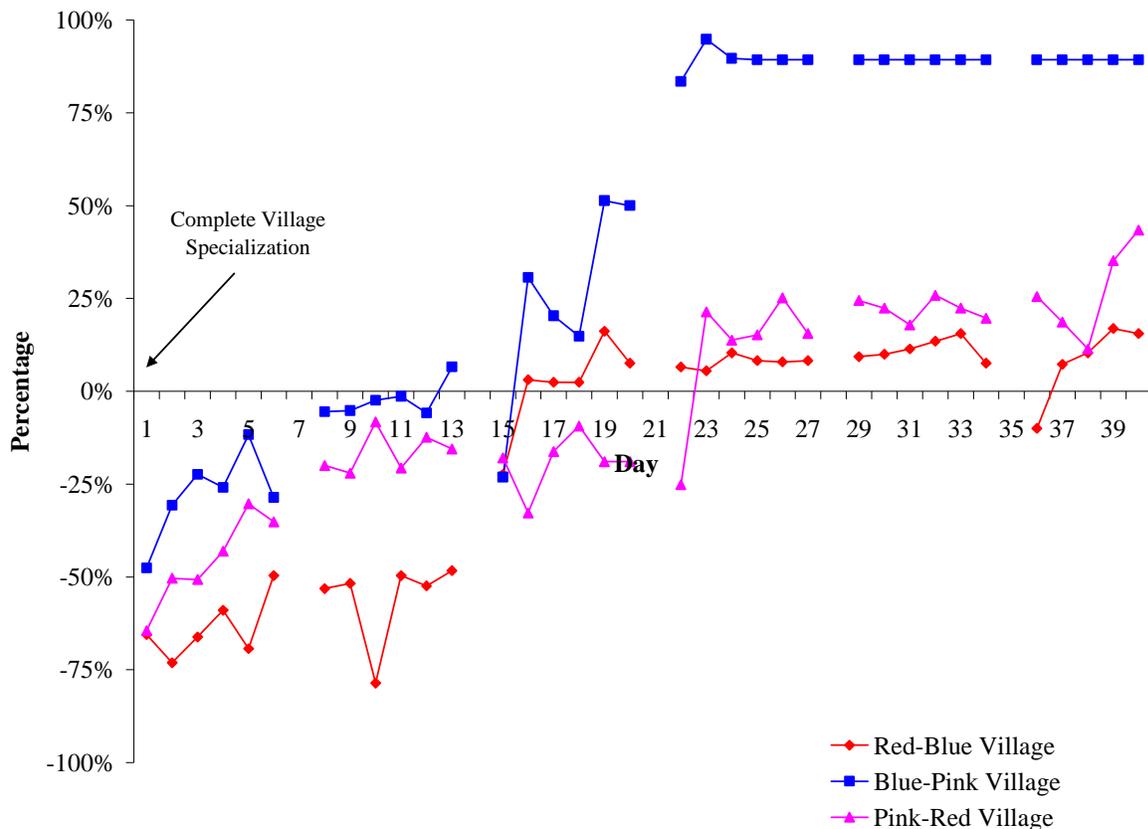
<sup>2</sup> Interestingly, the earnings of the other three villagers are \$1.39/day/person while *merchant8*'s earnings are \$0.97. *Producer6* offers to equalize *merchant8*'s earnings in period 20 but the merchant declines “u don't need to do that”.

Merchant8: and they only get 25  
Merchant8: and nobody else is really trading

*Merchant8*'s observation is notable. An outsider observing these economies with the knowledge of the experimenter could assert that these subjects are presumably aware of many capabilities (e.g. exchange, specialization) and so what they are discovering is something specific to this particular interface. But such an observer lacks the perspective of the subject, or better put, such an observer possesses additional perspective that is not available to the subject.

Hence, *merchant8* is expressing something deeper in his surprise that others are not stumbling onto the welfare-enhancing power of long distance trade. This is intriguing because it precisely highlights one objective of this project—to observe how subjects discover, implement, and develop long-distance exchange via impersonal networks. We are observing that subjects apparently learn and imitate how to implement opportunities more readily in personal exchange than in impersonal exchange. Why is that? Because the merchants are more cognizant of the circumstances of the local villagers than they are of those with whom they engage in distal exchange. Learning, it seems, occurs by analogy. With no guarantee of shared experience between the members of the separate villages and without the wholly tacit understanding that they share similar experiences in the villages, merchants do not even bother to look to the merchants from other villages to find ways of improving their production, consumption, etc. They have no evidence that others face similar circumstances, and as a result, they assume that they have nothing to learn from those others.

In the merchant trading area, there is no discussion of profits or how to maximize welfare of the merchants of different villages. It's business: "alright 20 for 20 pink", "same thing 8", "yep", and "just do it...don't even have to ask". Hence, if a merchant from the *red-blue* village is not aware why *merchant8* from the *blue-pink* village is trading to take home 50 reds, then the welfare benefits are not obvious for trading to take back 50 pinks to the *red-blue* village.



### Efficiency by Village: PRH3

Why didn't they think, "if 25 pinks are good, 50 must be better"? Because one has to know the extent to which the third good increases earnings. As *producer6* says, "maybe this means the other room has figured out that multipliers are good". But the goodness of 25 units of the third good may not be the same for both you and me, and that is precisely the point. An individual knows more about the circumstances of those with whom he engages in personal exchange than those with whom he impersonally exchanges.

The *pink-red* village can be characterized as a combination of the other two villages. Just like the *red-blue* village, the *pink-red* villagers try to form two producer-merchant pairs, but on day 16 *producer9* initiates the following discussion:

Producer9: I actually think that if 10 and I work together it would be better  
Merchant11: ?  
Producer9: cause I make a lot of pink and he makes a lot of red and we can balance it out  
Merchant12: ok i think we all need to work together  
Merchant12: thats why it is four of us in this room  
Merchant11: Yeah if the smaller producers work together they make a smaller profit

Thereafter, exchange among the villages becomes multilateral, though the producers still earn a little more than the merchants for the last half of the session (\$0.83/day/producer vs. \$0.72/day/merchant). These villagers take much longer, until day 21, to discover the benefits of long distance trade:

Merchant11: So 9/10 got the ability to produce many more than 11/12

Merchant11: But 11/12 got the ability to travel, which I still don't see a point to

Producer10: yeah, what IS the point of travelling

Merchant11: No clue

Producer10: okay so i switched to 90% red, 10% pink

Producer9: Hey 11 or 12 see if you can travel and pick up blues anywhere

Merchant11: Oh God

Producer10: i was JUST GONNA SAY THAT

Merchant12: there is a point in trying to trade with the others but we havbe to find a patter with us first to go ahead annd start something new

Producer10: smart thinking!

Merchant11: I think that's what it was

Merchant11: That's a little too much

Producer9: cause we need the blues for upping profit

Producer10: right

The *red-blue* and *blue-pink* villages have been trading for several days by this point, yet where do they discover the benefits of long distance trade? From within their own village. Immediately after this discovery in day 22, *merchant12* begins a trading relationship with *merchant8*, exchanging 25 red for 25 blue for the remainder of the session. However, the welfare-enhancing power of this exchange is limited at home because the producers in the *pink-red* village are the least specialized (70%) in this economy.

Just as in the *blue-pink* village, this merchant divides the third good evenly among the four members of his village, to the point of rotating the 25<sup>th</sup> unit across the four villagers from day to day. On day 39, *merchant11* begins trading 8 pink for 8 blue with *merchant4* from the *red-blue* village.

#### PRH4

Like other *PRH* sessions, these villages are highly specialized. Over day 29-40, the *red-blue* and *pink-red* villages are 100% specialized and the *blue-pink* averages 97% of the fully specialized output.

Cooperation among the *red-blue* villagers begins on the first day. They specialize to differing degrees for the first 17 days, some reaching full specialization only to de-specialize during the next day as another fully specializes. By the 18<sup>th</sup> day, the entire village is has achieved full specialization. On day 4 the villagers decide to pair off, but the pairs shift around as they

discover their relative productive capacities. Initially merchant-producer pairs form, but the producers quickly realize that they would be better served by working together. By day 12, the two merchants have paired off and so have the two producers.

Despite the changing pairs, the group as a whole remains quite close-knit, possibly too much so. This group is so focused on home production and consumption that they do not trade with the other villages until the 30<sup>th</sup> day. Their first curiosity regarding the buckets is expressed on the 16<sup>th</sup> and 17<sup>th</sup> days: “i bet when this chat room extends to more people, people will have pink, and its going to get crazy!” A discussion ensues about the relative productive advantages of the producers, and then *producer2* says, “or maybe 3 and 4 are supposed to use their buckets.” The response by the merchants is quick and short, “i dont know what the buckets are for” and “forget the buckets for now.” Innovation is stopped short. However, on the 18<sup>th</sup> day, *producer2* presses the issue, and *producer1* has the necessary intuition:

Producer1: the multiplier is going to get complicated ... becaue i bet some people cant product blue or red, and instead have a ratio of blue:pink, or red:pink.

Merchant3: yeah

Producer2: hmmm.... That's true

Merchant3: thats what the buckets are for so we can go trade and get some multipliers.

On day 26, the merchants finally find a suitable trading partner after experiment with the buckets for three days. They then ask the producers to provide a portion of their production for trade. As the merchants spend more time on the travel screen, the producers start to wonder what's going on and eventually turn to joking, “so I guess that's how theirs works ... they can go to the other room and see what the other ppl have... interesting... still i don't really get it yet...3 and 4 are cheating on us going to other chat rooms.” Finally, the merchants establish intervillage trade on day 30 and it continues, though fluctuating in scope, till the end of the session. The villagers earn \$9.90, \$8.80, \$6.69, and \$5.93 respectively over the last two weeks.

The villagers in the *blue-pink* village begin cooperating on the first day with a discussion of consumption ratios and a suggestion that they pair up. The subjects slowly coordinate specialization and shift their pairings around. Eventually, *merchant8* pairs with *producer5*, and *merchant7* with *producer6*, and by the 11<sup>th</sup> day, all are completely specialized for the first time. (For some reason, though, *merchant8* does not remain fully specialized, instead producing one or two pinks each turn at the cost of 10 blues.) The discussion in this village is largely about exchange, and the villagers are extremely slow to settle into a set pattern of production and trade.

By the third day of rest, they do not even discuss the experiment. Yet when it ends, they quickly return to the business of exchanging with one another.

Discussion of the bucket begins on the 4<sup>th</sup> day, but no action is taken until the 14<sup>th</sup>. By the 28<sup>th</sup> day, the fourth day of rest, *merchant7* has spent a few days on the travel screen just chatting idly wondering about the purpose of the buckets. Finally on the 33<sup>rd</sup> day, *merchant7* returns with some red. He does not, however, share it with the others. The producers try to find a way to “get in on the red action,” but the session ends before an arrangement can be reached. Over the last two weeks, the villagers earn \$6.19, \$7.60, \$7.55, and \$3.72.

In *pink-red* village, one of the producers begins by specializing completely and looking for a trading partner. And before the end of the day, he is explaining to the others how they are to acquire the third good by trading on the other screen. The group is fully specialized for the first time on day 8, but not until day 13 do they consistently specialize.

By day 3, *producer10* is trying to convince the merchants in his world to take some of his production to the travel screen to trade for blue, but to no avail. *Producer10* emphasizes this each day, but each time that his merchants go abroad, they come back empty handed. This continues for a few days until *producer10* gives up and focuses his energies on home production and consumption.

On day 12, *merchant12* becomes frustrated with *merchant11* and tries to partner up with *producer9*, who has thus far been paired with *producer10*:

Merchant12: 9 im gonna do 100% reds... trade with me next round  
(...)  
Producer10: 9 are you sticking with me?  
(...)  
Producer9: [to 12] work on red  
Merchant12: okay  
Producer10: 9 are you leaving me?  
Merchant12: and me and u trade  
Producer9: no im doing with 10  
Producer10: ok good thanks.

*Producer10* need not saying anything more than that to convince *producer9* to continue their relationship.

After completely specializing, on day 18 the villagers return to their attempts to understand the purpose of the buckets:

Merchant11: ok, now need to understand this bucket concept  
Producer9: yeah  
Merchant12: what is the bucket  
Producer9: i don't get that bucket thing any idea?

Merchant11: me neither, i have one and it does nothing

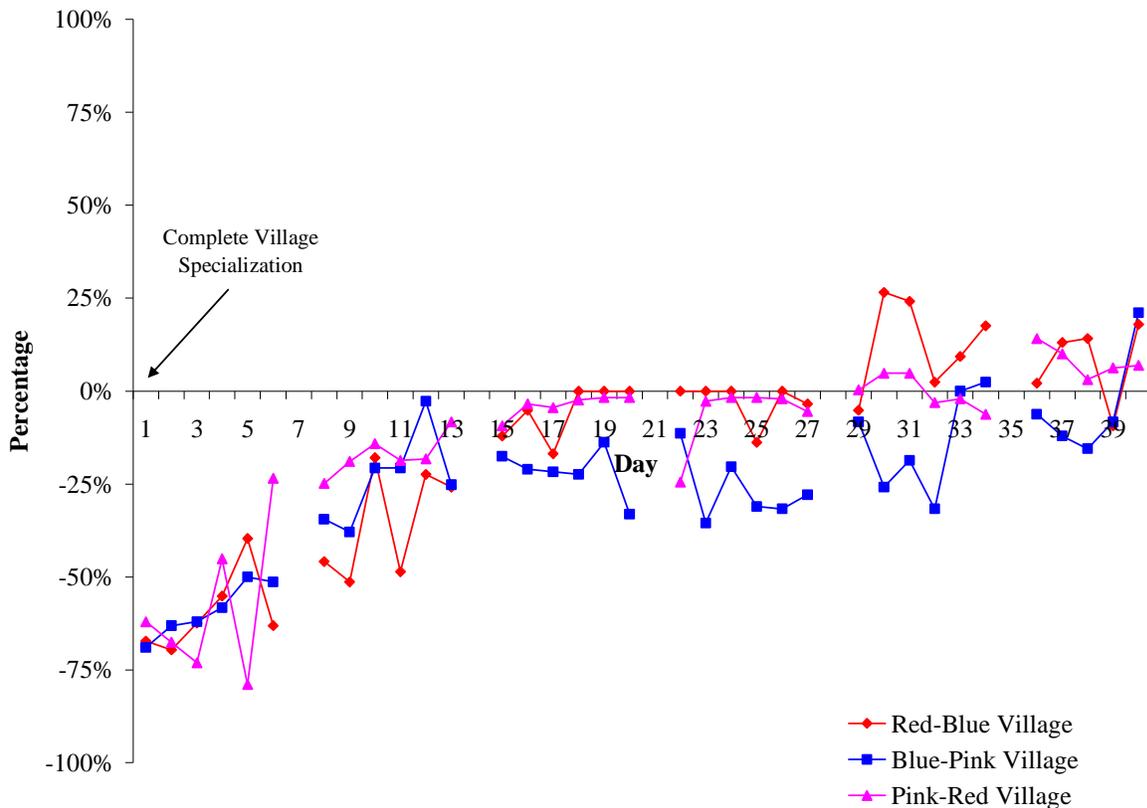
Producer10: you should be able to “travel” with the bucket and go get blue ones so that it takes your profit and multiplies it by 1.2 or something

Merchant12 i have one as well

Producer10: I have heard about it before (...) you would take it to another room and trade your extras (...) but apparently you are saying there is noone nextdoor

During the next day of rest, they discuss smoothing consumption, but nothing comes of it. Finally, on the 23<sup>rd</sup> day, the merchants encounter others on the travel screen, but it takes until the 29<sup>th</sup> day for them to begin importing any blue. *Merchant12* imports blue from this point forward and divides it unevenly between *merchant11* and himself. From that point to the end of the session, the villagers earn \$10.35, \$7.90, \$4.60, and \$6.33.

Overall, very little activity takes place on the trade screen until the 23<sup>rd</sup> day. At that point, the merchants begin to exchange. They quote some prices back and forth, but often they simply exchange without discussing prices. The volume of trade grows slowly until the session ends.



Efficiency by Village: *PRH4*

## NPRH1

The *blue-pink* and *pink-red* villages are highly specialized over days 29-34, 89% and 94%, respectively. The *red-blue* village, however, peaks at 44% specialization on day 30. Each villager produces at a level close to autarky, only specializing beyond that level by about 12%.

With no history of property rights, the *red-blue* villagers are quick to make their expectations about trust explicit. The second statement in the chat room is “let’s be real... no stealing... its just dumb.” They are as yet unaware that property rights are being enforced in their village. That said, they go immediately to the task of collective problem solving and seek out the differences and similarities among the members of their villages. They are also eager to explore the possibilities arising from the newfound ability to “travel”. Nonetheless, they seem to have difficulty rediscovering the ability to exchange. In their session from the previous day, exchanges usually involved the recipients agreeing to take from their counterpart as opposed to giving units to one another (though both were possible). Now, with only the latter possible, it takes until the 15<sup>th</sup> day for the producers in the village to learn that they can exchange by giving goods to the other villagers.

Their eagerness to emphasize the acquisition of the third good means that this group never successfully specializes; the most they ever specialize in a given *day* is 44%. As they discover that pink can “bring [them] FORTUNE”, they are mesmerized by “the magic bucket”. The focus is on how the pinks will be distributed and not on how to get more. They do not specialize more as intervillage trade increases.

In this economy we have explicit reference to a merchant taking a margin for providing the service of long-distance trade. *Merchant3*, returning from the trade screen with goods acquired on behalf of *producer1*, says “Should I divide it evenly person 1 or do you want all of your 13?...I will just give you what you give me...minus 1 or 2 for the effort.” For most of the session this pattern continues, but red is the only good that the villagers are able to trade for pink. Thus *producer2* and *merchant4*, who have a comparative and absolute advantage in producing blue, are distressed at their inability to acquire as much pink. By about the 28<sup>th</sup> day the other villagers express concern about the earnings of *producer2* and *merchant4* and attempt to devise ways to increase their earnings. Blue finally becomes an important commodity in intervillage trade, but *merchant4* is taken advantage of by *merchant11*, only receiving pink in exchange for

blue on one out of five days in which they attempt to exchange (2 pink for 44 blue in total). The group rallies around their exploited member, even calling Person 11 “mean” and “scandalous”, but the session ends before the situation can be rectified. Over the last two weeks of production the villagers earn, \$6.44, \$3.90, \$3.96, and \$1.41 respectively.

The interaction in the *blue-pink* village begins with a business-like attitude. The villagers organize production and consumption from the outset and begin to exchange on the first day, but most of the interaction focuses on terms of trade and differences in ability. They first engage in intervillage trade on day 10, and they are 99% specialized three days later. As they realize the value that they can provide for one another, the interaction slowly changes from impersonal to personal.<sup>3</sup> Each time *merchant8* returns with red, he receives congratulations from the producers, and they slowly work out exchanges so that each person contributes and each receives a portion of the imported reds, though *merchant8* consumes 1-4 more reds than the others. Much like the situation in the *red-blue* village, the *merchant7* who specializes in producing blue, which has no value on the intervillage market, quickly becomes excluded. And again, after a time, the other villagers attempt to help their fellow villager out with suggestions regarding his behavior. They do not, however, offer any direct charity, presumably because *merchant7* has never been able to provide anything for them. Their ambivalence can be seen clearly in this quotation from day 32. “Sometimes I feel bad for 7. Sometimes.”

By the third day of rest, the villagers believe they have figured it out. They are earning a good amount of money and begin to talk and make jokes, even referring back to previous jokes. Eventually, *merchant8*'s extra consumption of red gnaws on *producer5*. *Producer5* asks for a more even distribution of the reds, calling *merchant8* “you monopoly.” *Merchant7* acquires a small amount of the third good (3-5 units), but only on day 34 does he establish a larger volume to offer more units to others. Over the last two weeks, these villagers earn \$20.91, \$15.56, \$1.60, and \$10.38.

Three of the four *pink-red* villagers immediately establish in explicit conversations that success will hinge on group cooperation. By the third day all participants have learned how to exchange with one another, and they are completely specialized by day 10. They pair off and

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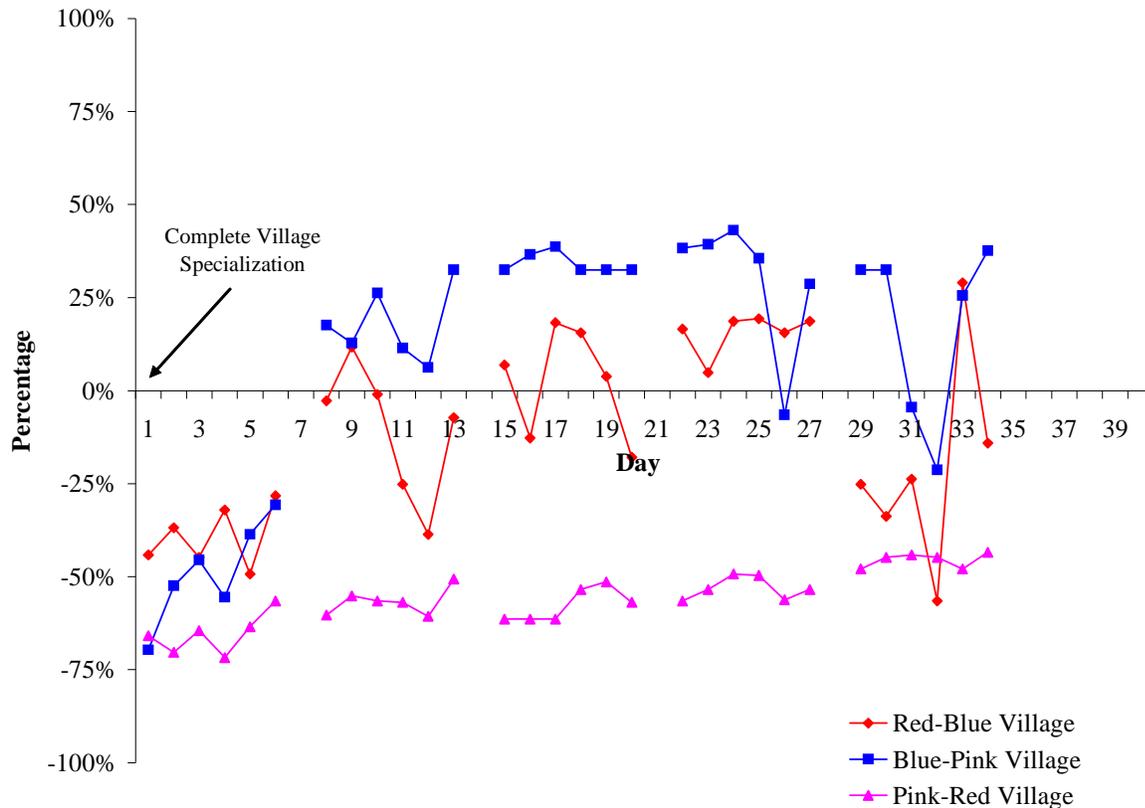
<sup>3</sup> This should not be taken as evidence that the intentions which undergird personal exchange are less than noble. Rather, noble intentions are possible among strangers because of the subjects' proximity and their ability to assist one another.

exchange to reap most of the possible benefits from trade within the village, but they fail to go beyond that. The exchanges remain fundamentally personal and bilateral.

Much of the chat in the session focuses on the differences in productive abilities between the producers and merchants; the merchants blame their disadvantages on their failure to specialize quickly enough, among other things, and they do not travel. They debate the meaning and usefulness of the buckets for 5 days, expecting it to increase their productive abilities and failing that, calling it “just trash”. There is an obvious fear of rocking the boat among the villagers. When the bucket does not produce the desired effect, *merchant12* says “let’s go back to [our old distribution of goods] I don’t wanna mess up with that bucket.” They do not begin to think about intervillage trade until day 29. When they finally do, it comes in a flash. Starting on day 34 *merchant12* trades 20 red for 25 blue with *merchant7*. *Merchant11*, as noted above, does not follow through on his exchanges with *merchant4* or with *merchant7*. Once is enough for *merchant7* to be burned. *Merchant4*, however, is anything but savvy and eloquent in the merchant area:

\*\*\*\*\* Day 33 \*\*\*\*\*  
[*Merchant3* received 31 Pink from *merchant8*]  
[*Merchant8* received 31 Red from *merchant3*]  
*Merchant7*: anyone need pink  
*Merchant4*: I need pink... but I have no reds  
*Merchant12*: who needs red  
*Merchant4*: can I have reds 12  
*Merchant7*: need pink 12  
*Merchant4*: and I’ll giev yuo pink  
*Merchant12*: 7?  
*Merchant3*: anyone want to trade pink for blue?  
[*Merchant11* received 17 Blue from *merchant4*]  
*Merchant12*: anyone want red for blue  
*Merchant11*: can one need pink 11  
*Merchant4*: can I pink 11?  
*Merchant7*: 12...ill trade red 4 blue nex round  
*Merchant3*: person 7 can I have those pinks?  
*Merchant12*: ok thats cool 7  
*Merchant3*: anyone want to just give me some pinks?  
*Merchant11*: can one need pink

These villagers earn \$9.72, \$9.96, \$4.22, and \$3.06 over the last two weeks.



### Efficiency by Village: *NPRH1*

The defining features of the intervillage trade are the largely impersonal character of the exchange and the exasperation expressed by those who specialize in the goods that no one wants. Even on the trade screen the exchanges are generally bilateral, but for the most part, the villagers just ask for the goods they desire and quote prices back and forth until they receive what they want. There is a huge surplus of blue because the *pink-red* merchants do not travel until day 31. Almost all trade thus occurs with red in exchange for pink, and those who produce blue are marginalized. They never complain on the trade screen, but they return home distressed by their inability to trade effectively. Their earnings are significantly lower than those of the others, and they are somewhat socially excluded within their home villages.

### *NPRH2*

The three villages in this economy are rather different: the *red-blue* village is on average 88% specialized over days 29-34, but lacks social cohesion with one merchant completely withdrawing from the community; the *blue-pink* village is 100% specialized over the same time

frame but is only engaging in minor intervillage trade; and the *pink-red* village wallows near autarky for the whole session and also noticeably lacks personal interactions.

On day 7, *producer2* explains that “person 1 and 3 should be 100 percent red and me and 4 will be 100 percent blue.” *Producer1* replies “k” but never follows through. Five, and again seven days later, *producer2* questions *producer1* on failing to allocate 100% of his time to red, and *producer1* simply says “sorry”. For undisclosed reasons, *producer1* never completely specializes whereas the other three villagers fully do so by day 27.

The most severe breakdown of the interpersonal relationships involves *merchant4*. Apparently unhappy with his station in the experiment, he exclaims on day 16 “listen, im getting dicked over in this particular exp, so dont worry about me”. During the day 21 rest time, *merchant3* initiates the following conversation:

Merchant3: 4, we gonaa work it out to cut you back in?  
Producer2: yea poor 4  
Producer1: how are we gonna do that  
Producer2: i got screwed in one of these experiments too  
Producer2: i made negative profit

But, *merchant4* never says anything and appears to have completely withdrawn to be self-sufficient in the merchant area, as the conversation on day 18 indicates:

Merchant4: ill do red for blue  
Merchant4: and red for pink  
Merchant4: who wants blue!  
Merchant1 1: i will give pink and red for blue  
Merchant4: ok deal!  
Merchant4: yyou and i will trade

The other three villagers cooperate with each other with *merchant3* securing pink from *merchant7* and dividing the product nearly evenly among the three of them. Over the last two weeks the villagers earn \$10.63, \$9.80, \$9.27, and \$0.00 respectively.

In contrast, the *blue-pink* village is highly social and cooperative with *merchant8* setting the tone right away in day 1: “we are going to need to cooperate in order to do best.” During the rest on day 7, the entire village solidifies its group mentality and agrees to 100% specialization in production and cooperation:

Merchant8: are we doing the smartest trading  
Merchant8: does anyone see anything smarter to do  
Merchant8: or is this the best way  
Merchant8: is eveyone max producing one color  
Producer5: no i think this is good  
Producer6: i think so too  
Producer5: no im doing 70/30 blue to pink

Merchant7: its straight  
Merchant7: I'm doing 100% blue  
Producer5: should we max produce  
Merchant8: im doing 100% pink  
Merchant8: lets try max producing  
Merchant8: and see what we can do  
Producer5: me and seven can do all blue and 6 and 8 do all pink

Interestingly, while all are highly social and engage in personal exchange, the distribution of earnings is not close to equal, even though *merchant7* nearly equally shares the 13 red that he receives from *merchant3*. On day 25, they consider rotating the entire consumption of red that the *merchant7* brings home, but *merchant7* and *merchant8* point out the diminishing marginal returns of the third good make them worse off that way (obviously, not in those words), and the one time experiment by *merchant7* on day26 is abandoned. Perhaps the conversation that best contrasts the personal exchange of the village with the impersonal exchange of the merchant trading area is the following one on day 33:

Producer5: is the other room cooler than this one?  
Producer6: i wanna travel...  
Merchant8: not really  
Merchant8: you just make deals  
Merchant8: it has a chat board  
Merchant8: and buckets  
Merchant8: thats it  
Merchant7: yea  
Merchant7: pretty much

These villagers earn \$16.17, \$10.09, \$7.26, and \$5.21 over the final two weeks.

Like the *red-blue* village, the *pink-red* village lacks social cohesion with one member, *merchant12*, eventually withdrawing from the community. On day 2, *merchant12* plants the idea of specialization and cooperation, but it does not go anywhere:

Merchant12: We can set this up so that two people make all pink, and two people make all red, and see if we can't manipulate things.  
Merchant11: ok.. im with it  
Merchant11: what should i do  
Producer9: give me all of your tokens  
Merchant12: Hah. That's where the game breaks down.

This is the first and last time anyone ever discusses specialization and they all produce near the autarky levels. They do exchange small numbers of extra units here and there, but what is unique about this is that they do so with the distinctly impersonal touch of quoting prices back and forth to each in the village: “ill give 2 reds for 1 pink, 2”, “10 pink for 3 red”, “#12, 5 pink for 2 red”. Eventually this leads *merchant12* on days 12 and 14 to proclaim:

There's got to be some way to do this on a self-sustaining basis....either that, or we're not trading effectively...There's got to be a better way, and it's probably by self-sustainment. Enough of this

touchy-feely trading stuff.

His irritation worsens on day 15:

Producer9: #12?

Producer9: 6 my pink for 2 ur red

Producer9: ?

Merchant11: i will trade 2 red for blue

Merchant12: Look, really, I told you.

Merchant12: Enough of this touchy-feely trade crap

Producer9: touch feely

Producer9: ok

Merchant12: Does crap count as profanity?

Producer9: yes

Merchant11: lol too late you already said it

Merchant12: Man

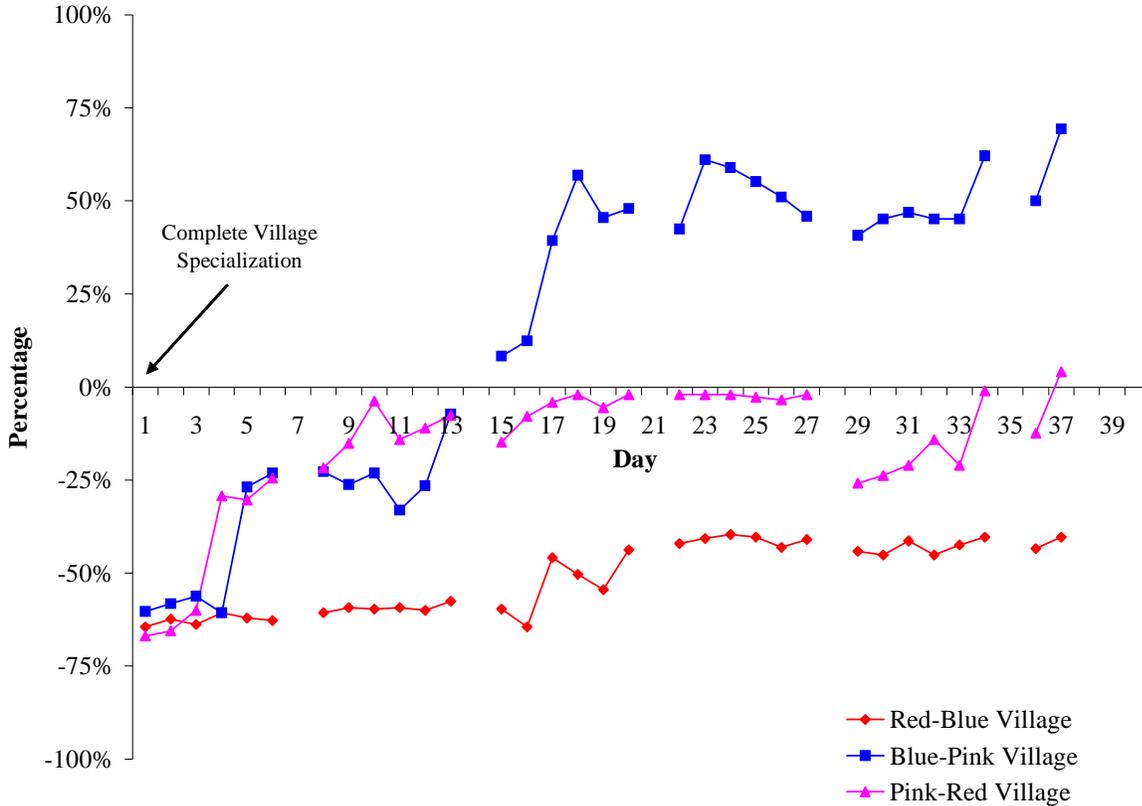
Producer9: I'm profanely OFFENDED

Producer9: haha

Producer9: jk

Merchant12: Well, sit back and be offended. It's not you that I'm worried about

Merchant12 reaffirms his unwillingness to trade the next day and from this point on remains socially distant from the group. Eventually on day 22, he begins trading 3 blues to producer10 for 6 reds, but in any conversation remains surly. The last unique feature of this village is that



Efficiency by Village: NPRH 2

*merchant11* is the beneficiary of *merchant4*'s exasperation. *Merchant4* eventually gives up trying to negotiate all of his trades in merchant area and gives all of his blues to *merchant11*, who then consumes all of them himself. Over the last two weeks, these villagers earn \$3.02, \$3.14, \$3.88, and \$3.40 respectively.

### NPRH3

This session is the most efficient of the four *NPRH* economies. Only the failure to fully specialize holds this economy back. The *red-blue* and *pink-red* villages produce, on average over days 29-40, 99% and 80%, respectively, of the fully specialized production. The *red-blue* village first achieves this high level of production on day 5. In stark contrast, the *blue-pink* village is only 33% specialized over the same period.<sup>4</sup> Not surprisingly, the amount of intervillage trade is correlated with extent of specialization. Over days 29-40, *merchant4* imports on average 37 pink, 9.2 from *merchant7* in the *blue-pink* village and 27.8 from *merchant11* in the *pink-red* village. *Merchant11* trades those 27.8 pink for 27.6 blues (their third good), and *merchant7* trades 9.2 pink for 10.3 reds with *merchant4*.

The *red-blue* village begins the session with the producers paired off in one bilateral trading relationship and merchants in another:

Producer1: ok so person 2 and 3, and 1 and 4 teams?  
Merchant3: no  
Merchant4: no  
Merchant3: 3&\$  
Merchant4: 1 and 2  
Producer1: ok  
Merchant3: 4&4  
Merchant4: 3 and 4

On day 2, *producer1* sets the tone with *producer2*:

Producer1: well 2 we'll work out the ratio  
Producer1: 2 go all blue next time, 100%  
Producer1: 2 could you send me some blues?  
Producer1: 2 i'm not going to help you unless you help me  
Producer1: if you work with me we will get a lot more out of this  
Merchant3: 2, he's right  
Producer1: go 100% blue, i'm going 100% red  
Producer1: we'll split it up to get profit for both of us  
Merchant3: you'll make about 3x as much  
Producer1: but show a gesture of good faith and send me some blues

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<sup>4</sup> In autarky, production is 32% of the fully specialized level of output.

While all the trading relationships are bilateral, the village is quite social, as the conversation on day 11 reveals:

Merchant4: i'm making 40 cents a period/round  
Producer1: lol we're making 90 and 80  
Merchant4: :P  
Producer1: well person 3 i guess this is redemption, and 4 uhh  
Merchant3: anybody get the pick things?  
Merchant4: then we should get more pink then you to be fair  
Producer1: you just got screwed  
Merchant3: lol  
Producer1: you guys can make pink?  
Merchant3: i don't understand what the pink is  
Merchant3: no  
Merchant4: not yet  
Producer1: ok  
Producer1: well when you can  
Producer1: lets figure out the formula  
Merchant4: but we will later i'm guessing  
Producer1: for max profit for the 4 of us  
Producer1: and we'll send ya some blues and reds

On day 13, *merchant3* and *merchant4* leave the first messages on the merchant trading area:

Merchant4: i'll trade 2 red and 4 blue for a pink if anyone sees this  
Merchant3: people come here individually  
Merchant3: the next person who comes, leave a message  
Merchant4: i'll trade 5 red and 10 blue for 2 pinks if anyone sees this

The following day, a rest period, *merchant12* responds with "I'll trade you pink for blue", and on the next day of production, *merchant4* trades 3 blue for 3 pink with *merchant11* and 2 blue for 2 pink with *merchant12*. When *merchant4* returns, *producer1* exclaims, "where did those pinks come from?" and follows that with "hmm, well how much is a pink going to cost me?" While the diction is impersonal, the mutual gains from multilateral exchange motivate *producer1*, evidenced by these statements on days 19 and 20 to *merchant3*:

Producer1: i'm ready to drag em if you send the 3 pink  
Producer1: i'll send 30/10  
Producer1: 3 you will profit off of this

On the rest day, the village organizes the multilateral exchange, sans *producer2*:

Merchant4: we need o make more blue  
Merchant3: lets try to set it up  
Merchant4: they love blue  
Merchant4: i'll be the trader  
Producer1: you guys know my offer  
Merchant3: k  
Producer1: 30/10 for 3 pink, it'll benefit 3 the most  
Merchant3: 4 does all the trading  
Producer1: oh ok  
Merchant4: we do 1 blue for 1 pink  
Producer1: person 2 will probably do that

Merchant4: over on the other side

Despite *producer2*'s not contributing any product towards the trade for pink, *merchant4* nearly equally distributes the pink among the villagers. *Producer1* then attempts to bring *producer2* into the exchanges on day 24:

Producer1: person 2, give up some of your profit to person 4  
Producer2: wut  
Producer1: he's the one who's hooking us up with pinks and giving us all profit  
Producer2: how mant  
Producer2: many\*  
Merchant4: no one is there!!!!  
Merchant3: idk  
Producer1: do 13 reds 26 blues

The sense of a community is starting to come through as a result of the intervillage trade, but *producer2* still does not contribute towards the pink trade consistently until the 29<sup>th</sup> day. Despite *producer2*'s contribution of 13 red and 26 blue to *merchant4* on day 29, *producer1* stays on her case through days 30 and 31: “person 2, send the stuff to them” and “send them person 2”.

As the designated trader for the village, *merchant4* earns the most (consuming more pink than anyone else), and as the villager who contributes the least, *merchant3* earns the least. In many ways this village looks like one from the *PRH* treatment. It is highly specialized, social, and engaged in intervillage trade. Over days 29-40, the villagers earn \$12.95, \$11.43, \$5.83, and \$13.93.

The *blue-pink* is nearly the complete opposite of the *red-blue* village. While they discuss how to “divide” the items among themselves, they are nearly producing at autarky levels. Furthermore, this group is very cautious about interacting with outsiders:

Merchant8: okay, I'm going to check out the bucket again, and see who's over there  
\*\*\*\*\* Day 21 \*\*\*\*\*  
Merchant8: okay it's another group of people  
Merchant7: yea  
Merchant8: should I tell them who we are? can we work with them or will they try to take our stuff?  
Merchant7: idk...considering yesterday i dont know who i trust  
Merchant8: yeah, same here  
Merchant8: this group is working really well  
Producer6: that's what we think  
Merchant8: 5 and 6 what do you think?  
Producer5: i think so too  
Merchant8: okay

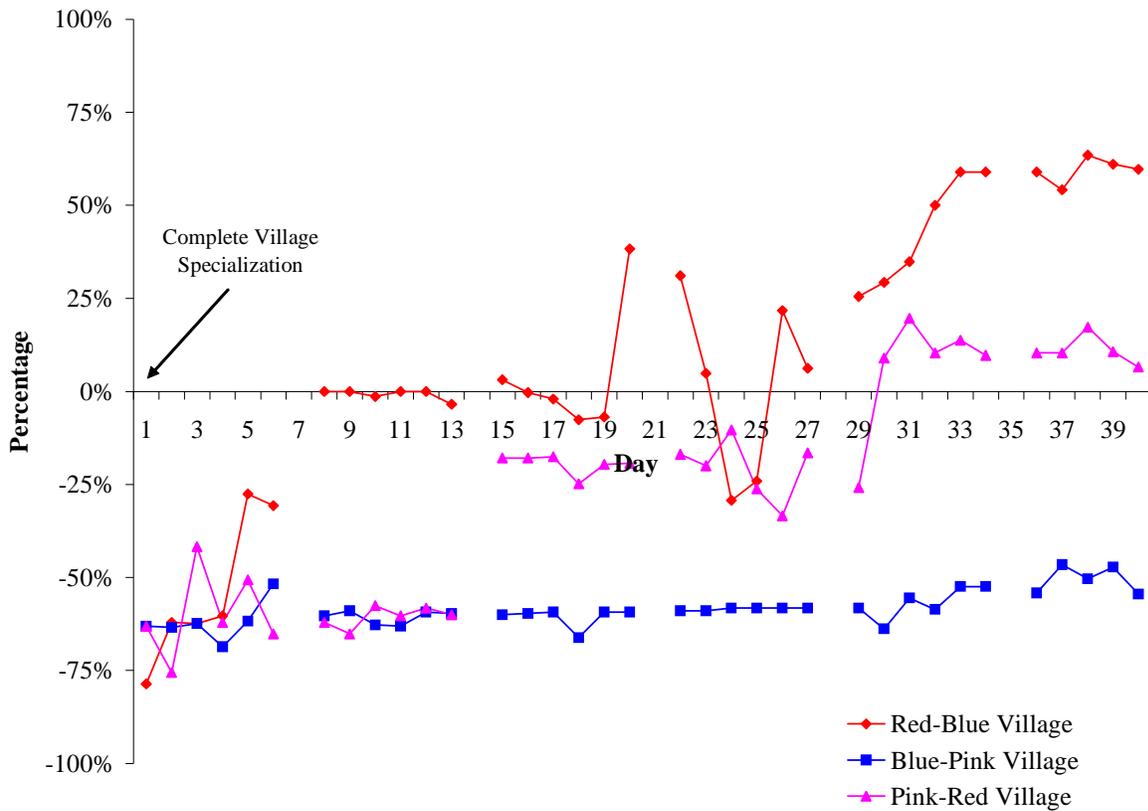
The village clearly has “group” orientation, but it is an autarkic mindset as they confirm on day 24 that “this is working though”. On day 25, *merchant8* makes the following (radical) proposal: “I can go to the other world and try to find out without talking if they make red, then we’ll think about if we want to talk to them”. Her conclusion from observing the merchant trading area for

three days is that “I think it’s a place where people can come to trade, but no one actually produces things there”. The continued hesitation to interact with the other merchants is clear on day 28:

Producer6: make sure they really need pink since you said they had a bunch already  
 Merchant8: we need to make a deal with someone over there though before we start making extras we can't use  
 Merchant8: exactly  
 Merchant7: i agree  
 Producer6: sounds good  
 Merchant8: seven do you want to ask them since you were the one who actually talked to them (you can be our ambassador)

Merchant7 does develop a trading relationship with merchant4, but without specialization they still wallow in poverty earning on average 24 cents a day over days 29-40.

The pink-red village is very similar to the red-blue village, except that the merchants do not stick with specialization. The merchants attempt it early on but prefer by the end of the session to self-produce pink and red. The early trading relationships are bilateral, producer with



Efficiency by Village: NPRH3

producer and merchant with merchant. *Merchant12* says on day 11: “wish I could be more of a help, but I got stuck with weak production”. By day 15, the producers are fully specialized and trading with each other. Only when the merchants begin returning with blue (on day 16) do the producers decide on day 28 to “give” pink to *merchant11* for blue:

Merchant11: 9 and 10 would you two mind pairing with either myself or 12?

Producer10: we're working on it

Producer9: 11 i was gonna give u 9 pink and 3 reds for a blue

Producer10: I think we'll give 11 extra pink to trade for blue and then we can divvy up the blue

Producer10: is it a 1:1 trade for pink and blue?

\*\*\*\*\* Day 29 \*\*\*\*\*

Merchant11: yea

Just as in the *red-blue* village, for providing the service, the trading merchant keeps additional blue for himself, giving an average of 8.5 blues to *producer9* and *producer10* after receiving 11 pink. Unspecialized *merchant12* is on the outside looking in by the end of the session because it appears that he has the least to offer the village. These villagers earn \$14.06, \$12.56, \$2.50, and \$1.59 over days 29-40.

#### NPRH4

This is the only economy in which no village is over 90% specialized at any point during the session: over days 29-40, the *red-blue* village is 73% specialized, the *blue-pink* 44%, and *pink-red* 61%. As a result, this session is the poorest of the eight economies.

All the subjects in the *red-blue* village begin in autarky. *Producer1* and *merchant4* discuss exchanging on the first day and are surprised to learn that they cannot take goods from one another.

Producer1: hey four need any blues?

Merchant4: yeh

Producer1: you cant take em from me can you?

*Merchant4* suggests that they specialize, and they spend the next two days deciding who will specialize in which good. The other two villagers do not even begin to interact with *producer1* and *merchant4* until the first day of rest, and they only do so because a discussion starts up about the third good. No more discussion of *pink* ensues, but on day 10, *merchant3* imports pink for the first time. The others continue to specialize and exchange, but only *producer1* and *merchant4* ever manage to specialize completely.

On the second day of rest, the villagers resume their discussion about how to acquire pink.

Producer1: where were you at last turn #4?  
Merchant4: trying to pick up some pink  
Producer1: lol  
Merchant4: im back in it now  
Producer1: good call  
Merchant4: haha  
Merchant4: theyre not sharnig the pink  
Producer1: its hard to get em to sometimes  
Merchant3: i can get some pink

The merchants agree to continue looking for it, but they are not successful until day 16. *Merchant3* returns with pink, and *producer1* trades him 40 red for 7 pink.

This stands in contrast to the rates of exchange in other sessions and provides evidence for a lack of trust in the village. *Merchant3* neglects to share with anyone when he first obtains pink on day 10. He is protective of his pink and only trades when a very generous deal is struck. Neither *merchant3* or *merchant4* have secured a consistent trading partner in the meeting area, and so the merchants begin to keep what little pink they can acquire for themselves.

The shift of the merchants' attention to the acquisition of the third good drives *producer1* and *producer2* into a tighter relationship as *merchant4* begins to ignore his previous trade relationship with *producer1*. Once the third day of rest arrives, they discuss this and agree to resolidify their relationship, stating explicitly what they will exchange each turn, but without any suggestion on the part of *merchant4*, *producer1* offers to increase his relative contribution.

These trade relations congeal, yet the interactions remain largely impersonal. The villagers discuss their exchanges and nothing more. *Merchant3* continues to import pink, but eventually *merchant4* loses his connection and has to trade with *merchant3* to receive it. They work out a larger series of trades during the fourth day of rest:

Merchant4: 3 if you get me pink ill hlp you out  
Merchant3: aight  
Merchant3: yeah i got u  
Merchant4: what do you need  
Merchant3: i think ima need blue and red  
Merchant4: all work in some sort of system  
Merchant3: yeah  
Merchant4: ok  
Merchant4: well i trade some with 1 and i usually have too many blues... ill see what i can do  
Producer1: you want more red #4, I'll always take more blues?  
Merchant4: yeh  
Merchant4: so you give 35 ill givr 20

But otherwise they simply continue the previous pattern of exchange. Notice the way in which

the exchanges are discussed. *Merchant3* brings in pink, and the others try to trade with him for it. And the cooperation is still made explicit, “if you get me pink ill hlp you out.” This continues to the end of the experiment without much additional growth. Over the final two weeks the villagers earn \$8.49, \$4.03, \$5.20, and \$5.57 respectively.

The *blue-pink* villagers do not begin to talk until the second day. They are also extremely slow to exchange and specialize. The villagers begin discussing the third good, red, on day 4, but their discussion centers around their lack of knowledge regarding its whereabouts.

Merchant8: need pink anyone/  
Merchant8: i need pink plz!  
Producer5: need pink 2  
Merchant8: would love red actually!  
Merchant8: ill trade somethin 4 red

They beg for it, plead for it, and ask to trade for it, but not until the first day of rest do they all realize that they cannot acquire it in their village.

Merchant8: ok break time  
Merchant8: so did anyone have red durin any of that?  
Producer5: no  
Producer6: it looks like no one did if you look at the dominos  
Producer6: this is weird  
Merchant7: it says zero for all

Then the next day, *merchant7* brings red back from the meeting area. He takes the first batch all for himself, and on the next day he begins to trade red for other goods with the members of his village.

The exchanges within this village display a distinct lack of trust among some of the members. *Producer6* asks his co-villagers to give him some red or blue in exchange for pink, but he explains that he won't trade unless they move the goods first:

Merchant7: i need pink  
Producer6: person 7, i have pink  
Merchant7: i'll trade 1 reds for 3 pinks  
Producer6: but you must send the reds over 1<sup>st</sup>

Also, much of the chat room discussion is very business-like; the villagers quote prices to one another. On day 13, *producer6* tries to trade for red with *merchant7*, but the merchant will not give him more than one of the 20 he has acquired.

Merchant7: i have red  
Merchant7: 1 red for 3 pinks  
Producer6: i have pinks!!!  
Producer6: yay  
Merchant7: ok  
Merchant7: gimme 3

Merchant7: for a red  
Producer6: send me more than 1 red & ill send pinks  
Merchant7: i only have 1 spare red  
Merchant7: send me the pinks  
...  
Producer6: well one red doesn't do anything lol

Because a single red provides no additional benefit, there is no exchange.

The price quotes continue as specialization stagnates. Even in the rest periods, price discussions continue:

Merchant7: #6, I'll trade u 3 reds ofr 6 pinks every time ok?...and #5, i'll trade 3 reds for 18 blues  
Producer5: that's not fair  
Producer6: so, say, say could make blues & i could make extra pinks  
Producer6: 5 do you need more blues or pinks?  
Merchant8: i need more blues  
Producer5: red  
Producer5: i'll produce more blue then  
Producer6: i need more pinks  
Merchant8: yes, u produce more blue #5  
Merchant8: and #6 produce a lil more pink  
Producer5: to trade red from 7

This blatant unequal treatment within the village highlights the tendency of their interactions to lean toward impersonal exchange. These trends continue, and *merchant8* also begins to import red. The producers continue to deal with *merchant7* in order to acquire red until day 30 when *merchant8* begins to offer some of his red to the others.

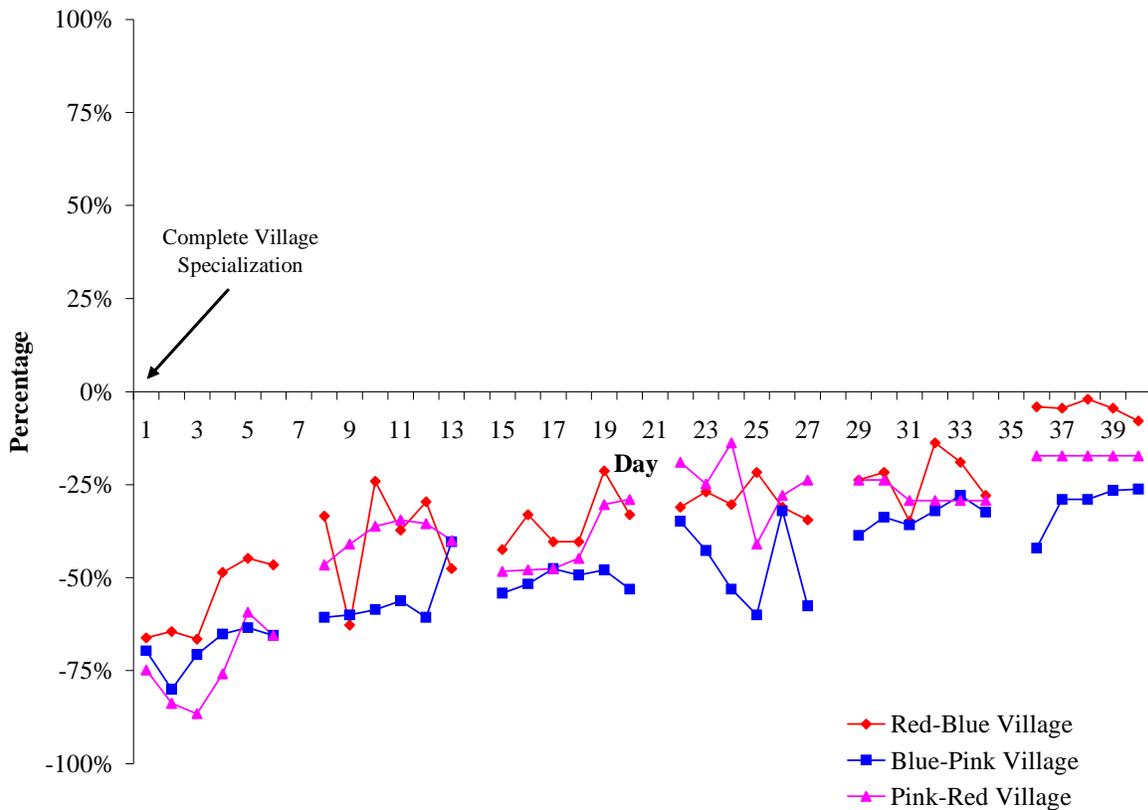
The lack of trust is still evident in day 34:

Merchant7: person 8, 1 blue for 1 red?...  
Merchant8: u first hurry

Cooperation in the *pink-red* village is also fairly slow to develop, and this impedes specialization. Notably, only the merchants in this village ever specialize completely and the producers decrease the extent of their specialization over time, eventually settling at 61%. The interactions between these villagers are largely impersonal, and at times nonexistent. They spend a lot of time quoting prices at one another, and they do little other chatting. In most sessions we observe no interaction in the common meeting area during the days of rest. This session is no outlier in that regard. But we also see the same impersonal behavior within this village that is typically limited to the meeting area. In all but the first day of rest, there is absolutely no chatting whatsoever between the *pink-red* villagers.

As early as the 10<sup>th</sup> day, *merchant12* begins importing a substantial amount of blue, but he almost always retains it all for himself. This continues until the 22<sup>nd</sup> day when he trades some

to *merchant11* for the first time. For a few days, there is no one on the travel screen to provide the blue, and some discussion results from that. However, on day 31, trade takes off and discussion tapers off. No talking at all occurs during the last 4 days, and there are a total of 8 wordless days. The behavior in the merchant area is typical—the interaction is largely price quoting and discussion surrounding the establishment of trading relationships. These villagers earn a total of \$4.29, \$5.52, \$6.86, and \$6.10 over the final two weeks.



Efficiency by Village: *NPRH4*