Insight & Beyond

Class 9, Part 1: November 4th 2009

Chapter 5: “Space and Time”

Chapter 6: “Common Sense and its Subject”

Summary of Material

• Discussion of students’ papers on an insight they had.

• Wide range of situations. How pervasive insights are.

• Comments about how the assignment – “Describe *an* insight you have had.” – opens onto even more activities for self-appropriation – especially, learning to differentiate insight and inquiry.

• Taking the time to describe one insight inevitably reveals oneself as having many insights in a self-correcting process.

• The distinctive feature of being human is being an inquirer – inquiry as the fundamental movement of self-transcendence.

• Shift from personal and public reference frames of the common-sense mode of understanding, to ‘special’ reference frames.

- Scientific/explanatory understanding's concern to relate everything to everything else – relate every extension and duration to every other, none privileged.
- Science does not privilege any reference frame.
- Special reference frame begins by stipulating a particular standpoint, instant, and orientation, (as do personal reference frames).
- Using insights, order other extensions and durations in relation to the selected origin and orientation.
- Recognition of indefinite multiplicity of special reference frames raises a problem for classical scientific statements of how things relate to one another.
- Transposing from one reference frame to another is not unique to scientific/explanatory reference frames; it is also an achievement of common-sense in transposing personal reference frames.
- Piaget (and Lawrence Kohlberg) studied stages at which children were to be able to master the transposition to another point of view (spatially) as a prelude to having ethical empathy for another's concerns.

- What makes it possible for human beings to know how things will look from a location which they do not actually occupy? Insight, imagination, and inquiry. Inquiry draws us out of the limits of our own experiences. Inquiry and insight makes possible self-transcendence from one reference frame and one culture to another.
- Student questions about terminology: transformation versus transposition; transformation and conversion.
- Discussion of intellectual versus existential transformations. Insights that take one beyond the limits of one's intellectual organization of a spatio-temporal reference frame (second level of consciousness) vs. deliberating and choosing to live according to a different scale of values (fourth level of consciousness).
- Since classical laws and principles are abstract, they are invariant over differences of particular places and times.
- What does "invariance of formulation/expression" mean?
- Yet some terms ('left') vary with orientation. This poses a problem for physics.
- Hence, Invariance is a test for whether a classical correlation is truly explanatory.

- Laws of motion should be free of local variance and particularities. Example of Galileo's law.
- Yet one can't do physics without some particularity; some particularity is required for physics because its measurements always originate from instruments at a particular place (earth), although laws have to be general.
- Scientists make observations and gather numbers for the sake of arriving at something beyond numbers.
- It isn't scientific just because it has numbers associated with it. Numbers are on the way to something more important – namely, covariant correlations.
- Clarification of technical meaning of *co-variant correlation* (e.g., equation) versus *invariant numbers*. *Numbers* gathered at different times and at different locations can differ, although their variations compensate for one another to leave correlations invariant.
- Special reference frames and transformations.
- Changing the origin points of the Cartesian coordinate system is one kind of transformation.
- Expressing this change in origin points by a transformation equation that shows how general reference frames relate to one another.

- Transformation equation starts by relating one origin point to another, but then also makes it possible to transform the relation of any point to one origin into the relation to another origin.
- From geometrical considerations, can work out transformations?
- From transformations, can work out the geometry (i.e., the geometrical considerations).
- What do we need to know, in order to construct the ordering of Cartesian reference frame?
- Among other things, need to be able to draw parallel lines and to understand how they differently relate to one another in the different geometries – especially in Euclidean (Cartesian) geometry.
- The ordering of extensions to one another in Euclidean geometry is mediated by their relations to parallel lines.
- How do you know all points are covered? Because in a merely mathematical reference frame, you get to intelligently and creatively select the rules (intelligible relations) of the kind of geometry.
- Example of Euclidean geometry and Euclidian space.
- Key to intelligibility of Euclid's world is parallel lines. Covariant expression.

- Oversight of insight: forgetting that the initial premises implicit in the mathematical geometry were introduced by the intelligent construction of the mathematician.
- But what if we turn from mathematical to empirical, physical, special reference frames. Then the intelligibilities (the "geometrical considerations") are not simply up to the intelligent selectivity and creativity of the empirical scientist.
- What happens if the physicist has to actually construct a reference frame under the conditions imposed by the physical universe? What problems would a physicist encounter in attempting to construct a physical reference frame? Would he or she actually be able to make it turn out Euclidean/Cartesian?
- How do we know how parallel lines truly behave in real, physical space?
- How to determine if lines are parallel in physical space? Use a light ray, like a laser pointer.
- But what if light curves? What other standard of straightness could one use besides a light ray?
- What if Euclidean and Galilean "geometrical considerations" are not true of the physical world?

- This was the gist of Einstein's critique of Euclidean/Galilean assumptions about physical Space and Time.
- More illustrations of transformations.
- An example of an equation that is *not* covariant with respect to a transformation. So it could not be an example of a truly explanatory, classical correlation.
- Further example of a dynamic transformation from one reference frame to another moving inertially with respect to the first.
- Where things are relative to the second reference frame constantly change.
- This is called a Galilean transformation.
- The Galilean transformation gets a sophisticated, metaphysical formulation in Newton's presuppositions about absolute space, time, and motion.
- Especially, the assumption that time is the same for all moving reference frames.
- Absoluteness presupposed so we can have an absolute science of motion and invariant classical correlations (laws).

• Einstein (preceded by Berkeley) said Newton privileged one particular as absolute.

If we do not presuppose an absolute Space and Time, how is it possible to have invariant, classical correlations?

• Einstein's intellectual career began with intellectual dissatisfaction, in wonder and inquiry, as to why the laws of electromagnetism were not covariant under inertial transformations.

• Why two different expressions to express one relationship?

• What the principle of relativity really means: not privileging any particular reference frame.

• Principle of relativity tells how to transform one reference frame into another.

• Einstein was convinced that there was an invariant (co-variant) intelligible relatedness to all of electromagnetic phenomena, and this led him to assert the law of the constancy of the velocity of light.

Relativity of the Simultaneity of Time.

Famous train and lightning example as given by Einstein in his *Relativity: The Special and General Theory.*

• Neither person has a privileged reference frame?

• But each person has a different perception of the timing of the events (simultaneous or sequential).

• Measurements of times of occurrence are different, but can be calculated for (transformed into) the other.

• Therefore, simultaneity of events not absolute.

Student questions:

– Isn't the true reference frame where the lightning actually strikes the tracks? Put sensors on the track to get the true timing.

– This would lead to the same conclusion.

– Not a question of where the lightnings strike, but when.

• The strangeness of the non-simultaneity of time.

– Is the relativity due to our definition of our perception? Because observers *see* bolts at the same or at different times?

• Einstein called this a *Gedankenexperiment* – This is a thought experiment. One can imagine away complications to get to the essential point.

• Not just perception of the events, but the perceptions as interpreted and adjusted by insights and – What if measure the tracks, where the bolts strike.

• Concretely, if actually try to measure these distances, need to invoke simultaneity of time measurements as well.

• Einstein realized that cannot assume that time does not enter into spatial measurements, and that space does not enter into temporal measurements.

- He realized that Space and Time are not structured the way that Galileo and Newton assumed.
- In a parallel way, in Kevin Lynch's book, *What Time is this Place?* reveals the historicity of human spatial meanings.
- Why is this experience of Space and Time so strange?
- Inverse insight that uniform motion has no intelligibility of its own and thus makes no contribution to classical correlations.
- No privileged frame of reference, no particular space and time. Runs counter to our existential rootedness in our public reference frames.
- Lonergan critiques Galileo, Newton, Kant for thinking that science must be about the necessary: They were looking for the absolute, but they were looking for it in the wrong place.
- Really just privileging themselves.
- Curved and hyperbolic geometries. Angles add up to more than 180 and parallel lines are different.
- Outside of Euclidean space, odd things happen. Things relate differently, and these different relations can be verified empirically.
- These are completely plausible versions of the real, physical explanatory space.

Insight & Beyond:

Lecture 9, Part 1:

"*Insight*, Chapter 5,

Explanatory Space and Time

Special Reference Frames

4th November 2009

Class 9, November 4, 2009

• Discussion of students' papers on an insight they had.

• Wide range of situations. How pervasive insights are.

• Comments about how the assignment – "Describe *an* insight you have had." – opens onto even more activities for self-appropriation – especially, learning to differentiate insight and inquiry.

• Taking the time to describe one insight inevitably reveals oneself as having many insights in a self-correcting process.

• The distinctive feature of being human is being an inquirer – inquiry as the fundamental movement of self-transcendence.

I'd like to give a little bit of an overview of the vast range of topics that people talked about in their insight essays. We had things about kick-boxing; about computers; software problems; about being a defensive player in basket-ball; dealing with behaviour disorders of children in a classroom; the relationship between God's will and one's own will; searching for a match between genes of two different species; being lost in an exploratory walk — I wish I had that paper last week! I could have benefitted from it. It was perfect: a person who got lost — decided to go off on an exploratory walk and suddenly, they didn't know where they were, didn't know how to relate their personal reference frame and their bodily orientation to the public reference frames that he couldn't see. There was something about a therapy, a skin therapy that went awry, and what went wrong.

[Laughter]

There was one that was nearer to my heart about learning to drive a standard shift and drive car. Been there! Done that!! How to run a delivery service, the person who has their own delivery service business. The difference between — another computer related one; learning French, and the big insight about the difference between translating and actually learning to speak a language; an insight into a symbol of darkness; an insight into how to overcome learning disabilities; insight into construction, a building site; something of an insight into a crisis in Catholicism, its symbols; an Ignatian insight, an Ignatian spiritual exercise. How to understand, another language one, in *dedans*; insights into jealousy and resentment; and insights into *déjà vue*.

So that just gives you — and I'm saying this for the benefit of the class, because it gives you *some sense of just how pervasive the phenomenon of insights are*.

I also wanted to draw attention to something that happened in these papers; it typically happens when people do this exercise. The first: I think, most of you actually recognized — but most of my comments are just helping you to be more attentive to certain things. So a lot of the comments are: notice that this is an insight or notice that this is an inquiry. Many of you were aware of that, but I just did it for the sake of showing you that you set out — many of you, as is always the case, saying: "Gee, I don't know if I can write this paper: I don't know is I ever had an insight in my life!"

[Murmur of laughter]

And lo and behold, inevitably, when people write these papers, they write about not just one insight but several, often linked! So that the process of self-appropriation: you take that *eureka* moment — and Lonergan begins with that Archimedes example because, as he says, it's a dramatic instance. And

> *the first level, so to speak, of self-appropriation is learning how to be attentive to your inquiries, and your images, and your insights.*

And the ones that are easiest to begin with are the ones that are kind of big ones. The big baboon (?) ones, the big dramatic instances! But the minute you start to do that, you start to notice — you all did start to notice — that you're having lots of insights! And these are often the people who start off "Gee, I've never had an insight in my life," and then suddenly they're there!

> And *not only, of course, insights but inquiries! And as I've suggested, one of the most important things in Lonergan's project of self-appropriation is to appropriate yourself as an inquirer. It's your inquiry that makes you be human!*

I won't get into discussions about whether dolphins or seals, or other wonderful species, ask questions; but

> *it is the distinctive phenomenon of being human that we inquire; and it's because we're inquirers that we have this unique capacity of self-transcendence*, which is at the heart of Lonergan's, if you like, philosophical anthropology. *To be a human being is to be an inquirer.* And everything, all the wonderfulness about insights, and judgments, and valuings, and decisions, and so on, they don't come isolated.

They always come in response to that dynamic of
the inquiry.

And so also, you folks, in your papers, made the discovery of how many inquiries you had. Sometimes I would just sort of draw a line and say "flow of inquiries," because you yourselves were spelling out all the questions that were arising as you were going through this process of trying to get to your insights. Sometimes you didn't put them in the grammatical form of an interrogative with a question mark at the end; and I would kind of highlight some of those things. Sometimes you didn't use the word 'insight'; you might have used a word like 'realized', or "I saw …", or something like that; I would highlight that. Just to help you to begin to move to the next level of self-appropriation.

Another thing that showed up very, very typically in your papers: some of you explicitly referred to it in the papers – most of you didn't – is that you were engaged in *the self-correcting process of learning*. And you were getting insights, and then asking further questions, and getting more insights, and asking further questions. Sometimes in these papers, although I think it's not typical of this class, but sometimes people get so focussed on the big end-product insight, that they don't notice that they're having *a series of insights* along the way. So I would tend to point that out! There were people who had higher viewpoint insights; there were people who had insights about spatial ordering, which we talked about. There were people who had insights – interesting – not just into visual images, visual phantasms, but what you might call "muscular phantasms." So some of the physical things that people talked about doing, it involved having some insights into their musculature and their skeletal system and their balance and things like that. Very interesting — this doesn't happen very often, but somebody actually did write — this wasn't — this was actually one of the many insights was an inverse insight. Lonergan does say that inverse insights are rare, but in fact somebody described that. That was wonderful on this project. And there was also — a number of people had not only higher viewpoints where a number — as one person put it, a number of smaller insights coalesced into one larger insight: that's a higher viewpoint type of phenomenon. But a few people noticed how a sort of a big wonderment began to differentiate into particular questions.

So lots and lots of rich things in these papers: they were really quite wonderful! I love giving this assignment because I love reading these things. I am always so fascinated with the responses and the results that people have.

So do you have any questions about these papers? … Okay! Well, if you do, please make a point to see me in class, or send me an email and we can get together and talk about it more fully. Okay! Great!

• Shift from personal and public reference frames of the common-sense mode of understanding, to 'special' reference frames.

• Scientific/explanatory understanding's concern to relate everything to everything else – relate every extension and duration to every other, none privileged.

• Science does not privilege any reference frame.

At the end of the last class, I kind of rushed a little bit in hopes of getting through *special reference frames*, and the third kind of space we talked about, *personal reference frames*, personal space, *public reference frames*, common communal social space. We didn't really do justice to Lonergan's discussion, the most technical, the part that takes up the most — deep in the chapter, about special reference frames. And so I decided I would return to it, and kind of slow it down, and see if we can get some of the main points here.

Kinds of Space and Time:

***Special* Reference Frames**

Where is everything?

When did everything happen?

What time is it, for whom?

Scientific Orderings

(Explanatory & Abstract Ordering of Extensions & Durations)

"**A Problem Peculiar to Physics**" (*CWL* 3, p. 167).

So remember from last time: there's a shift in questions, so to speak, when you move from the personal reference frames and the public reference frames — which is all part of our intellectual equipment when we come into this class — to the thing that is a little uncommon, and that is the special reference frames. And some of this is going to be very familiar to some of you, hopefully put it away [meaning unclear] a certain sense of what Lonergan is doing.

But there is a shift from talking about: "Where am I?" "Where are we?" "What is this place?" "What time is it?" to "Where is everything" "Why did everything happen?" [Slide reads "When did everything happen?"] "What time is it, for whom?" "And where?" There's that shift because when Lonergan is talking about "**the Abstract Intelligibility of Space and Time**" (*CWL* 3, pp. 172-184), he's talking about a problem, as he says, that is peculiar to the science of physics. Because scientific understanding is concerned with how things relate to one another. It's how everything relates to everything else! So it's a problem of the spatial relatedness of all extensions and all durations, none privileged!

- Special reference frame begins by stipulating a particular standpoint, instant, and orientation, (as do personal reference frames).
- Using insights, order other extensions and durations in relation to the selected origin and orientation.
- Recognition of indefinite multiplicity of special reference frames raises a problem for classical scientific statements of how things relate to one another.
- Transposing from one reference frame to another is not unique to scientific/explanatory reference frames; it is also an achievement of common-sense in transposing personal reference frames.
- Piaget (and Lawrence Kohlberg) studied stages at which children were to be able to master the transposition to another point of view (spatially) as a prelude to having ethical empathy for another's concerns.

- What makes it possible for human beings to know how things will look from a location which they do not actually occupy? Insight, imagination, and inquiry! Inquiry draws us out of the limits of our own experiences. Inquiry and insight makes possible self-transcendence from one reference frame and one culture to another.

Just to anticipate a little bit, the spaces and times that we talked about last week are in the common sense mode of understanding. Someone I think mentioned that in class last week. That's quite right, because this is a matter of relating extensions and durations, places and times, to oneself or to one's social group. *Science cannot privilege some spaces that are worthy of investigation, and others that are not worthy of investigation, some times that are worthy of investigation, and others that are not.*

So to move into that third kind of ordering of extensions and durations is to move into a domain where we want to understand how every duration and every extension relates to every other.

So in talking about that, Lonergan refers to his notion of the special reference frame, as opposed to the personal or the public. And in doing a special reference frame, we select a position and a direction and an instant; some place and some orientation — we do that with our personal reference frames: the orientation of 'up' is where our head is, the orientation 'down' is where are feet are. Gravity is overwhelmingly determining the 'up' and the 'down.' The 'left' and the 'right' are determined by the way our body happens to be standing.

Kinds of Space and Time:

Special Reference Frames

"Thirdly, there are special reference frames. A basic position, direction, and instant are selected …

"There can be as many distinct reference frames of any kind as there are possible origins and orientations.

"From this multiplicity there follows the problem of transposing from statements relative to one reference frame to statements relative to another. (*CWL* 3, p. 168).

So in a sense, the special reference frame begins a little bit like a personal reference frame. It's like where you stand, or where something stands, and some orientation; and then you make an organization, an ordering, through insights of other extensions and other durations, some near, some farther away, some present, some in the past, some in the future.

Given that that's what one does, as Lonergan says, **"There can be as many distinct reference frames … as there are possible origins and orientations."** (*CWL* 3, p. 168). And this raises a problem for classical scientific statements, classical scientific correlations. Because remember that the quality of a classical correlation is that it's concerned with how things relate to one another, not how they relate to me, not how they relate to my sensations. But given the fact that you choose an orientation and an origin, you thereby stipulate how things are going to be related to that orientation and to that origin. So this, as he says, give rise to the problem of explanatory space and explanatory time.

Jean Piaget

The Child's Conception of Space

Transformations of Intelligible Relations

And just to recall, transposing from one of the multiplicity of reference frames to another is not something that's specific to explanatory understanding in science. It's something that we saw Piaget exploring in children, and it's something that we talked about in terms of being lost and getting oriented, and something you learned about in your paper. So the idea of transposing from what you concretely see in front of you to how things would be seen and ordered by somebody standing elsewhere with a different orientation, that's something we actually do develop insights to.

It's something that I think I didn't mention last week: Piaget worked on things like the child's conception of space, and time, and number, and the variety of causality, and a number of these, if you like, classical, physical notions. Lawrence Kohlberg, who took Piaget's method and applied it to the area of moral development, made I think a very profound insight. And it was that *children, young children need to have been able to master the ability to say how things would look from somebody else's point of view, before you can say to them: "How would you feel if somebody did that to you?"*

So there's an intellectual underpinning to that. I tried that on my kids!

[Affectionate laughter]

How do you think they would feel, at a certain age? This was sort of off the chart! No skin off my nose!

[Affectionate laughter]

But it isn't just because they were morally corrupt!

[Affectionate laughter continues]

It was because they didn't yet have the intellectual ability to make that transformation. And this is really what Lonergan is talking about. Modern physics and modern geometry are all about transformations. They are about orderings, but more importantly than that, they are about the principles of orderings that are underpinned by the capacities for transformations. So it is a terribly important thing!

And again to anticipate a little bit, what makes it possible for human beings to know how things will look from a perspective that they are not occupying, and may indeed never occupy, is what? What makes it possible for human beings to know how space and time is ordered for someone else with a different origin and a different orientation?

Students: Insight.

Pat: Insight, that's right! But remember, there are insights involved in just the ordering of one's own reference frame. So more fundamentally than insight it's …?

Student: Imagination!

Pat: Imagination … And? … What's the other 'I'? … Inquiry!

What makes it possible to effect a transformation
from one's own reference frame to that of another is
inquiry. Because it is by inquiring that you are
drawn out of the limits of your experiencing.

It is true that we also need to be able to imagine in order to get the insights that would satisfy that inquiring spirit. So in other words, when I would ask my children: *"How do you think the other child would feel?" That's a question! That's asking them to perform an act of self-transcendence*. It's an act that they don't yet have either a sufficiently developed imagination, or a sufficient retinue of insights to be able to give an adequate answer to. But *the primary thing that underlies transformations is inquiry*! And we're going to come back to that in the chapter on "**Common Sense and its Subject**" (*CWL* 3, chapter six, pp. 196-231) as well. How do you transform from the insight of one culture and one society to the insights of another society, another culture;

and the common sense of one society and one culture to that of another. *What gives us this capacity is inquiry*!!

There are lots of things that stand in the way as well, but it is the inquiry. It showed up particularly in the work of the two people who wrote about language learning issues. It was because they could wonder about language things that they did not yet understand that they were eventually able to understand.

- Student questions about terminology: transformation versus transposition; transformation and conversion.
- Discussion of intellectual versus existential transformations. Insights that take one beyond the limits of one's intellectual organization of a spatio-temporal reference frame (second level of consciousness) vs. deliberating and choosing to live according to a different scale of values (fourth level of consciousness).

Pat: Mike?

Mike: I guess it's an interpretation of the use of the term 'transformation.' Why does he use 'transformation' as opposed to using 'transposing'?

Pat: Yes, he does use the word 'transposing' once in a while.

Mike: Okay, fair enough.

Pat: I think I have it on one of the slides here, a place where he uses 'transposing.' He uses 'transformation' because it's a term in physics and mathematics. So he is familiar with that literature, and he is referencing that. So that's primarily why he does that. It also – it's a frame of reference, so you trans-frame referencing. … That's a bad aetiology,[1] but — … Byron?

Byron: Are there any parallels between 'transformation' and 'conversion'?

Pat: Ah, the word 'transformation' is in fact used sometimes for conversions. *One of my favourite books of all time is called "Transformation of Man" by Rosemary Haughton. And the subtitle is Conversion, "**A Study of Conversion and Community**.*" So she's certainly using the word 'transformation' interchangeably with 'conversion'[2]. And I learned about the book from Lonergan. *Lonergan just thought it was a terrific book! And he recognized that her meaning of 'conversion' was very much his*. So certainly it is used that way. In this case, it's being used in a more restrictive sense. It's being used, not for the existential changes, which we will be talking about next semester, in the subjective orientation in the existential horizon of the subject. So 'transformation' in that sense is different from 'transformation' in this sense.

'Transformation' in this sense is primarily an intellectual achievement, a positive achievement and accomplishment. 'Transformation' in the sense of conversion is an existential achievement. To put it another way, transformation in the sense that he talks about in chapter five of Insight is primarily at what he calls the second level of consciousness; the activities of inquiring, imagining, getting direct insights, ordering. It's on that level that transformation is of concern. Transformation in the sense of conversion is on the fourth level. It has to do with valuing, growth in valuing, transformation of value, and decisions that transform value commitments, et cetera. Okay?

Byron: Thanks.

Pat: Sure. Anything else? …

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[1] The attribution of the cause or reason for something.

[2] Pat used the word 'community' here, but it seems a slip of the tongue for 'conversion.'

- Since classical laws and principles are abstract, they are invariant over differences of particular places and times.
- What does “invariance of formulation/expression” mean?
- Yet some terms (‘left’) vary with orientation. This poses a problem for physics.
- Hence, Invariance is a test for whether a classical correlation is truly explanatory.
- Laws of motion should be free of local variance and particularities. Example of Galileo’s law.
- Yet one can’t do physics without some particularity; some particularity is required for physics because its measurements always originate from instruments at a particular place (earth), although laws have to be general.
- Scientists make observations and gather numbers for the sake of arriving at something beyond numbers.

- It isn't scientific just because it has numbers associated with it. Numbers are on the way to something more important – namely, covariant correlations.
- Clarification of technical meaning of *co-variant correlation* (e.g., equation) versus *invariant numbers*. *Numbers* gathered at different times and at different locations can differ, although their variations compensate for one another to leave correlations invariant.

Kinds of Space and Time:

"A Problem Peculiar to Physics"

"since all mathematical principles and all natural laws of the classical type are abstract, it follows that their appropriate expression must be invariant." (*CWL* 3, p. 165).

"However, the science of physics does not enjoy the same immunity. It investigates local movements, and it cannot state their laws without some reference to places and times." (*CWL* 3, p. 165).

Pat: Okay. So we saw this slide last week very briefly, but I want to dwell on it a little more in depth today. "**Since all mathematical principles and all**

natural laws of the classical type [classical correlations] **are abstract, it follows that their appropriate expression must be invariant.”** (*CWL* 3, p. 165). Okay. So let’s recall for a moment, by ‘**abstract**’, Lonergan means what? … Greg?

Greg: Removed from particular time and place.

Pat: Right, right! So there is an intelligibility that is not limited to a particularity in place and time. That’s what he means by ‘abstract.’ That whole issue of the empirical residue: that intelligibilities can dwell in different times, in different places, and in different individuals, and yet be the same intelligibility. So ‘abstract’ in that sense: not limited to particularities of place and time.

Why then would it be that the appropriate expression of a classical correlation, a law of the classical type, would have to be invariant? What does the word ‘invariant’ mean?

Student: It would be the same in all different concrete instances.

Pat: Okay. It would be the same expression in all different — Say that again please!

Student: I said: in all concrete instances.

Pat: In all different concrete instances. Deborah?

Deborah: I just said it does not vary!

Pat: With what? Does not vary with what?

Deborah: With place and time.

Pat: Right! That’s right! So it doesn’t vary with place and time. It is the same expression.

Now, everybody look to your left! [Pat looks to his left.] … You didn’t look to your left! Oh, you looked to my left! You see, the expression ‘left’ varies with place. Those of you who are facing me, left is that way [Pat gestures to his right]. But for me left is that way [Pat gestures to his left]. So the expression ‘left’ varies with place, and in this case, with orientation. We’ll see some more of these kinds of things.

So if indeed you’ve got the real thing of a real scientific correlation, then a way — or let’s put it this way — you’ve got a way to test as to whether or not you’ve got the real thing, the really scientific correlation! It is to figure out if its expression varies when you change your spatio-temporal orientation. So invariance becomes a test that we can use to see whether or not you've gotten the right classical correlation, or if somehow you've unconsciously sneaked something particular, a particularity of place and time, a privileging in that shouldn't be there if it really, really is a classical correlation.

Now what comes in between these two quotes [displayed in the slide on the next page] is his remarks that we don't run into that problem in biology and chemistry. One can dispute whether that's true or not!

Kinds of Space and Time:

"A Problem Peculiar to Physics"

"Since all mathematical principles and all natural laws of the classical type are abstract, it follows that their appropriate expression must be invariant." (*CWL* 3, p. 165).

"However, the science of physics does not enjoy the same immunity. It investigates local movements, and it cannot state their laws without some reference to places and times." (*CWL* 3, p. 165).

But the reason why we run into the problem specifically in physics is that physics, in its modern origin, which is with Galileo, is an attempt to understand the classical correlations that relate what: extensions and durations of motions to one another. Motion is always a change in extension in correlation with change in time; a change in extension in the sense of: the football was in this extended place right here, in this extended area here [Pat gestures to a space in front of him] and now the football is in this extended area over here [Pat gestures above his head]. And there was a different time when it was there [in front] and when it was here [above].

And what Galileo wanted to do was to understand how did those extensions and those durations relate to one another. And that was his famous "Law of Falling Bodies." Now there's a few other things in there too. And it was also, as we saw a couple of weeks ago, what he thought he had really done that hadn't been done before. That in fact people hadn't had the intellectual curiosity and seriousness to ponder about was: the curve that projectiles follow; and that it is a parabolic curve was really kind of a surprising thing, and quite a marvellous thing when you see how he figures it out. But that's all a matter of figuring out some correlations among extensions and durations, places and times. And that was what he was doing. So that from the get-go, the first person to do modern physics is trying to figure that out.

I think you can make the argument that Aristotle was also dealing with those sets of concerns, but at the very least, let's just start with Galileo here. And *from Galileo to the present, modern physics has been overwhelmingly underpinned by trying to get it straight about the classical correlations that pertain to motion: what are usually called the Laws of Motion*. And those laws of motion ought not to depend upon any particular person's point of view — ought not to depend upon any particular person's state in the world, or where they stand, or what time it is. *It ought to be the same expression, because it's the intelligibility that the explanatory definition is expressive. It's the intelligibility independently of the particularities, the particularities, or the empirical residue*. Okay!

But on the other hand, you have the problem that you can't do physics without *some particularity*. If you keep away the particularity, there are no places and times.

So think of it this way: that scientists are making measurements. Almost all scientists who have ever lived, with the exception of maybe fifty, or maybe a hundred tops, have made their observations on the surface of the earth. They've used instruments of all kinds, very, very sophisticated instruments, we've have computer assisted instruments of all kinds. *They're always making those measurements on the surface of the earth! But they can't let the measurements that they make, the concrete specific numbers that they get, be the classical laws. They are the lower blade that's moving upwards and bringing the material upwards of the measurements for the sake of getting something that isn't just specific numbers*.

I spoke — I mentioned this a couple of weeks ago — *It isn't scientific just because it's got numbers associated with it*. It's scientific, in Lonergan's sense, at least classical scientific, if those numbers stand in some kind of explanatory relationship with one another, and with the extensions, durations, temperatures, colours, smells, intensities, and so on, that those numbers are associated with.

So that's why it has to be invariant. And just as a side-note, the technical phrase in physics is actually not 'invariant,' it's 'covariant.' *Covariant* means that when the law is — when you're trying to do an experiment to determine what the classical correlation is, in a different reference frame, you get different numbers. We're going to see that in a second. You get different numbers, but it's *covariant* if the difference in this number [Pat gestures to a point in front of him in space] is compensated for by the difference in this number [Pat gestures to a point above his head]. That's why it's called a covariant.

Technically speaking, '*invariant*' is a *number* that doesn't change. '*Covariant*' is a *form of expression* that doesn't change. The speed of light, at least from the point of view of Special Relativity, is an invariant number: three times ten to the eight metres per second, more or less.[3] But it's thought to be the same no matter what person — Einstein writes the General Theory of Relativity, but that's …. [last phrase unclear]. But if there's a number that doesn't change, like say, the speed of light, no matter what reference frame you're in, then that's an *invariant*. And the idea that an expression doesn't change its form because the intelligible relatedness doesn't change upon changing from one perspective to another, that's called *covariance*. Lonergan doesn't make that distinction in *Insight*, but for those of you who are going on to the PhD in physics, you will come to it [last phrase unclear].

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[3] The speed of light in a vacuum, as commonly denoted, is a universal physical constant important in many areas of physics. Its value is exactly 299,792,458 metres per second, a figure that is exact because the length of the metre is defined from this constant and the international standard for time. This is approximately 186,282.4 miles per second, or about 671 million miles per hour.

- Special reference frames and transformations.
- Changing the origin points of the Cartesian coordinate system is one kind of transformation.
- Expressing this change in origin points by a transformation equation that shows how general reference frames relate to one another.
- Transformation equation starts by relating one origin point to another, but then also makes it possible to transform the relation of any point to one origin into the relation to another origin.

Special reference Frames and Transformations
Left side only visible

This slide presents just a simple Cartesian co-ordinate system: choose a basic position, an origin, which in this case is marked off by the letter A, and then origin and orientation, so you've got an 'up,' and a forward or to the right, if you like, the Y arrow and the X arrow. So a basic origin and orientation. And there's a position up there, or an object up there, P. *And we want to know what place is* P *at*. And the ordering that we would use is to draw lines parallel to the Y arrow, going vertical, and lines going horizontal parallel to the X, and we come upward, two, and to the right, four: and we say that that point is at the location 4,2.

Special reference Frames and Transformations

Both sides of slide visible

But what happens if we change our origin? *We changed the orientation in this case, which means we change the origin, what happens? P no longer gets the same expression. So this is an example of something that's not going to be invariant.* The name for that relative to the new frame of reference, B, is going to be different; and it's going to be this! [Pat brings an algebraic expression to light on the slide].

$$(X_B \,.\, Y_B) = (-1, 4)$$

It's going to be "minus-one, four," because, as you can see, P is actually to the left of the Y arrow, where before it was to the right! And it's higher up — if you count the squares, it's exactly one to the left instead of one to the right, and four up. Okay? I think you're all familiar with that.

But what you might not be familiar with is what's called *the transformation equation*! We can generalize what we just did, and say: "We worked that out for a particular, let's say, red balloon, it's sitting up there — and saying where it is, so that we can perhaps track its motion. But we can also generalize, as if to say that any place at all that has a name X and Y from the point of view of the A reference frame, *you can transform* and figure out what the name of that is in the B reference frame. And the X name or location, from B's point of view, is related to A by being minus five, and the Y co-ordinate of B is related by being A plus two. And you get that by actually figuring out where B is relative to A, or by where A is relative to B.

*So the **transformation equation** starts out telling you how one point is related to another, but it gives you the possibility of relating any of the points to any of the other points*. You can see why that might be an interesting thing to do in a second. But that's an example of a transformation!

Now, there are some implicit things here that I'm going to come back and talk about in a minute.

- From geometrical considerations, can one work out transformations?
- From transformations, can work out the geometry (i.e., the geometrical considerations).
- What do we need to know, in order to construct the ordering of Cartesian reference frame?
- Among other things, need to be able to draw parallel lines and to understand how they differently relate to one another in the different geometries – especially in Euclidean (Cartesian) geometry.
- The ordering of extensions to one another in Euclidean geometry is mediated by their relations to parallel lines.

And one of these implicit things is this. … I explained that [the issues arising in the slide] last week but we didn't talk about it very much. **"From geometrical considerations it will be possible to find three equations relating *x*, *y*, and *z*,** [I only have x and y up there] **respectively, to *x prime*, *y prime*, and *z prime*."** So think of x y, z, as being the A reference frame, the ones with the primes on as being the B reference frame. Where I distinguished those numbers and those coordinates by putting a sub A and a sub B, it's typical practice in mathematical and scientific notation to use a prime to distinguish them. It means they are different numbers. But *what Lonergan is interested in is how the general reference frames are related to one another*. And in order to do that, you need to invoke "**geometrical considerations.**" (*CWL* 3, p. 169).

Abstract Intelligibility:

Transformations & Geometries

"From geometrical considerations it will be possible to find three equations relating x, y, and z, respectively, to x', y', and z', and further, to show that these equations hold for any point (x, y, z). In this fashion there are obtained transformation equations, and by the simple process of substitution any statement in terms of x, y, z can be transformed into a statement in terms of x', y', z'." (*CWL* 3, p. 169).

Now what geometrical considerations were invoked in doing this reference frame?

Special reference Frames and Transformations

Both sides of slide visible, plus transformation equations

What geometrical considerations were invoked in doing this reference frame? Transformation!! Think about that for a moment! … What did we have to do to be able to invoke some — to be able to figure out the relationship between, not just particular points, but the two kinds of orderings that are going on here? What do we have to do? It was all done implicitly, with a certain amount of hand-waving by me a few minutes ago: but now I want to go back and to tackle it a little bit. What are the relevant geometrical considerations that are involved, first of all, in constructing frame of reference A? … Ah, Samantha?

Samantha: Well, the frame of reference A is based around that point A, and you have a specific way of counting where P is relative to not point A and [final words unclear].

Pat: That's right! That's right! And what did I need to know to be able to have a specific way of counting? … Matt?

Matt: A reference frame.

Pat: Well, the reference frame is A, as Samantha just mentioned. What else to I have to know? … Think back last week, when I was talking about Mircea Eliade; the symbol of chaos, which is complete homogeneity, the same is everywhere! Okay, we said we could name that sameness with a point of differentiation: A is not like every other place; it's the origin place, and you get an orientation. We got a — So the problem is you are seeing too much on the screen right now. You've got a point and an orientation. And now what do you need to do? … Samantha?

Samantha: You have to define, sort of — is it increments, or something — some way of measuring how far it is —

Pat: That's right! That's right, we have to be able to measure how far it is. So that's an important thing! Let's come back. In order to do that, I do what? Maggie?

Maggie: We have to establish a unit of measuring.

Pat: Right! Which is what I think Samantha was also getting at. Okay. So suppose we establish a unit of measurement, right here [Pat uses his pointer onto the slide]. So there's our unit of measurement, right there. So I've got a point, an orientation, and a unit of measurement, *and the rest is just all sea*!

[Some laughter]

Where do I have to go from a point, and a unit of measurement, and an orientation, to have something that is an ordered, an ordering of extensions? … Mike?

Mike: You have to put the grid down. You have to —

Pat: Right, you have to put the grid down. Okay! And where do the "geometric considerations" come in, in putting a grid down? What "geometric considerations" do I have to draw on to put the grid down? … Greg?

Greg: I guess, you could say that the units of measurement are ordered, such that —

Pat: Not yet!!

A number of voices: [sound indecipherable].

Pat: Now, we're getting somewhere! We've got the orientation, we've got the A, we've got the origin, we have the orientation, we've got the x and y, we've got a unit of measurement. What don't we have? We don't have a grid! Why — What do we need to be able to do a grid? … Chris?

Chris: Isn't it extension? Is it — I mean —

Pat: Ah, *extension is an experiential thing*!

Chris: Right. What order — I guess intelligibility —

Pat: That's right! And what is the intelligibility that we don't have yet? … Mary?

Mary: The information that relates the points to each other.

Pat: Ah … Well, yes. But let's go back to the grid! What geometrical considerations do we need to make the grid? … Matt?

Matt: The geometric considerations that you need when drawing a rectangle?

Pat: Yes! And what's the definition of a rectangle?

Number of voices: Draw a line — [indecipherable] — The interior angles are as 90.

Pat: Right!

[Laughter]

Pat: But at least now we have some geometrical consideration on the floor. Right! Ninety degrees, right? … Sharon?

Sharon: I was thinking about: do we need to assume that the space is homogenous?

Pat: That's actually right! You do have to assume that it is homogenous. There are a few other things that we have to assume. …

Student: All the points are on the same plane, for example.

Pat: Okay. They have to be on the same plane; they have to be homogenous. *You have to be able to draw parallel lines*! *You're going to have to be able to draw parallel lines*! That's what I was trying to get at with the rectangle thing. *Rectangles are defined as parallelograms whose angles are all equal*. That's one definition of a rectangle. *So you have to know what a parallel line is before you can know what a parallelogram is; and you have to know what a parallelogram is before you can know what a rectangle is*. And so on!

But the key thing here — You can do this in different ways. There are actually two ways of constructing a Cartesian Co-ordinate System. One is by drawing lines parallel to one another; the other is by drawing lines perpendicular to one another. So for — You can do two things. You can take your orientations, the AY orientation and the AX orientation, and you can draw lines perpendicular to the AY orientation,[4] and then draw other lines perpendicular to the AX orientation; *or* you can draw them parallel to the AY orientation and parallel to the AX orientation. But you need to be able to do that to be able to do all the things that you were saying. You can have the unit, but if you don't have the parallels and their points of intersection, and everything that you know from Euclidean geometry about parallels and perpendiculars and intersections, you can't get from your unit. Your unit is sitting down here [Pat uses his pointer] and the balloon is sitting up there, and you can't get there. And in fact *in Euclidean geometry, everything just sort of sits where it is*!

The ordering of extensions and durations in Euclidean geometry is through constructions of various kinds. You can construct triangles; you can construct two triangles together, you get a parallelogram; and so on and so forth. And you relate

[4] Pat said 'organization' at this point, but perhaps he intended 'orientation.'

things to one another by a series of constructions at one location and another location until you get them all connected. That's really how Euclidean geometry works!

Everything in Euclidean geometry depends on parallel lines. Well, not everything, but about — ah well, let's say about eighty-five percent of everything included in Euclidean geometry depends on parallel lines. That's why what is called ***the parallel postulate*** is so crucial in Euclidean geometry. And a Cartesian Co-ordinates System of the kind we are looking at, a reference frame, is based on Euclidean parallelism.

- How do you know all points are covered? Because in a merely mathematical reference frame, you get to intelligently and creatively select the rules (intelligible relations) of the kind of geometry.
- Example of Euclidean geometry and Euclidian space.
- Key to intelligibility of Euclid's world is parallel lines. Covariant expression.
- Oversight of insight: forgetting that the initial premises implicit in the mathematical geometry were introduced by the intelligent construction of the mathematician.

Now if you go from — Lonergan makes this distinction between a *mathematical reference frame* and a *physical reference frame*. A mathematical reference frame — somebody said this last week — how do you know that you can cover all the points in this homogeneous plane by just drawing parallel lines? How do you know you're not going to leave some points out by doing that? And last week somebody said: "You'd know it because you got to make it!" [Pat's summary of this point quoted above reads: Because in a merely mathematical reference frame, you get to intelligently and creatively select the rules (intelligible relations) of the kind of geometry.]

That same thing that we saw back in chapter two, about the oversight of insight. When you start working in a Cartesian geometry or a Euclidean geometry, you get to say what the intelligibility is going to be! I get the biggest kick out of Euclid: he's sort of like God: [Pat deepens his voice to a God-like sound] "Let there be a triangle —"

[Laughter]

"— where all sides are equal, and the third one is twice the size —!" So you just know, just out of the creativity of his intelligence, he can say: "I'm going to build an object that has this intelligibility. But more importantly, I'm going to build a world [Pat makes a wide world-sweeping gesture] that has this intelligibility!" *And the key to the intelligibility of Euclid's world is parallel lines*! Parallel lines in Euclid's geometry[5] have the unique property — this is the way he does it — that if they're really parallel, and you run another line through them [Pat makes a down-sweeping gesture], the ultimate interior lines are equal.[6] He doesn't quite do it that way — he does it the negative way. He says that if they're *not* parallel, then you'll get a triangle on one side or a triangle on the other. So he has a kind of — there's very — It's very subtle how he does that, why he does that. We're a little bit more used to saying that in Euclidean geometry, a two-way line through a point external to that line, there is one and only one line parallel to it. That's a more modern definition — It's not exactly Euclid's. They turn out to be equivalent formulations.

Now the interesting thing is that *that statement that I just made, if you are in Euclidean space, is invariant, or if you like they co-vary*. No matter where you are, there is only one line parallel to it. If you are here on the earth, and there is a line here [Pat gestures towards the 'imaginary' line on the earth below him] and there is a point there, there is only one parallel line; go up to the moon, same thing; go out to Jupiter,

[5] Pat referred to "Newton's geometry" at this point, but this may have been a *lapsus linguae*.

[6] Is it possible that Pat meant to say that "the opposite interior angles are equal"?

same thing; go to alpha omega, same thing! *That is an invariant expression; that never changes. That's an example of what he [Lonergan?] means by an invariant or covariant expression*. Okay. So that's what we're dealing with here.

- But what if we turn from mathematical to empirical, physical, special reference frames. Then the intelligibilities (the "geometrical considerations") are not simply up to the intelligent selectivity and creativity of the empirical scientist.

- What happens if the physicist has to actually construct a reference frame under the conditions imposed by the physical universe? What problems would a physicist encounter in attempting to construct a physical reference frame? Would he or she actually be able to make it turn out Euclidean/Cartesian?

- How do we know how parallel lines truly behave in real, physical space?

- How to determine if lines are parallel in physical space? Use a light ray, like a laser pointer.

- But what if light curves? What other standard of straightness could one use besides a light ray?

- What if Euclidean and Galilean "geometrical considerations" are not true of the physical world?
- This was the gist of Einstein's critique of Euclidean/Galilean assumptions about physical Space and Time.

So now, let's turn that around! Suppose you don't get to be God! Suppose you don't get to invent the geometry, as you might if you were doing just mathematics. Suppose you have to actually do a co-ordinate system. Suppose you have to order extensions and durations by selecting a place to stand, an orientation with which to stand: what problems might you run into in trying to make a Cartesian co-ordinate grid, relying on parallels? … Jeff?

Jeff: Ah, a lot of things might get in the way?

Pat: Absolutely! Things can get in the way. And you don't have to go very far: the walls and the floor and the ceiling would get in the way. We can only just extend any physical lines we might draw just so far! Okay. And why is that important if parallel lines are the underpinning of your geometry? … Because parallel lines don't intersect! And if you get to the wall, *you don't know if they'll never intersect*. You just know that you can't — they didn't intersect when you got to the walls.

So if you're going to do this, you want to make sure that your name and your place has profited [word unclear] by these geometrical considerations. You start — *you have to figure out how do you know if they're really parallel.* And one way you can do it is with a *laser pointer* [Pat directs his pointer at the wall.] Yeah. That's a straight line!

My brother — He's very good. He's a very good guy. He's a very good carpenter. He literally built an addition on the house that I grew up in that doubled the floor space. And so he gave me a gift: it was a laser leveller!

[Some gentle laughter]

Ah, personally, I'll never use it! I said: "That's really sort of generous of you!" Why do — You can go now to Home Depot and for a thirty-five dollars you can get a laser leveller that will give you a nice level line, that would be very useful if you're putting a cheap wrap or putting up a window casing, or something, all things which I spend lots of time doing!!!

[Laughter]

So people at home — people are using laser beams as a way of determining straightness, and what makes some straight line to be straight. And then, you can figure out whether or not lines are parallel to one another by intersecting two of them with another line and by measuring the angles that they make up. Then you know that you've got parallel lines. The problem of course is that you're not using parallel lines; you get one line going this way and another line going that way [Pat illustrates with diverging gestures]. You get a big space out there some place that isn't getting in. So you've got to make sure you've covered everything.

What happens when we use light to figure out what makes a straight line to be straight, and what makes two lines to be parallel? … Kurt?

Kurt: I guess we run into the problem of curvature!

Pat: Yeah. Suppose the lines — *suppose light curves*! Now if light curves, then what you should do is to get something that is really straight and then you can see how it curves. *But the problem is how do you determine straightness*? So here's an object. [*Pat holds in front of him a bending set of papers*:] This is not straight! How do you know it's not straight? You know it's not straight because it's flopping down here, like this [Pat makes a downward gesture]. How do you know it's flopping down there? By the way in which the light bounces off of it. *We use light to determine straightness, overwhelmingly*! There are other ways, you can fiddle around with other ideas of straightness. But overwhelmingly, we rely upon straightened light as our determination of straightness.

So if you're going from starting with geometrical considerations to figure out how you're transforming from one ordering to another, what if your geometrical considerations aren't the ones that actually characterize the real world? *And that of course is what Einstein argues. He argues that the Euclidean and Galilean notions of* *space and time are not the real physical space and time*. Okay. So let's walk through that a little bit.

Abstract Intelligibility:

Transformations & Geometries

"From geometrical considerations it will be possible to find three equations relating *x*, *y*, and *z*, respectively, to *x′*, *y′*, and *z′*, and further, to show that these equations hold for any point (*x*, *y*, *z*). In this fashion there are obtained transformation equations, and by the simple process of substitution any statement in terms of *x*, *y*, *z* can be transformed into a statement in terms of *x′*, *y′*, *z′*." (*CWL* 3, p. 169).

- More illustrations of transformations.
- An example of an equation that is *not* covariant with respect to a transformation. So it could not be an example of a truly explanatory, classical correlation.

So from geometrical considerations — This is just another example.

Special Reference Frames

& Transformations

[Complex drawing]

Here's one where we have not only a movement of the origin from one location to another; so we have not only a different origin, but we also have a different orientation. And you can see here [in the overhead display] that the point now has — [Pat uses the pointer] — this parallel line, parallel to the vertical orientation, and this other parallel line, parallel to the horizontal orientation, that from O's points of view, is the right name for that location. Whereas from O prime's point of view — O prime is not only in a different location than O, but it has a different orientation than O, it has a different way of naming that.

That's another kind of transformation. The transformation equations that transform *all the names* from O's point of view to *all the names* from O primes point of view are a little bit more complicated — I'm not going to go into them. This is just to give you a sort of a sense of the difference of a different kind of transformation.

Special Reference Frames
& Transformations
Grid display

But here is something that, for our purposes, is a little more illustrative. In fact they are the same reference frames, ending the magic [last three words unclear], there is no trick here! They're the same reference frames. But what I've done now is to add a line, to draw a red line through P. And if you work out the equation of that line according to reference frame A, it looks like that:

$$Y_A = 1/2X_A + 0$$

Y sub A is equal to one half of X sub A plus zero. I stuck the zero in there. You normally wouldn't have to, but you have a point in there. Well, the same line relative to reference frame B is this: it's this equation:

$$Y_B = 1/2X_B + 4.5$$

Which is to say *that the description, the equation, the equation that relates the points along that red line to one another, that equation is not invariant with regard to* *the transformation. So that is not going to be an example of classical correlation*. It's not a classical law. Just to have an equation — Just like just having a number doesn't make it a classical correlation, so just having an equation doesn't make it a classical correlation. What happens, as we'll see later on in the second semester, you've got a combination of something that's invariant, with something that's particular. So that equation is not an invariant expression.

Abstract Intelligibility:

Transformations & Geometries

"From geometrical considerations it will be possible to find three equations relating x, y, and z, respectively, to x', y', and z', and further, to show that these equations hold for any point (x, y, z). In this fashion there are obtained transformation equations, and by the simple process of substitution any statement in terms of x, y, z can be transformed into a statement in terms of x', y', z'." (*CWL* 3, p. 169).

And we're also able to figure out — or I was able to figure it out — that the difference — I was able to transform the equation from A's reference frame to B's reference frame by knowing some geometrical considerations, or, in this case, by *assuming* some geometrical equations. They were insights operative there, but they haven't been empirically determined.

- Further example of a dynamic transformation from one reference frame to another moving inertially with respect to the first.
- Where things are relative to the second reference frame constantly change.
- This is called a Galilean transformation.
- The Galilean transformation gets a sophisticated, metaphysical formulation in Newton's presuppositions about absolute space, time, and motion.
- Especially, the assumption that time is the same for all moving reference frames.
- Absoluteness presupposed so we can have an absolute science of motion and invariant classical correlations (laws).
- Einstein (preceded by Berkeley) said Newton privileged one particular as absolute.

Unlabelled complex drawing of J and F

Right! This is another kind of transformation. The transformations that I've done so far are simply: Suppose you had A here, and B here [Pat gestures to imaginary points distant from each other] and A had to say: "I think this is what it looks like to you, right! I think this is what numbers you would have assigned to that location, or what numbers you would have assigned to that equation, based on my geometrical considerations. *And since we are both in what Lonergan is going to call the abstract intelligibility of space and time; since we both have the same abstract intelligibility of space and time, the intelligibility of space and time doesn't depend on where A is or where B is. But because we are both in it, it allows us to transform from one account to another*. And some things that we transform, the expressions will change, but the interesting thing is that even though you're at A and somebody else is at B, you can say how things will be regarded, understood, or ordered, *et cetera*, by B, because you know the abstract intelligibility of space and time.

This [the unlabelled slide] is a different kind of transformation; this is actually in motion. Somebody [J] is actually moving. Somebody [J] is on a — that's supposed to be a rocket ship — going along with velocity V to the right. And someone else [F] is standing on the sidewalk there. And they have their reference frame, they have their origin and their orientation. *The interesting thing about this is that this is no longer a static space and time, as the Euclidean space and time is, this is a dynamic space and time. Or if you like, these are dynamic reference frames, because relative to one another, the locations are changing*. So I simplify this diagram a little bit:

Moving Transformations of Inertial reference Frames

This is the same diagram, but what I've done here is to — well, I haven't do it, another person did it — is to make the Y and the Z — so this [Z] is supposed to be a third dimension, coming out of the board — orientations be the same. So that the only thing that is actually changing here is not how high a point is, or how far out in front of the screen a point is, but where along the horizontal dimension things are!

Suppose that S and S prime start out the same; and you push a button and S prime starts moving with velocity V. Okay? Now, this is a big suppose. *Let's go back to the moments before we push the motion button. What difference will there be at that stage between the co-ordinates that S and S prime assign to a location or to an equation*? ... *None*! *Because they have the same orientation and the same origin*! *But* *the minute you push the button, and S prime starts to move, where things are relative to its origin are constantly changing*. And so where, at one time, they would both say "This is the zero point!", S prime is now going to say: "Oh no, that's behind me. That's got a negative value; and it's getting more negative as time goes on." And that's expressed in this first part of this equation, the Galilean Transformation.

Galilean Transformation

$$x^1 = x - vt, \quad y^1 = y, \quad z^1 = z, \quad t^1 = t$$

The Galilean Transformation says that X prime is going to say: "whatever point, whatever number, S assigns to the horizontal dimension, that is going to get more and more and more negative as time goes on." *So there is a transformation that is a motion/temporal transformation*. The larger time gets, the more negative those measurements, from S's point of view, are, compared to S prime's point of view.

But this has been set up to keep things relatively simple, so that the Y measurements and the Z measurements are all the same; and the t measurements are all the same. That's called a *Galilean Transformation*. Galileo actually didn't do this.

Newton's Presuppositions about

Space, Time, and Motion

"1. Absolute, true, and mathematical time, in and of itself and of its own nature, without reference to anything external, flows uniformly and by another name is called duration.

Relative, apparent, and common time is any sensible and external measure (precise or imprecise) of duration by mean of motion; such a measure for example, an hour, a day, a month, a year — is commonly used instead of true time."

$$x^1 = x - vt, \quad y^1 = y, \quad z^1 = z, \quad t^1 = t$$

It's said that it's a Galilean Transformation, because he's the person that came up with the Law of Inertia: that in constant velocity there is no significant change in the displacements over different times.[7]

That Galilean Transformation is what gets a very sophisticated explanation in that *scholium* of Newton's that we saw last week. We went over it. Absolute time is always flowing equably and in itself, with reference to nothing. [Pat uses his pointer to indicate the relevant part of the above display]. It is — This is that *time is the same for all observers*. What could be more obvious? How could it not be the case? How could that not be so?

Newton's Presuppositions about

Space, Time, and Motion

"2. Absolute space, of its own nature without reference to anything external, always remains homogeneous and immovable.

Relative space is any movable measure or dimension or measure of this absolute spaces; such a measure or dimension is determined by our senses from the situation of the space with respect to bodies and is popularly used for immovable space, as in the case of space under the earth or in the air or in the heavens …"

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[7] **Inertia** is the resistance of any physical object to any change in its motion (including a change in direction). In other words, it is the tendency of objects to keep moving in a straight line at constant linear velocity, or to keep still. The principle of inertia is one of the fundamental principles of classical physics that are used to describe the motion of objects and how they are affected by externally applied forces. Inertia comes from the Latin word, *iners*, meaning idle, sluggish. Inertia is one of the primary manifestations of mass, which is a quantitative property of physical systems. Isaac Newton defined inertia as his first law in his *Philosophiæ Naturalis Principia Mathematica*, which states:

> The *vis insita*, or innate force of matter, is a power of resisting by which every body, as much as in it lies, endeavours to preserve its present state, whether it be of rest or of moving uniformly forward in a straight line.

And we saw last week that Newton gives this account of absolute space. And I talked a little bit about why he gives this account of absolute space: *there has to be an absolute space and an absolute time so you can have an absolute motion. And then the equations that govern absolute motion, those are the invariables, those are the classical correlation ones. Those are the ones that are the real scientific knowledge*!

Now in effect, Einstein is going to come along — although actually Berkeley was the first person to do this, several centuries earlier — Einstein is going to come along and say: "*All you did was pretend that some person's privileged orientation and privileged location is an absolute one. But in fact it's just particular!! And there aren't any absolute spaces and there aren't any absolute times*." The difficulty is if you do that, then you can't do Newtonian physics. So you have to invent a whole new physics, which of course is what Einstein did.

Newton's Presuppositions about

Space, Time, and Motion

"4. Absolute motion is the change of position of a body from one absolute place to another;

Relative motion is change of position from one relative place to another. Thus, in a ship under sail, the relative place of a body is that region of the ship in which the body happens to be or that part of whole interior of the ship which the body fills and which accordingly moves along with the ship.

And relative rest is the continuance of the body in that same region of the ship or some part of its interior. But true rest is the continuance of a body in the same part of that unmoving space in which the ship itself, along with its interior and all its contents, is moving …"

- If we do not presuppose an absolute Space and Time, how is it possible to have invariant, classical correlations?
- Einstein's intellectual career began with intellectual dissatisfaction, in wonder and inquiry, as to why the laws of electromagnetism were not covariant under inertial transformations.
- Why two different expressions to express one relationship?
- What the principle of relativity really means: not privileging any particular reference frame.
- Principle of relativity tells how to transform one reference frame into another.
- Einstein was convinced that there was an invariant (co-variant) intelligible relatedness to all of electromagnetic phenomena, and this led him to assert the law of the constancy of the velocity of light.

Kinds of Space and Time:

"A Problem Peculiar to Physics"

"since all mathematical principles and all natural laws of the classical type are abstract, it follows that their appropriate expression must be invariant." (*CWL* 3, p. 165).

"However, the science of physics does not enjoy the same immunity. It investigates local movements, and it cannot state their laws without some reference to places and times." (*CWL* 3, p. 165).

So we're back to this problem then: that if you don't have the leisure of assuming that there is an absolute space, an absolute origin, an absolute orientation, and an absolute time which just flows invariably no matter what, you have to figure out how you're going to have anything like classical correlations that are going to be, you hope, the solid foundation of your science of motion.

Kind of Space and Time:

Special Reference Frames

Einstein's dissatisfaction

Biot-Savart Law $F = q \, v \times B$

Faraday's Law $V \times F = V \times q \, E = —q/c \; \delta B/\delta t$

Law of Propagation of Light: $\Delta^2 A/\delta X^2 \; — \; (1/c^2) \, \delta^2 A/\delta t^2 = 0$

$$(1 - v^2/c^2) \, \delta^2 A/\delta x^2 + 2(1 + v/c) \, \delta^2 A/\delta x \delta t - [(1 - c^{2)})/c^2] \, \delta^2 A/\delta t^2 = 0$$

Now we saw this slide last week. I wanted to draw on it just a little bit more. Einstein, before he figured out where the problem lay, he was already dissatisfied. So he had that *intellectual dissatisfaction*, that *intellectual tension of inquiry*. He couldn't figure out why you should have to have expressions with different forms for one and the same set of relationships. If magnetic fields and electrons flowing are what we're talking about, what difference does it make whether the magnetic field is moving or the electrons are moving? You shouldn't have two different expressions. And in mathematics, that's what these expressions [on the slide] look like.

The Bio-Savart Law and Faraday's Law just plain look different! If they look different, *they are not expressing the same intelligibility*. And if they're not expressing the same intelligibility, then they can't be the whole story on the classical correlation that relates, in this case, moving electrons and moving magnetic fields.

And the implication of this difference is that, from one point of view, the *Law for the Propagation of Light* will look like this [Pat uses his pointer]; but if you're on that *rocket ship moving along with velocity* V — so that's the V that shows up in that transformation that we saw, the Galilean Transformation — that from the point of view of the one who's doing the moving, this [Pat uses his pointer to highlight the relevant element in the display] will be the way in which electromagnetism and space and time relate. But from the point of view of the one who is stationary, that [Pat uses his pointer] will be the way it looks.

> *Well, Einstein is convinced that there isn't any absolute space and time, so you can't write laws of electromagnetism in forms that look different for different human observers! And to that, he — That's actually called the Principle of Relativity.* ***The Principle of Relativity is: you don't privilege any relative frame.***

Kinds of Space and Time:

Special Reference Frames

Einstein's Law: Constancy of the Velocity of Light

Transformed Correlation of Propagation of Light:

$$\delta^2 A/\delta x^2 - (1/c^2)\, \delta^2 A/\delta t^2 = 0$$

$$\delta^2 A'/\delta x'^2 - (1/c^2)\, \delta^2 A'/\delta t'^2 = 0$$

Some people think that the Principle of Relativity means that everything is relative, and nobody can communicate with anybody else. That is really not true! The important thing is that the Principle of Relativity tells us how to go from my observations, my experience, my measurements, my accounts of what equations look like, to yours, even though you are moving; even though you are moving really fast — if you have a powerful enough communications systems [last word a guess]. So relativity doesn't mean: things are the way I see them, and things are the way you see them. *Relativity means that there is no privileged point of reference, and that the points of reference can communicate with one another based on geometrical considerations*!

And what Einstein did, in addition to articulating this Principle of Relativity, is to further insist that something else is the case: namely, that *the invariant law was the* *law about the speed of light*. If you go back here [Pat brings up the previous slide, repeated below, and uses his pointer], this equation, if you work with it, you will discover that the velocity of light is less than three times ten to the eight meters per second, in this equation.

Kind of Space and Time:

Special Reference Frames

Einstein's dissatisfaction

Biot-Savart Law $F = q\, v \times B$

Faraday's Law $V \times F = V \times q\, E = — q/c\ \delta B/\delta t$

Law of Propagation of Light: $\Delta^2 A/\delta X^2 — (1/c^2)\, \delta^2 A/\delta t^2 = 0$

$$(1 - v^2/c^2)\, \delta^2 A/\delta x^2 + 2(1 + v/c)\, \delta^2 A/\delta x \delta t - [(1 - c^{2)})/c^2]\, \delta^2 A/\delta t^2 = 0$$

But in Einstein's equation [Pat reverts to the Einstein's Law slide] it's always the same speed of light.

Kinds of Space and Time:

Special Reference Frames

Einstein's Law: Constancy of the Velocity of Light

Transformed Correlation of Propagation of Light:

$$\delta^2 A/\delta x^2 - (1/c^2)\, \delta^2 A/\delta t^2 = 0$$

$$\delta^2 A'/\delta x'^{2} - (1/c^2)\, \delta^2 A'/\delta t'^{2} = 0$$

But importantly, *for the purposes of what Lonergan is doing, the intelligibility of the relatedness is the same*. So Einstein thought that there was something very special about light, about electromagnetic radiation, that its relatednesses were relatednesses that are not going to change! And that's where we get the **Law of the Constancy of the Speed of Light**. Well and good!

Kinds of Space and Time:

"A Problem Peculiar to Physics"

"since all mathematical principles and all natural laws of the classical type are abstract, it follows that their appropriate expression must be invariant." (*CWL* 3, p. 165).

"However, the science of physics does not enjoy the same immunity. It investigates local movements, and it cannot state their laws without some reference to places and times." (*CWL* 3, p. 165).

So the Law of the Speed of Light, the Law of the Propagation of Light, which is to say that the law for the correlation of the ways in which places and times, and intensities of electromagnetic radiation, and so on, that *they are all related to one another the same way, no matter what your frame of reference is, including no matter how fast you're moving, or how slow you're moving*. … Now, what happens when you do that?

Relativity of the Simultaneity of Time.

Famous train and lightning example as given by Einstein in his *Relativity: The Special and General Theory.*

- Neither person has a privileged reference frame?
- But each person has a different perception of the timing of the events (simultaneous or sequential).
- Measurements of times of occurrence are different, but can be calculated for (transformed into) the other.
- Therefore, simultaneity of events not absolute.

Relativity of Simultaneity of Time

Einstein's Train

And this is an example that Einstein cooked up in his little book, *Relativity: the Special and General Theory*. It's actually a very readable book. It has very few equations in it. It is very, very clearly written. It's not that long! It's only about — I think it's about ninety pages long. Big print, small pages. It's very easy to read!

[Some happy laughter!]

And very early in this book, he does some of what we've just done. He says here is what you do: there's a reference frame, you pick a spot, you take some — as people said — some units of measurement, and you set them up with parallel lines, and so on. And then, about maybe twenty pages in, after he has gone through and articulated his *Principle of Relativity* and the *Constancy of the Speed of Light*, the first consequence he draws is this:

Suppose you've got two people: somebody sitting in a railway train right here [Pat uses his pointer], dead smack in the middle of the railway train. And a person out here on the ground watching the railroad train go by, waving to the person on the train. And just at that instant when the person moving by is exactly face to face with the person that's waving, bolts of lightning *strike* the front and the back of the train! …

So what should happen? What should happen is this, [inaudible phrase]: Those lightning bolts struck the train, front and back, at the same time. They both should agree on that, because after all, remember time is — absolute time is flowing equably without reference to anything else, and so it shouldn't matter whether one is moving and one is not! And that is exactly what the Galilean Transformation equation says.

Well, Einstein says, "Well, watch this! If they strike simultaneously, then the light waves — that's what these little arcs on the slide are — the light waves from that lightning bolt, they propagate in all kinds of different directions [Pat gestures to all sides] but among other things, they propagate towards the guy standing on the ground. And they cover the same distance in the same amount of time, and lo and behold, both — because if you remember, he was dead smack in the middle of the train equally distant between this lightning bolt and that lightning bolt.

And — remember the Law — *the speed of light is the same for all observers*, right? So if the speed of light is the same for all observers — and since the speed of light is the same and they have to cover the exact same distance, both those flashes are going to get to the guy standing on the ground at exactly the same time. So he's going to say: "I saw them simultaneously!" And from that he is going to infer that they really happened simultaneously, because he knows enough physics to be able to calculate backwards, and to figure out how much time elapsed between the time he saw them, and the before moment when they actually occurred. So he'll say: "*I saw them simultaneously, and my God, they were simultaneous! And that's all there is to it! They happened at the same time*!"

Except not!! Because what happens to the person on the train? The person on the train, remember, is moving in this direction [Pat uses the pointer] with a velocity V; which means that the lightning bolt at the back of the train, its light has to travel farther before it reaches her. And the lightning bolt's light from the front of the train has to travel less of a distance, because she's closing the gap. *And lo and behold, she is going to see the lightning bolt from the front before she sees the lightning bolt light from the back.*

But she should know better, don't you think? "Just because I saw one first and saw one later, I shouldn't infer that the front bolt really happened first and the other really happened later." She should know how to make the adjustment, right? … *No*!!

Student questions:

– Isn't the true reference frame where the lightning actually strikes the tracks? Put sensors on the track to get the true timing.

– This would lead to the same conclusion.

– Not a question of where the lightnings strike, but when.

• The strangeness of the non-simultaneity of time.

– Is the relativity due to our definition of our perception? Because observers *see* bolts at the same or at different times?

• Einstein called this a *Gedankenexperiment*
  – This is a thought experiment. One can imagine away complications to get to the essential point.

- Not just perception of the events, but the perceptions as interpreted and adjusted by insights and – What if measure the tracks, where the bolts strike.
- Concretely, if actually try to measure these distances, need to invoke simultaneity of time measurements as well.
- Einstein realized that cannot assume that time does not enter into spatial measurements, and that space does not enter into temporal measurements.
- He realized that Space and Time are not structured the way that Galileo and Newton assumed.
- In a parallel way, in Kevin Lynch's book, *What Time is this Place?* reveals the historicity of human spatial meanings.

Okay. *Why not? Why shouldn't she make the adjustment*?

Student: *Because making that adjustment privileges the reference frame of the person standing on the platform*.

Pat: That's exactly right! Making that adjustment says that *the true reference frame* is the person standing on the ground rather than the person on the train[8]. … Beth?

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[8] Pat actually says "rather than on the platform" at this point, but it seems likely that he meant "rather than on the train."

Beth: Isn't it an even truer reference frame, like, where they strike the tracks?

Pat: I'm sorry?

Beth: Isn't it an even truer reference frame where the lightning strikes the tracks, so that to measure by viewing that any way is kind of nonsensical? I mean, if you really wanted to know, you could like put electricity measurement or something along the tracks that the train is on, and like sense it there?

Pat: Well, that turns out to be exactly the same thing as looking for the light, because if you put a sensor at the front of the train and at the back of the train, and you want to know when the lightning bolts struck: the sensors have to be coordinated somehow, they have to be synchronized somehow. One way of doing it is a simple way of running a wire through the middle of the train. Because, as we all know, electricity doesn't happen instantaneously; it takes a certain amount of time. And in the best of all possible worlds, it moves at the speed of light. It slows down because of resistance. Another way to do it is to have that (?) send a signal some place, and then calculate backwards again.[9] *No matter how you do it, you're in the same problem*.

Beth: But isn't the question where — Is the question where did the lightning strike the tracks?

Pat: No. The question is *when* did the lightning strike the tracks!

Beth: Yeah. Yeah.

Pat: And the guy with the hand [word unclear: the guy on the ground] is saying that: "They struck at the same time, they were simultaneous. They actually were simultaneous — they *were* simultaneous because I saw them simultaneously, and I know that they happened simultaneously because I know the constancy of the speed of light, and the distance that they travel."

Now what's the person on the train going to say? … How far does the person on the train — What distance does the person on the train regard that those light beams have travelled? The same distance! She knows that they hit the back of the train and

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[9] This sentence was a little difficult to hear and some words may be lost or misconstrued.

the front of the train, she knows that she is in the middle of the train, and knows therefore that the amount of time from the hitting to the reaching her is going to be the same! But she is going to see the first one first, the front one first, and the back one later. And she is going to say: "Ah, this one [Pat uses his pointer] really happened later, and this one really happened earlier, because I saw this one earlier and I saw that one later; and I know that it took the same amount of time to go from the front of the train to me and the back of the train to me. … So they really didn't happen at the same time!"

So one person says that they really happened at the same time; the other person says they really didn't happen at the same time. Who is right?

Student: Are they both right?

Pat: Are they both right? *Yes, they're both right. That's exactly right. They are both right, because simultaneity of time is not invariant. Simultaneity of time depends on your state of motion*. And what's more interesting still — once you've been educated by Einstein — you can say how the other person is going to calculate the actual occurrence and know that it is different from the actual occurrence. So you can relate their ideas of the occurrences to yours; even if you think that the lightning strikes happened simultaneously, you will know how they understand it, because of geometrical considerations.

Only now we're beginning to get into a very weird geometry!

Okay! This — There's two things that most people have — the kind of look that Samantha has on her face — about: "Why is the relativistic non-simultaneity of all events … *The simultaneity of events is not an absolute*! *It's not the absolute time that Newton said it was; that it's relative to observers*. And the other thing is that we can create money!!

[Laughter]

Those are the two things that people really don't think you can do. The creation of money we'll have to leave for another time! But in fact that also …

[Laughter]

Matt?

Matt: So I've actually been thinking about this problem for a little bit. And the question that I might have is that, you know, in Einstein's definition in this book … He starts with a dialogue with the guy standing on the embankment. And the guy's definition of simultaneity is his perception of the events. Okay. So, is the difference, the difference of the relativity, is it because we take the same definition of the perception of the simultaneity, and apply it to the woman on the train?

Pat: No!

Matt: Because — All right. Because that seems to say — that seems to be — I mean, that's why I heard you saying is that: she sees the front bolt first and the back bolt second, because she's moving. But even though, really like, because it's so negligible in the distance compared to the speed of light, we're really just looking like at an instantaneous — like a differential, like a derivative of velocity, or something.

Pat: It's very short. It's not quite a differential. It's not an infinitesimal!

Matt: Okay! It's not an infinitesimal.

Pat: It's not an infinitesimal. But it's very short.

Matt: Because — I mean, in this example, she would be like anybody an inch, you know, further to the front — then she would be —

Pat: A lot less than an inch.

Matt: Right!

Pat: A great deal less than an inch. But nevertheless — Okay? Einstein is doing this as what he called a *Gedankenexperiment*, an imaginative experiment.

Matt: Sure!

Pat: And you can do a couple of things. You can make a very long train, or a very fast train, or very accurate instruments!

[Laughter]

Matt: But she's still going to — So okay. Granted that we're still considering minute variations in place. So does she have — Is she still going to perceive the bolt in the front first, and then the bolt in the back second?

Pat: Yes.

Matt: So she will say that they are not simultaneous events.

Pat: That's right!

Matt: But that's the same criteria of perception as the guy on the embankment?

Pat: No! It's varied. You've got part A. But part B is that they're both — *they have both taken courses in Insight and in Relativity Theory, and they know that what they see needs to be adjusted to the way it happened. They know that they have to subtract some amount of time from the time they actually observe it, to go back to the time of occurrence.*

Matt: Okay.

Pat: And they know how to do that because they know the velocity of light, and they know the length of the train.

Matt: Okay. So either basic distance equals rate time's time. Like, there's — The rate is what is constantly between those, so that —

Pat: That's right.

Matt: So she has to do some sort of mental gymnastics —

Pat: That's right!

Matt: — and do the subtractions over still the same distance, even though we are in the same position, even though my reference frame has an X, has an X factor to it.

Pat: Right!

Matt: Okay. I see!

Pat: And the guy standing still has to do the same thing. He has to say: "I saw them at the same time. Oh, did they really happen at the same time? Yeah, they did because" —

Matt: I'm in the same position.

Pat: — You know, "because I know that they travelled the same distance to get to me."

Matt: So the insight is —

Pat: "And I know that the speed of light is constant."

Matt: Okay. So the insight then is in that mental adjustment?

Pat: That's right! You see, that's how they're relating their 'here and now,' their extension and duration, to other extensions and durations.

Matt: Okay. Thank you!

Pat: Okay. Sure. Good question! … Greg?

Greg: What if you, instead of the people, take the measurement of the track, and the two places where they hit. So if the track is a defined distance, you can, you know, gage the mid-point, and gage where the lightning bolts meet, presuming they're travelling at the same speed, which presumably they would be. And if those two points coincide, can't you — without making it be a subjective reference to the subject — say that they hit the track simultaneously, because they arrived at the exact mid-point at the same time. And then, could you argue that there is a privileged position, which is not subjectively observational, not an observation of a subject, of a human subject.

Pat: You're sort of importing a little bit too much of the subjectivity of the subject in there! But aside from that, tell me more concretely how you're going to do this! This is —

[Laughter]

Greg: Okay! I'm getting out!!

[Increased laughter]

Pat: This is a sixty-two car train; and you can't be at both the front and the back at the same time.

Greg: Uh, uh, yes.

Pat: So what you have to do is to get somebody else at the back while you're at the front. And you have to get down to say what time it is when they are making their measurement. Because otherwise, as I said last week, if you measure the train, and you say okay: "I'm going to put a stake right here at the back of the train, and I'm going to go measure the front of the train." But the train is moving, and it's a very long train. So you have to measure the front and the back simultaneously, but ooops, there's that word*! How are you going to determine simultaneity? Simultaneity is going to be relative to the frame of reference*.

You see, the thing about Einstein is that he — The thing about the Galilean reference frame that Einstein changed was: *you can't assume that time doesn't enter into your spatial measurements*! *And you can't assume that space doesn't enter into your temporal measurements*! By insisting that the speed of light is constant — which is to say that that wave-equation I showed you is, it's invariant in its expression no matter what the frame of reference — *Einstein realized that the only way that that could happen is if space and time are not structured the way Newton thought. The ordering of extensions and durations isn't what he thought*!

Kevin Lynch has another book — not the one that I read from last week — which does something similar. To an extent, he's doing it under the inspiration of Einstein. This second book is entitled *What Time is this Place*? It's the historicity, human historicity of location, exploring the historicity of human spatial meanings. So there is another layer of this. But *Einstein is the one that realized that that absolute separation of absolute time and absolute space by Galileo and Newton is not the way our world is organized*!

Okay, we've gone a bit over where we would normally take a break, so I just want to jump ahead and look at one thing — or a couple of things.

- Why is this experience of Space and Time so strange?
- Inverse insight that uniform motion has no intelligibility of its own and thus makes no contribution to classical correlations.
- No privileged frame of reference, no particular space and time. Runs counter to our existential rootedness in our public reference frames.
- Lonergan critiques Galileo, Newton, Kant for thinking that science must be about the necessary: They were looking for the absolute, but they were looking for it in the wrong place.
- Really just privileging themselves.

Einstein on Space and Time

What is it about Einstein's insights into space and time that strike us as *so* strange and alien?

This stems from an *inverse insight* underlying uniform motion,
but is more fundamentally a matter of intellectual conversion, away from Space and Time as already-out-there-now-real (body-grounded, as fundamentally known as related to our senses) to intelligible relations, and intelligible relations lack that bodily sense of reality.

What is it that makes this experience so strange, and so alien? It's partly that there is an inverse insight that Lonergan talks about in — actually chapter one first, and he comes back to it in this chapter, chapter five. *There's an inverse insight that we think motion has an intelligibility of its own; and therefore that real motion ought to modify how things are measured, thought about, regarded, and so on. And the inverse insight* is *that uniform motion, inertial motion, doesn't have any intelligibility of its own, and therefore does not make any significant intelligible contribution or alteration to the expression of classical correlations. That's strange*!!!

But what was ***really*** *strange is that it makes us let go of the subtle ways in which we privilege space and time*! *And that's very strange*! And we're going to see that that comes back again and again and again in this book. And Lonergan — when we get to chapter eight, Lonergan is going to talk about the *already-out-there-now*. The already-out-there-now is presence, and presence is privileged; and it's privileged according to one's particularity of place and time.

And one of the things that Einstein does is to say that the woman on the train has every legitimate right, from the point of view of physics, to say, she's actually sitting still in the middle of the train; and the tracks and the guy on the ground are moving along!

Now, you must have had this experience where you're sitting on a train and you think you're moving, when in fact the train next to you is moving.

Students: [Murmurs of recognition and agreement].

And you figure out how you're right. Why? Because you go back from that very, very primordial experience of extension and duration and change; you go back to your public reference frame. And your public reference frame is the privileged reference frame. *And it's a very good thing to have a privileged reference frame when you're operating in a common sense world! But it's not a good thing to have a privileged reference frame if you're trying to do explanatory terms and relations*!

So from her point of view, the lightning bolts *really* do happen at different times; and the guy on the ground just *thinks* they happen at the same time, because he's moving towards the one that hit the back. It really happened later, but he sees it earlier because he's moving towards it, because she of course is just sitting still. And *there is no privileged place or time or state of motion. And therefore the terms and relations of explanatory physics, or rather its practitioners, have to always work hard to not privilege any particular space and time*!

I'm just going to jump ahead to this slide here, and then we'll take a break.

Abstract Intelligibility:

Transformation & Geometries

"Galileo, Newton, and Kant were looking for some sort of absolute, but they were looking in the wrong places. They sought the real as opposed to the apparent, only to end up with everything apparent, the notion of the real included. Let us follow a different tack." (*CWL* 3, p. 178)

This passage continues as follows:

> **Then every content of experience will be equally valid, for all are equally given, and all equally are to be explained. Next, explanations result from enriching abstraction, and so they are abstract, and their proper expression must be invariant. Thirdly, not every explanation is equally correct; some can be verified, and some cannot. There follows at once the conclusion that the real, objective, true consists of what is known by formulating and verifying invariant principles and laws. Our account of Space is simply a particular case of that conclusion.** (*CWL* 3, p. 178).

Oh, this is — So Lonergan complains with regard to Galileo and Newton and Kant that they were looking for an absolute. For them, physics had to be of the necessary. And *for Lonergan, physics is no longer of the necessary. It's of the possibility that happens to be true, is what physics is about, what science is about.* But for them it had to be about the necessary and the absolute. And as Lonergan says, they were looking for the absolute, but "**they were looking in the wrong places**." (*CWL* 3, p. 178). They were looking in some privileged space and some privileged time as the absolute, according to which everything else would be done. But, in fact, what they were really just doing is privileging themselves. And that *to really make the break from the privileging is to recognise the intelligibility, and the manifold possibilities of intelligibility, that could be the universe*.

- Curved and hyperbolic geometries. Angles add up to more than 180 and parallel lines are different.
- Outside of Euclidean space, odd things happen. Things relate differently, and these different relations can be verified empirically.
- These are completely plausible versions of the real, physical explanatory space.

And I'll just —

Non-Euclidean
Spherical and Elliptical Geometries

This is one kind of geometry. It's called Elliptical or Spherical Geometry. And the funny thing about this is that the sum of those three angles that appear to constitute a triangle add up to *more* than 180 degrees. And you would say: Well, that's not real geometry, because it's on the surface of a sphere! Well, it turns out that you can have three-dimensional Spherical Geometry! The reason that we can see that that sphere is curved is that we're standing outside of it in a third dimension, and we can see that it is a two-dimensional curved surface in three-dimensional space and time. But if three-dimensional space is curved, all you can do is to use things that are embedded in that network of intelligibility; and they're going to be curved also. You're going to be using curved instruments to determine whether or not something is curved!

[Subdued and intrigued laughter]

Now, that's an interesting one! You can actually figure out that you're in an Elliptical Geometry. But you can't do it by saying that's a curved line and this is a straight line!!

Non-Euclidean Hyperbolic Geometries

You have something similar called a Hyperbolic Geometry where all triangles have *less* than 180 degrees. And in a Spherical Geometry, there are no parallel lines through a point external to another point. They all intercept!

In a Hyperbolic Geometry there are *many* parallel lines through an external point. And in a Hyperbolic Geometry you have the funny thing that if you transform from one reference frame to another, the triangles change. And they change the size of their angles, and they change their area, which is represented by this [Pat uses his pointer]. This is a triangle from one reference point of view; this is the same triangle from another reference point of view, this is the same triangle from yet another point of view. So if you transform your frame of reference, and your geometrical considerations are no longer Euclidean ones, you get some very strange things happen. *And in fact some of those strange things happen in our physical universe*.

Okay. Let's take a break, and don't get lost with all the weirdness we've talked about!!

Insight & Beyond: Lecture 9, Part 2:

Chapter 6 §1: "Common Sense as Intellectual"

November 4, 2009

Summary of Material

- Transition from Science to Common Sense.
- Why Lonergan left the treatment of common sense until later in *Insight*: common sense as a blend of common sense and common *nonsense*: difficulty of dealing with the biases.
- With science there is a certain degree of methodological control over biases.
- Lonergan making a case that being intelligent in the realm of common sense is consonant with the natural universe.
- Common sense as a different kind of understanding. What *is* common sense?

• Common sense as *intellectual*. An accumulation of a fund of insights.

– Born into a community with an accumulated fund of insights. Social capital of group. Different common senses; variations in common sense dependent on social group, place, etc. People acquire the accumulated fund of insights of their community and become persons who have common sense.

• Two meaning of "experience": Experience^1 as sense stimulation, and experience^2 as more than mere exposure to sensations from different situations; being experienced^2 as having insights into those sense experiences.

• Lonergan is focusing on this *intellectual component* in common sense.

• The fact of different common senses raises the question as to how we transform from our own common sense to that of a different community.

• "Common sense is the only interpreter of common sense." – i.e., by the same basic process of self-transcending self-correcting cycle of learning.

- Just as children learn to transform from their own visual perspective to that of another person by acquiring commonsense insights, so also more generally this is how we move out of our own common sense to understand the common sense of others.
- What makes common sense intellectual:

(1) its tested fund or inventory of insights, often specific to a place or group.

(2) its method of a self-correcting process of learning (comparable to the self-correction of science).

- What differentiates commonsense insights from scientific insights?
- Common sense as a specialization in the concrete and particular.
- "Adds at least one further insight into the situation at hand."
- Clarification of the meaning of "the particular and the concrete."
- Unlike science, not concerned with general rules; and especially since there are no rules as to when to apply the general rules. Application to the particular and concrete is common sense intelligence.

- If common sense does not operate according to rules, what does it operate according to?
- Operates according to the more primordial normativity of inquiry.
- If common sense is not rule-based, seems it would be chaos; but inquiry more basic than rules.
- Student question about difference between common sense that applies, and common sense into the concrete — no fundamental difference.
- Not choice of either common sense or science, but of both in their own proper spheres. Grasping relatedness, uniqueness.
- If particularity has to do with the empirical residue, how can common sense be a matter of getting insights into the particular?
- What made the insights in the assigned papers be “particular”?
- Here ‘particular’ means something different from its meaning in association with empirical residue. Its meaning is clarified by its association with ‘concrete.’
- ‘Concrete’ means to grow together. What’s concrete is the complexity of multiple intelligibilities that have grown together.

- Common sense language usage as addressing particular individuals in concrete situations made up of complex intelligibilities.
- Relying, therefore, on a collection of insights that can be used in concrete situation, but only by adding additional insights of how to use that collection to comprehend the complex intelligibility of the concrete situation.
- Startling realization that ultimately common sense must rely upon the guidance of intelligent inquiry.
- Being wise as self-appropriation. Accepting and trusting the lead of your own intelligent inquiry.
- Student question about relation to Aristotle's ethics.
  - Aristotle gives a frustratingly incomplete account of *phronesis*.
  - Lonergan is more specific in giving an account of common sense as intellectual (part of what is meant by *phronesis*) as the accumulation of insights, and inquiry, the desire to know, as the standard.

– In Chapter 18 of *Insight*, Lonergan gives an expanded account of practical insight into a course of action, and its place in ethics.

– In Chapter 6, however, Lonergan has not yet clearly distinguished between practical insights as *poesis* (making something different from oneself) and as *praxis* (self-constituting).

• Student remark about whether ethics transcends common sense.

• Student question about relation of theory and common sense.

• Theory, science, explanation, are not dealing with the concrete and particular.

• Lonergan's thoughts about political theory are rudimentary and scattered throughout the book.

• In his view, much of what is called political theory is a mixture of common sense and theory in his sense.

• There are times when it is essential to distinguish between explanatory/invariant dimensions of human political behaviour and the more culturally specific, commonsense aspects.

• Hobbes presents himself as giving a political theory; but in fact he is giving an account that is very much drawing upon the concrete circumstances of his times.

• Student question: are there other forms of intelligence that lie between common sense and explanatory, scientific knowing?

- For Lonergan there are many distinct forms of knowing; they are not along a spectrum or derived from either science or common sense.
- What allows common sense to be concrete?
- Questioning as such can go on forever, without ever coming to practical closure.
- Common sense can be particular and concrete because its questioning is restricted by our immediate concerns and interests.
- Student question of whether there are certain commonsense insights that are found in all cultures — formally the same insight, although different in specifics.
- The only interpreter of common sense is common sense; which means that the answer to this is very specific.

Insight & Beyond: Lecture 9, Part 2:

Chapter 6 § 1: "Common Sense as Intellectual"

- Transition from Science to Common Sense.
- Why Lonergan left the treatment of common sense until later in *Insight*: common sense as a blend of common sense and common *nonsense*: difficulty of dealing with the biases.
- With science there is a certain degree of methodological control over biases.

Common Sense as Intellectual
What is "common" to common sense?

All right! So we now make the transition from the strange world of science, the relativity of simultaneity, and all the other things that Lonergan has covered in those first five chapters, into the more familiar realm of common sense [Chapter 6: **Common Sense and Its Subject**. (*CWL* 3, pp. 196-231)]. Lonergan does say that one of the reasons why he took up common sense later rather than earlier was because common sense is a blend of common sense and common nonsense.

[Some subdued laughter]

And you've got a little bit of a piece of that, so common nonsense is something he treats under the heading of '**Bias**'. Bias can be bias, it can mean prejudice, and distortion. *What he's talking about in Chapter Six on common sense is psychological aberration. And he's interested in his discussion of what he calls* "**dramatic bias**" *of identifying the intellectual component in psychological aberration.* People almost always think of psychological difficulties as emotional difficulties. And they are indeed emotional difficulties. But Lonergan wants to make us pay attention to the specifically intellectual aberration that is also part of psychological disturbance.

In Chapter Seven [**Common Sense as Object** (*CWL* 3, pp. 232- 269)], he's going to go on to talk about other forms of distortion, other forms of nonsense, including what he calls individual bias, group bias and general bias. So we'll be talking about those.

So from his point of view, one of the difficulties with starting with common sense, which is where we all live and move and have our being, is that to ask people to identify that experience of intellectual illumination that comes and relaxes the tension of inquiry, doesn't take into account the various ways in which deceive ourselves about having relaxed the tension of inquiry. You can want an answer so much that you can pretend that you've actually got the answer. And you can want to avoid the answer so much that you can pretend that you don't have a question. And so to some extent, that is why he began with those earlier chapters where there is a certain amount of methodological control over the biases.

Now, we talked back in the first couple of classes about how that's not the whole story: Lonergan himself is very aware of the ways in which various forms of bias do creep in to the practice of science. But he wanted to use that as, at least, as a kind of hermeneutical exercise. He wanted to use that as a starting point to get a certain good climate for understanding what understanding is, and getting readers becoming more aware in appropriating the phenomenon of inquiry, and how inquiries last until they are satisfactorily answered. And now he moves into the area of common sense.

- Lonergan making a case that being intelligent in the realm of common sense is consonant with the natural universe.

The other reason – I believe – is that *Lonergan wants to make a case for the fact that being intelligent in the realm of common sense is consonant with the universe. What we've been doing, something I mentioned early on, and we've actually been tracing it, is the way in which science is about discovering the intelligibilities of the* *universe.* The last thing we did is the intelligibilities of space and time. Just because they're weird doesn't mean they're not intelligible! And that *the exercise of intelligence in ordinary living is consonant with the physical, the chemical, the biological, the geological, the atmosphere of the universe that we actually do live in*. So that's I think one of the other reasons why he's structured the book the way he has.

- Common sense as a different kind of understanding. What *is* common sense?
- Common sense as *intellectual*. An accumulation of a fund of insights.
  - Born into a community with an accumulated fund of insights. Social capital of group. Different common senses; variations in common sense dependent on social group, place, etc. People acquire the accumulated fund of insights of their community and become persons who have common sense.
- Two meaning of "experience": Experience[1] as sense stimulation, and experience[2] as more than mere exposure to sensations from different situations; being experienced[2] as having insights into those sense experiences.
- Lonergan is focusing on this *intellectual component* in common sense.

Having said that, we are now into a different kind of understanding! So, what is common sense? According to Lonergan, what is common sense? … Beth?

Beth: Is it the knowledge of things in relation to us?

Pat: Right. That's — so it's knowledge of things in relation to us.

Common Sense as Intellectual

What is "common" to common sense?

Not only are [people] born with a native drive to inquire and understand; they are born into a community that possesses a common fund of tested answers, and from that fund each may draw … (*CWL* 3, p. 198).

Common sense, among other things, is an accumulation of a fund of insights! Why don't we let two year olds out on the sidewalk to do whatever they want? They have not accumulated enough of a fund of insights to be able to responsibly and safely negotiate oncoming traffic. *So common sense is an accumulation of a fund of insights*. This is one of his more marvellous expressions:

> **Not only are [people] born with a native drive to inquire and understand; they are born into a community that possesses a common fund of tested answers, and from that fund each may draw …** (*CWL* 3, p. 198).

So *this is another way of saying that we are situated*. We are situated physically in space and time in ways that he explores in that last section of chapter five on "**Space and Time**," [the section "The Concrete Intelligibility of Space and Time" is at *CWL* 3, pp. 194-195.] As we saw last week, *we are also born into an organization of extensions and durations that is the doing of the communities into which we are born*. And in order to be able to learn our way around, we have to acquire the insights that organize the space and time of the community. We have to acquire the common sense insights not only to organize the extensions and durations as the community understands their organization; we also have to acquire lots of other insights, insights into how to eat and feed ourselves, how to prepare food, how to heat homes, how to clean dishes, how to perform various tasks at various kind of work and jobs, and so on. And some of you were talking about that in your essays, of how you got insights into how they are going to organize your work.

Common Sense as Intellectual

What is "common" to common sense?

"Not only are [people] born with a native drive to inquire and understand; they are born into a community that possesses a common fund of tested answers, and from that fund each may draw …" (*CWL* 3, p. 198).

"For every difference of geography, for every difference of occupation, for every difference of social arrangements, there is an appropriate variation of common sense." (*CWL* 3, p. 203).

So common sense, from one point of view, is *a fund of insights*. And that means that there are different common senses.

> **"For every difference of geography, for every difference of occupation, for every difference of social arrangements, there is an appropriate variation of common sense."** (*CWL* 3, p. 203).

What that means is that there is an appropriate variation of the economy, of insights that is proper to the profession, to the neighbourhood, to the nation, to the culture, as to how to do things. *And the process of acquiring insights is the process of becoming a person of common sense.*

Now the word 'experience' is a funny word. We use the word 'experience' when we say a person is inexperienced, and therefore is not ready for that job. *The word 'experience' in Lonergan's context refers to sensible experience primarily, and to a lesser extent the experience of insight, the experience of seeing, and so on.* So when we say a person is not experienced enough, it sounds like we're saying that they didn't

— they weren't around long enough to have enough photons and sound waves bombard their bodies. If they just stay around long enough they'll absorb enough stimuli from the environment, and then they'll be experienced. *But from Lonergan's point of view what it means to be experienced is to have insights into those experiences, those sense experiences. To be experienced in the broader sense means to have gotten insights.*

Now it's important in this chapter to be clear about the distinctions and relationships between Lonergan's narrower use of the word 'experience', and to be aware of the fact that there is an experiential, just to say a sensational, dimension to our knowing, our common sense, but there is also an intellectual component! That's what he's interested in — is the intellectual component.

- The fact of different common senses raises the question as to how we transform from our own common sense to that of a different community.
- "Common sense is the only interpreter of common sense." – i.e., by the same basic process of self-transcending self-correcting cycle of learning.
- Just as children learn to transform from their own visual perspective to that of another person by acquiring commonsense insights, so also more generally this is how we move out of our own common sense to understand the common sense of others.

Now given the fact that there are different common senses — this raises the question about how do we transform or transition from one common sense to the other. In *Insight*, Lonergan says that *common sense ultimately is the only interpreter of common sense. He's using the word 'common sense' in two different ways there.*

"It follows that common sense has no use for a technical language and no tendency towards a formal mode of speech. It agrees that one must say what one means and mean what one says. But its correspondence between saying and meaning is at once subtle and fluid. As the proverb has it, a wink is as good as a nod. For common sense not merely says what it means; it says it to someone; it begins by exploring the other fellow's intelligence; it advances by determining what further insights have to be communicated to him; it undertakes the communication, not as an exercise in formal logic, but as a work of art; and it has at its disposal not merely all the resources of language but also the support of modulated tone and changing volume, the eloquence of facial expression, the emphasis of gestures, the effectiveness of pauses, the suggestiveness of questions, the significance of omissions. ***It follows that the only interpreter of commonsense utterances is common sense.*** **For the relation between saying and meaning is the relation between sensible presentations and intellectual grasp, and if that relation can be as simple and exact as in the statement 'This is a cat,' it can also take on all the delicacy and subtlety, all the rapidity and effectiveness, with which one incarnate intelligence can communicate its grasp to another by grasping what the other has yet to grasp and what act or sound or sign would make him grasp it. Such a procedure, clearly, is logical, if by 'logical' you mean 'intelligent and reasonable.' With equal clearness, such a procedure is not logical, if by 'logical' you mean conformity to a set of general rules valid in every instance of a defined**

> **range; for no set of general rules can keep pace with the resourcefulness of intelligence in its adaptations to the possibilities and exigencies of concrete tasks of self-communication.** (*CWL* 3, pp. 200-201, italics added).

He's using the word 'common sense' in two different ways there.

Jean Piaget

The Child's Conception of Space

Transformations of Intelligible Relations

What children have to do is to acquire the common sense of how to be able to transform from their visual perspective in space to somebody else's visual perspective in space. And likewise, what we have to be able to do is to transform from the common sense of the community that we were born into, into the common sense of communities that we find ourselves in, where the accumulated fund of insights is different from the one that we were born into.

Common Sense as Intellectual

"Just as the scientist advances from data through insights and formulations to experiments that stimulate further insights, so too the spontaneous and self-correcting process of learning is a circuit in which insights reveal their shortcomings by putting forth deeds or words or thoughts, and through that revelation prompt the further questions that lead to complementary insights. (*CWL* 3, p. 197).

• What makes common sense intellectual:

(1) its tested fund or inventory of insights, often specific to a place or group.

(2) its method of a self-correcting process of learning (comparable to the self-correction of science).

So what makes common sense intellectual? *First of all, it is that tested fund of insights! But common sense also is intellectual by its method*: for its

> **self-correcting process of learning is a circuit in which insights reveal their shortcomings by putting forth deeds or words or thoughts, and through that revelation prompt the further questions that lead to complementary insights.** (*CWL* 3, p. 197).

And notice how he draws attention to the similarity of common sense self-correcting process, and scientific self-correcting process. And quite a number of you had exactly that experience, or recognized yourselves as going through that self-correcting process, in the papers that you wrote describing insights.

Common Sense as Intellectual:

Self-correcting Process of Learning

Diamond Diagram

So the self-correcting process of what he's going to call **patterning of experience**, giving rise to inquiries, inquires to the satisfactory interventions of imagination, yielding insights, the insights grounding actions and decisions, and the actions themselves transforming the experiences, and thereby giving rise to further insights. So the self-correcting process is part of common sense.

So on the one hand, common sense is an inventory: it's an accumulation of insights. To have the common sense of a Bostonian, or the common sense of a Philadelphian, or the common sense of a San Franciscan: it means to have different sets of insights.

Not only that, but Lonergan is focussing on common sense as intellectual. His suggestion is that we don't, in talking about common sense and talking about socialization and talking about acculturation, that we don't have oversights of insights; that we appropriate the intellectual part of our common sense.

> *So common sense first of all is an inventory. It's the social — it's the social capital of a group. It is insights that may be hundreds of years old, and passed on from generation to generation. As he says, each person can draw from that fund to acquire that accumulated fund.*

- What differentiates commonsense insights from scientific insights?
- Common sense as a specialization in the concrete and particular.
- "Adds at least one further insight into the situation at hand."
- Clarification of the meaning of "the particular and the concrete."
- Unlike science, not concerned with general rules; and especially since there are no rules as to when to apply the general rules. Application to the particular and concrete is common sense intelligence.

- If common sense does not operate according to rules, what does it operate according to?
- Operates according to the more primordial normativity of inquiry.
- If common sense is not rule-based, seems it would be chaos; but inquiry more basic than rules.

Common Sense vs. Science?

What differentiates common sense insight from scientific insight?

Now if both science and common sense exhibit the self-correcting cycle of experience, inquiry, insight, action, transformed experience, new questions, new insights, new actions, further transformations of experiences, what differentiates them?

This is just what he gave us:

Common Sense vs. Science?

What differentiates common sense insight from scientific insights?

"Common sense, unlike the sciences, is a specialization of intelligence in the particular and the concrete. It is common without being general, for it consists in a set of insights that remains incomplete until there is added at least one further insight into the situation in hand; and once that situation has passed, the added insight is no longer relevant, so that common sense at once reverts to its normal state of incompleteness." (*CWL* 3, pp. 198-199).

> It's "**a specialization of intelligence in the particular and the concrete. It is common without being general, for it consists in a set of insights that remains incomplete until there is added at least one further insight into the situation in hand; and once that situation has passed, the added insight is no longer relevant, so that common sense at once reverts to its normal state of incompleteness.**" (*CWL* 3, pp. 198-199).

Now there are several significant moments in that passage. And the first one I want to draw attention to is what he means by "**the particular and the concrete**." (*CWL* 3, pp. 198-199). What do you think he means by common sense being "**a specialization of intelligence in the particular and the concrete"?** Because remember, up until now, even including the section on the abstract intelligibility of space and time, Lonergan's focus has been on the kind of understanding that has this notion of abstractness to it, abstractness in the sense of invariance with regard to changes in the empirical residue, changes in particular area of place, particular area of time, particular area of state of motion, particular area of individuality … What does he mean then by saying: "**common sense** … is "**a specialization of intelligence in the particular and the concrete"** (*CWL* 3, pp. 198-189)? … Samantha?

Samantha: That it's not — Common sense isn't a set of rules that will dictate how we should act or think all the time. It has to do with very particular situations!

Pat: Right!

Samantha: So although there is a rule, common sense might not apply to every single situation that arises.

Pat: Right. So he uses the example of aphorisms — or … what's the word? —

Student: Proverbs?

Pat: Proverbs, yeah! "A stitch in time saves nine!" [Perhaps "Look before you leap!"?] "Strike while the iron is hot!" Those are contradictory statements. … Or "Good things will come to those who wait!" Those are contradictory statements.

One says, "Be patient," and the other says "Don't let the opportunity pass you by!" Well, how do you know which one to pay attention to? *That's a matter of common sense*! So there aren't any — Samantha is exactly right! There aren't rules! *There are rules when you have abstract intelligibilities, intelligibilities that don't pertain to the particularity of a place and time and the individual, and so on*.

So common sense doesn't operate according to rules. What does common sense operate according to, if not rules? …

Student: Common sense!!

[Subdued Laughter]

Pat: Yes, common sense, but …? Yeah, Mary?

Mary: Our own insights and intellect.

Pat: That's right. Our own insights and intellect. And more primordially than that? … Our inquiry! Every time Professor Byrne says "more primordially than that," the answer is probably inquiry!

[Class Laughter]

Why? Why is that more primordial? Does it — Stop and think about this for a minute! ….

Lonergan is talking about common sense as being a specialization in the particular and the concrete; and there are no rules! It sounds like chaos!! … Right? It sounds scary! It sounds like "Literally, anything goes!" Except it's not true that anything goes in common sense.

Student: So I think it's the opposite, right?

Pat: I'm sorry?

Student: If anything, it's the very opposite of that, which is that you have to have an insight into the concrete particulars of any given circumstances, situation, or question. Sort of, it isn't — It precisely isn't 'anything goes', or even 'this broad sort of rule goes.' It has to be this very particular instant.

Pat: That's quite right! *It's very particular, and the normativity of the particularity is in the inquiry*. You've got to satisfy your inquiry. … John?

John: I was going to say, could you call the insight of common sense maybe an insight of applicability?

Pat: That's one kind of insight of common sense. That's quite right! And that's something we actually saw back in Chapter Three. There's a reference to it at the end of Chapter Five also: that you have to have insights into the particular in order to be able to know how to apply the general and the universal and the abstract!

John: But there's another side to the insights involved in common sense, besides that?

Pat: Yes! That's what we're trying to tease out here a little bit. …

- Student question about difference between common sense that applies, and common sense into the concrete — no fundamental difference.
- Not choice of either common sense or science, but of both in their own proper spheres. Grasping relatedness, uniqueness.

Pat: Greg?

Greg: So I had a question about what you just said. How do we talk about the insight that applies classical laws to specific situations as distinct from a common sense insight, that appropriates common sense understanding to a particular situation [previous five words not certain]?

Pat: There is not a distinction between them. It's just a matter of what's being applied.

Greg: So a scientist uses common sense in his work to apply —

Pat: That's right! There's a — I'm not sure I could find it quickly — There's a remark about the relationship between scientific description and common sense description. Let me see if I can find it quickly then.

[Pat consults his copy of Insight]

Student: Is it at the top of page 203?

Pat: Yes, thank you. So it's actually on the bottom of page 202:

> **The sciences need methods to reach their abstract and universal objects; but scientists need common sense to apply methods properly in executing the concrete tasks of particular investigations, just as logicians need common sense if they are to grasp what is meant in each concrete act of human utterance. It has been argued that there exists a complementarity between classical and statistical investigations; perhaps it now is evident that the whole of science, with logic thrown in, is a development of intelligence that is complementary to the development named common sense**. (*CWL* 3, pp. 202-203).

And then at the end of the paragraph, he says:

> ***Rational choice is not between science and common sense; it is a choice of both, of science to master the universal*** [or if you like, to discover the universal]***, and of common sense to deal with the particular.*** (*CWL* 3, p. 203, italics added).

- If particularity has to do with the empirical residue, how can common sense be a matter of getting insights into the particular?
- What made the insights in the assigned papers be "particular"?
- Here 'particular' means something different from its meaning in association with empirical residue. Its meaning is clarified by its association with 'concrete.'
- 'Concrete' means to grow together. What's concrete is the complexity of multiple intelligibilities that have grown together.
- Common sense language usage as addressing particular individuals in concrete situations made up of complex intelligibilities.
- Relying, therefore, on a collection of insights that can be used in concrete situation, but only by adding additional insights of how to use that collection to comprehend the complex intelligibility of the concrete situation.

Now, let's think about this a little bit more. I thought particularity had to do with the empirical residue. And the empirical residue is precisely that which is devoid of intelligibility. It's that which is left over after all understanding. How then can common sense be a matter of something intellectual, of getting insights into the concrete particular? ….

Particularity is empirical residue! And how can you have a common sense into the concrete? ….

Well, let's think of some examples: perhaps examples from the papers that you wrote illustrating insights? … What was it about the particularities or the concreteness that you had to get an insight into? What made it concrete? … Mike?

Mike: [Initial words unclear] kind of relation between two things.

Pat: All right. Well, I think that's important, that what you're really doing is you're grasping relatedness; and *you're grasping relatedness of something that's unique, that's particular in the sense of unique! It's not particularity in the sense of the empirical residue!*

That was a sneak question: because he does use the word 'particularity' in relationship to the empirical residue. *Here it actually means something a little different. And it's reflected in the word 'concrete' more than in using the word 'particular.' 'Concrete' comes from the Latin or Greek that means "to grow together." What is concrete is the complexity of a multiplicity of intelligibilities that have grown together.*

Any human language is an accumulation of insights that have grown together over thousands of years. And in order to know how to use that language concretely you have to grasp how its various terms have been organized by that multiplicity of connections among the terms. But more importantly, you have to be able to use it in a particular circumstance.

So think about how you explain something to somebody, or tell somebody an idea that you have. I once had to transcribe the Proceedings from a Conference off of a tape-recorder, and one of the problems that I ran into was in the Question and Answer period. The person who was giving the answer to the question would break off in the middle of a sentence, and go on to something else. He did that because they saw what Greg just did. The person nodded, and he said: "Ah, there's no point in beating a dead horse here! This person has got the insight; I will move on to the next point." I of course was not in the room when that was happening, and so I wasn't in the concrete, interlocutor, dialogical situation, and I had to kind of figure out what might have been the end of that sentence, because people don't like to read books with a lot of dot-dot-dots coming in the middle of the sentences!

[Class laughter]

So if that's an example of taking something — Language is not exactly a universal! What it is is a very flexible complex organism that can be made concrete by doing what Lonergan says here [pointing to the display "Common Sense vs. Science" still on screen], adding at least one more insight!

Common Sense vs. Science?

What differentiates common sense insight from scientific insights?

"Common sense, unlike the sciences, is a specialization of intelligence in the particular and the concrete. It is common without being general, for it consists in a set of insights that remains incomplete until there is added at least one further insight into the situation in hand; and once that situation has passed, the added insight is no longer relevant, so that common sense at once reverts to its normal state of incompleteness." (*CWL* 3, pp. 198-199).

So you bring the inventory of common sense insights that you've gotten, and you've gotten it through this process of experience, inquiry, insight and action, getting a reaction that means you didn't quite use the word right; and you try again! Until you accumulate your common sense understandings, your common sense insights into language, into interpersonal relations, into practical abilities, and so on. You accumulate those, and they are like having a tool-box that's available to be put to use as needed, as your inquiries make you want to understand how to use those tools in this concrete situation. And you've already got the acquisition of the common sense inventory of insights, but you need to further figure how to use them effectively in the situation in which you find yourself.

- Startling realization that ultimately common sense must rely upon the guidance of intelligent inquiry.
- Being wise as self-appropriation. Accepting and trusting the lead of your own intelligent inquiry.

So common — That's what he means by saying that it reverts to its incomplete state! *Common sense is a great potentiality of acquired insights that always has to be complemented and added to depending on the circumstances. And the circumstances are concrete*! It's how do I explain it, not in general, but to this person; how do I fix a car, not in general, but with this problem. And so on. Okay?

Any questions about that? ….

> So common sense: one meaning of it is *this inventory*; another meaning of it is *the self-correcting process*; and a third meaning of it is *that ability to be guided by the inquiry that is going to be the standard by which the right way to apply your inventory in the circumstances is going to be measured.*

So it isn't just chaos! It's not just all up for grabs! But when you stop and think about it, it's kind of scary!

> *This is really a big step of self-appropriation, to discover that to be a wise person, a person of common sense, means to really learn to pay attention to and commit yourself to being led by the questions.*

That's a huge trust: to trust your inquiring self as the standard for the understandings and interpretations of the common sense situations that you find yourself in.

- Student question about relation to Aristotle's ethics.
  - Aristotle gives a frustratingly incomplete account of *phronesis*.
  - Lonergan is more specific in giving an account of common sense as intellectual (part of what is meant by *phronesis*) as the accumulation of insights, and inquiry, the desire to know, as the standard.
  - In Chapter 18 of *Insight*, Lonergan gives an expanded account of practical insight into a course of action, and its place in ethics.
  - In Chapter 6, however, Lonergan has not yet clearly distinguished between practical insights as *poesis* (making something different from oneself) and as *praxis* (self-constituting).
- Student remark about whether ethics transcends common sense.

Pat: Any questions about that? … Jonathan?

Jonathan: This quote here [the "Common Sense vs. Science" overhead display] sounds an awful lot like a sort of expansion on the way Aristotle characterizes the intelligibility proper to ethics.

Pat: Uh, uh!

Jonathan: It's a science that does not admit of certainty. Ah, Could you explain — Ah, we're still a few chapters away from the chapter properly on Ethics

[Chapter eighteen, *CWL* 3, pp. 618-656]. But could you maybe preview, or explain a little bit maybe on the way in which that's a fair or unfair characterization of what this says?

Pat: I think it's quite fair! There are things that are just maddening about Chapter Six [Book Six?] of the *Nichomachean Ethics*. Aristotle tells you all kinds of fascinating things about the intellectual virtues; but there's a way in which you want to know more about *phronésis* than he tells you! I think what he's up to in that Chapter is to show that the close relationship between *phronésis* and *noésis* or *nous* — As the Chapter unfolds, he is sort of putting things aside like *techné* and *episteme*, but there's this kind of interesting dialogue that's developing between *phronésis* and *nous*, the intelligence that grasps the principles of things. So I think that, in some senses, that's one of the things that he is up to there. But you really would like to know — get him to tell you — tell me more about this *phronésis*! How does it work, you know? I know that *phronésis* is characteristic of the just person. If you want to be a just person you have to do what the just person does, and the way that the just person does it, and the manner of the just person towards the objects and towards — [Speaking forcefully:] *Can't you give me some rules? And he doesn't*!!!

> I believe Lonergan has kind of unpacked that for us, by giving us this account of common sense *phronésis* as the accumulation of insights, and this relying upon the desire to know as the standard by which one comes to understand just what's to be done under the circumstances.

So you're exactly right! There are things in that chapter that sound like they came right out of the *Nicomachean Ethics*. And I think he is very much inspired by that spirit of ethics! When we get to Chapter Eighteen, there is a section on practical insight [*CWL* 3, pp. 632-639]: that *practical insight is a matter of understanding a course of action that you could take in the concrete circumstances*. And he does expand that a bit more there! But I think you're right!

There's a tricky thing here because he isn't — He isn't yet fully differentiating between what Aristotle would call *poésis* and what he's going to call *praxis*. These are

— The common sense insights can be, on the one hand, just simple things like, how to use a tool, and how to bake food, and how to balance your cheque-book, and things like that. Those are not certainly what Aristotle would regard as practical in the sense of *praxis*. There are some *elements in here* that have to do with *praxis* and they're all in his account of the dramatic subject. And that will be expanded later on, and we'll see it then [previous four words uncertain]!

So here common sense is kind of an undifferentiated whole in which you've got practical in the American sense of practical, and practical in the Aristotelian sense, sort of cheek by jowl.

Jonathan: But if I remember correctly — it's been a few months since I read Chapter Eighteen — but apparently though, ethics does not fall — It's not *just* in the realm of common sense, for Lonergan though. It transcends the common sense way of knowing.

Pat: That's right! It's in the realm of self-appropriation! Ethics assumes an understanding in the realm of self-appropriation. [Sentence uncertain].

- Student question about relation of theory and common sense.
- Theory, science, explanation, are not dealing with the concrete and particular.
- Lonergan's thoughts about political theory are rudimentary and scattered throughout the book.
- In his view, much of what is called political theory is a mixture of common sense and theory in his sense.

- There are times when it is essential to distinguish between explanatory/invariant dimensions of human political behaviour and the more culturally specific, commonsense aspects.
- Hobbes presents himself as giving a political theory; but in fact he is giving an account that is very much drawing upon the concrete circumstances of his times.

Pat: Okay. Any other questions? … Byron?

Byron: What would you say about 'theory'? Is this theory under the subset of common sense, like political theory, or something like that?

Pat: Well, for Lonergan, no! I mean, the way he uses 'theory' — He uses 'theory', 'science', 'explanation', more or less as interchangeable. And so that has to do, not with the concrete particular. And as he says at the top of page 203 there, *the choice is not between common sense or science, but both*!

> **Rational choice is not between science and common sense; it is a choice of both, of science to master the universal, and of common sense to deal with the particular.** (*CWL* 3, p. 203).

In understanding, there are various contributions and inter-relationships. So Political Theory — Lonergan's got a lot of rudimentary things about Political Theory that are scattered throughout the book.

A lot of what is written in the category of Political Theory is some combination of what Lonergan would call ‘Political Theory’ plus common sense. Which is not a bad thing, but *there are times when it is important to make the distinction. Why? Because common sense is very much rooted to particularity and concreteness*. Some Political Theory can be very culturally situated! And to call it ‘Political Theory’ is to say, like, “That that’s very wise! It’s a very sophisticated accumulation of insights.” But *sometimes it’s important to know the distinction between what’s the purely explanatory, the purely invariant dimension of human political behaviour, and what is more specific*!

So it depends on what you’re reading. Hobbes,[10] for example, clearly presents himself as giving a Political Theory. I think he’s giving a Political Theory that is very much rooted in the circumstances of his time, in the wake of the religious wars, and the inefficacy of Aristotelian and Platonic political theory as it was understood in his time. And his account of the political entity, the *Leviathan*, is very much, I think, full of all kinds of things that are very culturally conditioned. Okay?

Byron: Yeah, but someone like Michael Walzer would be, in his classic text, *Just and Unjust Wars: A Moral Argument with Historical Illustrations* (2006), would be doing kind of what Lonergan says is important, going back and forth between the two, and showing how, from historical examples, concrete, particular examples, this can be extracted [Byron points to the overhead display], theory!

Pat: Ah, I’ve read Walzer’s *Spheres of Justice*. I haven’t read *Just and Unjust Wars*. So … That is the sort of thing that counts as theory, yeah. You know, *The Spheres of Justice* says, like: “Okay! The first question is where to you like to put your boundaries. Once you’re inside their boundaries then you [words indecipherable]. He does that sort of thing! So as far as I know, that’s correct, yeah! …

[10] **Thomas Hobbes** (1588–1679), was an English philosopher, best known today for his work on political philosophy. His 1651 book *Leviathan* established social contract theory, the foundation of much later Western political philosophy.

- Student question: are there other forms of intelligence that lie between common sense and explanatory, scientific knowing?
- For Lonergan there are many distinct forms of knowing; they are not along a spectrum or derived from either science or common sense.

Pat: Ah, Greg?

Greg: Are there intervening types of intelligence? If we take common sense for the concrete and scientific knowledge to be — it kind of depends on the structure — Does this constitute between the two of them, kind of, the whole range of human knowing?

Pat: No! Do you remember back, I think the first class, I had — I talked about Lonergan giving an account of the different kinds of knowing?

Greg: Uh, uh!

Pat: And in addition to the explanatory-scientific which encompasses a great deal, and the common sense which encompasses a great deal, there are things like artistic knowing — and he briefly recurs to artistic knowing here — We'll do some of that next week, and also when we look at Chapter nine in *Topics of Education*. There's what he calls scholarly knowing, which is the capacity to transform from your present common sense to the common sense of a different culture; a dramatically different culture, and particularly a culture that is no more, a culture of different times or of different places. There is interpersonal knowing, which is part of common sense and it's the dramatic pattern of experiencing, that kind of thing. There's theological knowing; there's philosophical knowing; there's religious knowing!

Greg: And those aren't strictly derivative of common sense?

Pat: No! They're distinct! *So for him, there are at least — let's see, eight or ten identifiably distinct kinds of knowing, of which explanatory and common sense are but two*. Arguably, common sense is the big one! It's what makes up the intellectual component at least in every culture. And that means it covers the planet [unsure of words here], and it covers the whole of what is involved in history! But it's not the only one! And part of what he does is to try and look at some of the relationships among those kinds of knowing. Okay?

- What allows common sense to be concrete?
- Questioning as such can go on forever, without ever coming to practical closure.
- Common sense can be particular and concrete because its questioning is restricted by our immediate concerns and interests.

This finally brings us back to something Deb said at the beginning. *What exactly is it that makes it possible for common sense to be concrete*? In principle, any particular situation is the fodder for an indefinite number of questions! Questions can just go on and on and on. And that is what scholars and what scientists do! Scientists aren't bound by any limited kind of question. They just wonder about everything. And scholars do the same kind of thing. Philosophers do the same kind of thing.

> People of common sense don't do that! *What allows them to particularize and concretize is their understanding things in relationship to themselves — but now we've got this added proviso in relationship to our concerns and interest*s.

> ### Common Sense vs. Science?
>
> **Common sense, on the other hand, has no theoretical inclinations. It remains completely in the familiar world of things for us. The further questions by which it accumulates insights are bounded by the interests and concerns of human living, by the successful performance of daily tasks, by the discovery of immediate solutions that will work. Indeed, the supreme canon of common sense is the restriction of further questions to the realm of the concrete and particular, the immediate and practical.** (*CWL* 3, p. 201).

So common sense remains completely in the world of things familiar to us! It's a matter of the people we encounter, the things that they encounter, and how they are going — not just our unending interrogative spirit — but how we're going to understand what we encounter as potentially meaning some interest or concern for me. *And it's that that allows us to particularize*.

You can have a conversation with somebody that could go on forever! But if the conversation is: "How do I put — how do I make change for the tea?" that puts a limit on further pertinent questions that you need to get insights into to deal with the concrete situation in hand. *The concreteness of the situation in hand is determined by what your interests and needs are. That doesn't — Your interests and needs don't obviate the necessity of asking questions and getting insights as to how to respond to those. But it's the interests and needs that form the boundaries*.

Ah, is this the place where he says — Oh yes. He writes:

> **Indeed, the supreme canon of common sense is the restriction of further questions to the realm of the concrete and particular, the immediate and practical.** (*CWL* 3, p. 201).

— with the emphasis on *concrete and immediate, here and now*!

What I do here might make a difference ten years down the road, but here and now, for my practical interests and concerns, it doesn't matter whether I do it this way or I do it that way. So the concreteness is pulled down by the interests and concerns [previous three words uncertain].

Let's see if this — [Pat opens next slide, which turns out to be "Patterning of Experience."].

Okay. We're going to leave this — So "**Patterning of Experience**" we'll come to next week. It raises the question: Who are we?

Patterning of Experience

"There is, then, a subtle ambiguity in the apparently evident statement that common sense relates things to us.

"For who are we?

"Do we not change? Is not the acquisition of common sense itself a change in us? (*CWL* 3, p. 204).

Okay. We have a couple of minutes. Any questions on this?

- Student question of whether there are certain commonsense insights that are found in all cultures — formally the same insight, although different in specifics.
- The only interpreter of common sense is common sense; which means that the answer to this is very specific.

Student: This is a question about the common sense being relegated to a community. Is there — Are there examples of trans — or that is to say, like, transcultural common sense, in so far as certain concrete or immediate instances can have a formal similarity. I'm thinking like to a Bostonian, it's common sense not to take Storrow Drive[11] during a Red-Sox game; and to a New Yorker it's common sense not to take the Cross Broads [name presumably of some major highway] during a Yankee game. Now those two examples of common sense knowing are related to the community of the common fund of the commons sense insights, but they seem to be formally the same insight! Like, transcultural or trans-community —

Pat: — Sure!

Student: And that's common sense; it's not scientific knowing!

Pat: It's not scientific knowing. But what I think makes for the commonality is certain shared insights that get particularised between you knowing what the Cross Broads are [Pat names the second street mentioned in the question], what Storrow Drive is.

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[11] **Storrow Drive** is a major crosstown parkway in Boston, Massachusetts, running south and west from Leverett Circle along the Charles River. It is restricted to cars. Trucks and buses are not permitted on it.

When I was first in Boston, I was in a band and I didn't have a car, and the director would pick me up and take me to the gigs. And all I knew was just this marvellous panorama that was flying around: I had no idea where I was!

[Class amusment]

I now know what Storrow Drive was, and there were sometimes when I was on Storrow Drive, but I didn't know it! So knowing what Storrow Drive is, and knowing when to avoid it, is a matter of accumulating some insights.

But sure! *There's some general insights*! Just as Bostonians and New Yorkers, with a few exceptions, speak the same language!

[Class amusment]

So there's a commonality, but it's not with — So —

Student: But it's not the same insight? Because it's into a different concrete instance?

Pat: Well, what it is is applying some of the same kinds of insights to particulars that are different! So you have the same kinds of insights about the nuisance of wins/winds [word uncertain]. And —

Student: Right!

Pat: And then you have the insights that are particular to Storrow Drive, and the times of day, and — so you remember to check the paper and see when the teams are [unclear word]. And those are all the more particular insights to which we — to which "avoidance of nuisance insights" are added.

Student: Okay. And you'd expect it across all cultures, and at all times, and in all places. Those cultures have always had certain "nuisance avoidance insights"?

Pat: I don't know! I don't want to generalize. *Probably*! I don't know!

But as Lonergan says: the only interpreter of common sense is common sense. "**The only interpreter of commonsense utterances is common sense.**" (*CWL* 3, p. 200). And what he means by that is: the only way to understand what a common sense person is saying to you when they're talking to you or expressing themselves in some other fashion, is by having a sufficiently rich common sense fund of insights, and by using your intelligence and your inquiry to guide you in figuring out whether or not you've understood properly what they're saying.

Are there insights that are to be found in every human community? Well, probably! But I'd be hard pressed to make the case for any particular set of insights, that they must have been in every community on earth. It turns out not to be terribly relevant for Lonergan, because of the self-transcendent capacity to learn the common sense of another group. It can be harder or easier depending on what the cultural and temporal distance is. But for Lonergan to say whether the invariant insights that everybody has is not as important, for that reason.

Okay! So we'll see you next week! What I'd like to ask you to do for next week, in addition to going over "patterns of experience" again, is to read chapter nine in *Topics in Education.*[12] That's the chapter on "Art." If you wet your eyes in reading what Lonergan has to say about art in *Insight*, —

[Class amusment]

— he gave this wonderful lecture on art in his lectures on education at Xavier University in 1959. So we'll finish up Chapter Six and chapter nine of *Topics in Education* next time I see you.

[12] Bernard Lonergan, *Topics in Education,* eds. Robert M. Doran and Frederick E. Crowe, Collected Works of Bernard Lonergan: vol. 10 (Toronto: University of Toronto Press, 1993).