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- "Energy," the Rise of the Monistic Worldview and the Demise of Perceived Balances
- "Speed" As a State of Altered Perceptions (1989)

Jean Robert

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Presentación

Este número 20 de la REVISTA IMPULSA DE UNIVERSIDAD LA SALLE CUERNAVACA, recoge otra parte de la colección de los trabajos del Mtro. Jean Robert, varios de estos publicados ya en la Revista *International Journal for Illich Studies* y ahora reimpresos con el permiso autógrafo de Robert, para que nuestros jóvenes universitarios puedan enriquecerse de las propuestas que aparecen en los textos que ahora presentamos para conmover su pensamiento y su reflexión crítica para que como resultado, se incremente su toma de consiencia acerca de la responsabilidad que todos tenemos hacia el mundo que habitamos y reflexionesmos sobre los cambios destructivos, e irreversibles ocasionados a nuestro planeta.

En la síntesis curricular del Mtro. Jean Robert, que aparece en las siguientes páginas, se menciona que Jean Robert ha sido Arquitecto, especialmente interesado en problemas de urbanismo y en las consecuencias que muchas de las soluciones propuestas para resolverlas en las granadés ciudades, han sido, más bien, causas de mayores dificultades y conflictos.

Al establecerse en México, específicamente en la Ciudad de Cuernavaca, Morelos, la participación del Mtro. Robert en el CIDOC (Centro Intercultural de Documentación) fundado y dirigido por Monseñor Iván Illich, lo llevó a estar en contacto con tres importantes pensadores y visionarios en cuanto a las graves consecuencias de las fallidas decisiones acerca del crecimiento y organización social y urbanístico de las ciudades: el pensamiento de John Turner y su propuesta de centrar el discurso urbanístico en la participación popular; las ideas e investigaciones progresistas de John McKnight sobre los vecindarios urbanos, basadas en la participación de sus habitantes, tomándolos en cuenta como agentes de cambio urbano, contando con la utilidad de los recursos locales, las capacidades y las relaciones entre sus habitantes, con lo que se generó la "Guía Construyendo Comunidades" desde dentro hacia afuera, que llegó a ser una de las estrategias más importante para el desarrollo urbano en América del Norte y del Sur, Europa, África, Asia y Australia; y por último, con la fuerza de las ideas de Gustavo Esteva, activista defensor del postdesarrollo como una crítica radical al desarrollo y fundador de la "Universidad de la Tierra" en Oaxaca, para aprender de las culturas indígenas, empeñado en demostrar la capacidad que tienen las comunidades para encontrar sus propios caminos y tomar sus propias decisiones.

Toda esta dinámica de pensamiento, aunada a la fuerza de las ideas de Illich, llevó a Jean Robert a enseñar, además de Urbanismo en las escuelas de Arquitectura, a convertirse en un auténtico maestro, cuestionador y crítico de cualquier posición cómoda e irreflexiva ante los problemas sociales, especialmente los que ponen en riesgo la convivencia humana y la convivencia con la naturaleza.

Jean Robert es además una persona muy generosa, siempre bien dispuesto a compartir sus ideas, conocimientos y reflexiones con todos los que quieran escucharlo.

En este número de la REVISTA IMPULSA DE UNIVERSIDAD LA SALLE CUERNAVACA, se publican textos que tocan el tema de la ENERGÍA en relación con la VELOCIDAD, cuestionando la relación entre lo que la ciencia y la filosofía aportan, en donde la ciencia trata de prescindir de la filosofía, o al menos de supeditarla a su método.

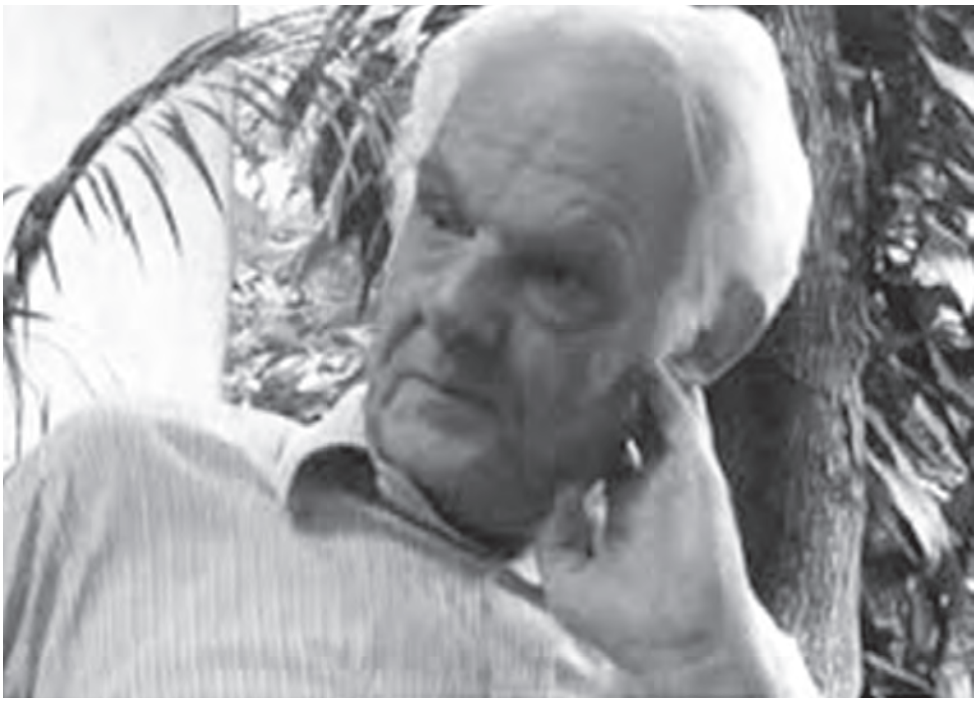
Jean Robert, nos lleva en estos textos a reflexionar acerca de qué tan sólidos y válidos son los hallazgos de la ciencia y cuáles serían las consecuencias, si los científicos se apoyaran en la mirada de la Filosofía para entender sus descubrimientos.

Invitamos a todos nuestros lectores a disfrutar de estos escritos y a reflexionar en las propuestas del Mtro. Jean Robert.

Indivisa Manent

Dr. José Francisco Coronato Rodríguez

Rector



Editorial

Una vez más, la REVISTA IMPULSA DE UNIVERSIDAD LA SALLE CUERNAVACA, tiene el privilegio de publicar la colección de textos que en 2017 fueron motivo de un número completo de *The International Journal of Illich Studies.*

En este número de nuestra revista, los textos aparecen también en el inglés original en que fueron escritos por Jean Robert y es con el permiso escrito de puño y letra de su autor que es posible, ahora, hacerlos accesibles a nuestra comunidad académica y a todos nuestros lectores en México.

Los contenidos de los escritos de la colección que ahora aparecen en IMPULSA, que tienen como tópico principal la ENERGÍA en su relación física y filosófica, con la VELOCIDAD están integrados a la colección de textos de Jean Robert que atañen a la reflexión sobre el tema de la relación entre el LUGAR y el ESPACIO que aparecieron publicados en el número 19 de nuestra revista.

La discusión que Robert propone ahora, se enfoca a entender a la velocidad como una de las formas concretas de la energía, más que como una manifestación mecánica. Esta sola diferencia modificó completamente la percepción que la humanidad del siglo XIX tenía de lo que podría ser una "experiencia cinética", que lleva a pensar en la extinción de lo que se había definido como un "lugar en el espacio" para conducirnos a pensar en que el cambio en la velocidad del movimiento de los cuerpos humanos en los trenes, por ejemplo, modificó la idea de lugar como algo concreto, háptico y definido, para sustituirla como una dimensión inasible que hace sentir al observador, que "los paisajes giran a su alrededor".

> "....el espacio que transforma a la gente en paquetes por transportar, a los ciudadanos en clientes por atender y a los vecinos en números".(Robert 2007). Y que nos hace sentirnos inmersos en una ubicuidad sin piso. (lo cual puede resultarnos muy angustiante).

Se incluye también en este número, un texto más de Jean Robert intitulado "La velocidad, forma velada de explotación de los pobres" escrito en 2004, en el que este prolijo autor nos muestra su interés por los temas de la vida del pueblo mexicano, de este país y en especial, del estado de Morelos que lo adoptó. Arquitecto y además filósofo, seguidor del pensamiento de Iván Illich, Robert se cuestiona constantemente acerca de las supuestas ventajas que tienen todos los grandes adelantos tecnológicos, aplicados aparentemente para el bienestar de las personas, pero que en el caso de las poblaciones empobrecidas económicamente, como abundan en nuestro país, estos adelantos vienen a ser nuevas formas de discriminación y explotación, ya que se da prioridad a la construcción de calles y circuitos periféricos para la circulación de vehículos motorizados, pero se ignora y no se da importancia a la circulación peatonal, como afirma Robert:

> La urbanización de las ciudades se diseña y construye para privilegiar a quienes tienen acceso a transportes de motor individualizados que pueden movilizarse a velocidades muy superiores que la que pueden alcanzar las personas que se transportan en vehículos colectivos, de uso público, frecuentemente en estado decrépito y que se mueven por vías congestionadas y en mal estado.

Este enfoque del pensamiento de Robert tiene una gran coincidencia con el pensamiento y la filosofía lasallistas, enfocadas principalmente a la atención de niños y jóvenes, preferentemente los más necesitados y que, aunque los profesores y estudiantes que nos consideramos lasallistas intentamos vivir desde estas premisas, difícilmente reflexionamos y profundizamos en lo que Jean Robert nos transmite en sus escritos.

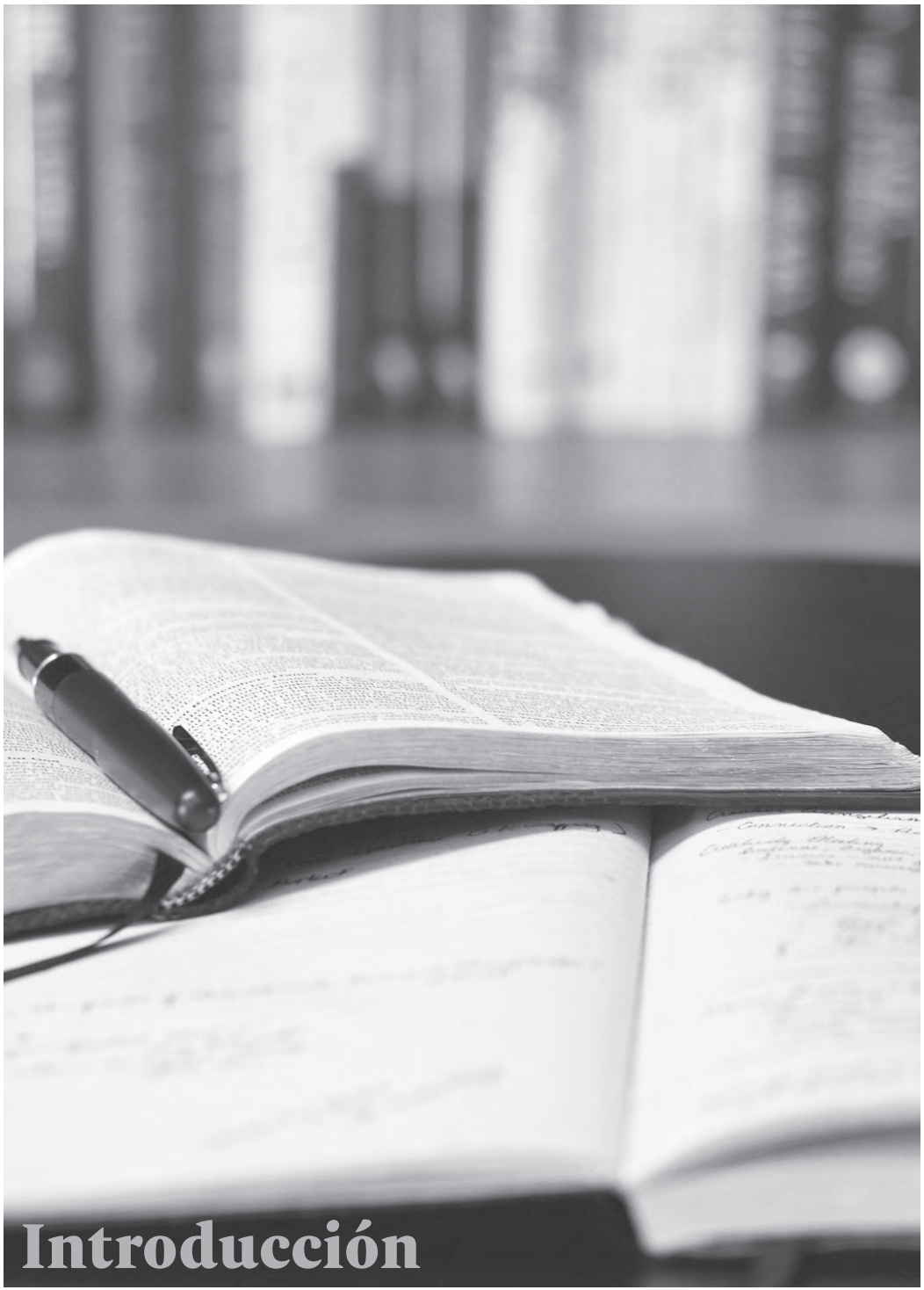
Invitamos a toda nuestra comunidad académica lasallista de México y del mundo, así como a todos nuestros lectores a disfrutar con la lectura de estos textos de Jean Robert y a tomarlos como pauta para una reflexión que nos permita un compromiso más profundo y consciente con los ideales y valores de La Salle[1].

Mtra. Ofelia Rivera Jiménez

Responsable del Área de Investigación ULSAC

Editora de la Revista Impulsa de Universidad la Salle Cuernavaca

1 A NUESTROS LECTORES: Se agradece dirigir sus comentarios, sugerencias y/o quejas a la dirección electrónica investigacion@lasallecuernavaca.edu.mx



Introducción

Síntesis Curricular del Mtro. Jean Robert

Académico y arquitecto mexicano de origen suizo, Jean Robert ha sido profesor distinguido de la facultad de arquitectura de la Universidad Autónoma del Estado de Morelos desde 1974 y de la Escuela de Arquitectura de la Universidad La Salle de Cuernavaca desde 1994.

Robert obtuvo el título de arquitecto de la Eidgenössische Technische Hochschule (Instituto Politécnico Federal) de Zürich. En los años 1960, trabajó y estudió urbanismo en Holanda, país en el que estuvo muy influido por la acción de "Provo", un grupo de activistas que lucharon en contra de que Ámsterdam fuera invadido por el uso de los autos, buscando propiciar el uso de las bicicletas. Ésta experiencia fue la que dio dirección a sus pensamientos: Robert se dedicó a abordar problemas urbanos desde la óptica del peatón más que del automovilista, del ciudadano a pie

más que del burócrata que ve la ciudad a través de un parabrisas virtual. En años ulteriores, trabajó en Holanda en la construcción de edificios administrativos y en Suiza, donde fue asociado varios años con los arquitectos Hnos. de Bosset en Neuchâtel. Como proyectista de ésta empresa, diseñó entre otros, el edificio de la sede local de la Unión de Bancos Suizos ubicado en la Plaza Pury de dicha ciudad. En 1972, se estableció en México, país en que sus encuentros con pensadores críticos y activistas como Iván Illich, John Turner, John McKnight y Gustavo Esteva fueron decisivos.

Entre 1973 y 1975, Robert impartió diversos seminarios en el Centro Intercultural de Documentación (CIDOC) de Cuernavaca, donde encontró a John Turner, quién influyó profundamente acerca de la visión de la autonomía en relación con los asentamientos humanos. Igual de decisivo fue su encuentro con el economista matemático y luego filósofo francés Jean-Pierre Dupuy, con el cual entabló una colaboración de varios años que se concretizó en varias publicaciones.

En México, Robert trabajó como experto de las Naciones Unidas con el arquitecto peruano Eduardo Neira y, de 1980 a 1984, como autor de "proyectos especiales" para el Gobierno del Estado de Morelos. De 1984 a 1990, trabajó en estrecha colaboración con Gustavo Esteva, fundador de ANADEGES, una Organización No Gubernamental de apoyo a los campesinos. Como miembro de la misma organización, Robert estuvo asociado a un semanario publicado en la Ciudad de México, "El Gallo Ilustrado", del cual fue articulista, co-editor y en ocasiones corrector de estilo. Siempre en el seno de la misma organización, Robert fundó el Centro de Indagaciones en Tecnologías Alternativas, el CITA cuyo acervo se encuentra actualmente disponible en casa del Maestro Roberto Ochoa. Desde 1984, empezó a publicar en el Gallo Ilustrado fichas técnicas relacionadas con diversas alternativas al W.C. y a su parafernalia asesina de las aguas naturales.

En 1985, la Cruz Roja suiza financió proyectos de ANADEGES tendientes a reparar casas dañadas en la Mixteca Baja y a construir una ayudantía municipal en uno de sus pueblos, San José de Sabinillo. Encargado de comprar los materiales en Huajuapan de León y de llevarlos a la Mixteca, Robert pudo disponer de algunos de éstos materiales para construir diversos tipos de baños secos. En una ocasión, lo acompañó su ex-alumno de la UAEM, el Arquitecto Cesar Añorve y fue en ésta ocasión cuando se optó definitivamente por la letrina vietnamita, construida en todo Vietnam del Norte bajo las bombas americanas por el Dr. Nguyen Dang Duc. De regreso a Cuernavaca, el Arq. Añorve decidió dedicarse de tiempo completo a la construcción de "letrinas vietnamitas", de ahora en adelante llamadas "sanitarios ecológicos secos". El proyecto tuvo éxito y, en la actualidad, existen en México, Ecuador y China, decenas de miles de baños ecológicos secos. En todos estos países,

Añorve impartió una gran cantidad de conferencias y con el tiempo se formó un consenso internacional sobre la superioridad de la "solución vietnamita" con su cuidadosa separación de los dos tipos de excretas.

En 1988 y 1989, Robert organizó sucesivamente tres encuentros internacionales sobre "saneamiento alternativo": una reunión preparatoria en San Salvador, la Primera Reunión de Alternativas Sanitarias en Medellín, Colombia en 1988 y la Segunda en México en 1989. Conceptualmente, se trata de llevar la crítica de la cultura material iniciada con el análisis de los transportes y de su contra-productividad al campo de la higiene corporal: el binomio W.C. – drenaje general ha de ser reconocido como una causa primordial de devastación ecológica.

De 1986 a 1990, Robert pasó los veranos en México y los inviernos en la Universidad de Pennsylvania, en University Park, donde, en compañía de Iván Illich, co-organizó seminarios y ofreció clases sobre temas relacionados con una comprensión filosófica e histórica de la modernidad. Illich tenía un proyecto de inversión de la institución universitaria consistiendo en hacer bascular su centro de gravedad de las aulas a habitaciones ubicadas al pie de la biblioteca y generosamente provistas en espaguetis y vino. En 1989, en un viaje de amigos de Iván Illich a Puerto Rico, el Profesor Douglas Lummis, un americano profesor en una universidad japonesa, propuso que los ahí presentes redactasen una crítica radical del proyecto de colonización cultural llamado "el Desarrollo". Ésta muy radical obra colectiva fue publicada por Zed Books en Londres en 1992. Constituyó un hito en el análisis crítico de ésta manifestación de la hubris occidental y fue traducido a más de quince idiomas. A partir de 1992, Robert redactó un curso en alemán para los estudiantes de la FernUniversität de Hagen, en Alemania. Este trabajo se publicó en 1998 bajo el título de Raum und Geschichte, "Espacio e Historia".

A partir del 2000, Robert colaboró regularmente con la revista Ixtus como articulista, editor y traductor. Tradujo al francés la novela de Javier Sicilia, "El reflejo de lo oscuro". Escribió artículos para diversas revistas e impartió seminarios en diferentes lugares, no todos universitarios. A principios de los años 2000, Robert participó en dos ocasiones en seminarios organizados en la casa del Alcalde de Oakland Jerry Brown, actualmente Gobernador de California, a quien encontró de nuevo en agosto 2013.

Del 2001 al 2004, Robert fue miembro activo (y fundador) del Frente Cívico en defensa del Casino de la Selva, un sitio querido de la ciudadanía cuernavacense y amenazado de destrucción por una empresa transnacional y, finalmente, destruido a pesar de todos los esfuerzos de ciudadanos calificados, en esta ocasión, de

"delincuentes". Ésta experiencia radicalizó a Robert que sabe ahora que vive en un tiempo peligroso en que la acción cívica pacífica corre peligro de ser criminalizada. Mientras vivá, denunciará tal aberración. Ha publicado un sinnúmero de panfletos en defensa del Casino de la Selva y, más allá de este patrimonio material, del patrimonio intangible que es una estructura comercial de negocios pequeños o medianos, en manos de comerciantes locales dispuestos a reinvertir sus ganancias en la economía y la vida cívica local.

En 2005, Robert tradujó al francés el "Testamento de Iván Illich", una serie de entrevistas de Illich con el periodista canadiense David Cayley. Publicada en Canadá por House of Anansi Press en 2005 bajo el título de *The Rivers North of the Future*, éstas entrevistas fueron editadas por Actes Sud en Francia en 2006 bajo el título de *La Corruption du meilleur engendre le pire.*

En 2006 y 2007, Robert se involucró activamente con la organización de un "Colloquio Iván Illich" que tuvo lugar en Cuernavaca en diciembre de 2008. En 2006, Robert empezó a colaborar para un libro en francés con su viejo amigo Majid Rahnema, ex-ministro de Ciencia y de Educación Superior de Irán. Éste libro contiene un análisis crítico de la empresa de destrucción cultural conocida como "Desarrollo". Fue publicado en 2008 en Francia.

En forma intermitente, dependiendo de las circunstancias políticas, Robert intenta convencer a sus conciudadanos mexicanos de la inhumanidad inherente de un bando del Cabildo Municipal de Cuernavaca que, no contento con criminalizar la prestación de servicios y la venta de objetos en las calles y plazas de Cuernavaca, conmina a los ciudadanos a denunciar tales actos cuando los presencian. Paralelamente a esta acción, trata de promover la urbicultura o cultivo de hortalizas urbanas.

Desde 2007, Robert trabajó en la organización de un Seminario de Iván Illich en Francia, que se celebró en Créteil (ex Paris X) en mayo de 2010.

En 2012, Robert organizó en la Universidad del Estado de Morelos, un coloquio conmemorativo sobre Iván Illich.

Desde 2013 a colaborado con sus escritos en la revista Impulsa de Universidad La Salle Cuernavaca.

En 2019, la editorial italiana Hermatena publicará el libro de Robert *"L'etá dei sistemi nel pensiero dell ' utimo Ilich"*

La Velocidad como forma concreta de la energía y la Introducción de los Ferrocarriles como una Fuerza Transformadora de las Percepciones

Jean Robert

Los textos que hablan de la percepción de la velocidad mecánica, primero en voz de Víctor Hugo, en tiempo de los primeros trenes, alrededor de 1840, y luego, en voz de Marcel Proust, en el tiempo de los primeros automóviles, mencionan también el cambio en la percepción de las personas acerca de cómo ver el mundo.

Los aspectos socio-técnicos parecen también fomentar cambios en las percepciones del espacio y del tiempo. La aparición de los primeros ferrocarriles en los años 1830 engendró una experiencia, la experiencia cinética, que, en sus primeras manifestaciones fue una gran novedad hasta que la repetición la trivializó en una rutina tediosa. Entre el entusiasmo

inicial y el tedio terminal tuvo lugar, en la segunda mitad del siglo XIX, una de las mayores transformaciones de la percepción del espacio. Antes de esta modificación, la respuesta a cada pregunta sobre el "dónde" se conservaban elementos de las antiguas historias de los lugares que, contrariamente al espacio abstracto universal, eran concretas, sensuales y hápticas, es decir ricas en evocaciones de contactos físicos. La serie de textos que ahora se presentan, continúan desarrollando el tema ya escrito en el ensayo, "Place in the Space Age" publicado en el número 19 de esta revista, para documentar la extinción de los conceptos de lugar en el espacio abstracto engendrado por los postulados de los transportes motorizados, empezando por los primeros trenes. Los años recordados como los del *railroad craze* (1830-1850) son años de transformación de la percepción del paisaje por los pasajeros de los primeros ferrocarriles. Sentados en un cuarto con sillones afelpados, ventanas con cortinas y otros símbolos de estabilidad, tenían la impresión de ver como las montañas, los campos, los bosques y hasta los campaniles de las iglesias, giraban a su alrededor. Tal fue la experiencia que reportaron, por ejemplo, Théophile Gautier o Víctor Hugo después de su primer viaje en tren. Cada paso de esta experiencia, entre el entusiasmo inicial y el tedio final asentó más el predominio del espacio abstracto sobre la percepción de los lugares. Al mismo tiempo ocurrían cambios en las matemáticas – como la aparición de las geometrías no-euclidianas – que permiten hablar, aunque sea metafóricamente, de cambios en los axiomas que soportan nuestros teoremas sociales.

La serie de trabajos aquí publicados, se concluye con ensayos sobre las primeras percepciones de la velocidad mecánica y la forma en que se genera el tipo de espacio desprovisto de concretud.

Como *Nota bene*, hago notar que el artículo, arriba mencionado, "Place in the Space Age" fue escrito para la mesa de nuestro amigo Jerry Brown mientras era alcalde de Oakland:

> Así que dediquemos esta serie de ensayos a la mesa de Jerry Brown. Desde este lugar, tres o cuatro amigos pueden poner en cuestión el monopolio radical del espacio que transforma a la gente en paquetes por transportar, a los ciudadanos en clientes por atender y a los vecinos en números.

La velocidad, forma velada de explotación de los pobres

Jean Robert 2004

En el momento en que la Gualupita, el último barrio histórico de la ciudad de Cuernavaca está a punto de ser sacrificada sobre el altar de la Velocidad Vehicular, es justo y necesario analizar las caras de este dios cruel, los espejismos que genera y la hebetud de sus idólatras.

Sueño, realidad, ritual y mito

El sueño: la velocidad, la liquefacción de las distancias, una *quasi* ubiquidad para todos.

La realidad: el tiempo creciente dedicado a los desplazamientos vehiculares.
El ritual: la pendularidad obligatoria**.**
El mito: El tiempo es dinero. El tiempo puede ser ganado. Ganar tiempo es tragar kilómetros. Tragar kilómetros es ganar dinero: quien gasta en tragar kilómetros gana dinero.

Analizaré un sueño: la velocidad; una realidad que lo contradice: la lentitud de los transportes urbanos. Examinaré un ritual destinado a velar la realidad: la pendularidad; deconstruiré un mito generado por este ritual: la velocidad hace ganar tiempo, es un dato esencial de la economía.

La velocidad: una forma de explotación del trabajo de los demás

Desplazarse más rápidamente que la marcha a pie es siempre recurrir a los servicios de otros, consumir el tiempo de trabajadores móviles, como las azafatas, o inmóviles, como los cobradores de las autopistas.

Planteo una pregunta: supongan que se efectúe la operación aritmética que consiste en dividir todos los kilómetros recorridos por los mexicanos entre todas las horas de trabajo necesarias. ¿Cuál sería la velocidad social generalizada obtenida así? ¿Sería más parecida a la velocidad de la marcha a pie o a la de la bicicleta? Sobre sus piernas, el hombre puede recorrer cuatro, cinco o seis kilómetros en una hora. En avión, sobre la autopista o en tren, quien se da el lujo de la velocidad siempre consume trabajo ajeno. Más rápidamente se desplaza, más trabajo de los demás consume. Por ejemplo, el automovilista cuernavacense capitaliza bajo su asiento horas de trabajo en Civac o en Naucalpan, en los pozos de petróleo del Golfo, en la gasolinera, sin contar el trabajo impuesto a los empleados de Hacienda, a los jueces, los policías y los cirujanos. El poder de los motores oculta que, para transportar un hombre sobre seis kilómetros, se necesita siempre entre media hora y una hora de trabajo social sea cual sea la velocidad. Estudios de presupuestos de tiempo podrían precisar esta cifra, pero no modificar su orden de magnitud.

El tiempo consumido por los transportes no es únicamente el tiempo que los usuarios pasan en los vehículos, ni el tiempo de los trabajadores de los transportes. Es también el tiempo que los usuarios pasan caminando hacia el vehículo y el tiempo de los que, sin ser usuarios, pasan sin embargo minutos en recovecos impuestos por las infraestructuras o tienen que esperar a que pasen los vehículos.

Los usuarios de los transportes más rápidos nunca pagan la totalidad de los costos que generan. Exportan parte de ellos hacia terceros inocentes. Los aeropuertos y las autopistas exportan hacia el conjunto de la sociedad costos no cubiertos por los causantes que los economistas llaman costos externos o externalidades negativas.

Para acelerar a unos, hay que frenar a otros

El transporte urbano es un juego en el que los usuarios de poco peso social se paran para mirar pasar a los usuarios con mayor peso social. Las autopistas son suturas-cortaduras: relacionan en el sentido longitudinal y separan en el sentido transversal, acelerando a unos y frenando a otros. El automovilista que se apura en la autopista hacia el aeropuerto para no perder su cita en Nueva York en la tarde, corta el camino al ama de casa que vive cerca del aeropuerto y que espera llegar a casa a tiempo para preparar la comida familiar. Los transportes motorizados de personas realizan transferencias netas de privilegios de los más pobres hacia los más ricos.

Los expertos en transporte saben muy bien que lo que los transportes hacen "ganar" no es tiempo en absoluto, sino tiempo de valor elevado. En términos absolutos, los transportes expropian cada vez más tiempo de vida a la mayoría. El instrumento de la discriminación que atribuye valores diferentes al tiempo de los ciudadanos es un concepto económico llamado el valor del tiempo. El valor del tiempo de usted es su sueldo horario ponderado por criterios de confort o de su falta. A cada categoría socio-profesional, su valor de tiempo. El valor del tiempo de un jardinero no es el mismo que él de un profesor de urbanismo sobre-pagado de una universidad. Es el valor del tiempo general de la sociedad que los transportes pretenden maximizar y es en función de él que los planificadores deciden quien debe ser acelerado y quien decelerado. Se pide a los decelerados considerar lo siguiente: ya que los acelerados son los miembros más activos de la sociedad - la prueba es que ganan más - participan más que los lentos a la producción del pastel global. Por lo tanto, al mirarlos pasar en la autopista que le corta el camino, usted contribuye también, aunque pasivamente, a aumentar su parte del pastel.

El dilema del prisionero

Los transportes llamados rápidos son un juego de suma negativa. Para permitir la velocidad a unos pocos, imponen pérdidas de tiempo a la mayoría. La velocidad es contraproducente.

El nivel técnico o "clínico" de la contra-productividad de los transportes es el congestionamiento. Es una relación entre outputs y outputs del sistema de producción industrial de movilidad, por ejemplo, entre el último y el penúltimo kilómetro-pasajero producido, o entre el tiempo perdido por los usuarios de una carretera congestionada y el tiempo que pasa en ella un vehículo adicional.

Cuando la velocidad de circulación es de 8 km/h, cada carro adicional impone al conjunto de los otros una pérdida de tiempo total equivalente a diez veces el tiempo que el vehículo adicional pasa en la circulación (Smeed, R. 1968). Cuando - como se está haciendo frente al Casino de la Selva - se aumenta puntualmente la velocidad de un tramo dado mediante obras infraestructurales, se causa una disminución de la velocidad de circulación sobre el conjunto de la ciudad, una "ley" que se parece estructuralmente a la ley de entropía de los físicos (Smeed R. 1968). El congestionamiento es la pérdida de calidad de un producto cuando su cantidad aumenta. El congestionamiento del transporte es una pérdida del valor de desplazamiento de cada hora pasada en un vehículo. La huida individual fuera del congestionamiento, hacia vías temporalmente más rápidas, contribuye por su parte a disminuir el valor de desplazamiento de todo kilómetro recorrido (léase: a aumentar los recovecos obligatorios).

> El resultado de todas las decisiones en este sentido de los usuarios (...) es una serie de oscilaciones alrededor de una velocidad de equilibrio que, en el centro de Londres, tiende hacia 16 km/h en las horas de punta y 18 km/h en las otras horas laborales (Smeed R. 1968).

La teoría del congestionamiento es un caso particular de una teoría económica francesa llamada teoría de los bienes de calidad variable con su cantidad o más sencillamente *théorie de l'encombrement*. El *encombrement* de un sistema por su propio producto es la pérdida de calidad de este producto cuando aumenta su cantidad. Por ejemplo, el valor de un doctorado en el mercado laboral disminuye a medida que aumenta el número de los doctores; o el servicio de desplazamiento de una autopista disminuye cuando aumenta el número de los vehículos en ella.

La paradoja del congestionamiento

El experto en congestionamiento Reuben Smeed (1968) ha puesto en evidencia la paradoja siguiente:

Es casi en el momento de alcanzar su nivel de congestionamiento máximo, que es la parálisis completa, que la productividad de una red de transporte es máxima.

Demostración: La productividad de una red de vías de circulación se mide en kilómetros-pasajeros por hora (o por día). La ley de composición que relaciona la velocidad individual de cada vehículo con la productividad del conjunto se puede resumir mediante los datos siguientes, donde se compara la capacidad de circulación en porcentaje de la capacidad total y la velocidad posible correspondiente:

caudal (%)	velocidad (km/h)
25	32
50	26
75	18
9.3	9.6
9.8	5,1

(Smeed 1968)

La palabra "caudal" indica que, para los ingenieros en transporte, la circulación vehicular es un flujo que, en vez de medirse en litros/hora se evalúa en kilómetros-pasajeros/hora. En otras palabras "es cuando menos sirve lo que es lo más eficiente". A la velocidad de 5 km/h, el sistema vial se encuentra en estado de inestabilidad estructural: su productividad pude pasar de un golpe de su máximo a cero.

Indicadores de velocidad

Veamos ahora cuales son los indicadores de velocidad que manejan los expertos.

La velocidad técnica es la velocidad que permite determinado vehículo en condiciones técnicas óptimas. Cómo estas condiciones son teóricas, no nos interesa este indicador.

La velocidad de circulación medida sobre una vía obedece a la ley de composición estudiada por Smeed. Se acerca a la celeridad peatonal cuando alcanza su capacidad o productividad

máxima. En las grandes metrópolis, incluyendo a las que tienen metro, se acerca a 15 km/h, para todos vehículos incluidos y es considerablemente inferior en las ciudades pequeñas.

La velocidad puerta a puerta es la distancia medida sobre la carretera entre el origen y el destino dividida por el tiempo entre el inicio y el fin de un desplazamiento (SETRA *Service d'Études Techniques des Routes et Autoroutes*). Toma en cuenta los trayectos a pie impuestos por las infraestructuras (piensen en los corredores de la estación de metro de La Raza). En Paris, la velocidad puerta a puerta promedio es de 10 km/h por los transportes colectivos y de 14,5 km/h por los automóviles. Es bastante inferior en las ciudades más pequeñas.

La velocidad puerta a puerta a vuelo de pájaro es el cociente por el tiempo de la distancia medida sobre el mapa, entre origen y destino. Permite evaluar el valor de desplazamiento real de los transportes motorizados y confrontarlo con el valor de uso de la marcha o de la bicicleta. En París es, para los desplazamientos París-París, 6,9 km/h para los transportes colectivos y 9 km/h para los automóviles (Orselli, 1975).

La velocidad generalizada es el cociente del kilometraje anual de un usuario por la suma de todas las horas que pasa 1) en su vehículo, 2) en su puesto de trabajo, para ganar el dinero necesario, 3) en el taller de reparación, 4) en los tribunales, 5) en la cárcel, 6) en los hospitales, 7) en imprevistos diversos. Para las categorías socio-profesionales medias, en Francia, es de alrededor de 10 km/h (Dupuy y Robert, 1976).

Pregunta final: ¿Quién aun piensa que se debe sacrifica nuestro último barrio histórico en nombre de la absurda ilusión de la velocidad urbana?

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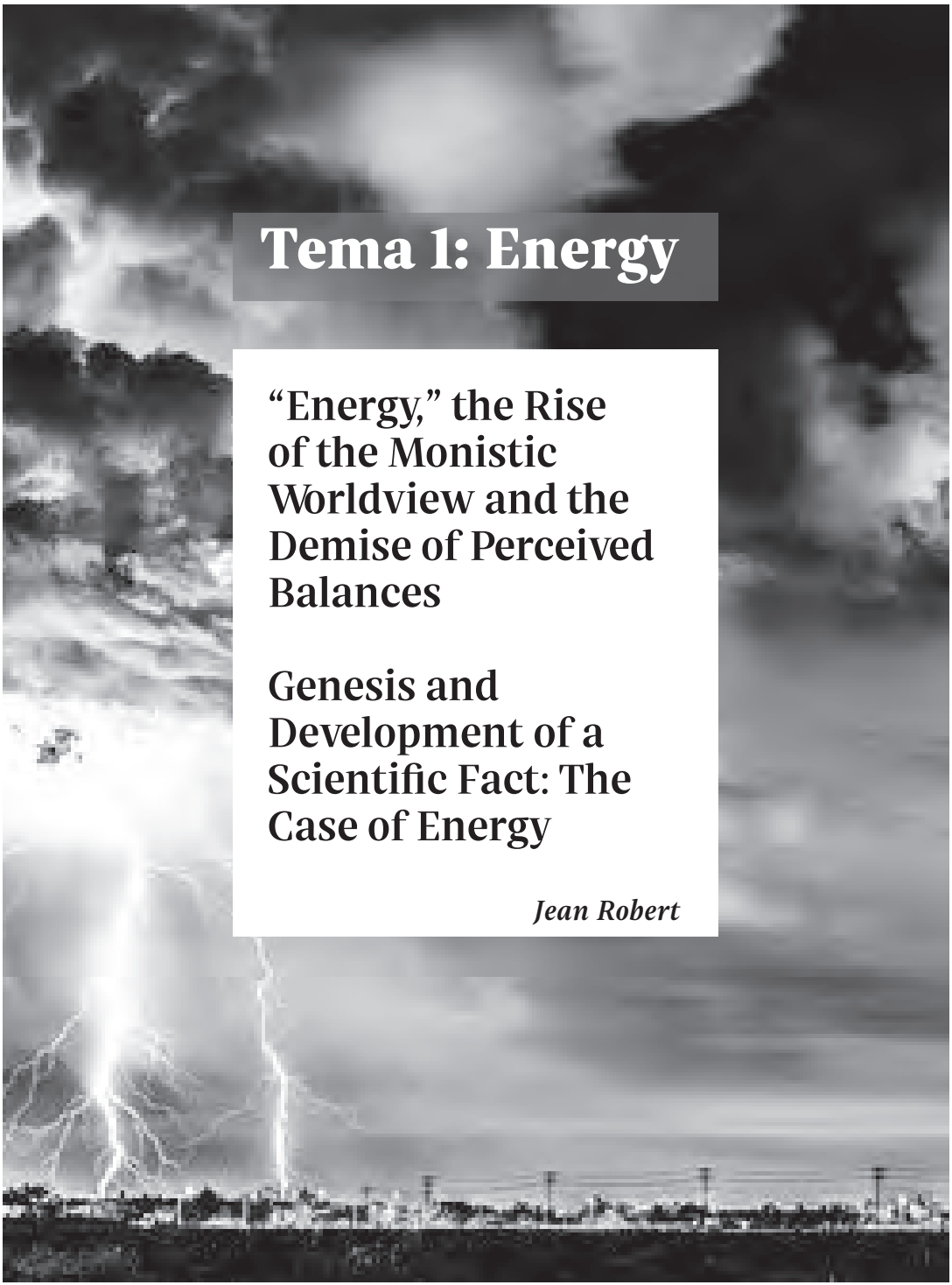

Tema 1: Energy

"Energy," the Rise of the Monistic Worldview and the Demise of Perceived Balances

Genesis and Development of a Scientific Fact: The Case of Energy

Jean Robert

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"Energy," the Rise of the Monistic Worldview and the Demise of Perceived Balances

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A Season Among XIXth Century Physicists

I spent part of the winter of 1981-82 on a cold veranda of the library of the Marburg Physics Institute reading books that were no longer part of the curriculum of modern Physics. There, I delved into the intricacies of the surge of the energy concept, or better

of its direct ancestor, Kraft, force, and the principle of its conservation. The turning point was a paper of 1842 on the base of which Julius Robert Mayer, a young medical doctor, claimed his priority right on the "discovery" of the principle of the conservation of "force." I write this essay as an exercise in a style of history consisting in interpreting an epoch according to its own concepts. It means that I'll methodologically refrain from reading the modern energy concept in Mayer's formulation:

> Two departments of causes can be found in Nature, and it is a fact of experience, that there are no bridges (Übergänge) between them. The first department is constituted by the causes that share the characteristics of "Ponderabilität" (the fact of having a "weight," or as a professional physicist would say, a mass) and impenetrability; to the other belong the causes who lack these characteristics [...] and that are thus named "Imponderabilien" (mass-less entities, that is forces). Forces are thus indestructible and imponderable objects subjects to variations[2] (Trad. J.R.).

Such dual thinking can be traced back from Antiquity to the eve of modern times. It was part of the "background philosophy" of classical physics until its ideological demise around 1890. My contention is that this background philosophy trained scientists to constant intellectual and moral negotiations between poles of reality that have become incompatible: philosophy and science, human decency and scientific reputation, solidarity and power, tradition and modernity. With the present-day imperative to pu(bli)sh or perish, such balances have been broken by the predominance of one pole over the other: philosophy is tolerated as a servant of science, and moral inhibitions are disregarded for the sake of a career in the sciences. Mayer's claim to the "priority" of the discovery of the principle of conservation of "force"—in reality a simultaneous discovery[3]–is a calculation, and not an experiment performed in 1842. It was more exactly an experiment in thought that, according to the constants relating a volume of gas to its temperature and pressure allowed Mayer to calculate the mechanical equivalent of heat.

Mayer wanted to align physics with chemistry, paying special attention to the cycles, metamorphoses and mutual conversions of immaterial entities that he called Kräfte, "forces," and which later physicists all too easily read as energy. For him, a single fundamental

2. Bemerkungen über die Kräfte der unbelebten Natur," (On the forces of inanimate nature), Liebig's Annalen der Chemie und Pharmacie, vol.4, 1842, p.24.

3. "Thomas Kuhn, "Energy Conservation as an Example of Simultaneous Discovery," M. Clagett, ed., Critical Problems in the History of Science, Madison: University of Wisconsin Press, 1955, pp. 321-356. Stresses the importance of three general ideas that were so to speak "in the air": 1. the recognition of circulation and conversion processes; 2. a new interest for machines illustrated by the railroad mania of the 1840's; 3. natural philosophy in the sense of the German idealism. See also: Jacques Merleau-Ponty, "La découverte des principes de l'énergie: L'itinéraire de Joule, » Revue d'Histoire des sciences 32, 1979. Yehuda Elkana, The Discovery of the Conservation of Energy, Cambridge: Harvard University Press, 1974. Erwin N. Hiebert, Historical Roots of the Principle of Conservation of Energy, Madison: University of Wisconsin, 1962.

principle ruled chemistry and physics: "The quantity of their entities is invariable, only their quality is variable."[4] Unfortunately for Mayer, his discovery was first attributed to an alleged competitor, in fact a simultaneous discoverer, James Prescott Joule, who in an experiment realized one year after Mayer's calculation, obtained a much more accurate value.

4. P.M. Heimann, "Mayer's 'Concept of Forces': The Axis of a New Science of Physics," Historical Studies in the Physical Sciences, 7th annual vol., 1976, p. 284.

Force: Free Gift of Nature or "Nature's Currency"?

After Max Planck's definitive mathematical clarification in 1884, a force was to refer to what causes a mass to move or modify its motion, while energy was expressed mathematically as the path-integral of a force or, in technically controlled motions with constant speed and straight trajectory, the product of a force moving a mass against gravity and/or friction by the distance covered by it, whose unit for the engineer is the kilogram-meter. Mayer took that unit—probably from French railway engineers—and magnified it into the paradigm of what remains constant and can be *quantified* [5] in the conversion of Nature's forces. He had calculated the conversion rate of heat into mechanical "force," and suspected that similar conversion rates or "relative values" would be discovered to exist between all the forces of Nature.

Under the term "force," were still looming evocations of "the natural forces" such as the rain, the nourishing soil or the wind inflating the ships' expression of nature's free gifts, Mayer submitted them to the law of scarcity, and paved the way to the transmogrification of natural conversions into production processes ruled by money. Unwillingly, he opened the door to "energy accounting," a reinterpretation of economics along thermodynamic lines. Yet, in his natural philosopher's decency, he wrote:

> Let's state it from the start: the rule of the relative values ["conversion rates"] of the different forms of forces is only valid for our earthly economic relations, any application of it to the macrocosm's economy is inadmissible[6] (Trad. J.R.).

5. Mayer "quantifies" with moderation, guided by a kind of classical "everything in its place" perception that modern physicists have lost: "In physics, all is Number, in physiology, little is quantifiable, and in metaphysics nothing [...] Time is only productive within our time-horizon. God spoke: let become and it became! We do not entirely support our life-world: it grows and becomes more beautiful," in "Consequenzen und Inconsequenzen der Wärmemechanik," Naturwissenschaftliche Vorträge von J.R. Mayer, Stuttgart: Cotta, 1871, pp. 3-16. In this conference on the "consequences and unconsequences of the 'mechanics of heat' (thermodynamics)" to the General Assembly of Natural Researchers in Innsbruck, September 18, 1869 [where Mayer spoke just after Helmholtz], he added: "A correct philosophy cannot be anything less than a propaedeutic of the Christian religion" (p. 16). As we will see, Mayer would sometimes transgress his ingrained sense of the right proportion for his scientific reputation's sake.

6. J.R. Mayer, "Consequenzen und Inconsequenzen der Wärmemechanik," op., it., p. 7.

Energy and Force: Free Creations of the Human Imagination or "Ultimate Realities"?

The extraordinary gifted young Heinrich Hertz (1857-1894) first thought that he would dedicate his life to the humanities. He was proficient in Latin and Greek and never traveled without a copy of Homer in his pocket. He exercised himself as a sculptor and, in at least in one occasion, as an architect. It was Hermann von Helmholtz who lured him into physics by proposing a high-level problem to the auditors of a popular lecture on physics that he delivered at the Berlin University. Hertz, then untrained in the matter, solved the problem by sheer logic and intuition, and that sealed his fate: Helmholtz would not let him go before he had signed his inscription at the Physics department and become his student.

Hertz, the humanist and lover of harmony, simplicity and beauty complained about "the unnatural character of the mingling of the concepts of mechanics with extra-sensorial abstractions." The founder of electrodymamics and discoverer of the "Hertzian waves" had the epistemological aim of cleansing mechanics from "extra-sensorial abstractions" such as force and energy. According to him, these concepts ought to be renounced "as independent fundamental concepts"[7] since only with their complete elimination could mechanics be reestablished as the science of experience.

The modern certainty that energy is the ultimate "stuff" of everything does not predispose present-day philosophers to appreciate the depth of Hertz's epistemological reflection. Perhaps their prejudice could be eased if they knew of the lasting influence that Hertz had on one of last century's major philosophers, Ludwig Wittgenstein:

> Both [Wittgenstein's] old and new philosophy shared an inspiration he had come across as a teen-ager in The Principles of Mechanics by Heinrich Hertz, a German physicist. Hertz had suggested a novel way to deal with the puzzling concept of force in Newtonian physics: the best approach was not to define it but to restate Newton's theory in a way that eliminates any reference to force. Once this was done, according to Hertz, 'the question as to the nature of force will not have been answered; but our minds, no longer vexed, will cease to ask illegitimate questions.'

Ludwig's big idea was to apply this method to philosophical problems.[8]

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7. Die Prinzipien der Mechanik...," op. cit., p. 29.
8. Anthony Gottlieb, "A Nervous Splendor: The Wittgenstein Family Had a Genius for Misery," The New Yorker, April 6, 2009, pp. 70-74.

Hertz's attempt "failed" in the sense that it was not the path followed by mainstream physics. Einstein turned the "vexing" character of force around—being "action at a distance" or "not being located at any point in space"—by reducing it to a local geometrical property of a four-dimensional manifold, but that solution would not have satisfied Hertz, who wanted a reassessment of the relation between physics and sensorial experience. In Hertz' sophisticated spirit, the project of reestablishing a common-sense view of physical phenomena free of a priori noumena must have echoed the scholastic aphorism nihil potest esse in intellectu si non fuerit prius in sensu (nothing can be in the intellect if it was not first in the senses), whose various forms were traced back to Aristotle by the Schoolmen and ulterior philosophers.[9] For a thinker of Hertz's intellectual stature, "energy" pretends to be in intellectu without ever being in sensu, since there is no direct perception of it, but only of hot or luminous objects, of the speed of the railroad or of electric shocks and sparks in the lab. At the end of the XIXth century, energy was still mainly a principle of equivalence that should not lure a skeptical mind to construe all phenomena as manifestations of an underlying, mysterious, unique reality that nobody, nobody will ever perceive with her, his or its senses.

Half a generation younger than Hertz, Einstein endorsed the energy concept, but without the naiveté of most of his colleagues. By "geometrizing" it, he recognized that it is an entity that is in the intellect before [and without] being in the senses and insisted that it is part of these "free products of human imagination" that determine, not what we see, but the way we [physicists] see.[10]

9. One of its last expressions is to be found in F. Jacquier's Instititiones Philosophicae, Rome 1833: "Nihil esse in intellectu quod non prius fuerit in sensu."

10. Albert Einstein, "Foreword," Max Jammer, Concepts of Space. The History of the Theories of Space in Physics, New York: Dover Publications, 1993 [1954]. For Einstein, the mathematical concept of space was one of these "free products of the imagination" that determine how we see (p. xv). Energy was another.

The "Science of Experience" Loses Both Its Propaedeutic Language and Its Relation to Perception

In the last decades of the XIXth century, physics was disembodying itself from common language into one of its own. After the demise of the old linguistic continuity between science and everyday life, the path was open to monism. Scientific monism is the belief that a single principle ought to rule everything without opposition through the utter formalization and mathematization of all forms of once empirical knowledge[11] It is the dictatorship of one unique form of thought, one unique perception of reality, one unique language, one unique space. It expresses the utopia of a world without conflicts, resistances, distances and dissidences; a world where negotiations, checks and balances, arbitrations between contradictory imperatives, old forms of "coming to terms," and even politics would have become obsolete.[12]

11. Michel Foucault, Les mots et les choses. Une archéologie des sciences humaines, Paris: Gallimard, 1966, particularly chapter 7. English version, The Order of Things. An Archaeology of Human Sciences, New York,Vintage Books/Pantheon, 1970. The formalization and mathematization of knowledge weakened traditional forms of empirical, not formally scientific knowledge.

12. See Jean Robert, "Der Verlust der Erläuterungssprache in der Physic von 1840 bis 1900," Stephan H. Pfürtner, ed., Wider den Turmbau zu Babel. Disput mit Ivan Illich (Against the (re)-construction of the Babel Tower. Debate with Ivan.Illich), Reinbek bei Hamburg: Rowohlt, 1985, pp. 116-130, 152, 153.

Energetism and the Panderage of Tax-payers By a New Synthetic Language

For Wilhelm Ostwald, a longtime redactor of Der Monist, a journal he helped found in 1906, energy was not an "invention," an "extra-sensorial hypotheses" imposed on experience (Hertz) nor "a free product of human imagination" (Einstein). Energy was now the ultimate and unique "stuff" of which everything was made. In Der Monist, he fought the "fallacious" diversity of the phenomena and called for a recognition of a sole imperative, the "energy imperative" to supersede the diversity of moral imperatives. Hence monism was also called energetism.

According to Ostwald, "[e]nergy comprises the complete reality";[13] it rejects all forms of dualism and no other fundamental concept is needed to describe it. Monism had also linguistic effects. The demise of the physicists' ability and willingness to explain their ideas, discoveries and theories in a language accessible to a general public had made of physics an esoteric parlance only understandable to close colleagues. Ludwik Fleck has studied how esoteric languages also produce esoteric facts that utterly alter the life-world of modern man.[14] Lest physicists become philosophical anchorites, only equipped, like young Einstein, with a pencil and a pad, they must beg tax-payers for funding, and for this, a new synthetic language had to be invented. Modern science is a conglomerate of separated and often conflicting thought collectives, each attempting to make its thought style prevail. A scientist has hardly any degree of freedom relatively to his collective: belong or perish.

According to Fleck, the first signal of a new scientific fact is a line of resistance within a given thought style. As long as it has not reached the "public" along a chain of ever less specialized transmitters, the signal is not a "fact." A scientific fact has always a sociological weight acquired through what Fleck calls the migration of ideas. This migration from specialized to less specialized circles can be called popular science or pop science. Unlike the old propaedeutic language of science, pop science—which for Fleck is sociologically as much a part of modern science as the productions of its most inner circles—does not proceed by careful expositions and

13. Wilhelm Ostwald, Vorlesungen über Naturphilosophie, (Lessons on Natural Philosophy), Leipzig, 1901, see particularly pp. 146, 146, 377.
14. Ludwik Fleck, The Genesis and Development of a Scientific Fact, Chicago: Chicago University Press, 1979 [1935].

explanations. Rather, through apodictic statements, bright colored descriptions, and premature affirmations, pop science makes unquestionable facts out of ideas. The broad public, most exoteric of the circles, then functions as a mirror that sends a received "fact" back to its circle of origin, where the surprised and flattered scientists tend to accept this sociological transmogrification of their original idea. It is how energy, originally a principle of equivalence between Nature's forces, an extra-sensorial hypothesis, and a free construction of the imagination became, for the broad public and the scientists alike, an unquestionable fact. The difference here between, on the one hand, Hertz and Einstein and on the other, Ostwald, is that while the formers insisted on how they saw, the latter dumped one brutal fact upon the half- consentient public: there is nothing but energy, a universal recipe for intellectual freewheeling.

Monism helped as well channel further funds toward society's continuous need of ever more Research and Development (R&D) on energy "needs," energy-related concepts, processes, resources, systems, economies or wars.

Hugh's Mechanica and The Blind "Fleck" of Hertz' Mechanics

In 1983, in a public talk at the Colegio de México, Ivan Illich analyzed the linguistic differences between a scientific symbol, E, and energy, its pop science twin.[15] E has a pure denotation, generally compacted into a mathematical formula, while energy has only connotations of which physicists tend to prudishly distance themselves in private conversations, while anonymously endorsing them, pertinently knowing that these connotations are part of the propaganda by which their profession panders tax-payers for more R&D funds.

Building on that idea, Professor Uwe Poerksen, a German linguist, compared a denotation with the point of impact of a stone thrown into a pond, and connotations with the resulting concentric waves:

.....Energy... Energy...Energy ... Energy E Energy... Energy... Energy

...Energy.....

Poerksen discovered with astonishment that energy was part of a new class of words, rich in connotations and as deprived of precise denotation. In his path-breaking book, Plastic Words. The Tyranny of a Modular Language, he identifies how modern society builds its certainties and social theorems through semantic "Lego"-blocks such as energy, information, communication, resource, factor, system.[16]

While I was sitting on the cold veranda in the company of the old physicists exiled from their science's new curriculum, Ivan Illich, who had invited me to Marburg to talk about the history of the energy concept at his table of convivial friends, was teaching medieval history at the university. He was attempting to make his students feel how ill-equipped they were, conceptually and bodily, to understand a twelfth-century pilgrim, or even what the philosopher- monk Hugh of Saint-Victor meant, when he said that reading was a peregrinatio in stabilitate,

15. Ivan Illich, "The Social Construction of Energy," opening talk to a seminar on The Basic Option within any Future Low- Energy Society, Colegio de México, México, July 1983.
16. Uwe Poerksen, Plastic Words. The Tyranny of a Modular Language, University Park: Pennsylvania University Press, 1995 [Original: Plastikwörter.Die Sprache einer internationalen Diktatur, 1988].

a pilgrimage in stability.[17] In 1980, the author of Tools for Conviviality[18] and Energy and Equity[19] had written a short essay to honor Hugh as a colleague he had discovered in the XIIth century.[20]

In this text, Illich commented the Didascalicon written by Hugh around 1127-1128, focusing his attention on Hugh's concept of what he called mechanica. In his uniquely radical way, the philosopher of the mechanical arts was interested in the relation between science and society.

Hugh defined mechanical science as the part of philosophy which studies remedies for bodily weakness, when such weakness derives from humanly-caused disruptions of the environment—science, then, is a corrective for an ecological disorder. Asked to clarify the notion of a new conception of science which underlies the various movements of science by people, I know of no better approach than a confrontation with Hugh of St Victor's thought.[21]

Hugh's mechanica was infused with a deep apprehension of sensorial perceptions and their aesthetics and of the fitness of mechanical artifacts to the body. Paraphrasing Joseph Kockelmans,[22] a physicist and a philosopher, I dare say that "modern mechanics is an attempt to say anything meaningful about the physical world without any consideration of the body." What would be a mechanical art that would start with the body and the relations of mechanical artifacts to the hand, and relate their power to their scale and their radius of action to their distality? How much "abstraction" would it need? It is a contest open to talents.

17. Years later, Illich dedicated a book to Hugh's Art of Reading, In the Vineyard of the Text: A Commentary To Hugh's "Didascalicon." Chicago: University of Chicago Press, 1993.
18. Berkeley: Heyday Books, 1973.
19. London: Calder & Boyars, 1973.
20. Hugh? Or Science by People? Cuernavaca: Tecno-política, ed. Valentina Borremans, Apdo 479, 62.001, Cuernavaca, Mexico, later reproduced in Shadow Work, London, Boston: Marion Boyars, 1981.
21. Op. cit., p. 4
22. The sentence, with "philosophy" instead of "mechanics" was pronounced by the dean of the Philosophy Department, Professor Joseph Kockelmans, at the occasion of a meeting with Ivan Illich and Barbara Duden at Penn State University.

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Genesis and Development of a Scientific Fact: The Case of Energy[23]

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23. Originally published in Wise, March 1995.

When he asked me to write an article for the February Special, the editor, Michel Schaeffer commented on some reactions elicited by the editorial of the 1992 issue. To make a point about the ambiguities facing alternative technologists, he had used the example of a little shoemaker. At the beginning of the story, the shoemaker had a bulb hanging from the ceiling of his shop for some light in evening hours and a three-phasic socket to power his sewing and polishing machines. Though the shoemaker did not specially care to investigate where the energy distributed to him by the Electric Power Works came from, he somehow knew like everybody else that it came from the aging nuclear plant whose frightening refrigeration towers were sometimes visible on the far horizon.

Here we have a small, "ecologically innocent" craftsman who is plugged, together with the worst industrial sinners, to one of the most hazardous forms of energy production. Isn't it as bad as an Amish farmer using no telephone, no car, but struggling against economic competition with pesticides and chemical fertilizers? For the shoemaker, "salvation" came from a committee of concerned citizens who obtained the replacement of the obsolete nuclear plant by a large scale wind energy project. The energy that fed the shoemaker's bulb and powered his machines could now come from a cleaner source. Happy end? Listen to what has happened to the little shoemaker:

After the replacement of the nuclear plant, he lost control forever. Subsidies and economic profits went to the 'big shots' of the electricity cooperative. Prices went up to finance the new necessary (alternative!) technology transfers. Local electricians lost their jobs to Hilton-groomed alternative technologists from abroad.

This story made me sad: I too had wished a happy ending for the sound political fight in favor of softer energy sources. I have read Armory Lovins,[24] I know Lester Brown's efforts[25] to clean the energy landscape from useless gigantism, risk, and the relentless erosion of local ecological and cultural matrices.

By the way, the editor wrote me that the story had the following epilogue:

> A month after this publication, we received an angry letter from an American energy expert claiming that WISE was opposed to the use of wind energy. This was the starting point of a discussion on energy and Power.

24. Soft Energy Paths. Cambridge, Ma: Ballinger, 1977
25. For a list of the Worldwatch papers edited by L.Brown, write to Worldwatch Institute, 1776 Massachusetts Ave., NW. Washington, D.C. 20036, USA.

The editor begged me to frame my article in such a way that it would at least tangentially address that discussion. Though I gladly agreed to try, I am reluctant on embarking on a casuistic of alternative energy production, "good" in some cases, "bad" in others. Let's state right away that I find a wind energy plant less bad than a nuclear plant, and wind power worth militating for. I would like to say: always. Shall I go on to analyze the cases in which—given that the intention was good—but the unexpected result being such ..., had I known it beforehand..., but if not, then...? Clearly, such casuistic has no place in a general article. Are there perhaps general criteria of judgment? Of course: ecological impact and risks assessments, evaluations of the support capacity of the local ecological or climatic matrix (a term I prefer to the globalizing neutrum, "environment"). All that remains politically valid. But isn't there more at stake than pollution and risks? The shoemaker's story obliges me to answer "yes!." Armory Lovins suggests a first decision criterium:

> To be valid any alternative energy production project should not be content with proposing how to produce a constant quantity of megawatts. It should also contemplate the production of "negawatts."

WISE subscribers know that Lovins uses that charade to stress the urge for any alternative energy project to present ways of reducing a community's energy needs. Another catchword for the negawatt idea is "conservation" (a word that is indeed associated with "energy" since this concept's birth!). Alternatives to hard energy paths should not consist in aiming at the same thing through other routes, but in changing the goals too. Conservation is one of these "other" goals.

If there can be ecologically dirtier or cleaner forms of energy, there is no form of socially quite innocent energy, as, again, the shoemaker's story shows.[26]

But there is still more to that story. While telling it, I "had" to use the word energy 18 times. In less than 2 pages, this is many times. If that had been an exercise in English composition, my teacher would have strewn the margin with red remarks like "repetition!" "find a synonym," "what do you call so, in this context?" It seems that what can be done with any sound common word cannot be done with "energy." Try, and then ask yourself: "what are this strange word's characteristics that make it so resistant to synonymity?" The German linguist Uwe Pörksen has written a whole treatise to try to explain that phenomenon.[27]

26. Illich, Ivan, Energy and Equity. New York, Harper & Row, 1974 (or: London: Calder & Boyars, 1974).
27. Pörksen, Uwe, Plastikwörter: Die Sprache einer internationalen Diktatur. Stuttgart: Klett-Cotta, 1988 (an English abstract can be obtained by the author).

Re-reading my own prose makes me realize more acutely than ever, that underlying the debate on alternative energy production, beyond or behind the ecological and the social levels, there is the semantic bottom line from which cultural meanings, symbols and social myths all stem. Mainstream ecologists have thus far managed to ignore that ground. It has been a great mistake. It looks as if the first principle of thermodynamics and the word which is its stenographic token ("energy") has been allowed to be the Trojan horse for a contagion not only by ecologically and socially unsound, but also by culturally and symbolically destructive thought habits. Is perhaps the energy concept—the intellectual cathedral of 19th Century physics—a cultural equivalent of AIDS when it escapes from the lab and invades concrete life? Is the synonym-less word "energy" the vector of an acquired cultural immunodeficiency syndrome, as soon as it ceases to be strictly a technical term of a well- defined science, thermodynamics?[28]

I pretend to address the question raised by the American reader by inviting him to a tour into the epoch that created the concept energy.

28. Rahnema, Majid, "De l'homo oeconomicus au développement et à l'aide: l'histoire d'un autre SIDA," in Gilbert Rist, Majid Rahnema et Gustavo Esteva, Le Nord Perdu. Repères Pour L'après-Développement. Lausanne: Editions d'en bas, 1992, p. 115-166.

Can a Scientific Concept be an Object of History?

This question has always intrigued me. A decade ago, thanks to a friend's generosity, I spent two winters at the Physics Institute of the University of Marburg in Germany. More exactly, I sat day after day on the unheated veranda of its library. There had run aground, like on the strands on a lonely island, the wrecks of past generations of explorers. On the Institute's shelves, I found what remains of the "forgotten grandfathers": the works of 19th C physicists who are no longer part of the curriculum of standard physics. Half-jokingly, half in a spirit of vicarious revenge of the forgotten, I made a sign that said "Marburger Institut für Papierkorbphysik" (papierkorb = wastebin). It hung on the veranda's door until I was politely asked to remove it.

One of the two xerox copiers of the institute stood in "my" veranda. Once in a while, I was interrupted by one "Doctorandus" or the other—often a polite German-speaking Japanese—who needed to use "my" machine. I observed that no one ever copied more than five pages, generally concentrating on a single graph or table from a specialized publication. In contrast, I imagined myself snuffling like a scavenger in the landfills of physics. One day, one of the Ph.D. students remained standing near the door and observed me. He exclaimed, "What? You copy whole books!" I confess to that misdemeanor, that disrespect of the modern etiquette! Yet, on behalf of those two winters, I possess the entire conserved corpus of several of the great haemodynamicists of the mid-nineteenth century: Hagen, Poiseuille, Hagenbach, part of O.E Meyer and Plateau, the Podolinskys, father and son and some more.[29] But these were the few ones whose works were "kopiefähig." Most of the items piled up in the veranda's shelves were under a "Kopierverbot." Not that they contained some top- secret information, on the contrary, physicists considered them discarded stuff (never did I see a student pick up one of "my" authors' books). These books and booklets were materially so deteriorated, so gnawed by humidity and generations of bookworms that they would have disintegrated in the Xerox-machine. From those, I carefully made hand-notes and copied illustrations. Some of these sketches illustrate this article. I wonder if the dusty works of my friends materially survived the decade that went by since I frequented them.

It is through these friends ("durch sie hindurch," a Heideggerian philosopher would say) that I will now try to find an answer to the angry question of Michiel Schaeffer's correspondent. Physics is not a ukase of nature, not a monologue. At its best, it is a dialogue between man's imagination and nature's intimations. At its worst, it is an arrogant axiomatic construction warded by bureaucratic Cerberes. Ernst Mach (1838-1916), a forerunner of relativity "malgré

29. See for instance: Hagen, G., "Ueber die Bewegung des Wassers in engen cylindrischen Röhren," in Poggendorff's Annalen der Physik und Chemie, 46, 1839, p.423-442. Poiseuille, Dr, "Experimentelle Untersuchungen über die Bewegung der Flüssigkeiten in Röhren von sehr kleinen Durchmessern," in Poggendorff's Annalen der Physik und Chemie, 58, 1843, p. 424-448. Hagenbach, Ed. "Ueber die Bestimmung der Zähigkeit einer Flüssigkeit durch den Ausfluß aus Röhren," in Poggendorff's Annalen der Physik und Chemie, 109, p. 385-426.

lui" wrote once that scientific concepts are the machinery behind the stage of physics.[30]

As different playwrights require different offstage arrangements, the type of concepts that a physicist needs depends on the kind of empirical facts that he wants to manifest. For Mach, the facts of physics had their origin both "in the world out there" and in man's sensorium. Consequently, all physical analysis had to be impirio-critical, that means that it had to consider the way in which nervous sensations are construed as perceptions of physical facts. As a consequence, not the abstract atom, but elementary sensations were the conceptual building blocks of physics.[31]

The energy concept is part of the conceptual machinery depicted by Mach. It did not become a cornerstone of the building before the 1840's, when the "law of conservation of the 'force' (energy)" was simultaneously discovered,[32] or invented,[33] by at least three scientists (Mayer, Joule and Helmholtz) who spent part of the rest of their life claiming their "priority rights." I will first concentrate on the ten years (1842-1852) during which the concept of "force"[34] crystallized into what we now call energy. This is also the

30. Mach, Ernst, The Analysis of Sensations and the Relation of the Physical to the Psychical. (English by Sydney Waterlaw, with an introduction by Thomas Szasz), New York: Dover, 1959.

31. This position was violently attacked by Lenin, V.I., Materialism and Empiriocriticism. Saint-Petersburg, 1908.

32. Kuhn, Thomas, "Energy Conservation as an Example of Simultaneous Discovery," in M. Clagett, ed., Critical Problems in the History of Science. Madison: University of Wisconsin Press, 1955, p. 321-356. Simultaneous discovery is the rule, single discovery the exception (or, in Merton's phrasing: multiples, not singletons are the rule). The search for the pioneer and the resulting "priority struggles" are part of 19th Century's naive theory of science.

33. Merleau Ponty, Jacques, "La découverte des principes de l'énergie: l'itinéraire de Joule," in Revue d'Histoire des Sciences 32. 1979, p. 315-333. Insists on the invention character of Joule's itinerary. Truesdell, C., The Tragicomical History of Thermodynamics 1822-1854. Heidelberg: Springer, 1980. Einstein, in a letter of January 6 1948 to Besso: "I see [Mach's] weakness in this, that he more or less believed science to consist in a mere ordering of empirical material; that is to say, he did not recognize the freely constructive element in the formation of concepts. In a way, he thought that theories arise through discoveries and not through inventions (quoted in Holton, Gerald, Thematic Origins of Scientific Thought. Kepler to Einstein. Cambridge, Ma: Harvard University Press, 1973, p. 231). Thaddeus J. Trenn, in his preface to the reprint of Fleck's Genesis and Development of a Scientific Fact. op. cit.: "The conceptual creation of science, like other works of the mind, become accepted through a complex process of social consolidation. These thought products, and the thought style under which they arise, are never finalized but can undergo transformation through intra-collective or even inter-collective interaction whereby symmetry is democratically preserved between the esoteric circle of the experts and the exoteric circle of the wider society, and marginal men participating in diverse thought collective can create something new from the conflict." (p. xiii) Not long ago, Michaela and Augusto Odone, the inventors of "Lorenzo's oil" gave a striking demonstration of the truth of this last sentence.

34. I know that strictly speaking, the unity of force corresponds (now) to the dimensional expression C1 G S-2 while the unity energy has the dimensional expression C2 G S-2. But this distinction was not clearly admitted before 1887, after the Beneck Foundation of the Göttinger Fakultät had invited, in 1884, to a competition whose program was phrased in the following words: "Since Thomas Young (Lectures on Natural Philosophy, London 1807, Lecture VIII) many physicists ascribe to the physical bodies a property called energy. Since William Thomson (Philosophical Magazine and Journal of Science, IVth Series, London, 1855, p. 523), the notion of a principle of the conservation of energy valid for all physical bodies has gained acceptance, which seems (emph. mine) to correspond to what Helmholtz had understood under the name "Principle of Conservation of the Force." The Beneck Foundation asked to answer the question whether Young's and Thomson's concept of "energy" was equivalent to what Helmholtz called "force." There were two entries, but no first praemium was awarded. The young Max Planck won the second praemium with a book- length essay entitled "Das Prinzip der Erhaltung der Energie," Leipzig: Teubner Verlag, 1908 (1887).

decade when what we know as the first and the second principle of thermodynamics (the energy conservation law and the entropy maximization law) coalesced. These principles were no pure edicts of nature but rather the result of a chassé-croisé between the epoch's preoccupations, interests, representations, and nature's "resistance avisos." Neither is it irrelevant that the energy conservation law was discovered, or invented, a few years after England opened history's first national market for the labor force (1834),[35] Ricardo formulated a theory of value potentially disembedded from concrete costs, or when Liebig made the soil, once "the plant's stomach," virtually obsolete in agriculture by showing that chemicals could substitute for it,[36] when the first railroads and the first electric telegraphic lines were built,[37] photography invented, and when Marx wrote "Das Kapital"! Nature's intimations entered of course the constitution of the concept, for instance her refusal to be tricked by those who attempted to build machines producing both work and the cause of this work. In fact, the impossibility of the perpetual mobile is a perfect example of nature's avisos of resistance: in itself, it was not a concept, but a physico-logical constraint acting on the formation of the concept to come.

The law of energy conservation was that concept. In relation to the impossibility of the perpetuum mobile, the concept, energy, as all works of the imagination, is "overdetermined," redundant of societal and cultural meanings. It is, for instance, the product of a time that considered scarcity, the fundamental axiom of formal economics, to be the law governing social order, much as the gravity law governs the Newtonian universe.[38]

So, the first question I would like to ask the questioner is this: Do you not consider plausible that the industrial enthusiasm that characterized the time of the railroad mania and of the "energy mania" will nolens volens taint every social and cultural reality where the concept energy is imported, today? In other words, since it is a constitutive theme—or an active connection—of its genesis, will not scarcity be transferred together with the energy concept? And is this not the bottom line of the debate on "Energy and Power" courageously initiated by WISE?

The editor recalled to me the title of a pamphlet I once wrote, "Cow-dung Is Not Energy." I was thinking then of the Indian villagers who have no other fuel than dry cow- dung. Imagine that a do-gooder from abroad comes to the village with the blueprints of a marvelous bio-digester, importing with them a pop science version of the concept energy where people had one hundred words for nature's forces and gifts. If our alternative technologist succeeds in building his contraption, the villagers who can afford to pay for it will have gas in their

35. Polanyi, Karl, "The Great Transformation: The Political and Economic Origins of Our Time. Boston: Beacon, 1957 (1944), p. 102.
36. Dubiel, Ivo, "Cambios de relevancia social en el transplante de teorías. Los ejemplos de la teoría económica y agronómica," manuscript, 1984.
37. Postman, Neil, Amusing Ourselves to Death. New York: Methuen, 1988.
38. Polanyi, op. cit., on Edmund Burke's and Jeremy Bentham's belief in a "law of scarcity" governing society more efficiently than any political law, p. 117: "To the question 'What can the law do relative to subsistence' Bentham answered 'Nothing directly'."

kitchen. The poor will have no biogas and no cow-dung left. This can rightly be seen as a result of the transmogrification of cow-dung, a gift of a domestic goddess into an input for alternative industrial production: energy. Though it is scientifically correct inasmuch as it confirms the impossibility of tricking nature, the energy concept is more than a correct scientific statement. It is also a conceptual device that transforms all that it touches into gold for the industrial process. If you don't want gold, but cow-dung for everyone, you have to let cow-dung remain a free gift and, among ten dozen, use the appropriate word for it. If you aim at protecting the concrete living matrix of real women and men, "energy" is perhaps not an appropriate word.

It is no hairsplitting to insist that, underlying the debate on the appropriateness of technologies, there is the need of another debate on the appropriateness of the alternative technologists' semantics. In blunders like the one mentioned by the editor or the one just recalled, women are the first victims. So it is not idle either, to ask what the word "energy," when it evades from the lab and invades social reality, says about and does to the vernacular gender[39] of the ones exposed to the semantic and technological innovations imported from abroad. And here comes my second question to Michiel Schaeffer's correspondent:

Don't you realize that "energy," the concept underlying most alternative technologies, can be the vector of an industrial bias destructive of forms of local self-reliance founded in a place's perception of gender? In an attempt to address that question, I will delve again into the "waste basket of physics" in which I scavenged ten years ago. For, if "energy" imports unwanted industrial assumptions, they must be traced back to the epoch that shaped the concept.

39. Illich, Ivan, Gender. New York: Pantheon Books, 1982.

"Energy" and Gender

Before Marie Curie's time, physics was an exclusively and jealously guarded male's realm.[40] Yet, I do not share the opinion of the American feminist physicist Evelyn Fox Keller. Following her, physics is therefore tainted with a "gender bias"[41] and she claims that it is the female physicists' duty to cleanse their science from it. I see things differently. Physics, like modern science in general has on the contrary the eminently dis-gendered character of those realms of activity that do not stem from a living interplay between feminine and masculine, masculine and feminine spaces, times and tools. No matter how "macho" an individual physicist may be, the lab is a dis-gendered space because men and women alike are asked to leave their gendered body in the wardrobe in order to become physicists. The history of physics from 1840 to our days does not speak of a more intense dialogue of the genders, but on the contrary, of a steady increase of its dis-gendered characteristics. Yet, be sure that if traces of gendered perceptions are to be found in my old friends' works, they are imports of their inborn decency, that is of their cultural context or matrix, and not the effect of more feminine presences in physics, since the contrary was true.

Motion, its nature, has always been one of the fundamental concerns of physics. In the history of this science since Antiquity, there are broadly two concepts of motion:

1. the Aristotelian concept, that contemplated all kinds of change and always viewed motion as an affection of the medium, with this medium actively participating, as in Aristotle's example of the arrow, and

2. the Galilean concept of the motion of an individual body in a thought void, obtained by "peeling away" the motion's medium.

What do my friends have to say about that? Was perhaps a less dis-gendered concept of motion at home in physics before this was reshaped as "the science of energy"? I will show that around 1840, two contrasting concepts of motion, both analytically correct were at odds. One was thematically, if not mathematically, Aristotelian since it started by considering the medium's affections and changes. The other, inherited from Galileo, saw motion as a sheer displacement of individual bodies in a thought void. It only conceived motion disembedding it from its medium and finally succeeded in reducing even this to the individual displacements of "atoms" (till the mid-19th century, physicists called the molecules "atoms").

40. This is true for the 19th Century, the century during which physics became a profession. It is not quite true for the 18th Century, when enlightened aristocratic ladies performed physical experiments in their salons.
41. Keller, Evelyn Fox, Reflections on Gender and Science. Yale: University of Yale Press, 1985.

The Skinning of Nature

In the construction of the energy concept, a broad movement analogous to that of the social construction of the public fetus[42] occurred. Barbara Duden has convincingly shown how the fetus, now a dominant public emblem, was progressively arrived at by a process of elimination of the motherly body.[43] From the drawings of early 18th century midwifery books showing the correct position of the midwife's hands and the right delivery gestures that emphasized with all detail the concreteness of the motherly body, to William Hunter's pictures at the end of the same century, half the way to that disembedment was laid down (Figs. 1 and 2). The other half of the road leads to Life Magazine's famous picture of the fetus as a small cosmonaut floating freely in amniotic liquid and culminates with our days' sonographic images ("Hello, I'm Jimmie, I'll be born in 4 months from now.").

Hunter pictured the dead fruit in a dead motherly body whose fabrics were surgically removed layer by layer to lay bare the dead fruit as fetus. It will take the masculinization of midwifery into obstetrics, X-rays and the sonogram to socially construct the public fetus that we "have" nowadays and that often seems to be the common object emerging from the confrontation between the "reproductive rights" and the "pro-life" movements. Something very similar to this scanning or skinning process can be observed—at least by the "epistemological eye"—in the genesis and development of the energy concept between 1842 and 1852. One question was of paramount importance in the first sketches of the concept that we now call energy: it was the question of the origin of bodily heat. That is to say that the matter was more a concern of physicians than of what we now call physicists. In fact, the very first known formulation of the "law of conservation of the 'force'" was due to a modest doctor of the poor, Robert Julius Mayer from Heilbronn in Bad Wurthemberg.

Around 1840, most of the "compound" of German physicists thought that bodily heat was mainly caused by the friction of the blood with itself (internal friction layer upon layer) and with the inner surface of the blood vessels (external friction). The generally accepted explanation was that the mutual friction of neighboring layers affected with different speeds "ground," so to speak, the body's heat. The branch of physics associated with this concept was called haemodynamics, which was an "internal kinetics" of the blood and, by extension, of every fluid that happened to be affected by internal, also called molar-motion. There was, for instance, a "haemodynamical" meteorology in search for some ordered patterns in the majestuous, but seemingly haphazard celestial landscapes of

42. An expression coined in Pollack Petchesky, Rosalind, "Fetal images: the power of visual cultures in the politics of reproduction" in Feminist Studies 13, no 2, Summer 1987.
43. Duden, Barbara, "Disembodying Women: Perspectives on Pregnancy and the Unborn. Cambridge, Ma: Harvard University Press, 1993.

towering cumulus, whirling nimbus or raveling out stratus clouds.[44] Haemodynamics was the branch of physics in which, before 1845, a young physicist had more chances to illustrate himself and gather the laurels of academic awards. (Besides speculating about the origin of bodily heat, haemodynamicists also gave the first precise mathematical formulations of a liquid's viscosity coefficient and of the dependence of this on temperature).[45]

In contrast, by 1850 all the odds were in favor of the opposing school, which postulated that an oxidation of the food's juices taking place in the blood was the cause of bodily heat as it was of muscular "force." This new physico-physiological doctrine was called "die Wärmelehre" (the "doctrine" of heat). Its adoption of the steam engine metaphor and of the mechanics' technical terms—viz. the kilogrammeter[46]—as well as its reconceptualization of internal motion as occurring in a thought void was to originate the postulates of what we now call thermodynamics.

On the subject of bodily heat, haemodynamics was partially wrong and thermodymanics was right in part, by default. The last haemodynamicists had to retire or to convert to the tenets of the new doctrine. The "thermodynamical truth" had won over the "haemodynamical error." Was it really so? Though it of course corresponds to the victors' perception, this is

44. Babinet, "Ueber einen neuen Neutralpunkt in der Atmosphäre, in J.C. Poggendorf, Annalen der Physik, Vol. 51, 184 This was the feat of Meyer, Oskar Emil, "Ueber die Reibung der Flüssigkeiten," in J.C. Poggendorf, Annalen der Physik, Vol. 113, Leipzig, 1861, p. 55 ff., 193 ff and 383 ff (experimental results). Meyer (with e!) is a "late haemodynamicist," long reluctant to convert to the tenets of the opposing school. He however did so around 1875 and was as successful as in his haemodynamical studies, since, as a precursor of Perrin, he gave the first sketch of what is now known as the "Avogadro Number": Meyer, Oskar Emil, Kinetische Theorie der Gase, Beslau, 1877, p. 232. His brother underwent a similar "late conversion" and, before Mendeleiev, gave the first blueprint of what had to become the periodic table of the elements. About the Meyer brothers and their dramatic change of "philosophy of matter," see Rosenberger, Ferdinand, Die Geschichte der Physik, 3rd part, Brauschweig: Vieweg, 1887-1890. Notice that the passage from haemodynamical to thermodynamical views generally implied a shift of interest from the internal kinetic of liquids—with the mutual dependence of neighboring infinitesimal layers—to the kinetic of gas molecules conceived as individual Galilean bodies on a kind of 3-D "billiard board." I suspect that the motif for such changes of "matter philosophy" lies in the lack of a "scaling element" in continuistic considerations, probable reason of the haemodynamicists' failure to give a full mathematical analysis of the caloric equivalent of mechanical work. 0, S. 562, p. 618.

45. This was the feat of Meyer, Oskar Emil, "Ueber die Reibung der Flüssigkeiten," in J.C. Poggendorf, Annalen der Physik, Vol. 113, Leipzig, 1861, p. 55 ff., 193 ff and 383 ff (experimental results). Meyer (with e!) is a "late haemodynamicist," long reluctant to convert to the tenets of the opposing school. He however did so around 1875 and was as successful as in his haemodynamical studies, since, as a precursor of Perrin, he gave the first sketch of what is now known as the "Avogadro Number": Meyer, Oskar Emil, Kinetische Theorie der Gase, Beslau, 1877, p. 232. His brother underwent a similar "late conversion" and, before Mendeleiev, gave the first blueprint of what had to become the periodic table of the elements. About the Meyer brothers and their dramatic change of "philosophy of matter," see Rosenberger, Ferdinand, Die Geschichte der Physik, 3rd part, Brauschweig: Vieweg, 1887-1890. Notice that the passage from haemodynamical to thermodynamical views generally implied a shift of interest from the internal kinetic of liquids—with the mutual dependence of neighboring infinitesimal layers—to the kinetic of gas molecules conceived as individual Galilean bodies on a kind of 3-D "billiard board." I suspect that the motif for such changes of "matter philosophy" lies in the lack of a "scaling element" in continuistic considerations, probable reason of the haemodynamicists' failure to give a full mathematical analysis of the caloric equivalent of mechanical work.

46. The following, incredible statement by Mayer must be quoted in the original: "Den unproduktiven Druck haben wir umsonst, die Kraft aber, oder das sogenannte Kilogrammeter kostet immer Geld. In noch höherem Grade, womöglich, als für die Physik, ist für die Physiologie, welche bekanntlich in der Wärmelehre ihre wissenschaftliche Grundlage erst gefunden hat, das Kilogrammeter ein notwendiger Lebensbedürfnis" (Mayer, R. J., Kleinere Schriften und Briefe. Edited by Weyrauch, Stuttgart, 1893, p. 419.

a naive view of the "progress of science." In fact, a complex change occurred that an observer, Ferdinand Rosenberger has expressed in the following terms:

> At the beginning, almost every experimental physicist followed on the path that was his (before the invention of the energy concept), dedicating himself for some more years to the same tasks. However, these tasks were subtly inflected by the new theory, often without close notice of the concerned worker himself (sic).[47]

This particularly applies to experimental haemodynamics. After an eclipse around 1845, it flourished again in the 1850, as if the "late haemodynamicists" had wanted their theory to usher in an ultimate thematic protest against the growing grasp of atomicism on physics.

The rise of the thermodynamical view of the body, and of the world, was an epistemological landslide that gave the Young Turks the occasion for breaking off with old authorities. Along with the haemodynamic conception of bodily heat, the "vital force"[48], the separation between a "translunar" world of ideal realities expressed in pure concepts (see Lagrange's mechanics) and a "sublunar" realm of birth, growth, corruption and friction as well as the concept of the soil as the plant's stomach succumbed. Since its very beginning, "die Wärmelehre"—soon to be rechristened "mechanische Wärmetheorie"—was much more than a way to "correctly" explain the origin of bodily heat. Not unlike heliocentrism in Galileo's time, it was part of a worldview for which some, new Brunos and Galileos, suffered a true martyrdom and, more often, vilified their adversaries.[49]

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47. Rosenberger, Ferdinand, "Die Geschichte der Physik in Grundzügen mit synchronistischen Tabellen," Braunschweig: Vieweg, 1887-1890, 3rd vol., p. 386.

48. Dubois-Reymond, Emil, "Die Lebenskraft" in Reden von Emil Du Bois-Reymond. Leipzig: Veit Verlag, 1887, p. 1-28. This article is a historical summary of the decline of the concept of the vital force after energetism substituted mechanical metaphors for it.

49. See in this respect the incredible performance of Dühring, when he passionately took side with Mayer, "the true German physicist"—not like Joule, a stranger, and unlike Helmholtz, (the "Bismark of physics"), free of "English ideas"! The old German-English "Prioritätsstreit" became three-national in the 1880's, as France entered the arena with Hippolyte Carnot brandishing an old sheet of paper meant to prove that his brother Sadi had already calculated the mechanical equivalent of heat before 1824. Dühring, Eugen, "Robert Mayer, der Galilei des neunzehnten Jahrhunderts," Chemnitz: Ernst Schmeitzer Verlag, 1880.

50. Applied to social matters, the thermodynamicists' Galilean recipe reads: "Disembed from the context. Make abstraction of its reality. Re-introduce it as controllable abstract constraints." No wonder that outside the lab, such practices could only lead to the A-bomb and to the climatological catastrophe, which in the strong sense is a negation of the atmosphere and its climatic horizons. For an ambiguous attempt to take the atmosphere and a place's climate at face value and as the starting point of all ecological discussion, see Murota, Takeshi, "Heat economy of the water planet earth: an entropic analysis and the water-soil matrix theory" in Hitotsubashi Journal of Economics, vol. 25, no 2, Tokyo: Hitotsubashi University, December 1984. The strong part of the Japanese theory of the soil-water-air matrix is its repeated reference to the historical climatic concept of fudo as scaling element of geography.

We have seen that thermodynamicists conceive first motion as motion in a void "peeling away" its concrete earthly matrices (e.g. the atmosphere) and then eventually ask the lubrication and the hydro- or aero-dynamical lab to re-introduce "the medium's constraints".[50]

Haemodynamics had sustained itself on a contrasting worldview for which everything was embedded in concrete, terrestrial matrices, rejecting explicitly Galileo's abstract view of motion along with atomicism.

Such an opposition between two worldviews embodying thematic bundles is what Gerald Holton has called a Q-Q confrontation.[51] Such confrontations use to end up with the victory of one theta or thematic bundle, with the "valid tenets" of the loser—e.g. the superior analytical skills of the haemodynamicists—being subordinated to the victor's paradigm.

Exactly that happened with haemodynamics, whose "valid tenets," rechristened "fluid mechanics" are still an important but accessory branch of industrial physics (like research in the lubrication department of the transportation industry is today subordinated to R.& D. on engines and fuels). Haemodynamics lost first its short-lived hegemony on physics and then its epistemological autonomy to its victor. Since the epoch was imbued with the notion that the "law of scarcity," the founding axiom of formal economics, was the cause of all social order, energy, the concept that arose from the confrontation, was a reformulation of the forces of nature under the assumption of scarcity.[52]

The victor's interest in economic rentability—translating into the concept of a machine's duty!—became an implicit tenet of 19th Century physics. Concomitant with the emergence

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50. Applied to social matters, the thermodynamicists' Galilean recipe reads: "Disembed from the context. Make abstraction of its reality. Re-introduce it as controllable abstract constraints." No wonder that outside the lab, such practices could only lead to the A-bomb and to the climatological catastrophe, which in the strong sense is a negation of the atmosphere and its climatic horizons. For an ambiguous attempt to take the atmosphere and a place's climate at face value and as the starting point of all ecological discussion, see Murota, Takeshi, "Heat economy of the water planet earth: an entropic analysis and the water-soil matrix theory" in Hitotsubashi Journal of Economics, vol. 25, no 2, Tokyo: Hitotsubashi University, December 1984. The strong part of the Japanese theory of the soil-water-air matrix is its repeated reference to the historical climatic concept of fudo as scaling element of geography.
51. Holton, Gerald, Thematic Origins of Scientific thought: Kepler to Einstein. Cambridge: Harvard University Press, 1973.
52. See Illich, Ivan, The Social Construction of Energy. op. cit. "I am interested in the history of 'energy' because I discover in the emergence of this notion the means by which 'nature' has been interpreted as a domain governed by the assumption of scarcity, and human beings have been redefined as nature's ever needy children. Once the universe itself is placed under the regime of scarcity, homo is no more born under the stars but under the axioms of economics."

of the energy concept occurred the mathematization of the language of physics[53] and what Ferdinand Rosenberger already described as a specialization that did no longer allow inter- and intra-disciplinary conversations.

Some of the most dangerous tendencies of 20th century physics (its blind specialization, its thorough surrender to industry and the military, its lack of recognized meta-physical authorities, its disdain for concrete matrices like the atmosphere) can already be detected, as if it were "in the egg" in that change.

53. Schickel, Joachim, "Die Sprache der Physik," in B.P. Kurier, 3.4.1982, p. 26-28. Robert, Jean, "Der Verlust der Erläuterungssprache der Physik von 1840 bis 1900," in Stephan H. Pfürtner, "Wider den Turmbau zu Babel. Disput mit Ivan Illich," Reinbek bei Hamburg: Rowohlt, 1985, p. 116-130, 152-153. The commented bibliography of this disarmingly naive essay is still interesting.

The "Gender of Physics"

The German haemodynamicists of the 1830's called the internal motion of the medium "molare Bewegung" (molar motion), using an adjective that is very appropriate on three different grounds:

1. until the end of the 19th century, molar denotes physical processes "relating to a mass of matter as distinguished from the properties or motions of molecules and atoms" (Webster, vol. II, p. 1454): the haemodynamicists were convinced continuists, which means that they did not ignore, but actively rejected the atomistic hypothesis on the ground of their belief that matter was continuous until the infinitely small;[54]

2. "molar" connotes a sense of grinding inherent to its Latin origin: let me recall that molar motion was described analytically as the mutual "grinding" of the medium's layers through which internal friction converted mechanical motion into heat.

3. from its (casual?) homonimity with molar as "related to a uterine mole" (Webster, ibid.), the term seems besides to have been endowed with an implicit uterine connotation.

Insofar "Galilean" motion is disembedded from concerns for the medium that it affects and derives its themes from ballistics, it can be termed "phallic." Here is the core of the thematic difference between the Galilean and the molar sense of motion: molar motion is "uterine," if this means that it is completely embedded in the terrestrial medium of which it is an affection and describes concrete "matrices of physical existence" rather than their raping, transformation or annihilation.

Beyond these gender metaphors, I ask the reader to make the effort of imagining this alternative as a line of radical epistemological rupture: around 1840, a physicist could still either choose to consider motion in the Galilean, disembedded way, or he could stick to a molar sense of motion that starts with the consideration of how it affects its terrestrial

54. This is not so extraordinary, if one thinks that as late as in 1913, Mach wrote: "I gather from the publications which have reached me, and especially from my correspondence, that I am gradually becoming regarded as the forerunner of relativity. (...) I must, however, as assuredly disclaim to be a forerunner of the relativists as I personally reject the atomistic doctrine of the present-day school or church" (quoted by Holton, Gerald, op. cit., p. 230).

medium. Though physics in the broad "modern" (= post scholastic) sense was born with Galileo's decision to disembed motion from its medium and ignore secondary qualities,[55] the other path remained theoretically walkable and analytically describable in the sublunar world. It was the path—thematically if not analytically more akin to Aristotle's, against which Galileo built his kinetics—that haemodynamicists chose to go.

The emergence of the energy concept is contemporary and concomitant with the closing of that path, as if the thermodynamicists had re-written Galileo's Dialogues Concerning the Two New Sciences (1638)[56] taking the haemodynamicists for their Simplicios (Simplicio, the Aristotelian physicist, was the laughing stock of the Dialogues). Only that the haemodynamicists of 1840 were extremely well skilled experimenters and that their analytical descriptions (their math) were highly sophisticated and generally flawless. An epistemological gulf separates these "two new sciences." As Gerald Holton would say, the thematic origins of both scientific approaches are heterogenous. The first is "trans-lunar" in the sense that it is fit for the description of frictionless motion occurring in the thought void of outer space. Applied to terrestrial, "sub-lunar" motion, it first has to reduce it to an equivalent of the motion of the ethereal spheres, reintroducing stochastically certain terrestrial factors like friction as constraints (as in Stokes' and Langevin's versions of Newton's equation of friction and of the stationary speed of fall of a body of given dimensional characteristics in a homogenous viscous medium at constant temperature).

The second method is physical in the original sense: it takes terrestrial motion for what it is: a relation between a moving mass or mole—which can be part of the medium itself—and a medium affected by it.

55. Quoting Alexandre Koyré, Gerald Holton writes: "... Galileo's work was an experimental proof of Platonism as a methodology of science ('La découverte galilénne transforme l'échec du platonisme en victoire. Sa science est une revanche de Platon'). The scholastics had always been able to point to the two main failures of Platonism: on the one hand there was no good theory of terrestrial motion (...) and on the other hand there was no successful mathematization of quality (...) What of the second challenge? The mathematization of quality had proved possible for such qualities as motion and size, but not for others, such as taste, the sensation of heat, color (though most of these subsequently were indeed also found to have quantifiable aspects). Galileo's decision was simple: to banish (emphasis mine) the unquantifiable qualities from science—or more properly, to withdraw the attention of science from the realm of the unquantifiables" (Holton, op. cit., p. 439).

56. In Robert M. Hutchins, ed, "Great Books of the Western World," Chicago, Encyclopaedia Britannica, 1952, Vol. 28, p. 129-260.

Epistemological Reflections

Did haemodynamics contain the seed of an alternative understanding of energy and entropy? Such a question can of course not be answered, all what can be granted is that the haemodynamicists' concept of motion, their "active connections" in general, were distinct from those of the thermodynamicists. As to the obtention of the viscosity coefficient, and of the analysis of the average stationary speed of fall in a viscous medium, it can be said that it makes them retrospectively forerunners of Stokes, Langevin or Painlevé,[57] but again, that would miss the point of their epistemological specificity.

Haemodynamics could have reached an independent formulation of the law of energy conservation—and even more, of entropy—if it had given a full analytical description of Joule's experiment[58] of 1845. It failed to do so. What happened in reality is that, once agreement was reached about the "exchange rate" of the "bank of nature," this rate (confirmed analytically and experimentally in one sense and only experimentally in the other) was simply used both ways in all the physicists', and physiologists', equations and

57. One of the humidity and worm-gnawed documents I could save during my "trip to the grandfathers' country" was a handwritten version of Painlevé, Paul, Leçons sur le Frottement. Paris, 1895.

58. It has not been sufficiently noticed that Haller's haemodynamics, as exposed in his Physiology was the main source of inspiration of Joule's first experiments. The young Joule quoted Haller in the following terms: "... the hypothesis that blood is heated by friction in veins and arteries would account for that part of animal heat which Crawford's theory had left unexplained." See: Wobmann, Peter, "Albrecht von Haller, der Begründer der modernen Haemodynamik," in Archiv für Kreislaufforschung, Vol. 52, Fasc. 1-2, 1967, p. 96-128. Haller, Albrecht, Physiology, vol.ii, p. 304. In 1845, Joule built a machine in which the conversion of a liquid's molar motion could occur practically without heat losses, what allowed an experimental measurement of the caloric equivalent of mechanical work: Joule, James Prescott, "On the caloric equivalent of mechanical work" (communicated by Michael Faraday, Foreign Associate of the Academy of Sciences, Paris, &c. &c. &c.) in Philosophical Transactions 1850, Part 1, p. 298 ff. "In 1843, I announced the fact that 'heat is evolved by the passage of water through narrow tubes' and that each degree of heat per lb. of water required for its evolution in this way a mechanical force represented by 770 foot-pounds. Subsequently, in 1845 and 1847, I employed a paddle-wheel to produce the fluid friction, and obtained the equivalents 781.5, 782.1 and 787.6 respectively from the agitation of water, sperm-oil, and mercury."A question that historians of science have thus far not answered with due precision is this: why did the haemodynamicists repeatedly fail to formulate analytically the caloric equivalent of mechanical work (= to describe Joule's experiment mathematically without starting a priori from the inverse of the mechanical equivalent of heat), while Mayer, who was by no means a skilled mathematician succeeded in giving a conceptually—if not numerically—flawless analytical formulation of the mechanical equivalent of heat? The reason is this: nature is "scaled," which means that every creature is morphologically related to its size. The haemodynamicists failed to identify the scale at which a "mole" of liquid will necessarily cease to grind heat between its layers. Some still thought, like Leibnitz, that "the 'force' can disappear from particular bodies (falling into the 'abysses of the infinitely small') without being lost for the universe": "Etsi enim pars potentae ab impedimentis absorbeatur, non destructa tamen, sed in impedimenta translata est, quae in effectum integrum computantur." In other words, Leibnitz thought that friction can occur ad infinitum between smaller and smaller moles, the "force" not disappearing, but being unlimitedly fractalized, as if we would change good money for cents and these cents for hundredths of cents and so forth, until, without having "less" we would no longer have anything that means something in monetary terms. Wouldn't it be interesting to open a forum for those who will attempt to do what the haemodynamicists were impeded to complete by the victory of the opposing school? The epistemological wager of the exercise is this: While it is impossible, within one school or "theta" to disentangle the active from the passive connections, it is possible, knowing nature's resistance avisos, to compare the active and the passive connections of two schools engaged in a?-? controversy. Wise could provide the mail-box. Please, don't try alone!

experiments to come. Clausius elaborated the entropy concept in order to deal with the experimental fact that friction can convert all the mechanical work (energy) imparted to a medium into heat,[59] while a thermic engine can only convert a relatively small part of the caldron's or cylinder's heat into useful mechanical work.[60]

The controversy was closed by the victory of a "mechanische Wärmetheorie" that associated atomicism and the Galilean disembedding of motion with an insistence on economically useful energy conversions (viz. the "useful" conversion of thermic into mechanical energy) and considered the opposed conversions as nuisances to be minimized (friction, residual, "useless" heat, "entropy"). This economic bias has become such a built in thematic part of the energy concept that many physicists pretend not to notice it. I suspect that it is because their whole worldview is imbued with the notion that the cosmos is ... a scarce place (in that respect, the whole "heat-death" ideology of the late 19th Century, its echo in a physiological theory of fatigue and of social degeneration that became the subject of novels, and the speculations motivated by the ambiguities of the entropy concept would deserve a psychoanalysis). As the conversion of heat into mechanical work (the economy of the steam engine) became the stereotype of all conversion processes, in organisms as well as in machines, it metaphorically transformed nature into a giant "arbeitende Maschine" (economically working machine).[61]

Instead of the expression of nature's "idleness," that is of "cosmic" scarcity justifying economic assumptions, the haemodynamists of the mid 19th Century, a time when the energy concept was still "in flux,"[62] discovered that the conversion of mechanical work

59. It was only stated much later that, in the conversion of a liquid's internal mechanical work into heat, there must always be a remnant of macroscopically observable mechanical motions, named—after the Scottish botanist who observed them around 1840—Brownian motions. These are explained by stating that, for a very small body floating on a liquid's surface or in suspension within it, the resultant of the pressures on the body's immersed surface at any moment due to the shocks of the liquid's molecules' haphazard thermokinetic motions, is generally not zero and greater than the resultant of the resistance factors like inertia and friction. As a body of increasing dimensions is considered, these shocks tend to statistically equate themselves, leaving at any moment a resultant that can be neglected in relation to the body's inertia and the surface interactions (capillary adherence, friction). Einstein, Albert, "Ueber die von der molekularkinetischen Theorie der Wärme geforderte Bewegung von in ruhenden Flüssigkeiten suspendierten Teilchen," in Drudes Annalen der Physik, Vol. 17, May 1905, p. 549.
60. Clausius, Rudolf, Abhandlungen über die mechanische Wärmetheorie, Braunschweig: Vieweg, 1864.
61. Breger, Herbert, Die Natur als arbeitende Maschine. Zur Entstehung des Energiebegriffs in der Physik, 1840-1850. Frankfurt: Campus Verlag, 1982.
62. Elkana, Yehuda, The Discovery of the Conservation of Energy. Cambridge: Harvard University Press, 1974. "I consider this case as an illustration of that general aspect of scientific change which, to make it thought-provoking by the imag it creates ... I will call concepts in flux" (p. 12 ff).

into heat in a viscous fluid generates patterns of molar motion of which many of Plateau's experiments in the 1850's expressed the visual aesthetics.[63] In other words, a concept that has been taken as a paradigm of chaos (entropy) would have found a complement in an order-manifesting principle (fig. 5). The crucial difference between both schools is beyond error or correctness. Its essence lies in a radical difference in intellectual interests (Fleck's active connections) concerning nature.

I hope to have encouraged the reader to recover a sense of the fluidity of the energy concept in the decades in which it coalesced. However, our reflection must now concentrate again on the transfer of the energy metaphor as a Trojan horse for pre-, trans- or meta- scientific themes. If I am right, it will export scarcity together with thermodynamical rationality to cultural contexts in which it was not a dominant perception.[64] It will besides contribute to break the asymmetric complementarity of the genders.

63. Plateau, Joseph, "Recherches expérimentales et théoriques sur les figures d'équilibre d'une masse liquide sans pesanteur" in Mémoires de l'Académie des Sciences, Vol. XXXI, Paris, Brusell, 1857.
64. Dumouchel, Paul, "L'ambivalence de la rareté" in Paul Dumouchel and Jean-Pierre Dupuy, L'Enfer des Choses. René Girard et la Logique de l'Economie. Paris: Seuil, 1979.

Podolinsky: A "Molar," Matricial … or Easteuropean View On Energy

Would a concept of motion (and hence of "energy") genuinely respectful of living matrices because it shares their embeddedness have more benign social consequences when it evades from the lab than the thermodynamicists' motion in a void and its conceptual aftermath? The question is concretely whether the energy concept—and in this case: which energy concept? —can be used in a judo-like fashion to limit the destruction of self-reliant communities by the industrial package of which "energy" is always a part. This is in my opinion the intellectual project that Sergej Sergejevichtch Podolinsky succeeded in formulating if not in realizing.[65] In his attempt to enroll the energy concept for the protection of communities embedded in a cultural tradition, rather than for their exploitation or transformation, I found many fundamental molar intuitions. It is no wonder if one knows that Podolinsky's interests were haemodynamical and that he learned thermodynamics relatively late.[66]

Yet, Podolinsky has been thus far depicted as a pioneer of "ecological economics,"[67] of "social energetics" or of "energy accounting." I think that more can be read in his work. Social energetics has regained actuality in the 1960's, since it was seen as a possible antidote to a destruction of nature not quite wrongly ascribed to monetary economics. The concept of "energy accounting" was then presented as the truly ecological way of bargaining with nature, reckoning its forces and assessing the ecological costs of economic development. For a reading of Podolinsky in that light, I recommend Juan Martinez-Alier's seminal paper, which introduced the "green academia" to Podolinsky as a forerunner of Lotka, Cottrell, Leslie White or even Georgescu-Roegen.[68]

65. His son's commitment with the idea of protecting the Russian mir—peasant commune with its commons—by defining its horizon and legally limiting what could cross it both ways can be seen as a striking application of his father's ideas. A member of the Ministry of Agriculture led by his cousin Pyotr Stolypin, Podolinsky jr was the intellectual author of the tsar's last agrarian reforms. Podolinsky, Sergej S., Rußland vor der Revolution: Die Agrarsoziale Lage und Reformen. Berlin: Berlin Verlag, 1971.

66. While in Marburg, I have found Podolinsky's doctoral thesis: Podolinsky, Serge, "Beitrag zur Kenntniss des pancreatischen Eisweissfermentes," in E.F. W. Pflüger's, Archiv für die gesammte Physiologie des Menschen und der Thiere. Bonn: Cohen Verlag, 1876, p. 422-443.

67. Diwan, Romesh, "Ecological Economics: A Dangerous Myth or a Noble Vision? Notes on Gandhian Perspective," State College, 1968: Penn State Seminar October 14-16, 1988, manuscript.

68. Martinez-Alier, Juan, "Energy accounting and the notion of 'productive force'," Barcelona, Berlin, 1984, manuscript. Isn't it symptomatic that this work about a thinker from a region of the industrializing world that was despised as "marginal" was first published in Catalan? See also: Martinez-Alier, Naredo, J.M. and Schinepmenn. K., "Research Project: Energy Analysis and Economics - Studies on Neglected Interdisciplinary Currents of Thought," Berlin, 1984, manuscript.

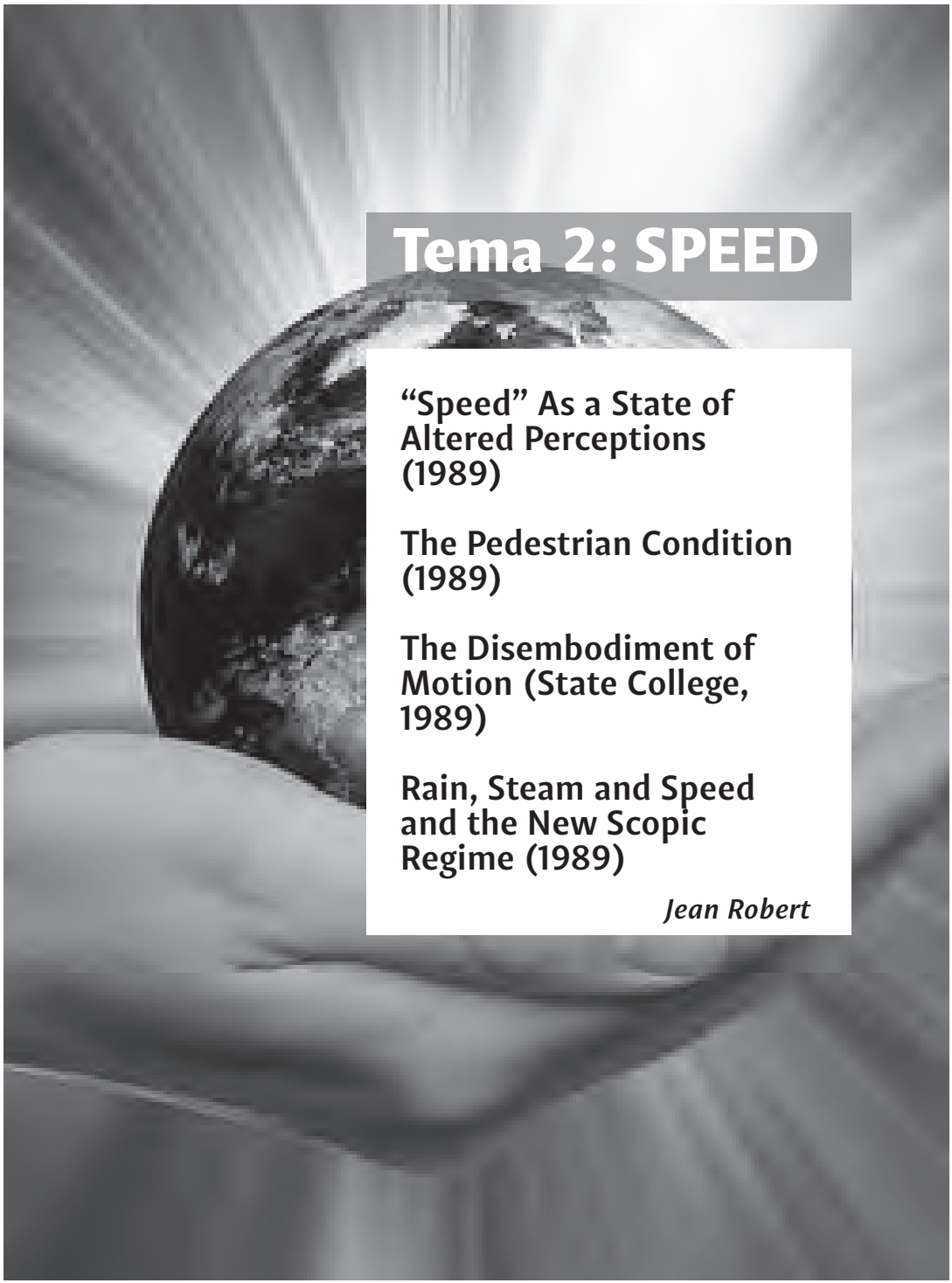
I will not repeat here what Martinez-Alier has so competently said. I will rather focus on one aspect that has thus far not been sufficiently highlighted: it is Podolinsky's use of the energy concept as a scale to evaluate and measure human labor and to limit it when it becomes industrial.

It is nowadays trivial to recall that: Every square meter of land receives daily between 2000 and 5000 kilocalories of solar energy. Some of it is conserved by the plants in the form of "affinity energy" (chemical energy), which constitutes the first circle of biological energy conservation, of which coal—Podolinsky does not speak of oil yet—must be considered an integral part. Animal life can be visualized as a smaller cycle "feeding" on the first and conserving energy as carbohydrates and proteins. Man contributes to conservation in both cycles, not only in agriculture and the raising of life stock, but also through the making of clothes, shoes and heated and well-insulated houses. Within this circle, man needs 1500-2500 Cal a day to keep himself alive and can transform one tenth of it into useful work. Yet, unless one tolerates the death of the soil—and Dutch-style industrial hydropony on dead soil—he has to remember that man ultimately derives his alimentary energy from the soil. So, as economics is scaled by the measure of a man's work output (some 200 Cal/day), social geography must be scaled by the amount of cultivated land required to feed one person (about one acre in intensive agriculture). No wonder that Podolinsky pretended to have unified the views of the Physiocrats, of the Marxists and of the thermodynamicists! Yet, man's labor can contribute either to the conservation or to the dissipation of energy. It will inevitably do the latter if his industry is based on the exploitation of fossil energy. But the evaluation of his work as conservative or dissipative depends also on the knowledge of his immediate or mediate relation to the soil that feeds him. Following Podolinsky, man's activity only deserves the name labor if it is conservative.[69] Dissipative activities do not deserve that name and must be sanctioned as undue withdrawal of a common good from a community's existential matrix. Heavy industry, which rely on conserved solar energy in the form of fossil organic compounds exhausts a common good and is not sustainable in the long run. As the over-exploitation of the soil, it is not legitimate labor and must therefore be sanctioned.

69. Podolinsky, Serge, "Menschliche Arbeit und Einheit der Kraft" in Die Neue Zeit. Stuttgart, 1883, p. 413 ff. The most important passage for my interpretation is: "We hope to have succeeded in burying the so-called doctrine of abstinence or 'negative labor' [of the capitalists]. For labor is always a positive concept denoting the expanse of mechanical or psychical energy for the sake of energy conservation" (p. 423).

The question that Podolinsky did not address directly is how illegitimate work must be sanctioned. Ulrich von Weizsäcker has recently suggested that all forms of tax raising ought to be replaced by a single tax on energy conversions. In other words, all "labor" that involves an industrial conversion of energy must be taxed in proportion to that conversion's intensity. I think that it is a practical complement to Podolinsky's embedded view of energy and the use of it as a factor of proportionality to evaluate man's productive activities.[70] Under the shield of this radical protection of self-reliant communities, their commons and their ecological-climatic matrices, an economy in the true sense of "administration of one's own house" could flourish again. A sustainable world of austere hedonistic activities, freed from the energy-entropy form of the obsession with scarcity, in which the soil would be the generator of plant life, wheat would again be allowed to be the substance of our daily bread, and cow-dung to be a goddess' gift.

70. Another modern complement to Podolinsky's alternative "social energetics" comes from Bettina Corves, who has recently written a thesis in which she shows the clash between East- European and West-European ideas in the formation of the energy concept. The victory of the utilitarian-thermodynamical paradigm attests the predominance of West-European, pro-heavy industry conceptions. Corves, Bettina, "Energie in der westlichen Industriegesellschaft. Geschichtliche Entwicklung des Begriffes und die Bedeutung in der Umweltdiskussion," Nürnberg: Wirtschafts- und sozialwissenschaftliche Fakultät der Friedrich-Alexander Universität, 1986.
In an old essay, Georgescu-Roegen, who had been himself an agrarian activist in his native Romania, deplored this catastrophic Western predominance and saw it as a threat for socialism: Georgescu-Roegen, Nicholas, "Economic Theory and Agrarian Economics" in Oxford Economic Papers, 1960, 12: 1-40 (on this theme there is an older, more interesting paper by G.-R., a statement of the "agrarian specificity" of East-European socialism which I was unable to retrieve in my files).
Clausius' response to Podolinsky is a striking illustration of the rightness of Georgescu- Roegen's point over the Western despise for East-European agrarian practices and theories: Clausius, Rudolf, Ueber die Energievorräte in der Natur und ihre Verwertung zum Nutzen der Menschheit. Bonn, 1885. "We now live in a marvelous period with respect to the consumption of mechanical energy. In economic relations, it is usually taken as a rule that of anything, only as much is consumed as can be produced in the same period (...). In reality, we go about in a totally different manner, having at our disposal under the earth stocks (...) formed in periods compared to which all historical times vanish. These we are now using and we behave just as the happy heir eating up a rich legacy." The tone of the several references to Podolinsky to be found in the Marx-Engels correspondence is in tune with Clausius': there are no reasons for limiting industrial progress in its tapping of nature's forces: "What Podolinsky has completely forgotten is that the laboring man is not as much a conserver of present sun energy as he is a waste of past sun energy." Marx, Engels, Lettres sur les Sciences de la Nature. Paris: Editions sociales, 1972, p. 109. The book contains 4 pages of comments on Podolinsky, the largest from Engels, dated Dec. 1882.



Tema 2: SPEED

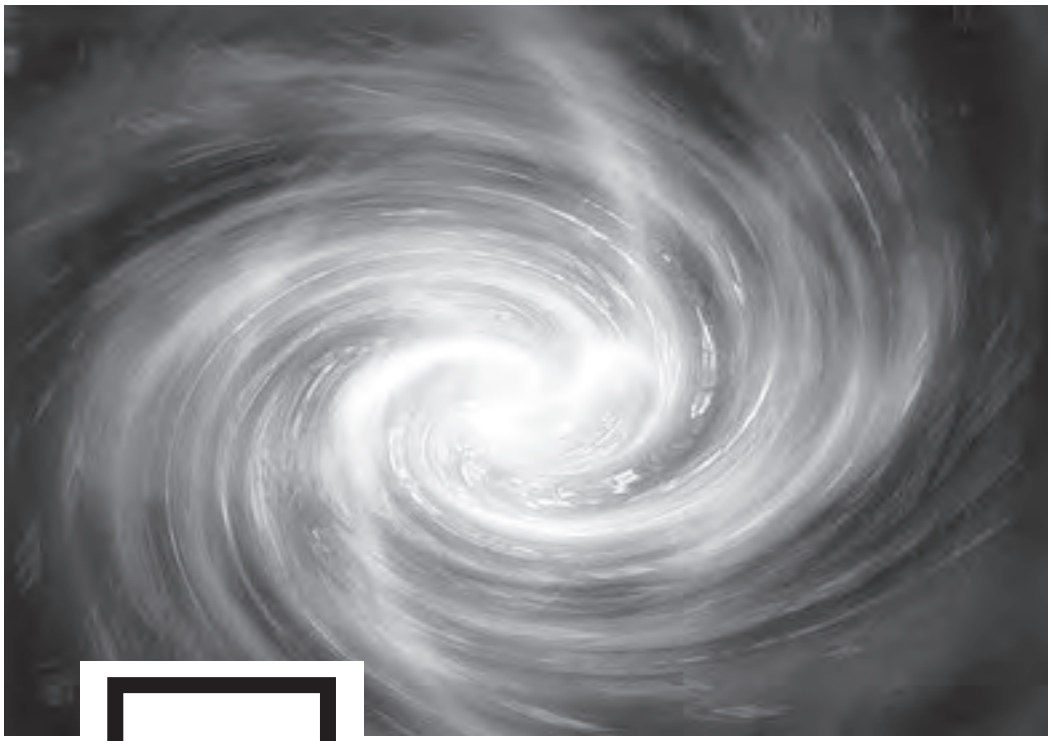
"Speed" As a State of Altered Perceptions (1989)

The Pedestrian Condition (1989)

The Disembodiment of Motion (State College, 1989)

Rain, Steam and Speed and the New Scopic Regime (1989)

Jean Robert



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"Speed" As a State of Altered Perceptions (1989)

Jean Robert

Most of the experiences which are a trivial part of the condition of modern man have a recent history. I myself belong to the generation who still remembers a time when there was no television and I also recall the day when, for the first time, I climbed into a jet: this was in Luxembourg, and the first landing was in Reykjavik. As Iceland appeared between the clouds, like a green and white jewel on a blue mantle, the plane turned into a graceful curve that soon put the island out of sight. When it appeared again, in the windows of the opposite side, I jumped from my seat to follow the beautiful sight. The plane turned again, and the island changed sides once more. It was only after having run to and fro a couple of times that I became aware of the disapproving glances of the other passengers. What I read in their eyes is that one does not behave that way in a plane. I was a quick learner. I spent my next flight glued to my seat.

One does not have to reach very deeply into family records to find an aunt, a grandfather or a great-grandmother who recalled a somehow comparable experience of first-time contact with tools whose use has become routine: Aunt Mary, who spoke into the ear piece during her first phone call, grandfather's tales about his first automobile travel to the South on unpaved roads where he met signs of disapproval by villagers, the stories he used to tell about his mother's memories of the first time she took a train. These are records of first-time experiences which must be carefully distinguished from the ensuing routines. Though they are experienced with the same tools, the initial excitement and the subsequent routine belong to different constellations of perception. First-timers are overwhelmed by a plethora of sensations which overflow the frame of their customary perceptions. Ordinary users, in contrast, have acquired a new perceptual frame which selects some sensations and filters away others.

This essay tries to catch what happens to first-time perceptions when routine takes command.

Records of people who, around 1915 or 1920, traveled for the first time in an automobile, convey something of the special quality of my own first experience as a driver. "Speed," when experienced as frontal sight from a vehicle's windshield is a sudden surge, as if all the usual transitions of motion where abolished.

Proust has described that experience of the "sudden surge" in a text published under the title "Impressions de Route en Automobile" in Le Figaro of November 12, 1907:

I had asked the driver to stop for a while in front of the steeples of Saint-Etienne; but remembering how long it took us to get near to them, while from the beginning they looked so close, I pulled my watch from my pocket to see how many minutes it would still take us, when the automobile stopped me at their foot.

After having been for a long time unreachable by our straining machine, which seemed to skid on the road, always at the same distance from the steeples, it was only during the last seconds that speed, which had been totalized during all that time, became appreciable. And the giant steeples threw themselves so rudely upon us that we just had time to stop before dashing ourselves against the porch.

When it becomes a routine, "speed" ceases to be the experience of the sudden surge of things abruptly flung in our path. The driver becomes a driver by acquiring a new sense of the sequence of events. Learning how to drive is learning how to focus on the freeway, and not on the threatening masses of houses, trees or walls along the road. These become a flow of fleeting images at the side of one's visual field. Only a first-time passenger, or a novice driver can still perceive speed as a "sudden surge" or as the fear of being dashed against an obstacle, and this perception reveals how much he is still a pedestrian; for him, motion is not yet a flow of fleeting images, but still an encounter with solid things. In Swann's Way, Proust writes:

The 'dépaysement' (uprootedness from one's place), the effect of strangeness due to speed allows a modification of the conditions of perception, of the categories of time and space; it helps to break these 'aggregates of reasonings' out of which our perception is made, to de- intellectualize this, in one word, to reencounter the freshness of sensation.

Actually, this text summarizes an expectation of sensory estrangement which was repeatedly expressed on the occasion of the arrival of the first trains, the automobile, and then the airplane. In the first decades of our century, at the time of the first automobiles, "speed" was the experience from which many poets expected to gain that "disarrangement of all the senses" which, for Rimbaud, was the condition of poetic creation.

In the "Manifesto of Futuristic Painters" that they wrote in 1910, Boccioni and five of his friends urged modern painters to paint what their eye saw, and not what their mind "knew." The surprise of things that, because of their unusual speed seemed to be irrupting from nowhere should lead painters "to put the spectator in the center of the picture" and "to force him to accept these new appearances." A bus, for instance, should be painted, not as a box into which people can climb, but as one of those "forces of a street" which Boccioni himself attempted to represent in a famous painting.[71] Here is a sentence from the "manifesto":

> The bus runs into the houses which it passes and the houses throw themselves against the bus to join themselves with it.

In 1912, only nine years after the Wright brothers had built the first motorized airplane and flew it over a distance of one mile, Marinetti, another Futurist, thought that the old world was crumbling and that a new world had to be built out of the vision gained by speed and altitude. He imagined himself riding an airplane through the sweeping plains of the sky:

> It was in an airplane, seated on the gas tank, my belly heated by the pilot's head, that I suddenly felt the ridiculous inanity of the old syntax inherited from Homer. (Marinetti, Le Manifeste du Futurisme).

The words which come to the mind reading the Futurists is "exacerbation of sensations." The perception of speed in means newly experienced is a distortion of previous perceptions. A man who sits in a train, in a car or in a plane for the first time experiences an upsetting of his habitual sensations, not a functional perception eventually allowing him to drive the machine or at least to behave in front of the other passengers. The poetic touch in the first testimonies of vehicular speed is based upon this exacerbation of sensations. Christoph Asendorf speaks of the "new coordination of the senses" which, starting in the mid-19th century, allowed men to build a new vision of nature out of the visual sensations generated by speed. He writes, "The 19th century is permeated with strategies for the reorganization of new sensory perceptions."[72]

71. See Asendorf, op. cit. infra, p. 160.
72. Ströme und Strahlen: Das langsame Verschwinden der Mate.

From the Excitement of the "First Time" to the Tediousness of Routine

Yet, as accustomedness sets in, this reorganization of perceptions under the mediation of mechanical aids is a departure from the perceptual riches of the first-time experience. In order to become functional, the new coordination of the senses must tend toward a state of acquired selective insensibility. For instance, the kind of focusing vision which is required for driving a car is acquired by filtering away most of the profuse "first-time" sensations: houses generally do no "throw themselves" against trained drivers.

The artists who celebrated speed in the decades of the first cars and airplanes attempted to prolong or fix the surprise of the "first-time." They cultivated just those sensations which the training to vehicular locomotion tends to erode. Whatever new visions speed inspired to the artists, these were "disarrangements" of their pedestrian sensory memories, not functional, adaptive ways of seeing.

In contrast, the man who hurries to work coordinates the speed of traffic, the distance to be covered, the reading of the gas gauge, the probability of finding a gas station in this area into a single web of meaning. For him, geography is reshaped by the "miles per gallon of gas ratio" that tells him which territory he controls with what he has in the tank. The idea that distances are covered at a given energy cost calculable in gallons of fuel introduces the logic of equivalence into the perception of the landscape. It is as if the distances between places were in a category with the liquid that fills the tank. The motor is the agent of a transaction in which, in exchange for gas, the landscape is swallowed up by the miles and left behind, sight after sight. In a subtle way, it is as if the common quality of being consumed and left behind gave a sort of co-substantiality to the fuel in the tank and the miles of landscape behind the windshield. Fuel is burnt liberating energy. The sight of the landscape disappears by absorbing that energy which, as any scientist will tell you, is now "bound" as residual energy— "high entropy"—in the very substance of nature.

Discarded Perceptions

I study what the habit of selecting sensory experiences and discarding most of them as irrelevant to orientation does to vision and perception. I nose around in the waste baskets of perception. I wonder about what becomes of smells and whispers, the touch of leaves, the salty taste of sweat when they are disposed of as the "rubbish of experience."

The walker draws a map of potential feelings and sensations which tells him what he can reach with the power of his feet. The driver's map is limited by what "he has in the tank." I see nature one way with my feet, very differently through the window of a machine whose radius of action is defined by gallons of gas.

What the driver "sees" in sites that his body will never meet are references structuring an itinerary. The sights framed by the windshield are not made of the same substance as the smelly mud that stuck to one's shoes. Though yellow as they ought to be, the strawstacks along the way are not made of the straw in which we played. The heath is not the one where we picked blueberries.

The glimpse of warren, bush, and marsh are fleeting images, easily discarded by a push on the gas pedal.

Vehicular locomotion leaves the body in command of only the instruments of driving: decisions about directions—right, left or straight ahead—are left to the hands, while the foot controls speed and stopping. Only the eye still knows the landscape, but it knows it through the commands of feet and hands on the instruments. Driving first deconstructs the unity of action of the senses and limbs; then, along with the acquisition of the necessary reflexes, it reconstructs their unity in a new guise. One can refuse to let this new "coordination of the senses" determine his vision of the world, but he must accept that he cannot behave in traffic if he does not let his perceptions be re-shaped by the driving instruments, the design of the highways and the rules of circulation.

Imagine an extreme situation, an "ideal type" with which real experience can be compared. Imagine a driver who had never been a walker, a man whose only vision is through a windshield. Like the figure of Kafka's Metamorphosis, he would be re-born as a gigantic cockroach, except that his shell would be of steel and glass and his feet of rubber. His new body would be empty of the memories walked landscapes imprint in the hiker's flesh. For him, what others still call the landscape, would consist of weightless images. The windshield would sever the comfortable interior in which his body rests from an abstract outside that

he would not call nature, not even landscape, but perhaps "the environment"—that undefined and half-threatening extension surrounding his vehicular uterus. All his representations of the world would differ from the walker's, who knows that the places he meets with the power of his feet have an independent existence. This theoretical driver would construct his reality on an epistemological ground fitting his confinement in a wheeled box. The images through the windshield—or better, on it—would come and go depending upon his ability to make them appear and disappear through manipulating his instruments and following the map. The visible world, he would state, is contingent on my technical skills. No wonder that such a man would not stop to assist a stranded traveler abandoned by the side of the road: a push on the gas pedal abolishes the disturbing image.

The "Lay Vehicularization" of Perception

When he steps into a vehicle, the walker ceases to be a walker in order to become a driver or passenger. However, no one is a "chemically pure" car driver or commuter. Memories of walked landscapes still mitigate the ultimate vehicularization of perception. Real men differ from the ideal driver in that they sometimes jump from one state to the other. At first, it appears that they have two interchangeable conditions: the pedestrian, in which many traits of traditional man are retained, and the vehicular condition, which is an unprecedented historical novelty. Closer observation, however, reveals that the experience of being a driver, a passenger or a commuter is more than a parenthesis between two pedestrian experiences.

Once he has framed nature with a windshield, the car driver never quite becomes a walker again. He now tends to see all landscapes through an imaginary shield, somewhat as compulsive photographers cannot help seeing you through an imaginary objective. His memories of driven landscapes silently shape his sensations when he walks. He focuses on time ahead as, on the highway, he focuses on the road signals: in one hour, he should be elsewhere. Driven away by an appointment he can't miss, he computes walking distances as if he would cover them with an imaginary vehicle, he tries to speed up, worries about the sweat that now covers his body.

Another symptom of the transposition of vehicular perceptions on pedestrian realities is the specialization of walkers into sub-species: some are called tourists and are recognizable by the cameras hanging from their neck; others, duly equipped with earphones, are called joggers; men and women too poor to afford transportation fares or rich enough to live close to where they work are officially described as practicing "transportation by foot"; the police keep an eye on loiterers, whom they check for their driving license—or, in its absence, their I.D.—and then dictate a destination: "go home" or "come with us." He who still loiters and chats downtown generally speaks Spanish or has a dark skin. He who risks walking along the highways joining the City with its residential suburbs has often an apologizing sentence ready for the police: "I'm going for stamps; I live two blocks from the post office" or "my car is in the shop, so I walked to the supermarket." He who is seen walking in the street needs to be rehabilitated as a pedestrian commuter: he must prove that he uses his feet as others use wheels.

However, there can still be moments where the driver or the commuter can recover for a moment the surprise of a first-time vision. There are days when the freeway which joins the town where I live to the metropolis where I work is free from traffic jams and the bus seems to dance joyfully on the smoothly meandering road that climbs to the pass. Pines, cornfields, ranches along the road, people cleaning fields, the smoke of a charcoal furnace climbing in the dawn sky, the smell of fresh hay, the pollen of the pines, flowers. Car stopped, along the road, men and women picking flowers. Sometimes, for brief moments, the tedious experience recovers its pristine freshness of impression.

At other times, just the opposite occurs and the commuter, for a moment does no longer know if he dreams or if he awakens to a nightmare made true. The wheels get clogged, flows congeal and the assumptions of traffic routines are briefly shaken as if by force of an epistemological subversion. For instance, the driver caught in a traffic jam may, for a while, forget about the power of gas to devour miles and see himself as Adam perhaps did: a fragile fleshy being, now caught in a horde of threatening insects. By empathy, he might suddenly see a human crowd, where only steel shells are visible. In a moment of hallucination, he could even imagine the never before seen: they all step out of their boxes and, as in a painting by Sydney Goodman, they walk nude on the asphalt. Macadam Adam: intimations of obscure or forgotten meanings sometimes overwhelm us in a flash. The flesh of tamed bodies pulsates again.

As the jam dissolves into a lazy flow, hands and feet reassume their function on the steering wheel and pedals. The acquired reflexes of daily routine take command again. Habit and the familiar daydream tame the strangeness of a moment.

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The Pedestrian Condition (1989)

Jean Robert

Pedestrian locomotion is not the abolishing of distances. It is the bodily experience of the intimate distance between unique places and moments. The hiker's tales enhance and sometimes exaggerate the estranging particularities of the far regions into which he ventured. Pilgrims had their most noticeable adventures in the most remote places they had visited, as if the intensity of their experiences increased with the traveled distance. Walking is not a disembodied motion relating an abstract distance to an abstract time. It is not an arrow between an origin and a destination, but an action that can shape its goals realizing them. It is not a scheduled forecast about my body's location within one hour or one day, but an unpredictable event.

The world's center is always under the walker's feet. To him who walks about, nature does not reveal herself as a mere sequence of images, but as an oikos of heavy and smelly substances limited by a horizon.

Far under the perceptual rubles of mechanized transportation, we find a form of locomotion which does not fit the schedules, the maps nor the internal arrow of whom who considers that time is the cost of an operation whose benefit is the attainment of valuable locations.

Any activity that puts means at the service of predetermined goals, Aristotle calls a motion.

He opposed motion to action, an activity which, like playing, sets its own goals and reveals the world in always new and unexpected ways. We have to contrast the perceptual habits gained in mechanical locomotion with a form of movement which was both an action and an always surprising revelation of this world's stuffs. I found inspiration in the works of two great phenomenologists.

Substantial Motion Versus the Vain Destiny of Fleeting Images

In his essay on the imagination of matter, Bachelard establishes a distinction between movements that entail "an essential destiny that endlessly changes the substance of the being," and "the vain destiny of fleeting images and a never-ending dream" (Water and

Dreams, p. 6). Motion either brings forth the substantial essence of moving stuffs, or it is a vain succession of immaterial images. True movement always reveals something of the substantial depths of the visible world.

The experience of motion is essentially the bringing of things into the presence of one's body in the revelation of their materiality. Substance-less, motion is nothing—it can be construed as a vain succession of weightless images. Bodiless, motion is a dream. It is not enough to say that motion is always motion of something: its true nature lies in the acts which, from the depths of substance, bring the materiality of the world into our incarnated presence. The walker's movements bring existents which were at best only potentially there—in thought or in memory—into the realm of his vision. It is by my movements that immobile objects facing me reveal their hidden face and become seizable. It is my motion which will reveal the things presently behind the horizon.

Conversely, nature seizes us in her motions. The world is an experience of seizure. In the sense of that double grasping, a doctrine of motion that would start from these powers of reciprocal revelation would be a "haptology": a science of the mutually palpable presence of the world and the body. Yet, the actuality of this seizure is, in itself, inexpressible through words, for we can only speak of motions that have happened and make guesses about their continuation.

In spite of all their merits, the physico-mathematical theories of motion that fix its trajectory in space-time miss this "haptologic" dimension. To regain a pristine conception of motion as the mutual seizure of the body and things, we must attempt to conceive it without our usual a priori's of space and time, as an experience that precedes, and not follows any reference to rods and clocks.

Before it could possibly be scheduled and mapped, perhaps before the conceptual invention of space and time, motion was the modality of our vision. Schedules, trajectories and space-time coordinates are means to catch, not the unseizable "haptologic" moment of motion, but its dead trace once it has passed away and to make that trace available to the eye as "trajectory." Trajectories are the past-ness of future motion, not its unspeakable present.

The "space" and "time" of actual motion, experienced in the flesh, is not the metric space-time of mathematics and physics. Embodied movement engenders its own "spime," which

is why it is so radically different from the motion of a mechanical contraption in the lab. Walking is a moving experience which, only by an abuse of language, can be dealt with in the terms applied to mechanical locomotion. The act of walking is the complement to the act of seeing. As Gibson has shown, seeing is an ecological act: it opens up an oikos to be seized, smelled, tasted, heard and seen while walking.

The walker sees nature with his feet as well as by walking her with the feet of his eye: even in the darkest night, a special fatigue in the ankle allows him to "see" the steepness of a path. At dawn, he who wants to climb a mountain prepares himself by evaluating and feeling "in the calf of the eye" the distance to be covered.

The walker's space is a manifold of actual and potential body sensations: not only the hill actually climbed is mirrored as fatigue in the walker's calves or the rider's loins, but distances to be covered are evaluated as potential sensations of effort. This sensation of movement is the reflection, in the walker's flesh, of nature's motive injunctions. As long as man was a pedestrian or horse rider, the perceived movement of things could be echoed in his entire body which was then, with all his senses—not just the eye—the sensorium of motion. Nature's movements were challenges to man's actions and claims for new gestures to be performed. When man could experience nature's motions by being immersed in them and responding with his own movements, every particular motion bore the coloration of a particular element: violent water, through which the swimmer escapes using all his muscles was radically different from the volutes of fire, from the wind's action on the dauntless walker or from the crumbling weight of earth. In a pedestrian world, nature's challenges are always embodied in material elements.

The perception of things in motion is, following Bachelard, strengthened by the knowledge of the depth of a particular element. This element, for him, was water. Water gave his imagination of matter its "fundamental color." For he was born "in a section of Champagne noted for its streams, its rivers, and its valleys—in Vallage, so called because it has so many valleys." Thus, his preferred image for substantial motion was flowing water. He never saw water as the ocean's surface, which evokes an infinite extension, but as the stream of rivers or the flow spurting from a deep underground spring, "for, in my own reverie, it is not infinity that I find in waters, but depth." Movements of water surging from the depths are, for Bachelard, the carriers of remembrance. They first remind him of Vallage, where "matter" is never abstract—tasteless, colorless, devoid of tactile qualities—but always embodied in sensible stuffs.

But the region we call home is less expanse than matter; it is granite or soil, wind or dryness, water or light. It is in it that we materialize our reveries, through it that our dream seizes upon its true substance. From it we solicit our fundamental color. Dreaming by the river, I dedicated my imagination to water, to clear, green water, the water that makes the meadows green. I cannot sit aside a stream without falling into a profound reverie, without picturing my youthful happiness. It does not have to be the stream at home, water from home. The nameless waters know all of my secrets. The same memory flows from all fountains. (Water and Dreams, p. 8).

"Dreaming by the river," letting water give him its "fundamental color," Bachelard made of flowing water a metaphor for motion. Readers of his other works might find my statement too exclusive and object that he recognized that each one of the elements—earth, water, air and fire— called for its specific imagination of substantial movement. He dedicated another book to the imagination of air and even gave it the subtitle "Essay on the Imagination of Motion." Bachelard, however, remained exterior to the invisible air volutes which shape and sustain the spectacle of the vault of the heavens. He was not a wind hero, a dauntless walker who, like Nietzsche "bends forward in the face of the wind, against the wind," whose walking stick "pierces the hurricane, makes holes in the earth, thrusts through the wind."

The movement which brings water from the depths to the visible surface allowed Bachelard to understand motion as an epiphany of the materiality of the world. What, for the sake of references to come I will call "substantial motion" (motion that brings forth the substantiality of things), Bachelard understood in accordance with the movements of the flesh it induces or demands (Ibid p.159). Again and again, he insisted that reality cannot be founded as a succession of images in a human's eye. I bring nature into my sensible presence by the movements of my flesh, and, in her motions, she responds by her active presence. "I see" means that my movements actualize as visible the potential existents which nature brings forth from her depths. Between nature—which Aristotle defined as a "principle of motion and change" (Physics 200b)—and my body there takes place an interplay of mutual challenges and responses through which both establish their carnal presence. It would be as silly to claim that nature is "an image in my eye" or "a representation in my mind" as to say that I am a dream of nature.

To address that carnal presence in a mutual activity, Bachelard—who wrote fifty years ago— spoke of "man's labor," the objects' "coefficient of adversity," our "offenses" and the elements' "anger." He wrote:

> ... as soon as we begin to distinguish—as I have tried to do by considering the composition of water and earth—every matter in accordance with the human labor it induces or demands, we shall not be long in understanding that reality can never be well founded in men's eyes until human activity is sufficiently and intelligently aggressive. Then all the objects of the world receive their true coefficient of aggressivity.

And: We will bring Schopenhauer's insight to its conclusion; we shall compute the sum of intellectual representation and clear will from The World As Will and Representation in a formula: The world is my provocation. I understand the world because I surprise it with my incisive forces, with my directed forces, in the rightful hierarchy of my offenses, which are like embodiments of my joyous anger, my ever-victorious, ever-conquering anger. Insofar as he is a source of energy, a being is an a priori anger. (op. cit. p. 159, 160).

We should not misread these lines as allusions to the offenses of homo industrialis or to the threats of climatic catastrophe. Bachelard searched for strong words to express the mutual claims of carnal presence of body and nature. His "labor" is my effort in walking, his "provocations" are my dauntless steps into the wind. An object's "coefficient of adversity" is the resistance felt in my flesh when it opposes my "incisive force": for example, the experience of lifting rocks to build a stone wall. My joyous anger corresponds to the anger of the elements, embodied in motions of earth, violent water, wind and fire. Bachelard was in search of the conditions of a pristine vision, which for him were no other than the conditions of the world's material reality and of my carnal presence in and to it. If, hearing his words, we cannot help thinking of our industrial offenses and our frozen anguish, it is because we have understood that we live in an epoch capable of limitless provocations but insensible to nature's elementary angers. Our aggressions are disembodied, our angers mindless. Nature's flesh has been peeled away. Like heavily loaded clouds before the storm, the elements keep a threatening silence. Bachelard died before pollution and ecological disasters manifested nature's obvious response to our industrial offenses; and therefore, he is at risk of being misunderstood.

Merleau-Ponty's understanding that the body "is an intertwining of vision and movement" echoes and completes Bachelard's intuitions. Substantial motion, which Bachelard called nature's elementary "anger," responds to my "provocations"—my claims of carnal presence—and elicits my "labors." Nature's angers, which reveal her deep, elementary materiality and my labors are the two complementary sides of the

same being. In The Primacy of Perception, Merleau-Ponty articulates the complementarity of these two sides:

In principle, all my changes of place figure in a corner of my landscape; they are recorded on the map of the visible. Everything I see is in principle within my reach, at least within reach of my sight, and is marked upon the map of the 'I can.' Each of the two maps is complete. The visible world and the world of my motor projects are each total parts of the same Being. (The Primacy of Perception, p. 162).

The "map of the visible" intimately coincides with the realm of my motor projects. What I see cannot be disembedded from what I can reach, seize, taste, smell, hear. No ideal "image" can be abstracted from these powers and their challenge by nature's moves. It is only by a kind of ellipsis that one can say that the senses "overlap" in a joint action, for they were never severed in the first place. In this joint perception, or synaesthesia, things are present before any analytical reduction of their perception to "sensorial data": eyes eavesdrop, words enlighten, feet see and the nose touches the body's aura.

We do not "think sufficiently" of the complementarity of "the map of the visible" with the realm of the "I can":

> This extraordinary overlapping, which we never think about sufficiently, forbids us to conceive of vision as an operation of thought that would set up before the mind a picture or a representation of the world, a world of immanence and of ideality. (op. cit. p. 162)

The breach of that overlapping opens the door to a picture of nature, sets up before the mind "a representation of the world, a world of immanence and ideality." Nature's destiny becomes the vain fate of "fleeting images and a never-ending dream" (Bachelard) and Merleau-Ponty reminds us that the word "image" generally refers to "a copy, a second thing" (op. cit. p. 164).

The world becomes a self-referent copy

We can now understand what radically distinguishes the vision of nature through a windshield—the "kinetic experience"—from the experience of walking. Our projects of vehicular displacements—let's call them our "automotive dreams"—do not match nature's substantial movements nor do they elicit her elementary angers. The old map of the "I can" is replaced by the map of "what I have in the tank." The act of seeing ceases to be the complement of the act of walking. Frozen by the windshield glance, nature becomes a neutral environment. It thus becomes clear that the essence of the kinetic experience is not the quantitative intensity of speed but the qualitative dislocation of the two sides of being which the walker knows as one. Speed produces a bipartite division of the flesh of perceived nature into, on one side, a quasi-immaterial environment manifest as sequences of fleeting images and, on the other, a body enclosed behind shields and screens.

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The Disembodiment of Motion (State College, 1989)

Jean Robert

Let us delve into the perceptual sediments of a century of car-related routines. Under that accumulated alluvium, we find the strata of pedestrian locomotion, with which we will contrast railroad journeys. Up to the epoch of the first iron ways, around 1830, everybody was a hiker or traveled in coaches at walking or riding speed. Pedestrian was almost a synonym for "common man" and in many languages, "horse rider"—cavalier, Ritter,

caballero, chevalier—was the first distinction from the common condition. Except for brief moments of gallop, the rider's pace is twice or thrice faster than the walker's. Let's imagine that the speed of human locomotion, today, be within the range of the velocities of walking and of driving a bicycle. Such a narrow spectrum of possible speeds would not allow for essential differences of perceptual modalities to occur. The bicycle and the horse enhance or exacerbate perceptions, but they do not break the circle of the pedestrian condition. The rider, or the cyclist are immersed in nature's materiality, even if they pierce the wind rather than pedestrians.

The pedestrian's is a condition of immersion and embodiment. The walker meets the sites of nature with his legs, his nose, his ears and all the pores of his skin. For him, there are smelly places, others are recalled for their unique rumor. Besides, places vary with the seasons and the hour of the day, constituting local "spimes" remembered by the walker's body. The feeling of sweat in my armpits will always recall me that fountain under a Jura pine where, on a summer afternoon, we washed our skirts and let the sun dry our sweating chests. I can still name the friends who remember that place, that day.

Through all of history, up to the modern epoch, the feet had defined the scale of inhabited places. The pedestrian condition common to all shaped common perceptions of natural sites and landscapes. The king, then, hardly traveled faster than his subjects and he perceived nature the way they did: by walking her or riding in her. For the best and the worst, neighbors truly dwelled in the same place, and every place engendered its peculiar perceptions and representations of the close and the far, this and the other world. Every inhabited site was, as E.V. Walter writes, "a unity of experiences organizing the mutual (...) influence of all beings within it."[73] It was a stage on which reigned a particular unity of place, time and action. An intimate distance, which was felt in the legs, but was also evaluated in kinship or in intensity of friendship or enmity made every site distinct from the next and gave it, in Walter Benjamin's words, its unique aura. Things, like places had, Benjamin writes, an aura of uniqueness: they were not reproducible. Except printed books, no object was an exact copy of another one, an even a book, in a given region, was generally unique, because the next copy was out of reach. In his essay on the village of Montaillou in the 13th century, Leroy Ladurie speaks of the man who possessed an exemplar of Ovide's Art of Loving and was known round about for that.

73. Eugen Victor Walter, Placeways: A Theory of the Human Environment, Raleigh: University of North Carolina Press, 1988.

Pedestrian locomotion is not a disembodied motion relating an abstract distance to an abstract time. It is not a scheduled forecast about my body's location within one hour or one day, but an unpredictable event. The world's center is always under the walker's feet.

Far under the perceptual rubles of mechanized locomotion, we find a form of motion which does not fit our schedules, our maps, nor the internal arrow of whom who considers that time is the cost of an operation whose benefit is the attainment of valuable locations. Any activity that puts ends at the service of predetermined goals, Aristotle calls a motion. He opposed motion to action, an activity which, like playing, sets its own goals and reveals the world in always new and unexpected ways. We have to contrast the perceptual habits gained in mechanical motion a form of motion which was both an action and an always surprising revelation of this world's matters.

The old philosophers who thought that motion is an actualization of substantial forms understood its nature differently—and perhaps more genuinely—than the modern scientists who draw its trajectories in coordinate space-time. For them, motion was an "actualization," by which they meant the bringing into being of a potential existence. In order to see how right they were, and in what, we don't need to share their belief in predetermined and eternal potentialities or "forms." It is sufficient to understand that motion—my body's and nature's—has the power to actualize existents into sensible beings by bringing them into my carnal presence.

The walker's movements bring existents which were at best only potentially there—in thought or in memory—into the realm of his vision and in this the ancient philosophers were right: motion actualizes hitherto hidden possibilities of being.

Unlike modern scientists, who freeze motion in graphs, the medieval philosophers attempted to catch its actuality with words. They defined it as a perfectio, by which they meant the bringing forth of a substantial form and its completion. They recognized that the via ad perfectionem (the path to that perfection) could be studied as something different from the "perfectio" itself, but they resisted the temptation to take the path for the motion. They insisted that the essence of motion was actualization. Further, if I see "actualization" as the bringing into my presence of things hitherto only potentially existent for me, I come to understand that the medieval philosophers—the great Scholastics or "Schoolmen"—were also great walkers, for their philosophy fits the experience of him who knows nature by walking her.

Galileo studied abstract trajectories in space-time, not motion as that which brings potential existence into sensible being. A theory of motion centered on trajectories and framed in an aprioristic space-time necessarily concentrates on repeatability and predictability. On the contrary, motion, experienced in the act of its completion, is never quite predictable because one does not know which hidden aspect of being, which "substantial form" it is going to bring into his presence. The "space" and "time" of actual motion, experienced in the flesh, is not the metric space-time of mathematics and physics. Embodied movement engenders its own "spime," which is why it is so radically different from the motion of a mechanical contraption in the lab.

A philosophy of walking is a philosophy of vision and, conversely, the philosophers who start their inquiry by asking "what is there, there?" used to be walkers: were not Aristotle and his students called "the ones who walk about," the "Peripatetics"? Through the middle ages, up to the beginning of modern times, philosophers who followed Aristotle's example and commented on his works claimed that same name for themselves, signifying that walking is the complement of the philosopher's vision.

Did not Socrates himself initiate the dialogue with Phaedrus with the injunction: "Move forward"? They went out of the city, took a stroll, and while walking reflected on the spell cast by letters on sensible being.

The walker sees nature with his feet as well as by walking her with the feet of his eye: even in the darkest night, a special fatigue in the ankle allows him to "see" the steepness of a path. At dawn, he who wants to climb a mountain prepares himself by evaluating and feeling "in the calf of the eye" the distance to be covered.

The alphabet first engendered a realm which is open to the eye only. The man of letters sits behind a desk. While his eyes pour over the pages, he sometimes dreams that he's left his body behind. What the mastery of the alphabet's technique once allowed a well-trained minority—letting the eyes abandon the body—the technology of speed internalized into everybody's perception.

Kinaesthesia

The walker's space is a manifold of actual and potential body sensations: not only the hill actually climbed is mirrored as fatigue in the walker's calves or the rider's loins, but distances to be covered are evaluated as potential sensations of effort. This sensation of movement or "kinaesthesis" (from Greek kinein, to move and aesthesia, sensation) is the reflection, in the walker's flesh, of nature's motive injunctions. As long as man was a pedestrian or horse rider, the perceived movement of things could be echoed in his entire body which was then, with all his senses—not just the eye—the sensorium of motion. Nature's movements were challenges to man's actions and claims for new gestures to be performed. This is how I understand the phenomenologists's intuition of an intentionality of nature.

Seeing Becomes "An Operation of Thought"

The ambiguity of speed—which can be experienced as a thrill or as unspeakable boredom, as the excitement of a departure from routines or as the most enslaving grind—lies in that dislocation of vision and bodily motion. In its "first-timeness," the kinetic experience could be a kind of premonition of that "systematic disarrangement of all the senses" which, after Rimbaud, was seen as a possible door to poetry for it shook the ground of common sense judgment. Yet it is a disarrangement or"dérèglement" only as long as it is experienced in a frame of pedestrian references. In that frame—as long as it holds and the body is not tamed—speed creates an illusory extension of the map of the "I can" and extends my motive projects. Then—as soon as I feel comfortable sitting quiet on my seat—a chasm is introduced between motion and vision, but speed still maintains me in an interesting state of giddiness. As long as the traveler is a transported pedestrian, motion is still substantial. Then, while nature's elementary angers seem more intense and colorful, the body surreptitiously recedes from their reach. When the chasm becomes the rule, the interesting "dérèglement" ceases and the windshield becomes the frontier of a new covenant: inside, the internal swarming of bodily stuffs under the skin; outside, the unbearable lightness of things in motion. Speed breaks the overlapping of the visible world with my motor projects.

When speed imbues the space situated beyond vehicular enclosures—the environment—with never-ending motion, motion becomes a disembodied flux of forms. Bodily exposure to mechanical speed—the "kinetic experience"—dramatizes formal aspects of nature, like tectonic lines, orological textures and materializes geometries: straight lines, horizontal planes, intimations of sphericity beyond pedestrian horizons. The routinized experience of speed severs the imagination of matter from powers of judgment grounded in the overlapping of "what I see" with "what I can." Like a dust, stuffs whose substantiality is not attested by intuitive judgments can stealthily cover the ground of synaesthetic perceptions and muddle judgments to come. It is then time to step out, extend your legs, shake off that unsubstantial powder and cleanse the eye of your feet from this cloud of dust.

If speed can extend its realm beyond all the limits of a pedestrian common sense, it becomes a reality-shaping experience. The ground of judgment is crushed, reality is molded in the new stuffs. Taking Greek etymology seriously, I call it a neo-plasm, a newly-cast matter. Unless we watch out, it will proliferate and pollute all the interstices between whatever synaesthetic harbors we have managed to keep. The neo-plasm is but a bad dream: it is matter in its absence, as only a numb, legless and handless no-body could possibly imagine it.

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Rain, Steam and Speed and the New Scopic Regime (1989)

Jean Robert

In 1844, during the years of enthusiasm recalled as the decade of the railroad mania, an already well-traveled lady described the strange dance of an individual who visibly did not yet know how to behave in a train compartment. In the coach seated opposite her, she commented, was an elderly gentleman, short and stout, with a red face and a curious prominent nose. The weather was very wild, and by and by a violent storm swept over the country blotting out the sunshine and the blue sky, and hanging like a pall over the landscape. The old gentleman seemed strangely excited at this, jumping up to open the window, craning his neck out, and finally calling to her to come and observe a curious effect of light.

The story, or rather the gossip was circulated by a Mrs. Simon during the Royal Academy Exhibition of 1844, of which the masterpiece was William Turner's Rain, Steam and Speed, which showed the Western Express crossing the Maidenhead Bridge over the Thames. The old gentleman was allegedly Turner himself whom Mrs. Simon, as she reported, had witnessed jumping and exulting in the train like a first-timer.

If the story wasn't true it was, as the French say, well invented. Rain, Steam and Speed has the freshness of a first vision. What it shows is the power the railroad exerted on the landscape, its "perception-shaping" force.

A Landscape Shaped by a Machine's Rhythms

Though the sky occupies more than half of the picture's surface, it is not a skyscape in which the clouds and the light piercing through them would play the dramatic part, as in Snow Storm, painted two years earlier. Nor is the sky of Rain, Steam and Speed the uniform grey lid that takes hold after days of bad weather, when it seems that the sun has lost the force to pierce the lead of fog condensed into low clouds. It is a threatening sky, but the threat is diffuse and suspended, as in the composure which succeeds a thunderbolt, when a cumulus, like a pierced barr verge of pouring a local deluge, but it hasn't happened yet. It might not happen, for the thunderbolt with which the sky resonates is not a heavenly, but an earthly explosion: it is the tumult which accompanies the train's sudden appearance.

Patches of the left part of the picture are still illuminated by sun rays, as if some parts of the landscape remained indifferent to the mechanical storm. More than an elementary uproar, the sky of Rain, Steam and Speed suggests a broad open space—in part diaphanous, in part veiled by stripes of rain—laden with the tension of a man-made conflagration. The line of the horizon is blurred, but it would not be adequate to say that it is hidden behind a veil of fog. It rather dissolves into a white substance that suggests infinity.

It is from that white that the train emerges like a fist blow. The train? No, the whole system of the railroad: the locomotive, the steam ribbons it adds to the strips of rainy fog hauled by the wind, the iron tracks and the black mass of the bridge that sustains the whole. The iron way is perfectly rectilinear and its tracks, like the strokes of light which suggest glitters on the convoy's wheels, converge toward a point that loses itself in the milky infinity of the horizon.

Whatever this is—a black monster, a technological structure, the Machine or the New Age—comes from very far. It does not properly belong to the landscape but a closer examination reveals that it structures it. Though the touch is of a quasi-impressionistic facture, several convergences of lines suggest that the infinite point from which the Thing stems coincides with the vanishing lines of the picture's perspective.

The technological infrastructure of the bridge is in strong contrast with the impressionistic conception of the rest. The two lines marking the edges of the bridge are so straight that the

painter must have traced them with a rod and though the tracks themselves, because they catch twinkles, partly dissolve into the space of light, the dark streaks that indicate their presence also organize themselves along perfectly straight lines.

Once Turner obtained the ideal point of convergence of these four beams of light and shadow, he must have marked on the canvas some other straight lines irradiating from that point, for the crest of some hills and of a remote forest also converge toward it. Some of the underlying lines of construction even seem to lurk, in a pentimento-like fashion, from under the brushes. I suggest that it was only once these constructive indications had organized the canvas that Turner surrendered to that kind of "acting painting" which so impressed a young onlooker who was to become the art critique G.D. Leslie, and, years later, recalled it in these terms:

> He used rather short brushes, a very messy palette, and, standing very close up to the canvas, appeared to paint with his eyes and nose as well as his hand. Of course, he repeatedly walked back to study the effect.

Leslie goes on to tell how the painter commented with him "the little hare running for its life in front of the locomotive on the viaduct" and even suggests that Turner did it to show him how painters of old would have represented a fast motion. Another allegoric intimation of the same style is the figure of a man ploughing on the plain below the viaduct which, Leslie recalls, evokes the name of a popular country dance, "Speed the Plough."

These are, however, hat bows to means of allegoric representation of the past or, as modern art critiques would say, "quotations." In Turner's picture, speed is not only emblematized—as it was for instance in Rembrandt's Landscape with a Coach, where a young boy running after the coach stood as an emblem of movement. Speed impregnates the whole space of the picture, and structures its meteoric and tectonic forces anew. What the whole space is filled with is the noise of the train.

Looking at Rain, Steam and Speed, the modern onlooker cannot help evoking The Cry, that picture by Edvard Munch in which a whole landscape seems to be molded in the vibrations of a shout. In Turner's painting, the noise seems to stem from the same

point from which the black mass of the railroad jumps into reality, and it is echoed by "perspectival reminiscences" among the lines of the hills and of the sky, as if the landscape's tectonics would vibrate with the artificial noise.

The train comes and its noise seems to suspend everything. What the noise does to rural rumors, the railroad and its infrastructure do to the landscape. The tracks have no locus, they know no "topos," respect no sense of "a concrete place." They do not meander, like old roads and they ignore valleys and hills. Their straight line floats, or better, the train with its infrastructure does not inhabit a place: it occupies a space. The structural integration of the iron way into the composition of the picture suggests that the railroad creates the space that it fills with its noise.

Once the train will have crossed the landscape, this will never again be the same.

A Chasm between Two "Landscapes"

The black shape of the railroad cuts the picture into two unequal parts, as if it were dismembering the body of the landscape. The right part is already re-structured by the new force and seems animated by a syncopic rhythm punctuated by vertical strips which resonates with the monster's noise. And look at the oblique alternating bands of rainy air which makes the bridge vibrate with the noise, taa ta ta ta, taa ta ta ta, scanning perhaps the music of the new age?

Intimations of verticality suggest the edge of a city beyond the field where a single individual passes the plow, probably chanting—as Leslie suggests—"Speed the Plough" at the new rhythm of production.

On the contrary, on the left side of the picture, we are recalled of the landscape of old: a "riverscape" under the arches of another, older bridge in which a man in a boat is fishing. On the river side, a group of bathers plays games and beckon some invisible travelers with the hand.

Remembrances of previous modes of perceiving and painting the landscape, "quotations" of the baroque palette, of the Romantic sky.

The lesson of Rain, Steam and Speed is that speed—mechanical motion and its action on the flesh—unlike the tectonic and meteorological forces of the Romantic landscape, cannot be "represented." By an irony of History and the unique genius of an old man, it was given to one of the creators of the "Romantic landscape" to understand this. In the "Romantic landscape," the elements—wind, fire, water, earth—were the actors. Speed is not an "actor" on the scenery of nature, but a force organizing its perception. What we, today, call "the environment" is perhaps the landscape seen through the looking glass of speed by the successive generations which came and passed since Turner painted a train. Or better: "speed"—the vision of nature through a vehicle's window—changed people's gaze.

The Kinetic Experience

The black mass of the tracks and the viaduct materialize the lines of construction of linear perspective. Yet, the space which is constructed by these lines does not reveal itself from the vantage point of a window in reality. Rain, Steam and Speed is a perspective without a window in a real place, it offers a viewpoint without a standpoint. In Turner's time, no real body had ever occupied the position from which the Maidenhead Bridge is represented and, today, only the helicopter, which stays immobile at any distance above the landscape could make it "real." This disembodiment of the onlooker's position is Turner's means to express the specificity of the new experience of speed. In its literary expressions, the core of the kinetic experience—that is of the experience of speed apprehended from vehicles—always implies the establishment of a fictitiously fixed vantage point from which the apparently immobile body sees the landscape as a space of images in motion. The habituation to speed, which renders veteran travelers numb to the profusion of impressions which overwhelms first-timers, amounts to a progressive reification of the imaginary place from which the landscape is seen into a stable space.

Upholstered seats, framed pictures on the walls, curtains at the windows, a whole register of symbols of stability borrowed from the architecture of all times make the mobile point look immobile. By contrast, the vividness of the first kinetic experience relied on the ambiguity of the newly gained vantage point, on its radical difference from all previous experience of being in a place. Turner wants to represent the space generated by the railroad while remembering the freshness of his first-time experience: his standing point is not solidified.

In its genuine profusion of stimuli, the kinetic experience is first an estranged glance at real places. Then, as the mobile vantage point solidifies into the simulacrum of a room, the landscape in imaginary motion dissolves into fleeting images in space. Or, to say the same in other words: speed and windshields first separate the body from sites which were still imprinted in the flesh. This ambiguous situation corresponds to the short period of exultation of the first experiences.

Then, accustomance makes the eye oblivious of "how it felt in the legs" and numb to the tastes and smells of seen things. The gaze becomes a dream-like sense of fleeting shadows.

In the kinetic experience, the onlooker is excluded from nature by the effects of speed and of the windshield. His perception of motion is dissociated from the feeling in the walker's calf of the leg or of the rider's buttocks. He sits quietly on a bench while, around him, everything turns, all is motion. Astonished, he experiences a motion that his body does not acknowledge.

Here is how an overwhelmed Victor Hugo described his first kinetic experience, in the train between Brussels and Antwerp, on August 26, 1837:

> It is a magnificent motion, that one must have felt to appreciate it. Speed is something unheard of. The flowers on the road are no longer flowers, but spots, or rather red or white stripes; no longer points, everything becomes a line; the wheat is a big yellow blur. The alfalfa fields are large green braids; towns, steeples and trees dance and mingle madly on the horizon; from time to time, a shadow, a form, a standing specter appears and disappears like a lightening: it's a railroad guard that, following military custom, presents arms to the convoy.

Jean-Bertrand Barrère, from whose book on "Victor Hugo's Fantasy" I borrowed this passage, comments:

> Joy opens his eyes. His gaze, always so sensitive to fresh impressions, first seizes the prodigious transformation of the landscape. Instead of dismantling it, speed recreates it, differently. He attentively acknowledges this new geometry of perception: 'no longer points, everything becomes a stripe.' It is an original modality of vision which, as any other, one must learn.

It was in 1837, too, that Théophile Gautier took the train for the first time and reported the following impressions:

> ... the trees fled, right and left, like a defeated army; the steeples disappeared and flew to the horizon; the gray earth, striped with white spots, looked like an immense guinea-hen tail; the stars of the daisy, the golden flowers of the rape lost their shape and hatched the dark background of the landscape with diffuse stripes; clouds and winds panted to keep up with us.

Turner's genius consisted in integrating his first-time impressions into a new spatial logic. He gave the constructive character of the space generated by speed its first pictorial expression. Rain, Steam and Speed is a picture without a foreground because speed dissolves close objects— "the flowers along the road"—into colored stripes. Since the kinetic experience melts all solids into thin air, Turner located the onlooker in the atmosphere, at an ideal point some fifty yards above the bridge. It was how he could paint the train seen from the outside, and yet convey the essence of the kinetic experience which lies in the dematerialization of the immediate surrounding. Alternating bands of rainy air constitutes the only foreground the onlooker is left with; by means of that dematerialization of his standing point, the painter translated his original exultation— "ex-sultation": leaping up— into a literal ex-altation, a physical elevation of his body.

From that imaginary vantage point, he discovered what Hugo and Gautier could not see from their wagons: speed does not only exalt the perceptions of first-timers; the repetition of the kinetic experience also substitutes a cold, homogenous extension—the mentally constructed space of the picture's right side—for the concrete diversity of places and sites.

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