1. Aristotelian powers

Demise of *potentiae*: One casualty of the demise of the Aristotelian notion of substantial form was the idea that each thing (or each kind of thing) can be characterised by its *potentiae*, potentialities to undergo certain kinds of change. The substantial form of a thing defines a set of intrinsic causal powers aimed at the perfection and reproduction of the form and the exercise of those powers accounted for all observable natural change.

2. Inertial conception of matter: Mechanists appear to eliminate causal powers by asserting that

(i) matter is inert, (and, therefore,)
(ii) that any force or power to move or produce change could only belong to incorporeal substances (spirits, God – the “other director”, plastic natures, vital elements or Leibnizian monads).

Descartes (from the letter to More; August 1649):

“*matter left to itself and suffering no impulse from anything else is clearly at rest...however, impelled by God, it has as much motion or translation conserved by him as was laid down from the beginning.*” (AT V: 404)

However, matter is inertial but not inert. If a body is at rest, it will not change unless interfered with by something else. But rest is not a negative state and resistance to change takes force.

Descartes needs force. Alan Gabbey (1971, 12-13): Beeckman and Newton realised that without active forces there would be no ground for the conservation of motion.

Beeckman: motion in a vacuum would decrease not increase without an active force to sustain bodies in motion and in equal collisions where no body surpasses the other, neither would be deflected nor transfer its motion to the other. In equal collisions bodies should “tend” towards rest. (*Journal tenu par Isaac Beeckman de 1604 à 1634*, vol 2, 45; 31 May- 7 June, 1620)
Descartes' first collision rule (Pr II. 46) predicts that bodies in this scenario would spring apart but what accounts for this elasticity if bodies are inert? As we shall see, Descartes refers to forces “of acting and resisting” (AT 8A: 66), distinguishes them from motions (PR II. 25), claims they are modes and as being conserved in collisions (AT 5: 404). But what is a force?

3. Three interpretations of ‘force’

Des Chene (Physiologia. 1996: 330-1) notes three ways that Descartes’ notion of force has been interpreted:

1. Force pertains solely to divine action (occasionalism)
   Malebranche: 'When a body at rest is struck by another body, it begins to move. You can believe here what you see...but you should not judge that bodies have in themselves moving force.... for you see no such thing...’ Med. Chretiennes. V.5; OC 10:48.

2. Force pertains both to divine action and bodies

3. ‘Force’ is a façon de parler, a way of describing how bodies will act according to the laws of motion – the deflationary reading.

Garber (1992: 298): “forces...can be regarded simply as ways of talking about how God acts, resulting in the lawlike behaviour of bodies; force for proceeding and force of resisting are ways of talking about how, on the impact-contest model, God balances the persistence of the state of one body with that of another.”

Des Chene: 2 and 3 can be reconciled, because ‘force’ as it applies to bodies is a way of characterising God’s action in terms of its effects on bodies. (cf Gabbey’s “Janus-faced” conception.) Force is real, but force in bodies is just God’s efficacy from the perspective of individual bodies.

“Descartes...defines matter as res extensa in part just to exclude active powers. Indeed, in his physics, if not his psychology, the very notion of concurrence begins to lose its grip. Concurrence is co-action, not action simpliciter. But if bodies do not act, there is no concurrence; there is only the outright effecting of change in the physical world by God alone.” (Des Chene, 1996: 341)

4. Proposal: Forces are Tendencies

Descartes’ laws are tendency laws: They state what happens if nothing interferes, not what always or even usually happens. Because of the laws, bodies
exhibits all sorts of tendencies which may never be fulfilled but which are causally relevant to explaining their behaviour.

**First Law**: that each and every thing, in as much as it is in itself (*quantum in se est*), always perseveres in the same state; and thus what is once moved, always continues to move. (AT 8A, 62)

**Second Law**: that every motion is in itself rectilinear; and hence any body moving in a circle always tends (*tendere semper*) to move away from the centre of the circle which it describes. (AT 8A: 63)

Bodies moving in a circular direction tend to move along the line of the curve (centripetal force) and in a straight line away from the centre (centrifugal force). Given that all bodies move in a circle (precisely, a vortex), as a matter of fact, the centrifugal tendency is always unfulfilled.

**Third Law**: if a body collides with another body that is stronger than itself, it loses none of its motion; but if it collides with a weaker body, it loses a quantity of motion equal to that which it imparts to the other body. (AT 8A: 65)

The third law states a fact – that motion is conserved – but relies on a distinction between the motion of a body, considered in itself, and the “determination in a certain direction”.

The cause of motion is not necessarily the cause of the directionality. When a projectile is deflected upon collision with a larger body, it changes direction without changing its velocity. This change is attributed to the “resistance of the body which deflects its path”, which Descartes suggests in the collision rules is a function of the relative sizes and hardness of the bodies in a collision and density of the medium (AT 8A: 71). How bodies behave depends on how the contest of forces plays out.

The operative phrase in the first law is “in as much as it is in itself” and the rationale offered is that “nothing carries (*ferri*) itself by its own nature towards its opposite, or towards its own destruction” (AT 8A: 63). Later, at *Principles II,*
43, the ideas of 'force' (to act or to resist – *vis... agendum vel resistendum*), the intrinsic powers or capacities of a body (*quantum in se est*) and 'tending' (*tendat*), are brought together: the “force of each body to act against another or to resist the action of another” consists “*in that each and every thing tends, as far as is in its power [quantum in se est], to remain in the same state.*” (AT 8A: 66)

4. **Forces are Potentialities:**

Descartes to Mersenne (Oct 5, 1637): whether something is in actuality or potentiality, the same laws apply for “although it is not always true that what has once been in potentiality is later in actuality, it is impossible for something to be in actuality without having been in potentiality.” [AT 1: 451; CSM]

*Principles of Philosophy* II, 25: distinction between motion, and "the force or action" which brings about the motion. (AT 8A: 233) Tendencies are “the first preparation for motion” (AT 8A: 115) — motive forces but not themselves motions.

Forces exert an influence even when bodies are at rest:

The parts of wine at one place tend to go down in a straight line through one hole *at the very instant* it is opened, and at the same time through the other hole, while the parts at other places also tend to go down through these two holes, without these actions being impeded by each other or by the resistance of the bunches of grapes in the vat. (Optics; AT 6: 86ff. CSM 1: 154)

The insertion of the clause ‘at the very instant’ in the above passage is quite deliberate on Descartes’ part. Given the way motion is defined, it cannot be motion which explains why the wine in the vat starts to move through the hole in the bottom of the vat once the plug is removed. Motion takes time and cannot therefore be an efficient cause at an instant. This is one of the functions that ‘force’ performs in Descartes’ physics: explaining action at an instant, both the first moment of change but also at the instant of impact. The impact of a body is determined *inter alia* by the force at the instant of impact.

5. **Forces are Actions Performed by Bodies**

The tendency of a spinning top to remain in motion once the whip is removed is attributed to the action of the top upon itself, for to deny this would be to claim
that there could be an action without a passion, which is absurd. The same
applies generally to nature:

“Nor do I see why we could not as well say that there are now no activities in the
world at all, but that all the things which happen are passivities of the activities
that were there when the world began.” (To Hyperaspistes, August, 1641; AT 3:
428)

**Forces are necessary to distinguish the agent and patient in any causal
interaction:**

There has to be a fact of the matter which is the mover and which, the moved. If
forces were not real and motion and rest are relative, then it would be
impossible to identify the agent in any causal interaction. If my finger moves to
the right, what makes it the case that the moved is the finger and not the rest of
the universe (moving to the left) is that I, as agent, moved my finger and not the
rest of the universe. You can have the relativity of motion only if you have some
other means of identifying the agent and patient.

**6. Experiments:**

Descartes takes the existence of tendencies to be “confirmed” by experience or
experiment. (PP 3: 59; AT 8A: 111)

*Principles,* III, 58-64: The verbs ‘tendere’ (to stretch out, to extend) and ‘conari’
(to endeavour, to strive; later uses equate it with “to set oneself in motion”) are
used interchangeably. Descartes means stretching and striving quite literally –
the tending of a body in a certain direction creates a tension (*tensio*), which
enables us to measure the force. The stone in a sling discussed at *Principles* III, 56
exhibits multiple tendencies: a tendency to move along the arc LABF, as
constrained by the sling, a tendency (resisted by the sling) to shoot off at a
straight line on a tangent LAC, and a tendency when the stone is being held
straight down in the sling to move away from the centre of the circle described
by the sling (e.g., EAD) and so for every other point on the arc (e.g., EBC, EFG,
etc).

*Principles* III, 59: “this tensio having arisen by the sole force by which the stone
strives to recede from the centre of its motion shows us the quantity of the
force.” [AT 8A: 112]

**7. Problems:**
I note several dangers for the “real tendencies” reading:

1. What is the categorical basis (are they occult?)
2. If dispositions, are they causally relevant?
3. Do tendencies presuppose ends?

7.1. La Forge: forces can’t be real qualities (otherwise they’d be corruptible substances) but nor can they be deduced from the concept of extension. (Of course, it's not clear that motion can be deduced either.)

If tendencies are potentialities (dispositions?), can they be reduced to counterfactual truths?

I.e., the wine has a tendency to move towards the hole in the bottom of the vat = df. If the plug were removed, the wine would flow out the hole in the bottom of the vat.

Problem: Descartes typically requires a truthmaker for every statement, including counterfactuals. Compare a typical "stalemate case":

And note here it is necessary to distinguish between the movement and the action or tendency to move. For we may very easily conceive that the parts of wine at one place should tend towards one hole and at the same time towards the other, even though they cannot actually move towards both holes at the same time, and that they should tend exactly in a straight line towards one and towards the other, even though they cannot move exactly in a straight line because of the bunches of grapes which are between them. (Optics; AT 6: 86ff. CSM 1: 155)

Case suggests two active tendencies that cancel out each other’s effect. Primitive dispositions?

7.2. Dispositions are used in causal explanations:

All the variety in matter, or all the diversity of its forms, depends on motion...All the properties which we clearly perceive in it are reducible to its divisibility and consequent mobility in respect of its parts, and its resulting capacity to be affected in all the ways which we perceive as being derivable from the movement of the parts. (CSM 1: 232; AT 8A: 52)

"Now we do not deny active qualities, but we say only that they should not be regarded as having any degree of reality greater than that of modes; for to regard them so is to conceive of them as substances. Nor do we deny dispositions (habitus) but we divide them into two kinds. Some
are purely material and depend only on the configuration or other arrangement of the parts. Others are immaterial or spiritual, like states of faith and grace (habitus fidei, gratiae) etc.; these do not depend on anything bodily, but are spiritual modes inhering in the mind, just as movement and shape are corporeal modes inhering in the body." (AT 3: 503; CSMK, 208)

7.3. Is **tendency** a teleological concept?
Descartes intends bodies to be acting blindly, even in the case where the outcome is the formation of a highly integrated system like an animal. The fact that a body has a tendency in a certain direction does not commit Descartes to the claim that it has a *terminus ad quem* or that any terminus ad quem defines which motion it is.

**8. Hobbes: tendencies are motions.**

‘Cause’ and ‘power’ are the same thing; the only difference is that when we speak of causes we tend to speak of what is past, whereas powers pertain to the future. (EP 127-8) Hobbes’ laws are also tendency laws: were the endeavour of a body made in empty space it would proceed with the same velocity indefinitely. (EP, 216-7)

**9. Differences:**

9.1 Forces have a categorical basis in extension: **tendencies are motions.** In the stalemate cases where a body is stationary because it is caught between equally opposing forces, there is still motion, only “infinitesimal” and “imperceptible”. The reason for his reductive analysis of tendencies is that Hobbes cannot envisage any kind of change which does not consist in motion because all change involves continual progression – a continual mutation in the agent and patient – which, being divisible into parts, requires us to think of each part, including the beginning as an action and cause of motion, and since only something in motion can produce motion or resist motion, so the conatus of a body must itself be motion. (EP, 123-4)

“For let a space be never so little, that which is moved over a greater space, whereof that little one is part, must first be moved over that.” (L 119)

Velocity is “motion considered as power” – i.e., the power by which a body moved may in a certain time transmit a certain length.” (203) The body's conatus
or striving is its **instantaneous velocity**: “motion made through the length of a point, and in an instant or point of time.” (206)

The account rests of Hobbes’ peculiar view of infinitesimals but this should not suggest anything occult. Strictly speaking, a point is a determinate body, of which length, breadth and depth is ignored. (E.W., vii. 202) A line is a body of which breadth and depth is ignored; a plane, a body of which depth is ignored. (DC 10.2) A point is “a quantity less than any quantity that can possibly be named”.

Although infinitesimal, not all endeavours are equal, and we can (a) conceive of differences much as we can conceive of different angles terminating in different points, and (b) measure their effects by comparing their velocities. (DC 206-7)

Endeavour is

“motion made in less space and time than can be given; that is, less than can be determined or assigned by exposition or number; that is motion made through the length of a point and an instant of time.” (EP 206)

A body’s impetus is the measure or quantity of its endeavour (EP 206-7) and its force is calculated from the impetus and the magnitude of the moving body, “whereof the said movent works more or less upon the body resisting it.” (EP 212)

Hobbesian tendencies are, therefore:

1. Not occult properties (motions)
2. Causal powers are neither dispositional nor potentialities.
3. Not teleological.

10. **Change implies perceptibility of motion**: We do not perceive change except as something is affected in our sense, but there are no changes in sensation that are not the product of motion, either as the result of a change in motion in the agent or a change of motion in the patient, rest being itself a cause of nothing. (EP 126; 131)

11. **Objection #1: Stalemate cases**

In the stalemate cases, where a body is held stationary between two opposing endeavours, the body must be moving in opposite directions at once. In *De Corpore*, Hobbes defines motion as ‘the continual relinquishing of one place and
acquiring of another’. (Molesworth, v.1, 109, 206-7, 211-13) This produces paradoxical results in the stalemate cases. Either the body is in motion and traverses a space in opposite directions at once, which is absurd, or no space is traversed at all, but then the body is not in motion. If the body is not in motion, not even infinitesimal motion, then, by definition, it is not the subject of any endeavour.

12. Human endeavours as bodily motions.

The powers of the mind to move bodies are nothing other than the endeavours of the human body to persevere in existence in accordance with the first law. Descartes’ rationale for the first law — that it is inconceivable that something tend towards its own destruction — is, for Hobbes, the first principle of nature. It is upon this principle that Hobbes’ entire civil philosophy is constructed:

A LAW OF NATURE is a precept or general rule, found out by reason, by which a man is forbidden to do that which is destructive of his life or taketh away the means of preserving the same; and to omit that by which he thinketh it may best be preserved. (L, 64.)

Human endeavours just are the body’s vital motion, which can be increased or decreased through our experience of environmental factors. Increases in vital motions are experienced in conscious beings as appetites or desires for certain objects and decreases as aversions:

This motion, in which consisteth pleasure or pain, is also a solicitation or provocation either to draw near the thing that pleaseth, or to retire from the thing that displeaseth; and this solicitation is the endeavour or internal beginning of animal motion, which when the object delighteth, is called appetite; when it displeaseth, it is called aversion, in respect of the displeasure present; but in respect of the displeasure expected, fear. So that pleasure, love, and appetite, which is also called desire are divers names for divers considerations of the same thing. (HN, 32)
Deliberation and will are not forces autonomous from the forces of natural bodies but consist simply in the *alternation* of contesting forces or endeavours in the animal or human body. When we alternate between appetite and aversion, hope, fear, desire, despair, as when we consider the pros and cons of a certain course of action, the good or evil consequences, the probability or improbability of attaining what we desire, “the whole summe of Desires, Aversions, Hopes and Fears, continued till the thing be done, or thought impossible, is that we call Deliberation.” (L, 127)

13. Objection #2: Identifying the agent and patient.

If force is not distinct from motion, and motion and rest are relative notions, then could there be a fact of the matter in any causal exchange, which is the agent and which is the patient?