

UNITED WISDOM

An Error of Scale: Transferring a Rule of the Part to the Whole

World and Consciousness

Andrey Zarinsh & Maria Evilkut

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@andrey.zarinsh @ilkutki

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Epigraph

“for similars do not constitute a state”.

Aristotle, Politics, II, Part II: the internal closing clause of the sentence beginning Again. Benjamin Jowett’s English translation; the Russian version is our translation from this English text, not from Greek.

What this article is about

A small group managed without a schedule, so a larger project should manage without one too. One expense is affordable, so the entire sequence of expenses is affordable. A component is strong, so the assembled structure is strong. These transitions sound natural because familiar words remain: group, expense, strength. Yet the object of the claim has changed. Sometimes the number changes, sometimes the connections, sometimes the meaning of “all”. This article examines several such transitions without treating every generalization as a mistake. Mill distinguishes individual cases from their collection; Aristotle discusses political unity that needs differences; Galileo’s opening dialogue asks why similar shapes need not preserve every relation of a material body. Through hypothetical numerical and everyday examples, we examine what transfers between levels and what needs further grounds. The aim is to understand arguments that offer one part’s experience as a sufficient explanation of a whole, while retaining useful connections between levels.

I. First name the transition’s object

Imagine a workshop where one person packs ten identical orders per hour. A manager expects ten people to pack a hundred in the same time. This could hold if each has a separate table, materials and prepared tasks. But if everyone uses one label printer, the original observation says nothing about its total capacity. The argument multiplies the workers while leaving the other conditions unexamined. The error lies in presenting multiplication as a description of a process whose shared organization is unknown. Even an operation with the same name need not have the same conditions whenever it is performed.

Three questions help. What property is being transferred: weight, speed, reliability, enjoyment or authority to decide? Between what objects: person and group, component and structure, small copy and large copy? How is the result produced: addition, sequential work, agreement

@andrey.zarinsh @ilkutki

or mutual constraints? Here “scale” names a family of transitions rather than a single physical quantity. Enlarging a cube and bringing people together are different operations. We can compare the premises they overlook without assigning them one formula beforehand. Sometimes the number of participants stays unchanged while the order of their actions changes.

In Book III, Chapter VI of A System of Logic, Mill asks when joint effects can be calculated from separate effects. He requires the relevant law to hold when causes act together. This gives the workshop a precise question: can we describe each worker’s contribution with shared resources as we did during separate work? We do not yet know. A sound proposal therefore remains conditional: with independent workstations and sufficient supplies, output can be estimated by addition. A different arrangement requires another calculation. The transition preserves knowledge about the part while identifying its role in explaining the whole and the further information still needed.

II. “Each” and “all together” mean different things

In Book V, Chapter VII, Mill describes confusion between collective and distributive meanings. A statement about each member is not yet a statement about the group as one object. If each of three boxes fits on a shelf, all three need not fit simultaneously. Suppose the available width is ninety centimetres and each box occupies forty. Any individual box fits; together they require a hundred and twenty centimetres. The individual measurements are true and the arithmetic straightforward. The missing condition concerns joint placement. “The boxes fit” conceals two tests while appearing to express one proposition.

The reverse transition can also fail. If three exhibition departments received twelve comments together, each did not necessarily receive twelve. An even distribution cannot be inferred from the total either. Overall and individual assessments need different information. In Politics, II, Part III, Aristotle encounters the ambiguity of “all” while discussing shared possession. He distinguishes each person’s claim from collective ownership language. We use this distinction without endorsing his property programme. The text disputes a proposed political arrangement; it is not a statistical study of every modern organization. Its historical example cannot replace examination of current rules and powers.

Rewriting a sentence sometimes reveals the shift. “Any participant can choose a convenient time” differs from “there is a time convenient for every participant”. In a hypothetical group, one person is free only in the morning, another only in the evening. Each has a free hour, but they have none in common. Choosing a participant and finding their hour is different from choosing one hour and requiring everyone’s presence. Technical language is optional. “Separately”, “simultaneously”, “for each” and “for the entire group” can make the distinction

explicit. These small changes identify which possibility was established and which remains an assumption before debate turns to the difficulty’s causes.

III. A whole can be a sum or a relation

Some properties genuinely add. In an imagined warehouse, five sealed packages each have a mass of two kilograms; their masses sum to ten kilograms. We cannot simply repeat the operation for every warehouse quality. The packages do not have five independent quantities of “ease of access” to add when describing the aisle. One can obstruct another; placement and retrieval order create relations between objects. Total mass and accessibility answer different questions. The error concerns the chosen description rather than acknowledging a whole. We may also need to specify whether a measurement includes packaging, so the object being counted does not change during calculation.

Mill distinguishes additive effects from combinations associated with another kind of outcome. His examples of mechanics, chemistry and life belong to nineteenth-century philosophy of science. They frame a useful question without licensing us to repeat his physiological claims as contemporary knowledge. Here the logical requirement suffices: before adding, identify the quantities and explain why the rule survives combination. Even cancellation may obey addition when direction or sign belongs to the description. A zero total does not show that nothing acted. Treating every interaction between people as a chemical reaction would, however, introduce a further unsupported transfer.

In Part II of Book II, Aristotle says a city comprises different kinds of participants, not merely many people. He discusses functions, rotation of government and the community’s self-sufficiency. Within his argument, the city’s organization depends on relations that enlarging one individual cannot supply. A contemporary team differs from an ancient polis, but the comparison suggests a specific question: which differences make joint activity possible? Our workshop might require preparing materials, packing and checking addresses. Individual competence matters, while coordination between stages remains another object of assessment. Team size says nothing about how results pass between stages until that arrangement is described and examined in the actual process.

IV. Similar shapes do not preserve every ratio

At the opening of Galileo's Dialogues Concerning Two New Sciences, Sagredo wonders why a device successful at a small size might fail at a larger one. If geometrical figures are similar, why should strength differ? Salviati replies that enlarging material objects in the same proportions does not preserve the same relative resistance. These are different voices: the initial puzzle is not the author's final assertion. The opening we have read sets out the question and specifies the same material and proportions. It cannot replace the later demonstration or a modern structural calculation. Recognizing the transition discussed here does not require us to give all machines identical behaviour.

Consider our own elementary example: two ideal cubes of equal density, the second with twice the side length. Length doubles, one face's area quadruples and volume increases eightfold. With constant density, mass increases eightfold too. This follows directly from squaring and cubing the side. The ratio of volume to the selected face's area therefore doubles. Shape remains similar while this ratio changes. Mathematics has not stopped working; it shows the different rates of increase. It identifies the relations that stay constant instead of vaguely assuming that everything about a larger body must remain the same.

This calculation cannot yield a universal building strength, an animal's allowable size or a recipe for a support. We specified only geometrical quantities and the density of ideal cubes. An actual structure would need information about materials, shape, loads and connections. The philosophical point is already clear: preserving side proportions does not establish preservation of mass relative to area. The workshop comparison has limits too. Agreement between people need not grow like a cube's volume. Geometry offers a concrete way to examine premises, not a ready-made social law. When the image replaces a description of human connections, the useful example becomes another scale error of the kind it was meant to expose.

V. Separately feasible actions can interfere

Imagine an editorial office with one available hour of a translator's time. Each of three writers requests twenty-five minutes. Any request fits into an hour; together they require seventy-five minutes. If each considers only their request, the collective promise becomes impossible under these conditions. Nobody misstated their task's duration. The error occurs between separate possibilities and simultaneous execution. Changing the time, scope or available resource could resolve it. Calling the writers insufficiently diligent adds nothing to the calculation and may conceal the real cause. The invented numbers are premises of this example, not observations about a real office's productivity.

Mill’s discussion of confusion includes an individually affordable expense that becomes ruinous alongside other expenses. This does not prohibit purchasing anything: the issue is the combined cost against an accepted limit. In Part III, Aristotle discusses a different mechanism: expecting somebody else to perform a shared duty may reduce one’s attention to it. This remains his political argument, not a measured proportion of irresponsible people. Together, the texts distinguish available capacity from assigned duties. An office might have enough time, yet nobody checks the final file because everyone assumes the task belongs to somebody else. Total working minutes alone no longer describe the process.

“Possible” conceals conditions: possible for one, for each in turn, or for everyone simultaneously. Possibility through coordination adds another case. If writers choose different days, the task changes and the contradiction disappears. A conclusion about the group must therefore include coordination rather than merely inventorying individual resources. Responsibility also requires precision: naming a person beside a shared task says more than promising that the group is attentive. Formal assignment does not guarantee completion, however. Access, time and verification still matter. Clarifying scale makes these questions visible without answering them automatically or replacing substantive agreement about the work.

VI. An average depends on what is combined

The transition may concern proportions rather than totals. Suppose two workshop units completed tasks: the first finished nine out of ten, the second five out of ninety. Their rates are ninety per cent and approximately 5.6 per cent. The simple average is approximately 47.8 per cent. Yet fourteen of all hundred tasks are finished: the overall rate is fourteen per cent. None of these figures has to be false. The simple average gives each unit equal weight; the overall proportion gives each task equal weight. The different task counts make these different objects of calculation.

A smaller example avoids rounding. One group completes three of four tasks, another one of twelve. Together they complete four of sixteen, or one quarter. Individual rates are three quarters and one twelfth; their unweighted average is five twelfths. Averaging by task requires acknowledging that the second group received three times as many. These invented numbers test arithmetic. They reveal nothing about real workers, quality or the causes of a difference. Equal numbers of tasks need not mean equal difficulty either, so an accurate count need not sufficiently assess whether work was distributed fairly.

An overall figure also cannot reconstruct each participant’s history. Four completed tasks do not tell us who performed which without a separate record. Still less can a total identify an able or lazy person. That judgment would need further information and an explicit criterion; some evaluative words resist expression as a single proportion. Mill’s question about the

conclusion’s object applies here. If the premise describes a collection of tasks and the conclusion assigns a quality to a person, both level and claim type have changed. Naming the denominator can be more useful than debating an impressive number: it shows which cases entered the calculation and which remained outside when two results are compared.

VII. Replacing one does not make everyone unnecessary

Mill examines an argument in which another outstanding person could compensate for one person’s absence, followed by a conclusion that all such people were unnecessary. Our concern is its structure, not his historical predictions about particular discoveries. Imagine a library where three staff members can restore the catalogue. Any one can take a day off: two remain. If all three leave simultaneously, that capability disappears. Replacing an individual who carries a skill does not make the skill unnecessary. The premise retains a substitute; the conclusion silently removes that person too. Changing the number replaced changes the condition that originally permitted replacement, although “replaceable” continues to be used without further explanation.

The opposite exaggeration also needs examination. If only one person knows the catalogue password today, this does not make them permanently irreplaceable. Somebody else could be trained or access arrangements changed. A present state differs from possible reorganization. A process’s dependence on a part should not become an eternal personal attribute. Sometimes we remove dependence while preserving a function; sometimes we remove the function with its holder and notice the loss later. First name what must remain available. This precision matters for work and relationships: discussing access arrangements need not become a judgment of someone’s entire worth or justify disregard for their contribution.

Aristotle’s different kinds of city participants illuminate a related, limited question. Uniform participants do not sufficiently explain the political community in his argument. This does not require preservation of every ancient social role today. The comparison concerns functions and connections, not a historical entitlement to hierarchy. Catalogue restoration can become a shared skill while other library tasks remain. Examining scale asks whether we can replace a worker, pass on knowledge or abandon a task. These have different consequences. Combining them in “nobody is irreplaceable” leaves the organizational issue undescribed and may lead to decisions whose meaning becomes clear only after a needed capability has been lost.

VIII. Unity need not mean uniformity

Four friends prepare dinner together. They can agree on a time and allocate dishes while keeping different preferences. If unity requires everyone to perform the same action at every moment, four people will peel one potato together while nobody prepares the table. This invented scene establishes no optimal kitchen arrangement. It distinguishes a shared plan from identical operations. Unity can connect actions through purpose, time and mutual commitments; differences then help produce the result. Assessing a group requires knowing which unity is intended and what it should accomplish. Agreement about a result need not eliminate disagreement about how to achieve it.

In Part V of Book II, Aristotle compares excessive simplification of unity to harmony becoming unison. The image draws attention to lost relations between different elements without proving a modern political claim. His argument criticizes a particular proposed city and includes positions we do not transfer into contemporary life. We can retain the question about partial unity without adopting his conclusions about property, citizenship or social classes. Comparing traditions responsibly means keeping an argument's original dispute visible while drawing a useful distinction from it. The analogy becomes more precise when we identify the boundary beyond which another historical and practical problem begins.

A joint project can distinguish common requirements from permissible differences. Every text needs checked references; styles need not be identical. Everyone needs access to a decision without taking the same preparatory role. Differences sometimes obstruct cooperation, as incompatible deadlines might. Then discuss that incompatibility rather than treating either diversity or uniformity as a universal remedy. Examining levels also checks the opposite slogan that every whole necessarily improves on its parts. A group may connect useful abilities or impose needless constraints. This concerns its organization and result. Assessment requires a named criterion rather than confidence in "unity", a beautiful word that can signify entirely different conditions in different sentences.

IX. When a transfer is justified

Caution should not prevent every calculation. Three separate containers each hold four litres of one liquid; their combined volume before transfer is twelve litres. We preserve the object counted and the addition rule. Moving the liquid to another vessel raises further questions: sufficient capacity, losses during transfer and changed measuring conditions. The initial sum does not settle these later questions, but remains correct. Likewise, an individual table's output can usefully inform workshop planning if the shared machine's limits are included explicitly. Clarifying conditions adds knowledge instead of dismissing an established observation because it does not explain everything at once.

Mill does not declare composition impossible: his chapter examines its conditions and other cases. Galileo does not reject geometry: geometrical analysis challenges unsupported physical extrapolation. Aristotle does not abandon political community when criticizing oversimplified unity. These distinctions resist a new universal denial: “a part can never tell us anything about a whole”. That would be as inaccurate as unconditional transfer. Each case requires its connections, conserved quantities and conclusion’s object to be specified. A substantive discussion can then confirm, revise or reject a transition instead of adopting a slogan that general knowledge is inaccessible.

A practical step is to state the intermediate premise. Between “each writer produces a page per hour” and “the group will produce ten pages per hour” lies a condition about independent work and resources. Between a component’s test and a product’s ability to withstand it lies an account of connections and total loading. The intermediate premise may be clear and verified, or it may require investigation. Recording it makes the grounds discussable rather than distrustfully doubting everything. We may discover that the proposed whole has another arrangement entirely. The correction then concerns the task’s model rather than people who truthfully described its parts, allowing their observations to inform the next decision more precisely.

X. The scale of a result does not determine human worth

Team success and one participant’s wellbeing cannot simply be equated. Imagine an exhibition opening on time because one person silently finishes every incomplete task. The deadline was met; distribution need not have been fair or acceptable to everyone. This is neither a report of a real exhibition nor a claim about all teams. It distinguishes project completion from relationships within the project. Overall assessment does not automatically answer every question about the parts. Discussing cooperation requires hearing specific participants and understanding previous commitments before treating success as sufficient reason to repeat the same distribution.

A poor result does not establish that every participant is incompetent either. A flawed schedule, missing materials or disconnected stages may create a problem individual diligence cannot resolve. These possible causes do not establish a cause in every case; they indicate where further information might be sought. Neither the abstract group nor an individual should receive a convenient label in place of events being described. Responsibility for an action can be acknowledged while shared conditions are examined. This needs a link between action and result, not an impression created by the final figure. Different scales offer no automatic excuse: we still need to identify what a person could know, do or change in the circumstances.

This returns us to everyday language. When something “works”, ask for whom, with which participants, over what period and by what criterion. Every conversation need not undergo

extended examination; conditions are sometimes clear enough. But when one part's success justifies changing an entire group's lives, the transition matters. We can respect a person's experience without making it the sole model of collective organization. We can recognize an overall result without erasing participants' different positions. Precision promises neither conflict resolution nor guaranteed decisions. It clarifies the subject and helps identify existing grounds, missing information and assumptions introduced only through a quiet change in familiar words' meanings.

What this means in practice

Choose a sentence that transfers a part's experience to a whole: "this deadline is enough for one person, so it is enough for everyone". Record the observation with its person and circumstances explicit, then write the proposed general conclusion separately. Do not immediately correct it. First underline repeated words whose meanings might have shifted. "Enough" may concern individual possibility or a shared resource; "everyone" may mean each in turn or everyone simultaneously. Other people's information may change even the starting description when a decision concerns them. Leave room for clarification rather than making your own formulation final.

Name the combining operation. Are resources added, tasks performed sequentially, participants agreeing on one hour or using a shared tool? Insert a condition that would justify the transition. Independent workstations and equal access to materials might matter for the deadline example. Mark whether the condition is known or assumed. When calculating a proportion, state numerator, denominator and the combining rule. A small hypothetical case can be recalculated by hand; this checks arithmetic, not causes or people's qualities.

State a limited conclusion: "the transfer is justified under these conditions", "the shared resource needs checking", or "this claim concerns each person separately". Specify what information is missing. Afterwards, examine whether you retained details about the parts that the overall figure does not express. This exercise examines an argument; it is not a researched method for improving productivity or relationships. Its purpose is to make a decision's grounds and limits visible so substantive discussion can continue with the people it affects.

Key quotation

> *"collective in the premises, distributive in the conclusion".*

John Stuart Mill, A System of Logic, V, VII, §1: an internal clause in the first sentence on the Fallacy of Composition and Division. English original, Eighth Edition, Harper & Brothers, 1882. This describes one direction of the shift; the same sentence considers its reverse too.

Connections between traditions

1. Mill and Aristotle: two meanings of “all”. In A System of Logic, V, VII, §1, Mill distinguishes collective and distributive terms; in Politics, II, III, Aristotle distinguishes collective possession from individual claims. Both passages help check whether an argument’s unit has changed. The mechanism is to make hidden “separately” or “together” explicit. The boundary: a logical classification does not validate Aristotle’s political programme, and his criticism does not replace research into contemporary common ownership.

2. Galileo and Mill: increase does not guarantee proportional outcomes. Salviati keeps material and proportions fixed at the First Day’s opening while disputing equal relative resistance; in III, VI, §3, Mill distinguishes a larger cause from a changed kind of effect. The comparison requires quantities and conditions to be named first. Its boundary: these are two ways of posing a question, not a modern engineering law derived from Mill’s philosophical heating illustration.

3. Aristotle and Galileo: what stays the same. Politics, II, II, describes a city through different participants and relations; the First Day’s opening distinguishes similar figures from material relations. One case concerns a community’s organization, the other a similar shape’s size. Both ask what preservation means. The boundary is fundamental: different political functions are not governed by a geometrical square-and-cube rule.

4. Mill and Aristotle: combination needs its own description. In III, VI, §1, Mill distinguishes additive effects from another kind of result; in II, II, Aristotle requires different participants rather than mere numbers for a city. The shared question asks how separate contributions become joint activity. It can inform examination of workshop stages. The boundary: society is not declared a chemical compound, and Mill’s historical views on life are not contemporary physiology.

5. Mill and Aristotle: replacing a part and performing a shared duty. In V, VII, §1, replacing one outstanding person does not justify dispensing with all; in II, III, Aristotle argues that expected performance by another may change attention to shared work. The comparison identifies dependence on participants who remain. The boundary: we analyse conditions of two arguments, not a measured law of collective irresponsibility or a claim that particular people are unnecessary.

6. Galileo and Mill: an abstract statement and its application. Sagredo’s initial transfer from similar geometry to a large machine meets Salviati’s qualification in the First Day; the closing passage of V, VI warns against forgetting modifying conditions. The mechanism is to state the intermediate premise between model and object. The boundary: mathematics remains valid; completeness of application, rather than geometry itself, may be at fault.

Primary sources

Aristotle. Politics, II, Parts I–III and V. Benjamin Jowett's English translation. A political argument about community, not general statistics of modern groups. Our Russian epigraph is translated from this English carrier.

John Stuart Mill. A System of Logic, III, VI, §§1–3; selected passages of V, VII, §1 and the closing limitation paragraph of V, VI. English original, Eighth Edition, Harper & Brothers, 1882. A historical methodological argument; its physiological and chemical positions are not presented as current scientific findings.

Galileo Galilei. Dialogues Concerning Two New Sciences, First Day opening. Henry Crew and Alfonso de Salvio's English translation, 1914. Only the available opening through the limit qualified by unchanged material and proportions is used. We do not claim to have read the later demonstration or entire dialogue here; the ideal-cube calculation is this article's own.

Tags

#scale, #part, #whole, #logic, #Mill, #Aristotle, #Galileo, #politics, #geometry, #proportions, #comparison, #conditions, #argument, #generalization, #aggregation, #relations, #unity, #differences, #cooperation, #responsibility, #possibility, #resources, #coordination, #average, #proportionsOfTasks, #denominator, #verification, #model, #explanation, #traditions, #decision, #UnitedWisdom

About the authors

Andrey Zarinsh is the author and founder of United Wisdom. He explores inner transformation, the unity of traditions, intercultural dialogue, and contemporary spiritual discipline. Instagram: @andrey.zarinsh.

Maria Evilkut is a co-author of United Wisdom. Alongside her research, she seeks to test these ideas in practice and observe how principles of unity and mutual understanding work in real life between people and cultures. Instagram: @ilkutki.