

Sitting Ergonomy I.

Chairs



Dr. Peter HANTZ
EcoBlue Ltd.
Fibervar Ltd.

Ergonomics

Ergon (ἔργον) = work

Nomos (νόμος) = rules

Wojciech Jastrzębowski, Polish, 1857 (forgotten)

Kenneth F.H. Murrell, UK, 1949 – Naval Motion Study Unit
"convergent evolution" – independently

1959: IEA – International Ergonomics Association

Alphonse Chapanis – USA,	USAF cockpit design
Étienne Grandjean – Switzerland	Office ergonomics

PHYSICAL – COGNITIVE – ORGANIZATIONAL ERGONOMICS

Evolution of Sitting

Egypt: inclined & throne & chair

B.C. 2000-1000



https://www.researchgate.net/publication/224028993_Milestones_in_the_Evolution_of_Lumbar_Spinal_Postural_Health_in_Seating
https://collezioni.museoegizio.it/en-GB/material/S_8509
<https://egypt-museum.com/ceremonial-throne-of-tutankhamun/>
<https://egypt-museum.com/throne-of-princess-sitamun/>

Greek klismos

B.C. 500-100



https://peacocksfinest.com/blogs/the_drawingroom/the-timeless-beauty-of-klismos-chair

https://www.researchgate.net/publication/340793554_Klismos_-The_Style_and_Form_of_the_Ancient_Greek_Chair

Milking chairs - one-legged



<https://www.volkskundemuseum.at/jart/prj3/volkskundemuseum/data/publikation/1524345942400/1524345942400.pdf>
<https://www.chairish.com/product/16227915/antique-danish-one-legged-milking-stool-19th-century>
<https://www.core77.com/posts/109784/Smart-Furniture-Design-from-Farms-When-a-Wearable-One-Legged-Stool-is-Ideal>
<https://www.antiquesboutique.com/antique-stools/unusual-one-leg-milking-stool/itm288602>
<https://calisphere.org/item/25a92db6ae62960217c1b7f8414344d8/>
<https://www.kerbl.com/en/product/milking-stool-17493>

e.g.
US 10,617,217 B1

Milking chairs – three-legged, saddle type



Kalotaszeg region -
blocker & straddle

<https://thisispidgin.com/products/milking-stool>

https://www.1stdibs.com/furniture/seating/stools/brutalist-mid-century-modern-rustic-stool-marolles-style-france-1950/id-f_38983442/

<https://www.arcanum.com/hu/online-kiadvanyok/Lexikonok-magyar-neprajzi-lexikon-71DCC/f-72612/fejosek-726C0/>

Misericords – ischium sitting

11th-16th Century



Chester Cathedral, late 14th century



<https://bestiary.ca/prisources/psdetail4837.htm>

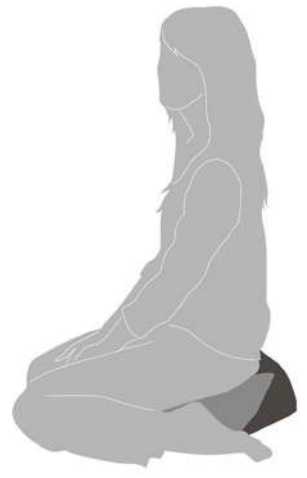
<https://www.misericords.org/bredagk.html>

<https://www.cambridge.org/core/journals/antiquaries-journal/article/abs/carthusian-choir-stalls-and-the-misericord-in-italy/233EA42A8044F2C2387480E7BDCF7D07>

Zafu & variants



Zafu pillow + zabuton square carpet (Chinese buddhism → Japan 12th Cent.)
Asana – comfortable yoga posture



<https://reforestdesign.com/products/floor-chair-comfort-natural>

<https://korean.alibaba.com/product-detail/Ergonomic-Positive-Thinking-Meditation-Cushion-Alexia-10000019170495.html>

<https://www.lilbee.ca/products/zabuton-meditation-xl-floor-cushion?variant=46816593051905>

<https://www.contemporist.com/asana-chair-by-mario-milana/>

<https://shop.japanobjects.com/blogs/editorial/zafu>

<https://basaho.com/blogs/blog/meditation-cushions-history-origin-and-evolution>

Prie-dieu variants & Seiza-isu



<https://www.etsy.com/ie/listing/4457597088/prayer-bench-hardwood-kneeling-bench-for>

<https://www.michiganchurchsupply.com/products/prie-dieu-kneeler-ai2303>

<https://www.yankodesign.com/2020/09/03/this-chair-was-designed-to-let-you-sit-cross-legged-for-better-posture-and-health/>

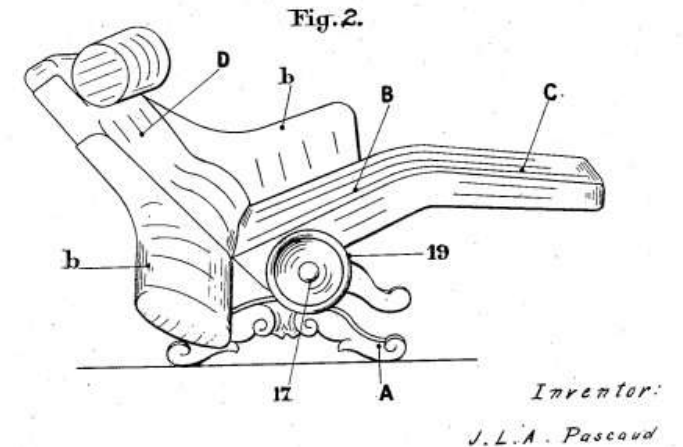
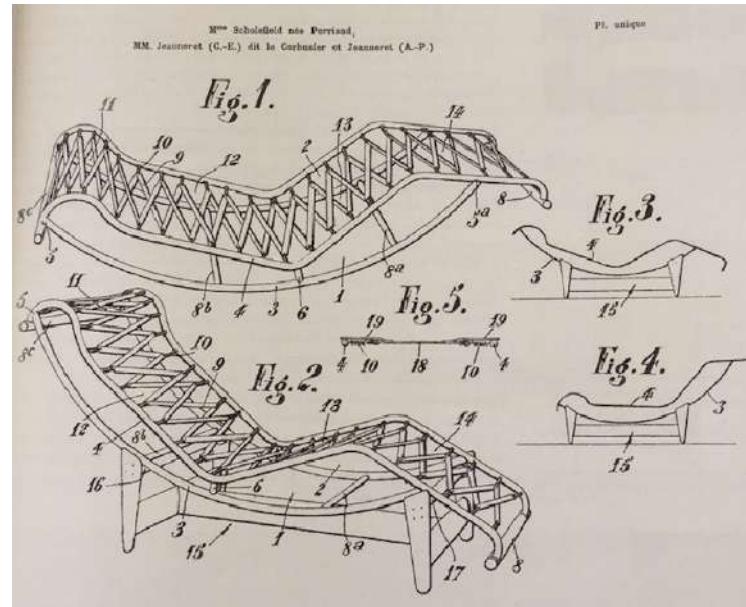
e.g.
US20050099053
US 8.465,099

Chaise longue articulées

Likely France, 19th Century // British Medical beds →

Jules L. A. Pascaud, 1921

LC4, Charlotte Perriand (Scholefield), 1928



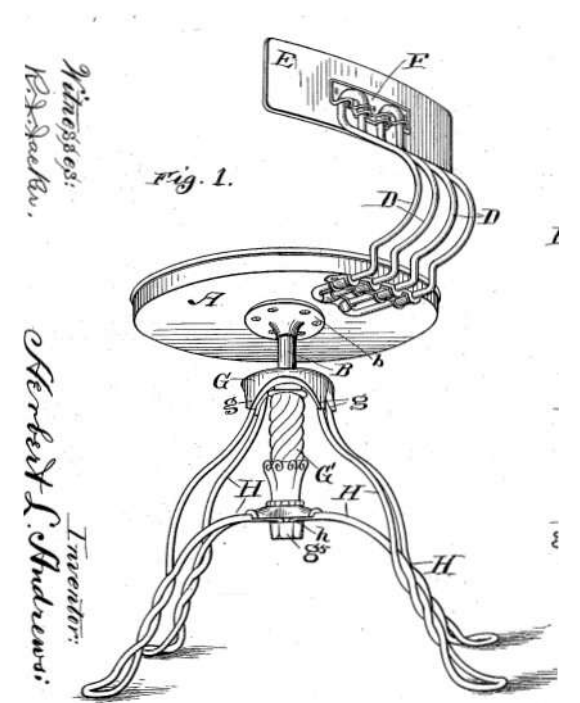
US 1,543,612

<https://blablaarts.over-blog.com/2020/11/la-chaise-longue-a-reglage-continu-lc4.html>

<https://patents.google.com/patent/US1543612A/en>

Novel foundations

- 1505 Swivel/spin/revolving + rolling wheels, Martin Löffelholz von Kolberg, 1505, Nürnberg
- 1775 Thomas Jefferson's modified Windsor chair
- 1849 Centripetal Spring Chair, patent US6740, spring AND rotation, USA
- 1896 Typewriter's Chair, patent US552502, back and height, USA



<https://www.geistsoz.kit.edu/germanistik/3222.php>

<https://chipstone.org/images.php/858/American-Furniture-2023/Witnesses-for-Independence>

<https://qor360.com/blogs/blog/a-brief-history-of-active-sitting>

US6740 (1849)
US552502 (1896)

Novel foundations

1720-30 British Reading Chair (multiposture) – “Cock fighting”, unknown

1776 Goethe’s “Sitzbock” (sitting trestle), Weimar

1853 → present, Gebrüder Thonet (Vienna), steam bending



<https://www.moma.org/collection/works/110615>

<https://www.nationaltrustcollections.org.uk/object/108612>

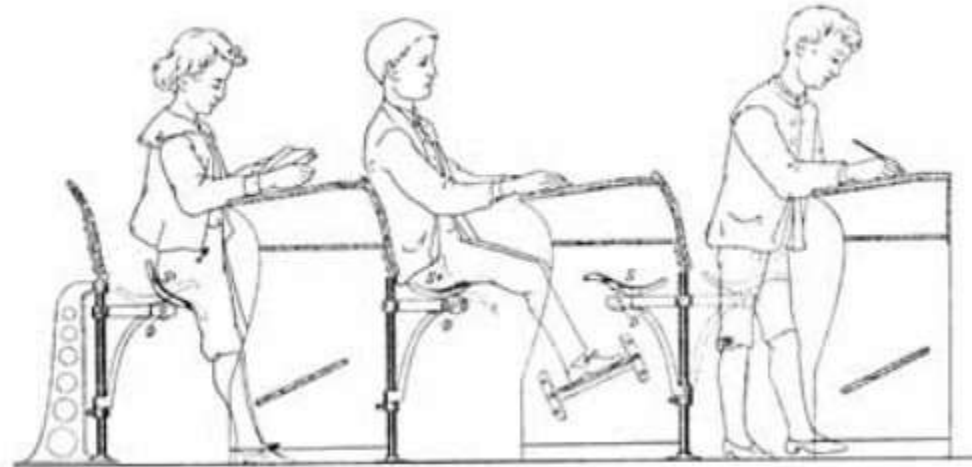
<https://crabtreefarmcollections.org/a-cock-fighting-chair>

<https://www.bada.org/object/mahogany-reading-chair-after-design-thomas-sheraton>

https://www.klassik-stiftung.de/service/presse/pressebilder/goethes-gartenhaus/?utm_source=chatgpt.com

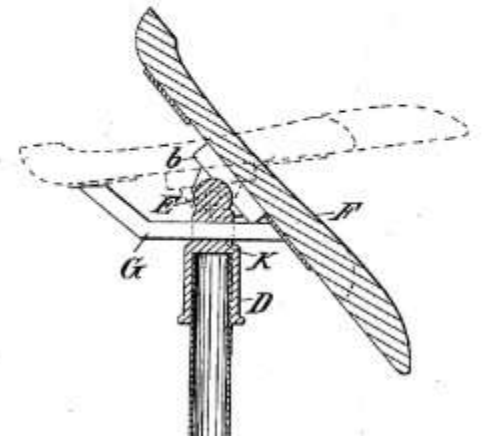
Novel foundations

19th Century - England/Germany - "Stehpult" (The Budenbrooks film)
Caspar C. A. Schindler, Basel, cca. 1890, multiposture proposal



No. 483,266.

FIG.1.



<https://kastellan-store.de/products/davenport-sekretar-massivholz-mit-schreibpult-und-schubladen>
<https://www.fachportal-paedagogik.de/literatur/vollanzeige.html?FId=2791318>
<https://www.antoniobustamante.com/Mobiliario.pdf> <https://patents.google.com/patent/US483266A/en>

CH1802=US483266A

Extras

Copulating chair or Albert Edward prince of Wales, cca. 1890, two girls/session, French bordell Le Chabanais
Kindof “Fungiture” – Alibaba “European Style New Magic Castle Balloon Chair”
Aquilino Cosani, 1950→ , Lederogramma company in Italy, latex, 1960→ PVC; Swiss MDs later
Varier Ekstrem “chair”



<https://www.dailymail.com/lifestyle/article-14038575/right-royal-sex-chair-Channel-4-series-furniture-British-king.html>

<https://www.aliexpress.com/item/1005009870865133.html>

<https://www.sportlaedchen.de/en/10-Original-Pezzi-exercise-balls-MAXAFE/DU2466970575/>

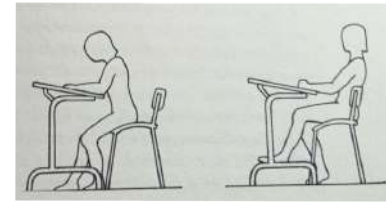
<https://www.varierfurniture.com/en/ekstrem/37001093691>

Functional design

HAG / Flokk (Norway)	1984	- saddle; Capisco
Salli (Finland)	1990	- saddle
Bambach (Australia)	1989	- saddle
Varier (Norway)	1979	- kneeling; Balans
Haworth (USA)	≈ 1994→	- forward tilt; Zody, Fern
Aeris (Germany)	1996	– active/spring-based, sit-stand; Swopper
SpinaliS / HAM (Slovenia)	1999	– active/spring-based
CoreChair Incorporated (Canada)	2008	– active/spring-based
Backapp Europe AB (Norway/Sweden)	≈ 2007	– active/spring-based
Wilkhahn (Germany)	2009	– Trimension advanced movements; ON
Ergo Impact (USA)	2016	– standing; LeanRite
Yanko Design	NA	– standing (just design)
Focal Upright Furniture	2006→	– standing; Locus
Humanscale (USA)	1999	– self-adjusting
Vivo (USA)	≈ 2024	– crossed-leg, kneeling; Dragonn
Pipersong (Hong Kong)	2020	– cross-legged; Meditation
Newtral (Hong Kong)	2025	– reverse, head support; StandingMate
NuChair	2015	– reverse, tilted
Herman Miller (USA)	1994	– Pellicle Aeron mesh, A/B/C sizes, Pelvis/Sacrum+Lumbar support; Aeron
Steelcase (USA)	2013/2018	– response to new tech's postures, SILQ recline; Gesture

Forward tilt

Hanns Schoberth, 1962, 60-deg hip limit
Åge Christian Mandal, 1976, hip angle => tilted seat



> *Ergonomics*. 1976 Mar;19(2):157-64. doi: 10.1080/00140137608931528.

Work-chair with tilting seat

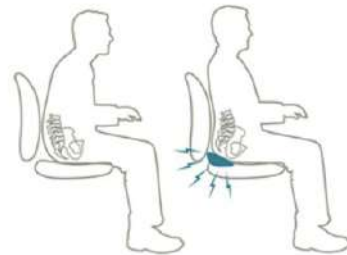
A C Mandal

Sitting on a Sloping Seat Does Not Reduce the Strain Sustained by the Postural Chain

Alain Hamaoui , Myriam Hassaine, Pier-Giorgio Zanone



Children's instinct



Sitting wedges/Seat cushions



Haworth:
Fern, Zody, Soji



Herman Miller:
Aeron, Sayl, Mirra



Levitask: Vision

Half-kneeling

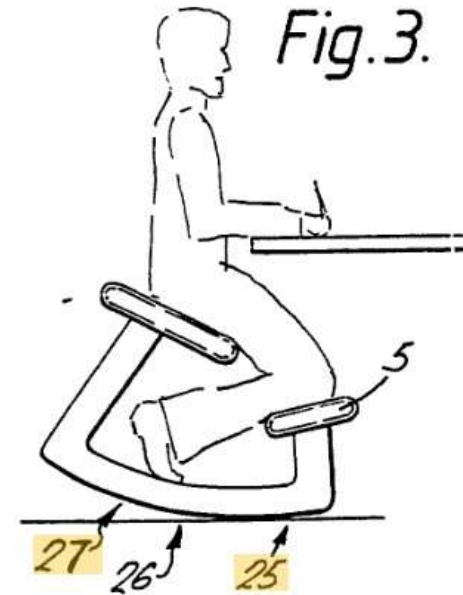
Hans Christian Mengshoel, 1976, ergonomics research,
O. Rykken's team to design, Norway
Rykken, 1979: commercial

<https://varierchairs.com/kneeling-chairs/>

<https://balans.no/history/>

<https://www.snipwonen.nl/ergonomie/ergonomisch-advies/het-concept-van-kniestoelen-en-wat-ze-voor-u-doen/>

<https://vivo-us.com/products/dn-ch-k01b>



Today: Varier, Sleekform, Vivo and many others



Variable™



Variable™ Plus



Vivo Dragonn

Saddle

Garber, 1973 medical patent

Bambach (1988) - 1980s, Mary Gale, AU

patients with musculoskeletal disabilities
trunk control and stability on horse

Salli (1990) – entrepreneur complained to a MD

Geneva debut

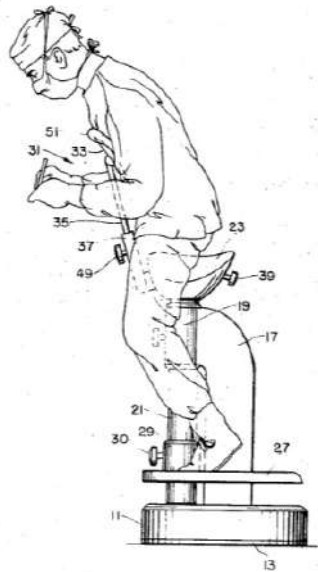
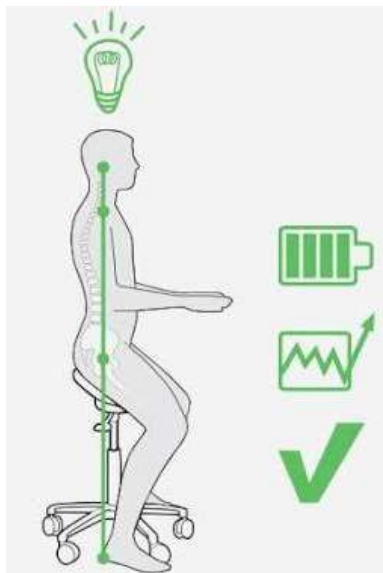
HÅG/Flokk Capisco (1984) - Peter Opsvik



<https://www.bambach.com.au>

<https://salli.com>

<https://hag-office.com>



Bambach



Salli



Hag/Flokk



US3754787; US4607882, US6709052B2, US8317267B2, AU768884B2, US10918213, USD328678, USD603631

Cross-legged “Turkish”, high

Historic tradition, SEA coffees
Vivo
Pipersong



<https://vivo-us.com/products/chair-cl02b-r>
<https://pipersong.com/collections/meditation-armchair>

US5029350A, US7628455B2, US12004659B2, US20120074753A1, US7946972, US8616651, WO2010103513A1

Leaning/Perching/Sit-Stand (ischium) structures

<https://ergoimpact.com/pages/leanrite-standing-chair>

<https://www.aeris.de/en/products/aeris-muvman-wollmischung-select-schwarz>

<https://www.yankodesign.com/2020/07/20/this-assistive-standing-support-relieves-pressure-and-reduces-shoulder-neck-and-back-pain/>

<https://ergowebshop.de/Lotz-3600-Standing-aid>

<https://www.standingdesknation.com/products/focal-locus-seat>

<https://www.upliftdesk.com/stools/>



Ergoimpact



Aeris
Muvman



Yanko
design



Lotz,
Grainger, ...



Focal upright



Varier
Move

Reverse / Astride sitting

Anti-lean

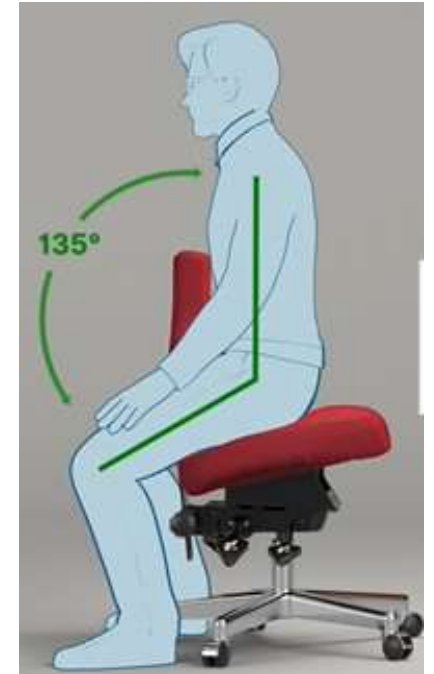
Astride bionics – Enyware accessory



Hag Capisco



Newtral – Freedom-X



NuChair

<https://newtralchair.com/products/newtral-freedom-x-multi-posture-standard-chair-with-armrest-pink>

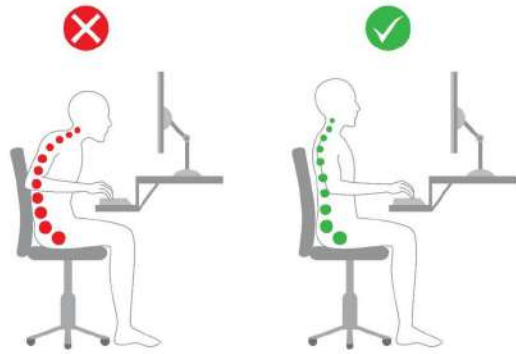
<https://hag-office.com/>

<https://astride.io/products/enyware-seat>

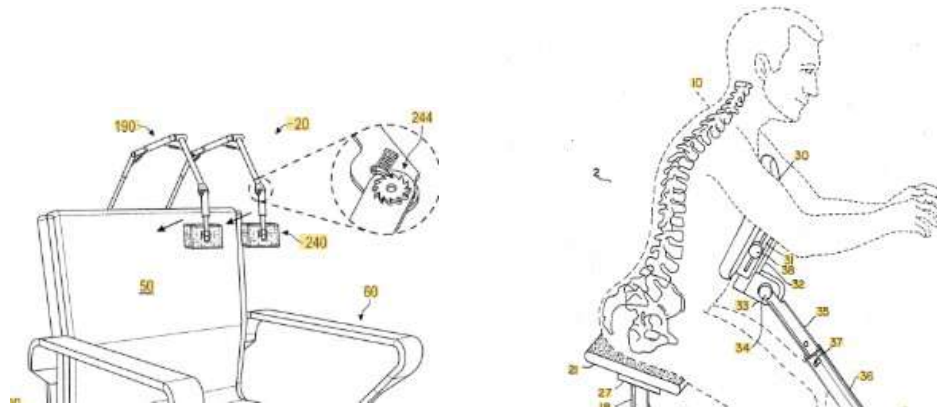
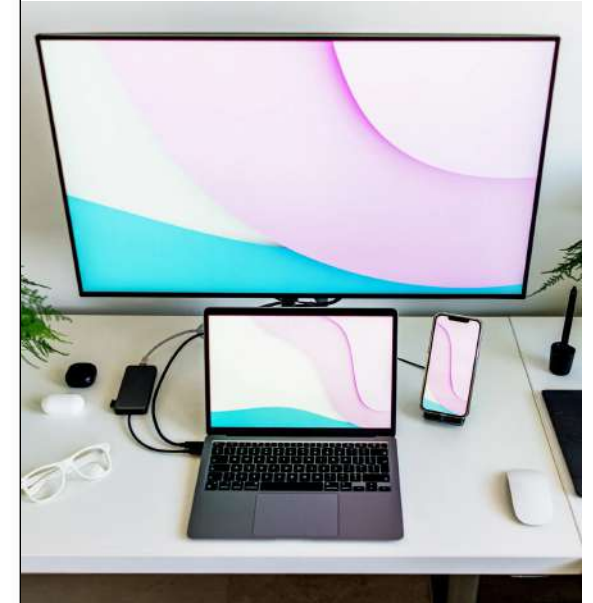
<https://nuchair.com/>

→ US10646051B1, US4650249A
US4607882, US4832407A, US7234768B2, US10960263

Anti-C-high: forward-stooped/leaned



Extra screen

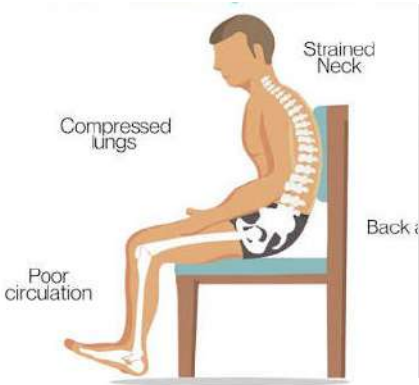


Anti-C-low: sacral/sliding/slouching w backrest

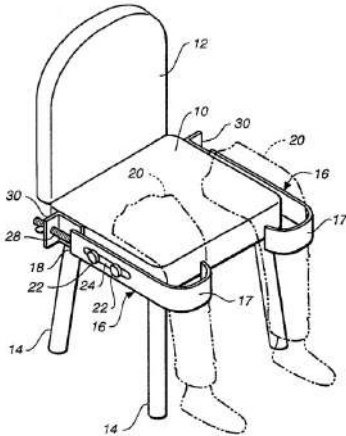
Knee-lean



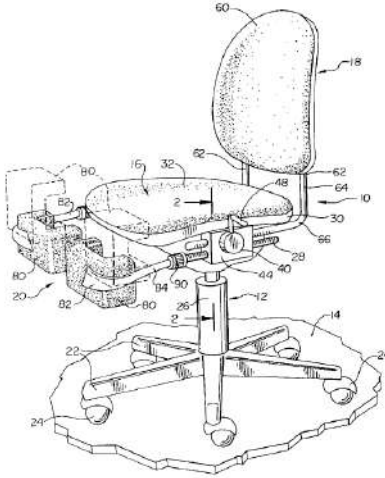
<https://www.getbetterback.com>



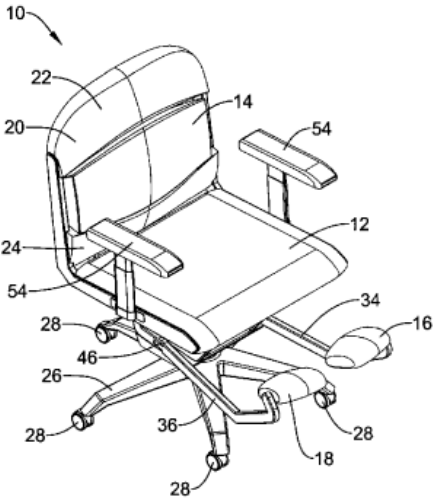
US4773106A



US5342116A



US6068157



US8052217B2

C: slump/collapsed



Muscles!

Lower Back

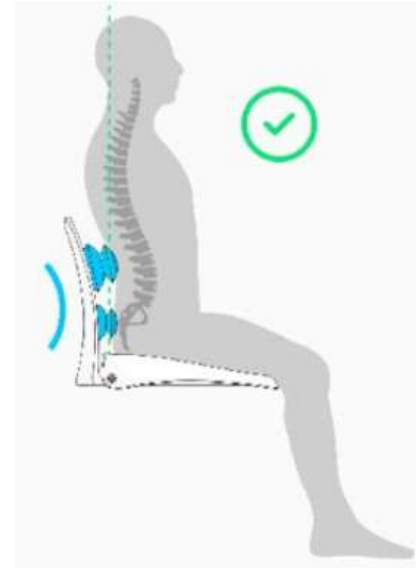
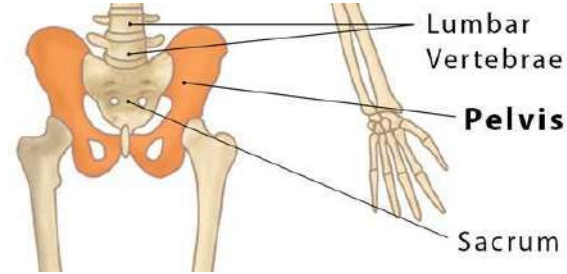
Lumbar / Pelvic support



Several vendors



Newtral NT002
Lumbar



Simply lower=pelvic: HM, SeatPlus, ...
HM "Pocket" solution – no slip



LiberNovo Omni
Motorized

<https://www.amazon.de/-/en/plastific-Support-Backrest-Portable-Breathable/dp/B093FPF132>

<https://newtralchair.com/products/newtral-nt002-ergonomic-office-chair>

<https://valueofficefurniture.com.au/officefurniture/ergonomic-office-chairs/sadie-high-back-office-chair-with-headrest/>

<https://newtralchair.com/pages/newtral-ergonomic-chair-magich-bp>

<https://www.workspaces.ro/en/benefits-pelvic-stabilization>

<https://www.hermanmiller.com/research/categories/white-papers/innovations-in-supported-sitting/>

https://www.researchgate.net/publication/352940416_SeatPlus_A_smart_health_chair_supporting_active_sitting_posture_correction

<https://www.kickstarter.com/projects/libernovo/libernovo-omni-worlds-first-dynamic-ergonomic-chair>

US D929772

US 6,125,851

JP 2012512694A

US 7458637

US 8622474

Back: is it used at all?

Work-chair with Tilting Seat

ÅGE C. MANDAL

Pages 157-164 | Published online: 25 Apr 2007

Backrest usually not used at all...

most work requires bending forward

C: lordosis is erased

old office chairs, only the front part is worn

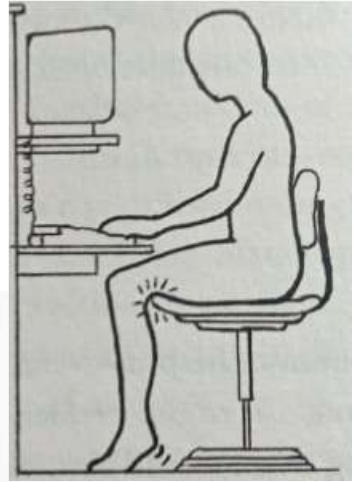
=> tilt the seat pan forward

Note: used @ “relaxing”, slight backward-tilt + ergonomic back



Waterfall-edge

Leg Veins



<https://www.gzhookay.com/the-benefits-of-waterfall-seat-edges-in-office-chairs.html>

<https://colamylhome.eu/products/colamy-aerix-futuristic-ergonomic-office-chair>

<https://ergodelux.com/product/adjustable-office-chair-with-sliding-back/>

Pressure distribution: ischiums + golden medium

GOOD

Load on sit bones (ischium), not sensitive tissue
Within: broader, not sharp

Moderate softness

Cut @ middle

Movement / micro-shifts

Poor

Sharp pressure peaks

Tilt: Sacral (not ischial) pressure appears

Much pressure on thighs

Strong front-edge thigh compression

Friction: varying: no strong shear

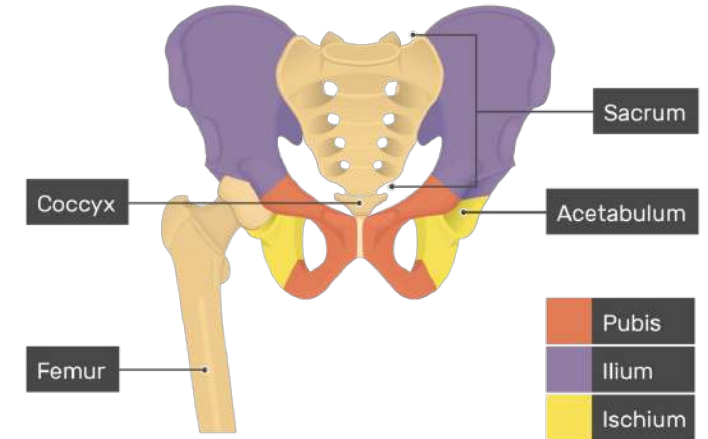
$$\mu = 0.35-0.45$$

Stiffness:

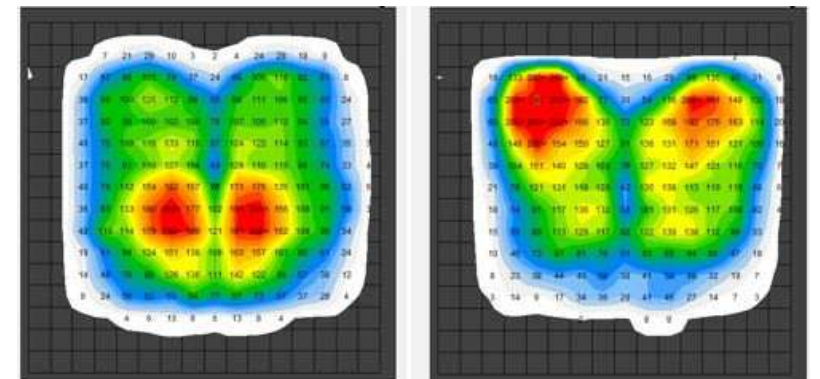
IFD: F required to compress by a given %

IFD65: 300-500N

Indentation: N/m



Pressure / Pressure gradient mapping



≈65–75% ischiums

Ischial tuberosities: adapted for weight-bearing

Combinations

Szabadalmi Közlöny és Védjegyzetítő 119. évfolyam 10. szám, 2014.05.28.

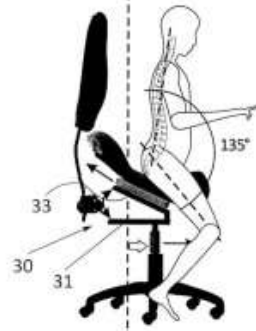
Szabadalmi bejelentések közzététele

4. ábra

CPC:
A47C7/029



5. ábra



Hungary → EP2735248A1

<https://patents.google.com/patent/EP2735248A1>



<https://humantool.com>

US 11,033,108

Activity

Lower and Upper
mechanisms



Aeris
Swopper



Aeris
Muvman



Backapp



FLEXISPOT Ergonomie Wobble Hocker

“Wobble” curved
bottom



Dynamic
standing



<https://www.aeris.de/en/products/aeris-swopper-wollmischung-capture-gruen>
https://www.ergocanada.com/ec_home/manufacturers/focal_upright_furniture_1.html
<https://www.backapp.com/en/products/backapp-wheels/>
<https://www.aeris.de/products/aeris-3dee-sondermodell-cu15-copy>
<https://www.flexispot.com/height-adjustable-wobble-stool-bh1r>

US5921628A, US7156790B2, US3024021;US20170021230

Activity

Lower and Upper mechanisms
Split



Noogi

<https://en.noogifurniture.com>
<https://core-flex.com>
<https://corechair.com>
<https://www.wilkhahn.com/en/>
<https://www.spinalis.com/en/>
<https://www.spinalis.com/en/office-chairs/>



CoreFlex



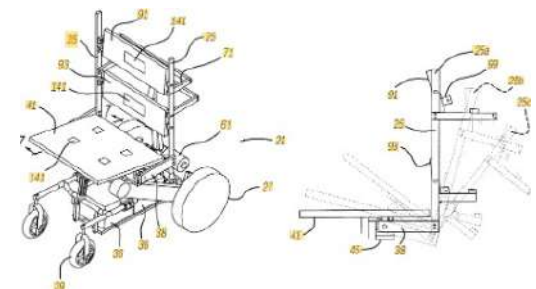
Wilkhahn



Spinalis



CoreChair



US 12,161,592 – articulating chair

US 10,945,528,
US7,350,865, US6,139,095, US11590045B2
US139948, US9211013B2, WO2000024296A1, SI-20508, US10531739B2, US7,637,570

Head and neck

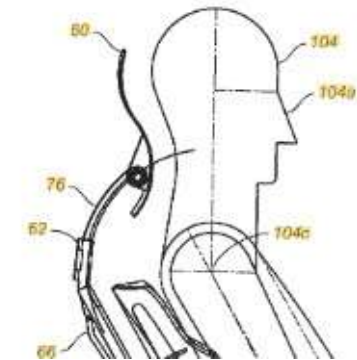
“Never used during work?”



Sihoo Doro C



Hinomi H2 Pro



US 10,299,601

<https://eu.hinomi.co/pages/h2-pro-ergonomic-office-chair>
<https://de.sihoooffice.com/en-eus>

Lean back:
head
Work: neck

US6,962,392B2, US9521908B1, US 10,299,601

Armrests

“Never used during work?”

Too high

→ shoulders shrug up → chronic trapezius tension, neck/shoulder pain

Too low

→ arm hangs unsupported → shoulder/neck muscles work constantly

Too wide

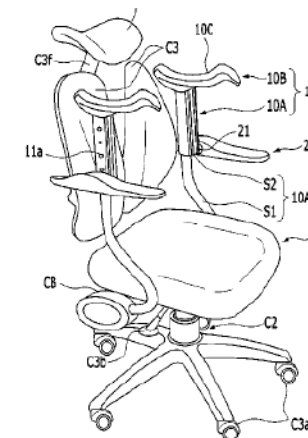
→ elbows splay outward → shoulder strains to reach → poor posture.



Steelcase Gesture – 360° Arms



2



US1000433

8

US5484187A,
US 6,053,578

Adjust to person!



Herman Miller - A/B/C
HÅG/Flokk – normal and petite
A lot: wide adjustment



*The best posture is the next
posture*

Market

<https://www.fortunebusinessinsights.com/ergonomic-chair-market-112042>

<https://dataintelo.com/report/ergonomic-posture-chair-market>

Google AI “market share of kneeling and saddle and active chairs”

Ergonomic furniture market: order of 20 Bn USD/yr; Office chair market: cca. 18 Bn USD

Ergonomic Chair Market: cca 12 Bn USD

cca. 20%

specialty chairs :: kneeling chairs, saddle chairs, active chairs

Kneeling and Saddle: cca. 5-6%

Active: cca 8%



HOME INDUSTRIES



Consumer Goods

/ Ergonomic Chair Market

60%

of premium ergonomic chair buyers prefer specialty stores

Share:

North America 36%

Asia-Pacific 30%

Europe 24%

CAGR (Compound Annual Growth Rate) 8%

Exoskeleton chairs

Several vendors – see Amazon



<https://www.amazon.com/Invisible-Adjustable-Ergonomics-Lightweight-Exoskeleton/dp/B0DFYF6B8F>

Bike chairs



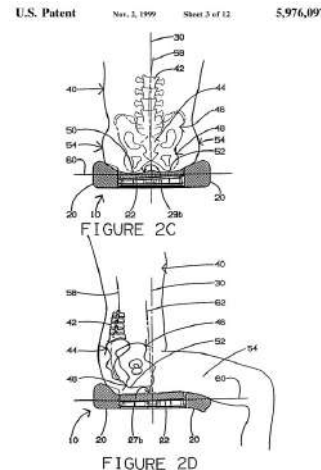
<https://www.flexispot.com/intelligent-office-fitness-chair>

Continuous passive motion (CPM) chairs

concentrated work and motion @ same time

encourages subconscious movement

motor-driven seat components



To date:
only medical applications

> PLoS One. 2023 Dec 22;18(12):e0294778. doi: 10.1371/journal.pone.0294778. eCollection 2023.

A novel motorized office chair causes low-amplitude spinal movements and activates trunk muscles: A cross-over trial

Hendrik Schäfer^{1 2 3}, Robin Schäfer^{1 4}, Petra Platen¹

Length of the spine while sitting on a new concept for an office chair

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Abstract

Changes in spinal length were used to evaluate a new concept for an office chair. This so-called dynamic chair imparts passive forced motion to the seated subject. The passive forced motion is a rotary movement about an axis, perpendicular to the seat with amplitude of 0.6° and a frequency of 0.08 Hz. Change of stature is assumed to provide a measure for spinal load. Eight subjects were

0.04-0.12 Hz

Spec professions'



Piano



Salli (Med.)



Airbus



Volvo



Foldable/
Baby



Space

Giovanni A. Borelli	(1680)	Italy	<i>De Motu Animalium</i> , founding text of modern biomechanics
Bernardino Ramazzini	(1700)	Italy	First occupational-disease link: sedentary work causes lumbago
Nicolas Andry	(1741)	France	First medical proposal: backrest for lumbar lordosis (Orthopaedia)
G. Hermann v. Meyer	(1873)	Germany	Functional anatomy & skeletal biomechanics
Franz Staffel	(1884)	Germany	Lumbar support, forward-sloping seat & physiological sitting posture
Hans Strasser	(1913)	Switzerland	Scientific chair geometry: seat/backrest inclination & body support
Beckett Howorth	(1946)	USA	Dynamic Posture
Bent Åkerblom	(1948)	Sweden	Åkerblom curve – lumbar support, EMG, Xray
J. Jay Keegan	(1953)	USA	X-ray: trunk–thigh angle → pelvic rotation & lordosis (~135°)
Hanns Schoberth	(1962)	Germany	X-ray: max 60-deg hip flexion @ stand → sit
Alf Nachemson	(1960's)	Sweden	In vivo intradiscal pressure
Étienne Grandjean	(1960's)	Switzerland	Changing postures, office ergonomics
Aquilino Cosani	(1960's)	Italy	Ball-based seating (Pezzi)
Don B. Chaffin	(1960s)	USA	Occupational biomechanics & biomechanical modeling
Gunnar B. Andersson	(1970's)	Sweden	Biomechanics, combining EMG + disc pressure
Åge Ch. Mandal	(1970's)	Denmark	Hip angle: Forward sloping seat; Neck angle: tilted table
Bill Stumpf	(1970's)	USA	Ergon & Aeron chairs – translated "no single correct posture" principle
Hans Ch. Mengshoel	(1980's)	Norway	Discovery of the kneeling posture (Varier)
Peter Opsvik	(1980's)	Norway	Kneeling chair + saddle chair (HÅG, Varier)
Tom Bendix	(1980's)	Denmark	Seat slope & backrest inclination effects on trunk posture
Michael A. Adams	(1980's)	UK	Posture and fluid content in the lumbar discs
Vladimír Janda	(1980's)	Czech Rep.	Upper Crossed Syndrome
Emilio Ambasz	(1970's)	Argentina/USA	Automatic response to sitter movement
Bill Stumpf	(1970's–90's)	USA	Ergon, Equa & Aeron – human-centred ergonomic office-chair design
Don Chadwick	(1970's–90's)	USA	Equa flexible shell & Aeron suspension seating (with Stumpf)
Michael J. Griffin	(1980's)	UK	Two-factor model of static seat cushion comfort
Alan Hedge	(1980's)	USA	20-8-2 rule, reclining posture (~110°), computer-work ergonomics
Mary Gale	(1990's)	Australia	Clinical validation of the saddle chair (Bambach)
L.J.M. van Deursen	(1990's)	Netherlands	Rotary continuous passive motion; motorized dynamic sitting

William S. Marras	(1980s–present)	USA	Occupational spine biomechanics, EMG-spinal loading & LBP
Hans-Joachim Wilke	(1990s–present)	Germany	Advanced intradiscal pressure measurements
Josef Glöckl	(1990s–present)	Germany	Active sitting (Aeris)
Veli-Jussi Jalkanen	(1990s–present)	Finland	Saddle chair (Salli)
Jack T. Dennerlein	(1990s–present)	USA	Workstation biomechanics & human–computer interaction
Stuart M. McGill	(1990s–present)	Canada	Lumbar spine biomechanics; sitting posture & spinal loading
Leon Straker	(1990s–present)	Australia	Computer-work posture, postural variability & sedentary work
Maury A. Nussbaum	(1990s–present)	USA	Occupational biomechanics; muscle fatigue & postural control
Michiel P. de Looze	(1990s–present)	Netherlands	Sitting comfort, seat biomechanics & pressure distribution
Mark Benden	(1990s–present)	USA	Sit/Stand workstation ergonomics
Svend Erik Mathiassen	(1990s–present)	Sweden	Muscular & postural variation
Kermit G. Davis	(1990s–present)	USA	Low-back biomechanics & postural variability
Peter Vink	(2000s–present)	Netherlands	Comfort/discomfort: office chair controls, seat & backrest angle
Carisa Harris-Adamson	(2000s–present)	USA	Office-chair design, sitting behaviour & occupational biomechanics
Wayne J. Albert	(2000s–present)	Canada	Occupational biomechanics; active sitting & lumbar loading
Pascal Madeleine	(2000s–present)	Denmark	Quantification of sitting dynamics & motor variability
Prawit Janwantanakul	(2000s–present)	Thailand	Postural shifts & active breaks
Shen Liming	(2000s–present)	China	Office-chair ergonomics, seat-pressure distribution & sitting comfort
Jack P. Callaghan	(2000s–present)	Canada	Posture variation, cumulative spinal loading & low-back pain
Jaap H. van Dieën	(2000s–present)	Netherlands	EMG, trunk kinematics, spinal shrinkage in office chairs
Paul W. Hodges	(2000s–present)	Australia	Sitting posture, trunk muscle control & low-back pain
Peter O’Sullivan	(2000s–present)	Australia	No ideal sitting posture, spinal kinematics & LBP
Rolf Ellegast	(2000s–present)	Germany	Posture change > chair-induced motion
Galen Cranz	(1990s–present)	USA	The Chair (1998); critique of right-angled sitting
Wim Dankaerts	(2000s–present)	Belgium	Sitting-posture subgroups, lumbar posture & muscle activation in LBP
Michelle Cardoso	(2000s–present)	Canada	Prolonged sitting, alternative/active seating, chair biomechanics
Kieran O’Sullivan	(2010s–present)	Ireland	Posture beliefs & low-back pain; challenges the “correct posture” concept
Hendrik Schäfer	(2010s–present)	Germany	Continuous passive motion chairs
Roman P. Kuster	(2010s–present)	Switzerland	Dynamic seat biomechanics & supported spinal movement
Ronald Zemp	(2010s–present)	Switzerland	Pressure distribution, sitting posture classification (ML), stress & LBP
Myles O’Brian	(2010s–present)	Canada	Sedentary Behaviour Research Network
Diana De Carvalho	(2010s–present)	Canada	Prolonged sitting, office-chair biomechanics & low-back pain

Callaghan Lab / Occupational Biomechanics & Ergonomics Lab (OBEL) – University of Waterloo (Canada)
De Carvalho Lab / Spine & Occupational Biomechanics – Memorial University of Newfoundland (Canada)
Albert / Occupational Performance Lab (OPL) – University of New Brunswick (Canada)
Wilke Lab / Spine Biomechanics – Universität Ulm (Germany)
van Dieën Lab – Vrije Universiteit Amsterdam (The Netherlands)
de Looze team / Physical Ergonomics – TNO / Vrije Universiteit Amsterdam (The Netherlands)
Marras / Spine Research Institute – Ohio State University (USA)
Nussbaum Lab / Occupational Ergonomics & Biomechanics Laboratories – Virginia Tech (USA)
Hitka/Sydor team – Zvolen/Zólyom (SK) – Poznań (PL)
Roman-Liu Lab / CIOP-PIB Biomechanics Laboratory – Warsaw (Poland)
Dept of Human Centered Design – Cornell University (USA)
Human Health Laboratory – InnoRenew CoE (Slovenia)
Hodges Lab – University of Queensland (Australia)
O’Sullivan Lab – Curtin University (Australia)
Straker team / Occupational & Sedentary Behaviour Research – Curtin University (Australia)
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Benden Lab – Texas A&M (USA)
Luximon Lab - Asian Ergonomics Design Lab - Hong Kong PolyU (China)
Zhang Lab – Tsinghua University (China)
Liming / Nanjing Forestry University / College of Furnishings and Industrial Design – Nanjing (China)
Harris-Adamson Lab / UC Ergonomics Laboratory – UC Berkeley / UCSF (USA)
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Chair of Ergonomics, TUM School of Engineering and Design, Technical University of Munich (Germany)
Loughborough University (United Kingdom) Design Ergonomics Research Group (UK)
Cardiff University Research Centre for Clinical Kinesiology (UK)
Sedentary Behaviour Research Network – SBRN (Canada)

Industry

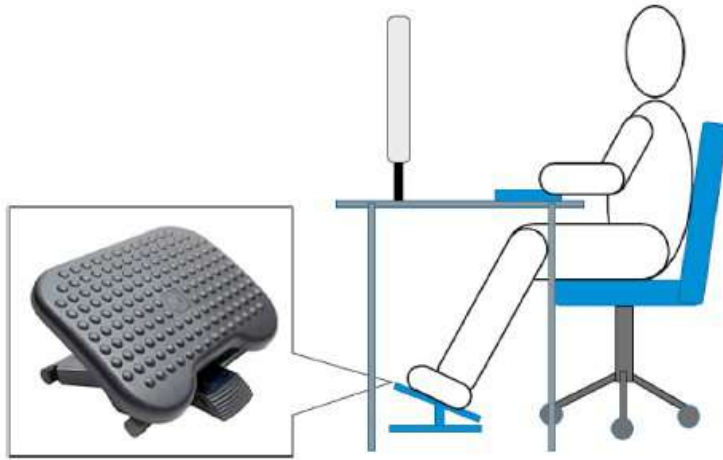
Herman Miller – USA – Kinematics, pressure distribution & pelvic support
Haworth – USA – Pressure-mapping & seating biomechanics
Steelcase – USA – Global Posture Study & technology-driven sitting postures
Wilkhahn – DE – 3D Dynamic Sitting
Okamura – JP – Task-dependent 5-postures

HÅG (Flokk) – NO – Rocking Tilt & Multi-posture Saddle
Salli – FI – Split Saddle Seat
Varier (ex-Stokke) – NO – Kneeling / Balans Seating

Institutes

IAO – Fraunhofer-Institut für Arbeitswirtschaft und Organisation (Germany)
TNO – Netherlands Organisation for Applied Scientific Research (The Netherlands)
NIOSH – National Institute for Occupational Safety and Health (USA)
JNIOH – National Institute of Occupational Safety and Health (Japan)
HSE – Health and Safety Executive – Science and Research Centre (UK)

Accessories +



Applied Ergonomics 98 (2022) 103550



KR20220163594A, US20210030618A1, US7654971B2 (massage)
US20220031080A1, US8322791B2 (footrest)

Accessories +



Neck corrector Anti-Bowing US7674234B2



Electronic posture corrector

Upright Go2



<https://www.uprightpose.com>



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cu Vibratii -...
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senzor, corecto...
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postură corectă...
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Postură Gât Și
Cocoașă, Supo...
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Angle
In-built
ultrasound

Why not immediate spread?

Delayed consequences

“Everybody knows, almost no one follows”

Temporal/hyperbolic discounting = close reward is important

– George Ainslie (1975, 1992), Loewenstein & Prelec (1992)

Construal Level Theory = far is abstract

– Trope & Liberman (2003, 2010)

Normalization of deviance => Challenger catastrophe

– Diane Vaughan (1996)

Switching costs / lock-in = uncomfortable to change

– Brian Arthur (1989)

Innovation resistance theory = being too comfortable

– Ram & Sheth (1989)

SEVERAL METHODS TO OVERCOME

Future self-continuity – “picture @ 80 yrs”

Immediate small reward

Loss-framing

Premortem-method – “assume its gone...”



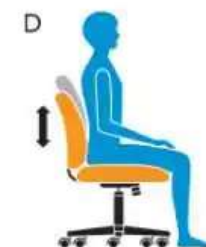
Tension Adjustment



Chair Tilt Lock



Seat Height



Back/Lumbar Height



Seat Depth



Seat Angle Adjustment



Back Angle



Arm Height



Waterfall Seat Edge



Properly Contoured Cushions



Width Adjustable Arms



Top View

Arm Rotation



Center-Tilt Movement



Soft Descent Pneumatic Lift



Lumbar Depth Adjustment



Curved desk



Sit-stand / height adjustable desk



KT1 Ergonomic Keyboard Tray Under Desk Japan

US7942374 keyboard
US9113703, US8752488B2 sit-stand desk
US8839723B2 display holder

Today: Sensors, Data, Refinement.
Only?

https://www.ccohs.ca/oshanswers/ergonomics/sitting/sitting_alternative.html

<https://www.baua.de/EN/Topics/Work-design/Digitalisation-AI/Modern-VDU-work/Dynamic-approach-to-standing-and-sitting>

Galen Kranz	2000	USA	The Chair
Peter Vink (ed.)	2004	Netherlands	Comfort and Design
Pheasant & Haslegrave	2006	UK	Bodyspace
Karl Kroemer	2025	USA	Fitting the Human
Chaffin, Andersson, Martin, Nussbaum	2023	USA	Occupational Biomechanics