

Ubumenyi butagira Imipaka

Itegeko ryo mu 1901 rigenga amashyirahamwe



Jean-Pierre Petit, Perezida w'iri Shirahamwe

Uyu Jean-Pierre Petit, Peresida w'iri shyirahamwe ry'Ubumenyi butagira Imipaka, yahoze ari diregiteri w'ubushakashatsi mu kigo cy'inzobere cya CNRS, mu Bufaransa. Akaba kandi inzobere ihanitse muri Fizike y'inyenyeri (Asitorofizike); yahimbye uburyo bushyashya by'inyandiko bita: *Ibitabo by'amashusho by'ubumenyi*. "Ubumenyi butagira Imipaka" ni ishyirahamwe ryahimbwe mu 2005 n'abagabo babiri, Jean-Pierre Petit na mugenzi we Gilles d'Agostini. Iri shyirahamwe ryihaye intego yo gukwirakwiza kw'isi hose ubumenyi ku buntu harimwo n'ubumenyi bwa tekhnike, ubukorikori n'ikoranabuhanga. Iri shyirahamwe ribeshejweho n'inkunga rihabwa. Izo nkunga nizo ziraha abantu bahindura inyandiko mu zindi ndimi. Buri nyandiko (igitabo cy'amashusho cy'ubumenyi) ihindurirwa mu rundi rurimi ku mafaranga angana n'amayero 150 (150 euros) kuva mu 2007 kugeza ubu. Iri shyirahamwe rinariha amafaranga ajyanye n'iyoherezwa ucishije muri banke ry'ayo mafaranga y'ihinduranya mu zindi ndimi. Abahinduranyi b'indimi bagiye bongera, buri munsu, umubare w'ibyo bitabo bisomwa hose k'ubuntu. (Nko kugeza mu 2007, hari hamaze kuboneka ibitabo magana abiri (200) bikurwa kuri interineti k'ubuntu kandi byanditse mu ndimi makumyabiri n'umunani (28) harimwo ikinyarwanda n'ururimi rwo muri Lawosi).

Biremewe ko iki gitabo gikopororwa cyangwa gifotorwa, cyose cyangwa igice; kinakoreshwa n'abarimu mu masomo ariko mu buryo butari uburya inyungu z'amafaranga. Gishobora gushyirwa mu masomero y'uturere, y'amashuri cyangwa ya za kaminuza, cyanditse ku mpapuro cyangwa cya shyizwe mu miyoboro y'imbuga z'ikoranabuhanga zigose (intranet).

Uyu mwanditsi w'ibi bitabo yatangiye kwandika ibindi byo byoroshye kandi bigenewe abana bato (bari mu rugero rw'imyaka 12). Ibindi biriho bikorwa n'ibitabo by'amajwi avuga, bigenewe abatazi gusoma cyangwa abashaka kwiga urundi rurimi rutari urwo bakuriyemwo.

Iri shyirahamwe rishaka buri gihe abahinduranyi b'inyandiko bazishyira mu ndimi zabo zakavukire ariko bafite ubuhanga buhagije bwo gutanga inyandiko mpiduranyi nziza z'ibitabo basomye.

Ushatse kugira icyo ubaza cyangwa ugeze kuri iri shyirahamwe, wajya ku rubuga rwaryo ku interinete aha hakurikira: <http://www.savoir-sans-frontieres.com>

Iranga-konti mu Bufaransa → Inyandiko ngaragaza mutungo muri (RIB)

Ikigo	Umwanya wo kwakiriramo amafaranga	Nimero ya konti	Urufunguzo rwa RIB
20041	01008	1822226V029	88

Aho ikorera: Banki ya Posita
Hagati y'Umujyi wa Marseille
13900 Marseille CEDEX 20
Mu Bufaransa

Mu bindi bihugu → Ibanki Mpuzamahanga (International Bank) Nimero ya Konti (IBAN):

IBAN
FR 16 20041 01008 1822226V029 88

→ N' Inyandikobanga ya banki (BIC) :

BIC
PSSTFRPPMAR

Amategako agenga iri shyirahamwe agaragara ku rubuga rwa yo kuri interineti. Imibare ngaragaza mutungo nayo irahari kandi ihora ishyirwa ku gihe. Iri shyirahamwe nta mafaranga na make rikura ku nkunga rihawe uretse ayo kohereza, bicishijwe muri banki, ahemba abahinduranyi b'indimi ku buryo babona abagenewe yose. Nta munyamuryango w'iri shyirahamwe n'umwe rihemba kuko bose ari abakoranabushake.

Abanyamuryango ubwabo nibo barihira amafaranga ishyirahamwe rikoresha ngo ribeho nk'ayo kwishyura no gukoresha urubuga rwa yo rwo kuri interineti kuko ayo atarihwa n'ishyirahamwe.

Bityo mugaragarizwa neza uko umutungo w'ishyirahamwe ukoresheka kandi mukibonera ikizere ko, muri iyo "mirimo y'ubwitange mfashamuco", inkunga yose mutanga ikoresheka neza mu kwishyura abahindura ibitabo mu zindi ndimi.

Dushyira ku rubuga rwa interineti buri kwezi, ugereranije, nk'ibitabo cumi bihinduwe mu zindi ndimi.

Savoir sans Frontières

Ingyendo nshakisha z'Anselimi Lanturulu

ASiPiRiSUFULE

Johani-Petero Petit



Byahinduwe na :
Mohamed Abdel aziz Kamanzi

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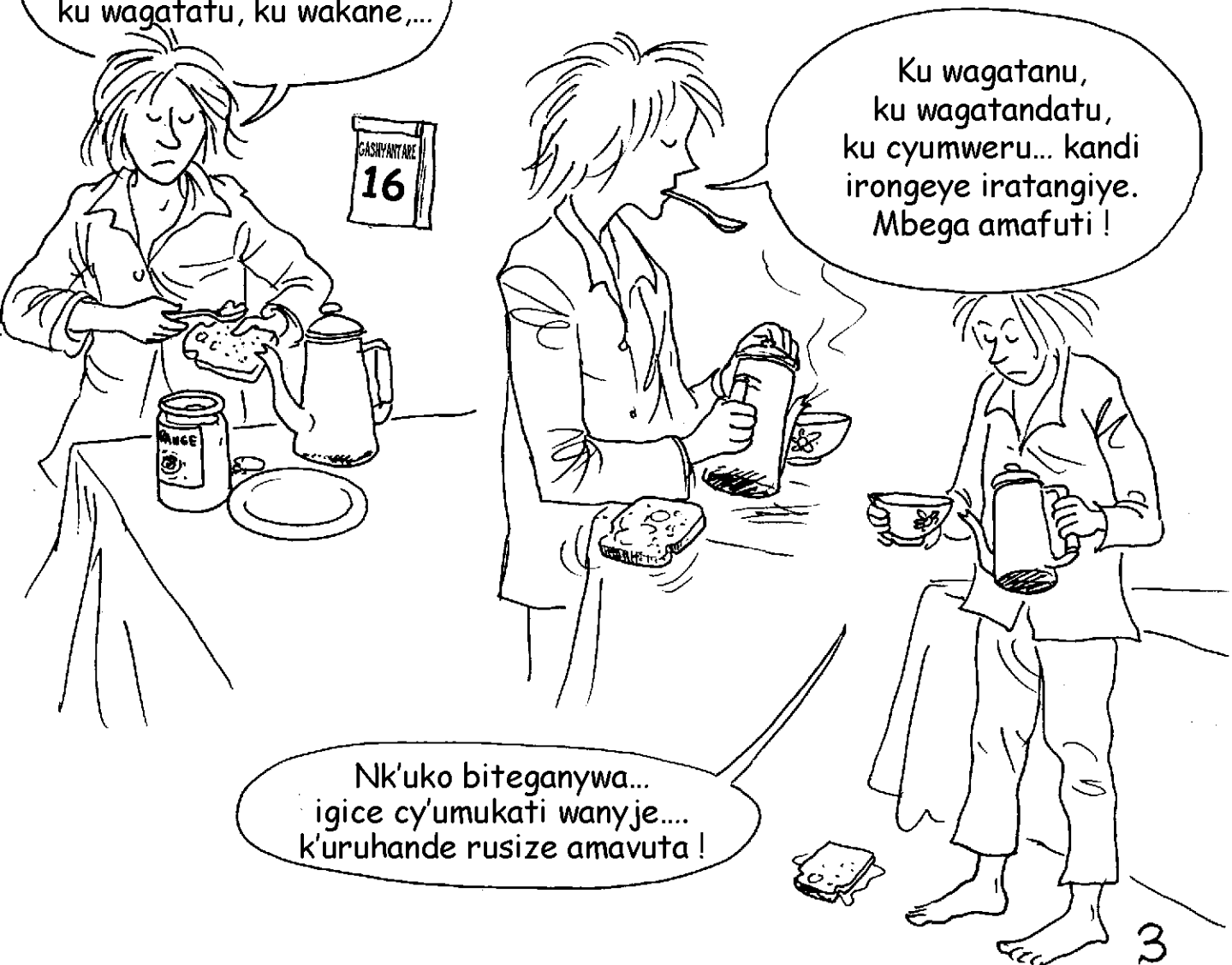
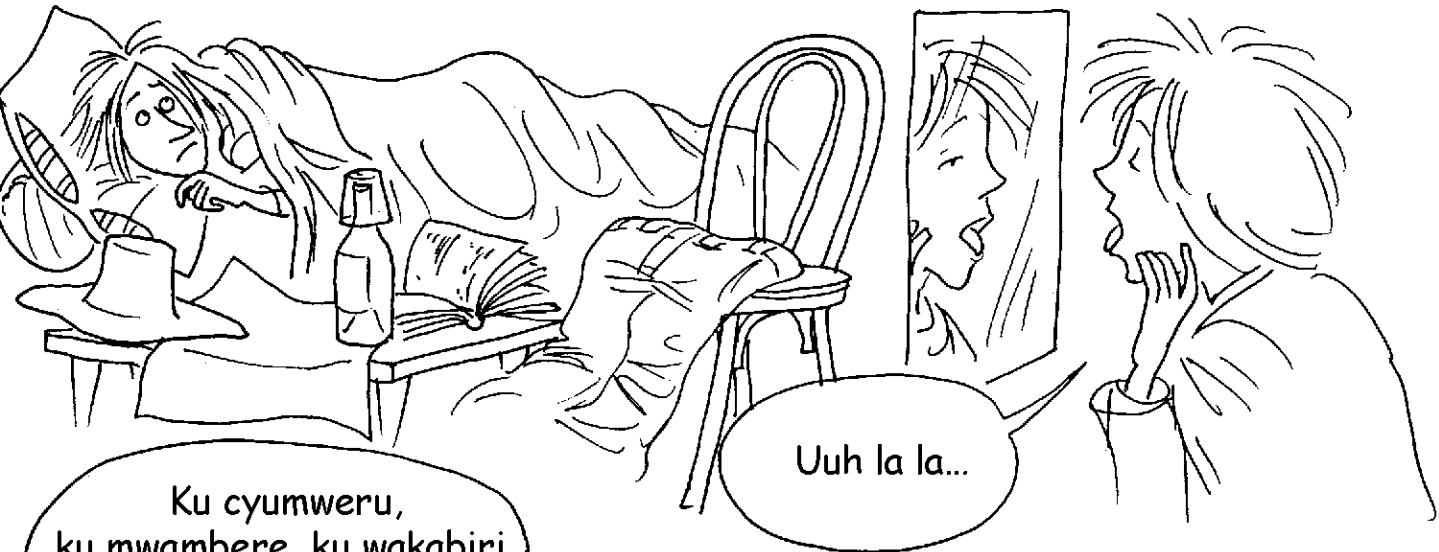
<http://www.savoir-sans-frontieres.com>



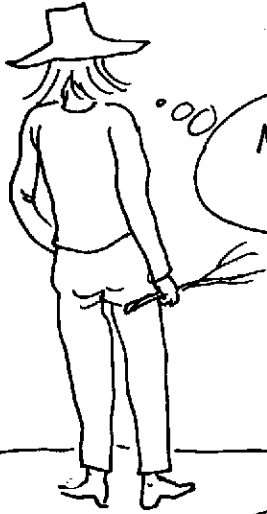
... Murabyumva,
hatabayeho itsirimana
n'umuyaga, ishokashoka
iruhande y'izuru ry'indege
ryaba ritandukanye kandi
ntiryatanga igurukisha...

INKOMOKO Y'INKURU :

Umunsi umwe, mu gitondo, Lanturulu yazindukanye umushiha ukabiye.



Anselimi yumvaga ababaye kandi ari nk'igishushungwe mu buryo burengeye ibyamubayeho. Isi yari ibyataraye nk'ibitigeze bibaho. Iminsi yarasaga nk'ibitonyanga by'imvura...



Magisi, Magisi arihehe ?



Ari hariya hejuru. Mbega amahirwe agira !



**MAGISI !
NANJYE NDASHAKA
KUGURUKA !**



Kuguruka ?
Mana nkuru !

Magisi, uzanyigishe kuguruka.
Tuzabibonera neza uburyo. Narambiwe
gukurura inda kuri iyi si !



Reba, nzamuye ikirenge.
Noneho ninzamura ikindi n'ingoga, yenda nza....

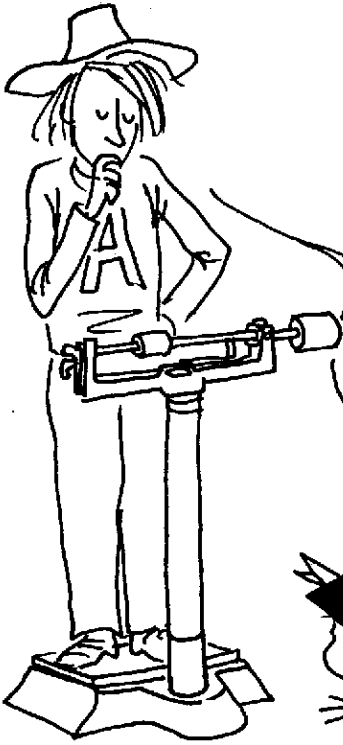


Bigomba kuba
ari uyu mwuka wose
uremerera intugu



Ibiramambo ! isunika ry'Ashimede rigabanya
uburemere bwa we ho garama mirongo inani.

IGIHE KIMWE HABAYEHO ARISHIMEDE



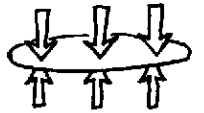
Urashaka kuvuga ko iyo nipimye uburemere, u munzani utagaragaza uburemere bwa njye neza kubera isunika rya Arishimede ?



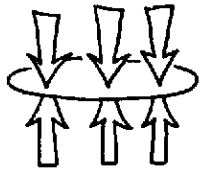
Ni byo rwose, mu by'ukuri uburemere bwa we nyabwo bugana n'ubwo umunzani ukwerekana wongeyeho garama 80.



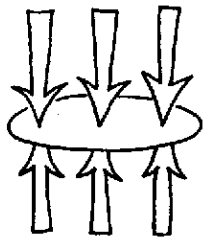
Ihame ry'Arishimede... bararivuga...bararivuga... ariko se ubundi ni iki koko mu by'ukuri ?

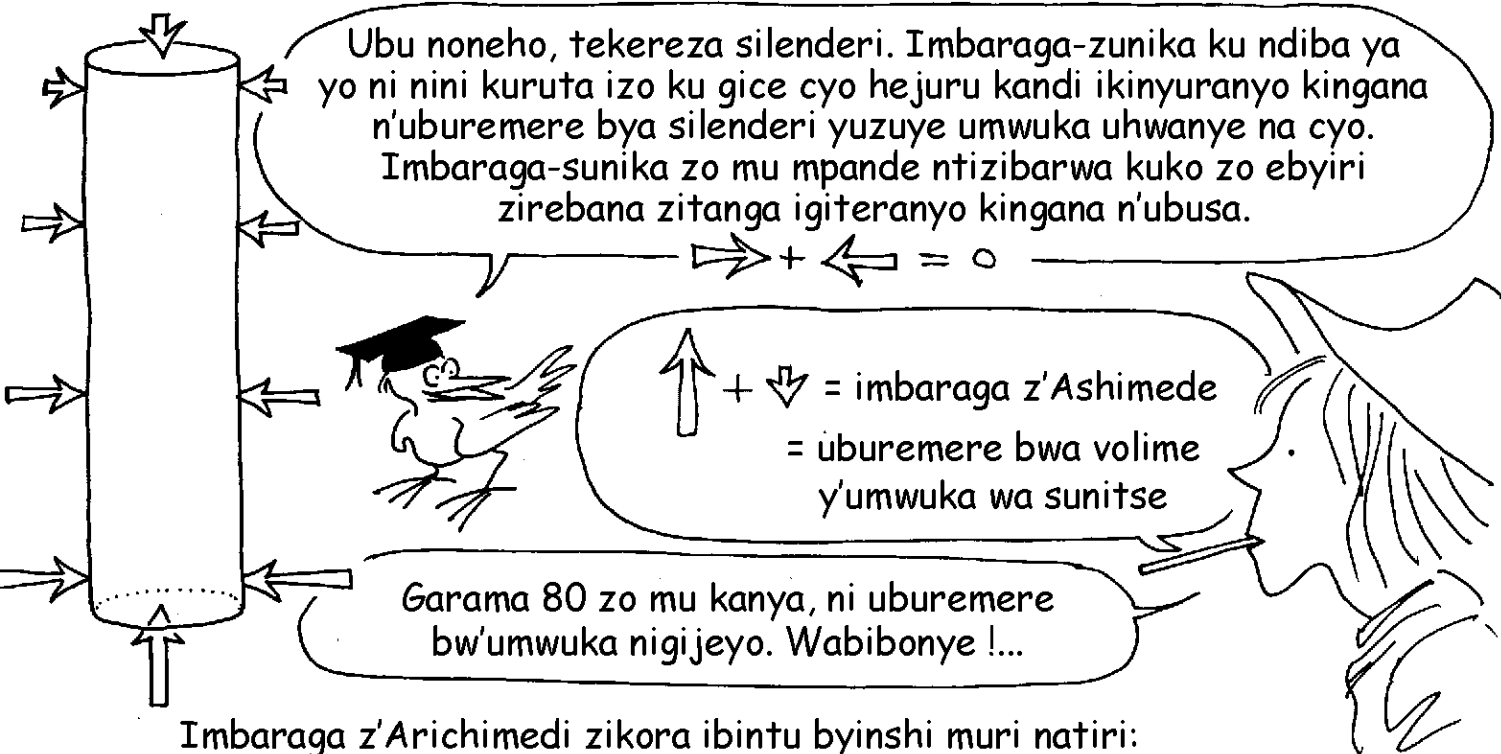


Imbaraga zishyirwa kuri disikye yinitse mu gitamba :



Tekereza idisikye yinitse muri atimosiferi. Inkingi y'umwuka iri hejuru, iremerera urwo ruhanda rwo hejuru. Uko iyo nkingi y'umwuka iba ndende, ni ko izo mbaraga ziba nyinshi. Ariko niba iyo disikye ifite umubyimba muto cyane, imbaraga zitsindagira, zingana kandi zihanganye, zitsindagirwa ku ruhanda rwayo rureba hasi kandi igiteranyo cy'imbaraga zose kikangana n'ubusa.





Imbaraga z'Arichimedi zikora ibintu byinshi muri natiri:

IMIYOBORO YO GUSERURA

Garama mirongo inani... ntabwo arizo zituma umuntu aguruka...

Ngiye kwitekerera icyayi.



Ese ndashyuhisha iki amazi? Ese uwakoresha iyi radiyateri ihetamye ?



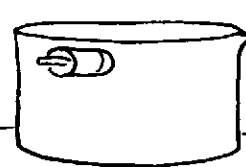


Irabikora
neza bitangaje, yatangiye
kubira aka kanya !

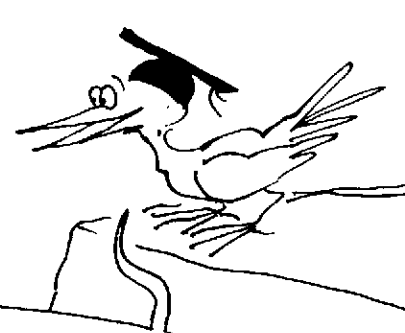


Ariko icyi cyayi
kirakonje pe !!

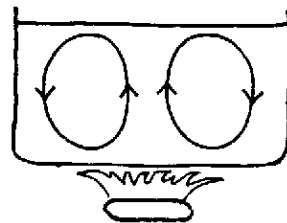
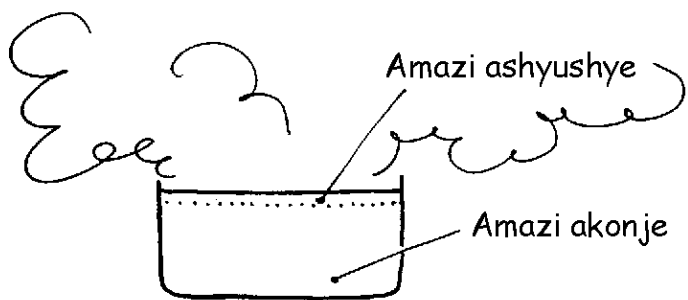
N'amazi
yo mw'isafuriya
nayo ni uko !!



Sinshobora kubyumva.
Hashize umunota umwe
gusa ayamazi yabiraga !



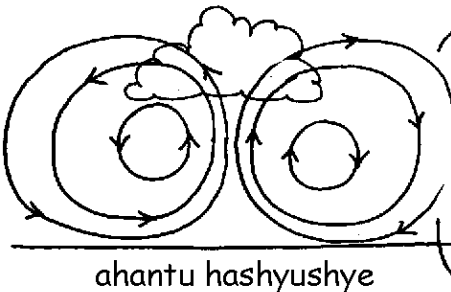
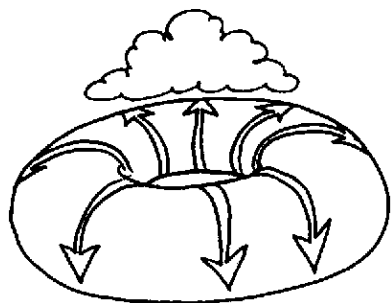
Washyushyaga gusa amazi yo hejuru,
kandi ako gasaso k'amazi ashyushye,
gakwedutse kubera ubushyuhe,
gahita koroha noneho kakarembere.
Ni ibyo gusa.



Ibiramambo, iyo ushyuhije amazi uturutse hasi, amazi yaho mundiba arashyuha agakweduca, bigatuma agira uburemere buke, akazamuka hejuru. Aho rero ahita asubira akiyegeranya noneho agasubira hasi mundiba. Ibyo niko **UKUBIRA BISANZWE**.

Muri atimosiferi, iyo fenomene irahabera. uduce tumwe tw'ubutaka twakira cyane ubushyuhe by'izuba kurusha utundi. Umwuka, muri utwo duce, huzuramwo ububobere (uko umwuka ushyuha, ni ko ushobora kwakira amazi yahindutse nk'umwotsi). Uwo mwuka urakweduca noneho ukarushaho kuzamuka.

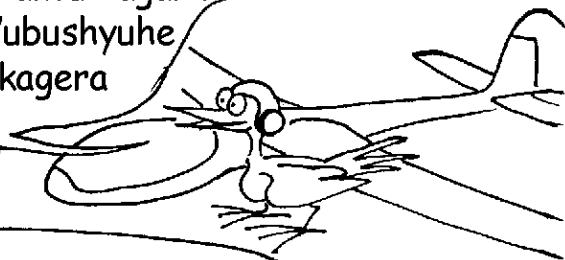
Iyo ugeze hejuru cyane, ubukonje butuma ya mwotsi y'amazi awurimwo yiyegeranya agahinduka udutonyanga hanyuma tukiyegeranyiriza mu **GICU KIZA KININI**.



ahantu hashyushye

Iyo fenomene yo kwivanga ituma igipimo cy'ubushyuhe kiba kimwe ahantu hagari.

Iyaba itabagaho, igipimo cy'ubushyuhe kw'isi cyazamuka cyane kikagera ku ma dogere Magana n'amagana.



Noneho nishumitse ku kabumbe k'umwuka ushyushye, nshobora yenda umunsi umwe kuzaguruka mu kirere ?



Itondere ibirenge bya we, wa mfurawe !!



Ni nde uvuze ?

Ntushobora kujya gutekereza ahandi !

Mwari mugiyeye kudukandagira, mwamfura mwe !

Ooh, mbabarira

Kuguruka?
Nk'aho ubuzima budakomeye cyane !

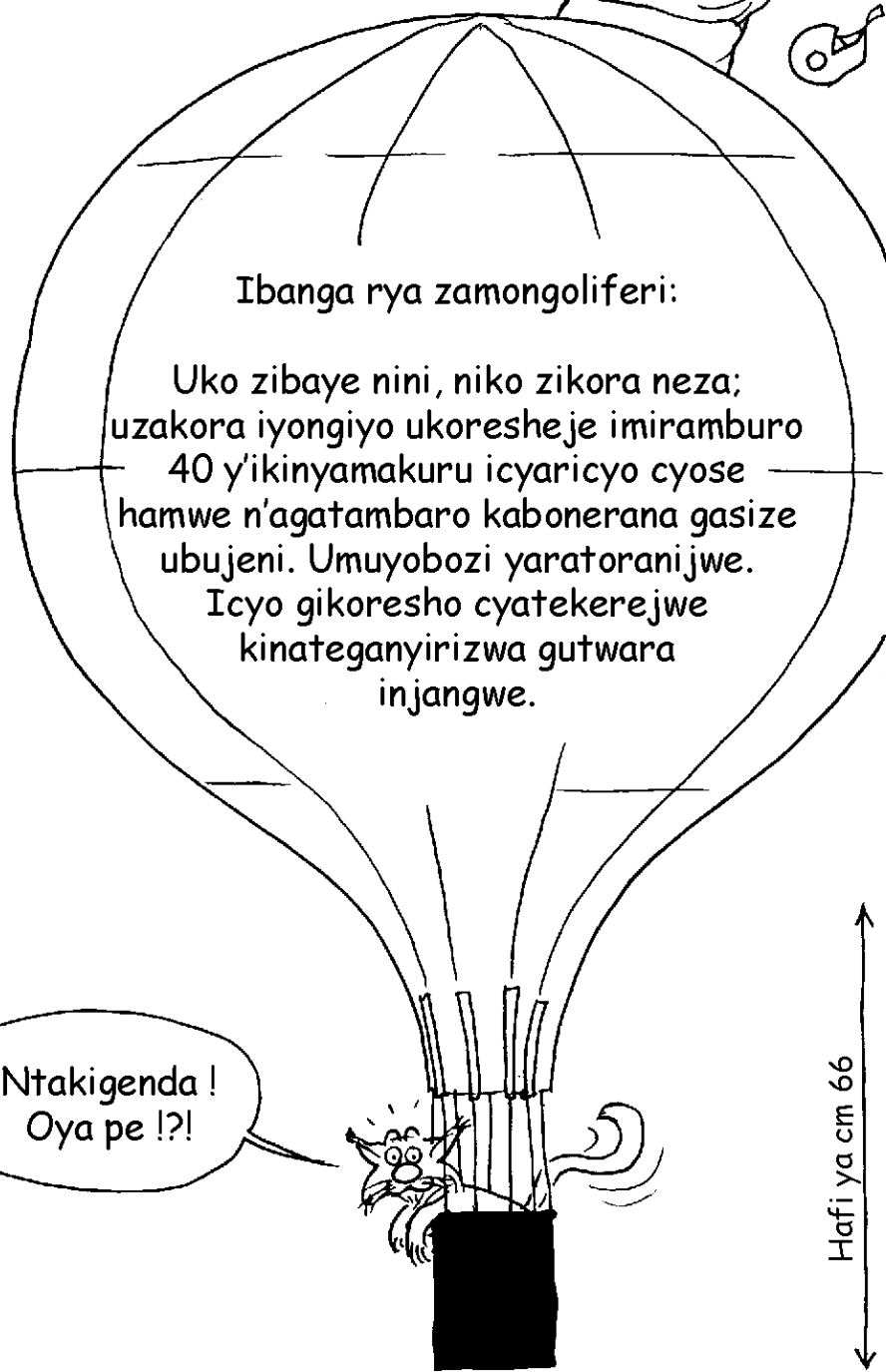
Ubwambere, abahanga bacu bagaragaje ko ukurikije imibare, bidashoboka !

Ese ducishije mu kuri, muratekereza ko nta bindi bintu by'ingirakamaro byo gukora biruta... kuguruka !

Ibyaribyo byose !

Na bigezeho: ngiyeye gushyira akabumbe k'umwuka ushyushye mu kintu kimeze nk'ibahasha

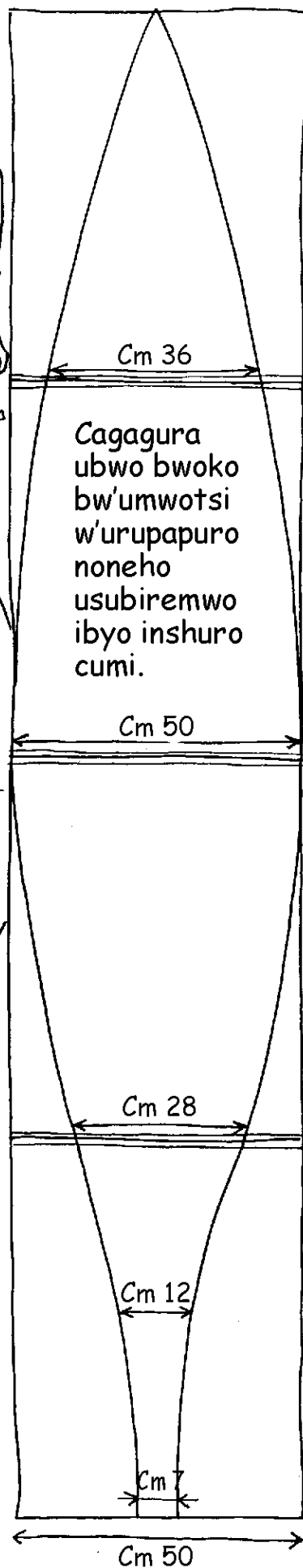
IBYO UMWUKA URUSHA KUREMERA



Ibanga rya zamongoliferi:

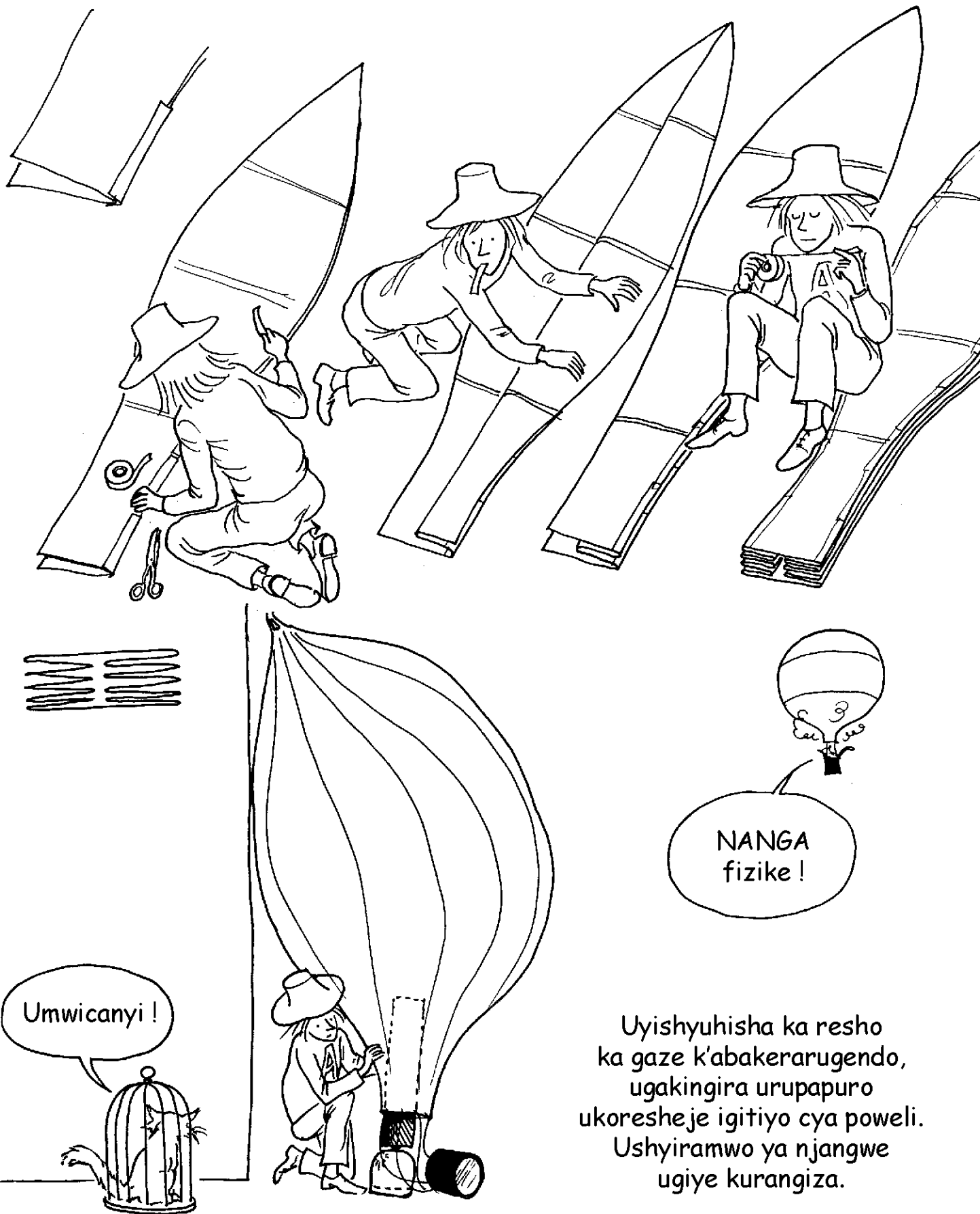
Uko zibaye nini, niko zikora neza;
uzakora iyongiyo ukoresheje imiramburo
40 y'ikinyamakuru icyaricyo cyose
hamwe n'agatambaro kabonerana gasize
ubujeni. Umuyobozi yaratoranijwe.
Icyo gikoresho cyatekerejwe
kinateganyirizwa gutwara
injangwe.

Ntakigenda!
Oya pe!?!

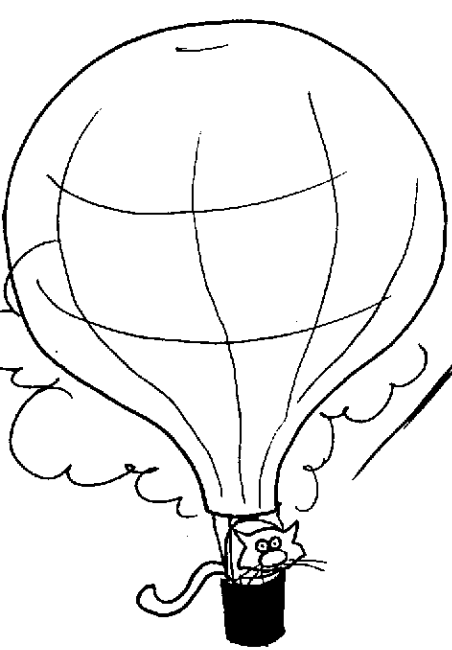


Impapuro ennye z'imiramburo y'ikinyamakuru, zifatanijwe n'agatambaro gasize ubujeni.

Dore uko Anselimi ateranya iye irushwa uburemere n'umwuka :



Uyishyuhisha ka reshho ka gaze k'abakerarugendo, ugakingira urupapuro ukoresheje igitiyo cya poweli. Ushyiramwo ya njangwe ugiye kurangiza.

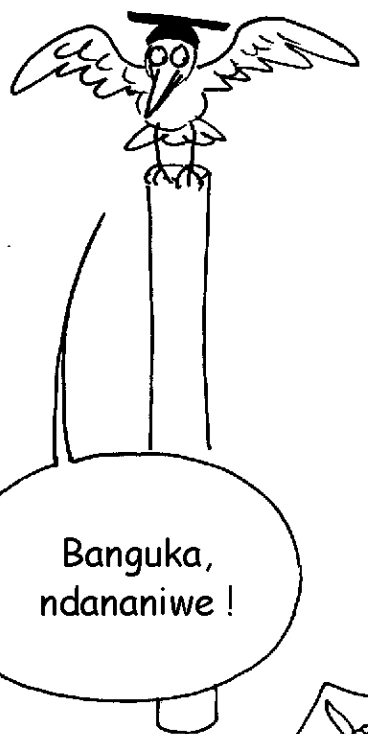


Ibyo nkora, nta njangwe
nimwe yigeze na rimwe ibikora !

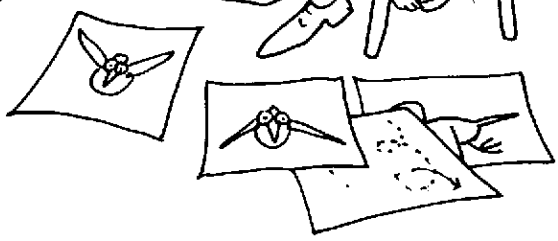



Indoto z'impapuro...
Ibi byose ntibizazamuka kure
mu kirere. Ikindi, aka kamashini
ni igikinisho cy'imiyaga. Sinshobora
kukayobora aho nshaka...

Ibanga ryo kuguruka,
icyo ni iki ?




Banguka,
ndananiwe !







Icyo twakora icyaricyo cyose, ntibikunda.
Hari ikintu ntashoboye gusobanukirwa !



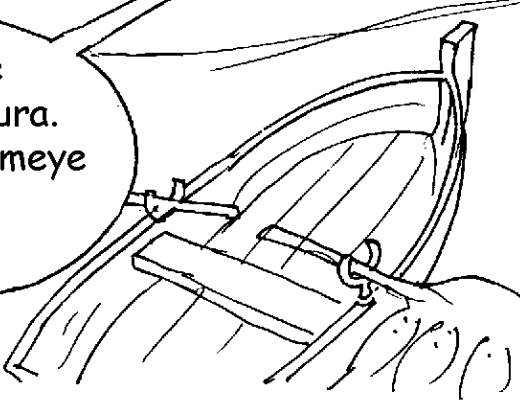
Tsss...
Tsss...



Anselimi, kugirango uguruke,
ugomba mbere na mbere kwimenyereza
MEKANIKE Y'IBITEMBA ! Kuguruka si
ibintu byorosye nk'uko bivugwa !



Igitemba,
ubundi ni iki rwose ?
Ese ni ikintu cyose
gitemba ?



Yego, ushatse
ni uko wagisobanura.
Ariko kandi birakomeye
kurusha uko
ubitekereza.

Bite !...

Umucanga, uratamba nk'amazi.
Haba hari impuzamiterere hagati
y'ibyo bintu bibiri ?

Sofi, ese amahame
ya Arishimede arubahirizwa
ku bijyanye n'umucanga ?


Ese umucanga
ni igitemba ?

IBITEMBA

Gerageza urebe !


Dore ibintu bibiri: igiceri
cy'ifaranga n'agapira ka pingi-pongo.
Niba umucanga ari igitemba, ukurikije ihame
rya Arishimede, ibyo bintu, biteretswe mu
mucanga, byasunikwa n'imbaraga zituruka
hasi zizamuka hejuru zingana n'uburemere
bwa volime y'umucanga wasunitswe.

Ah la la...




Mfite noneho umupira
kandi nateretse cya giceri ku
buso bw'umucanga. Mu by'ukuri
igiceri cyagombaga kumanuka
mu mucanga naho uyu mupira
ukazamuka.

Nta
nabusa...

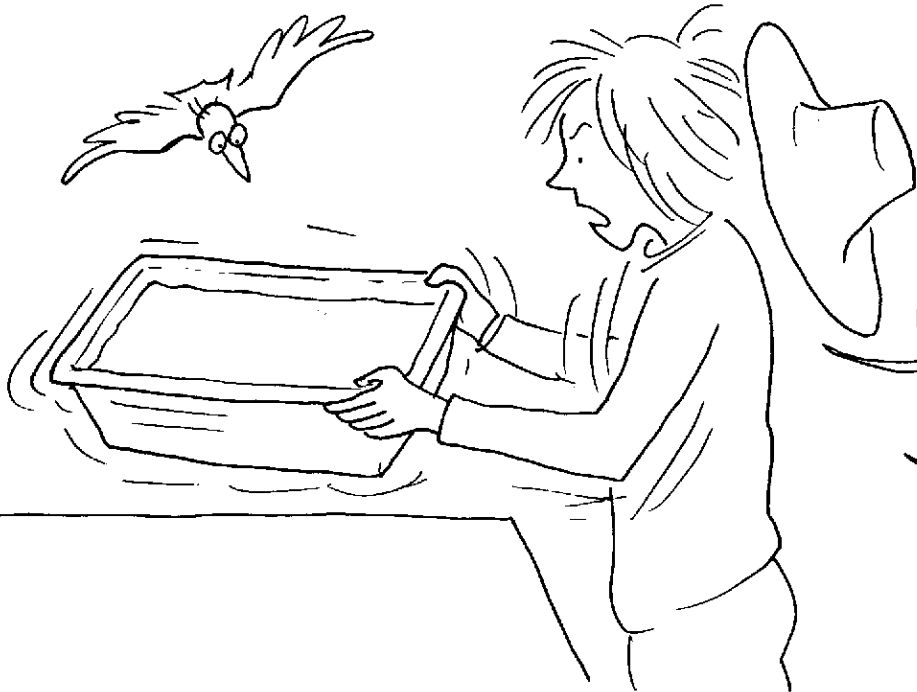


Yenda ni ikibazo
kiyanye n'umwanya...



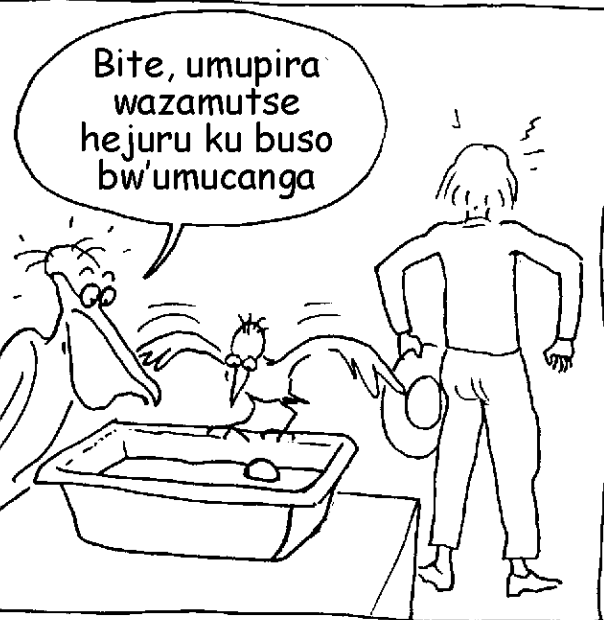
Mugenzi wa we
yahindutse umusazi
burundu ?

Ibiyanye na fizike,
ni ukubiyitondera.




Ni nde
wantamitse
amageza nk'aya !


Ndabirambiwe
pe !




Bite, umupira wazamutse hejuru ku buso bw'umucanga




Naho igiceri kiri hejuru. kwa gutingisa umucanga bya Anselimi byatumye udutete tw'umucanga tugerekerana. Birtyo rero umucanga wahindutse nk'ikimeneka.



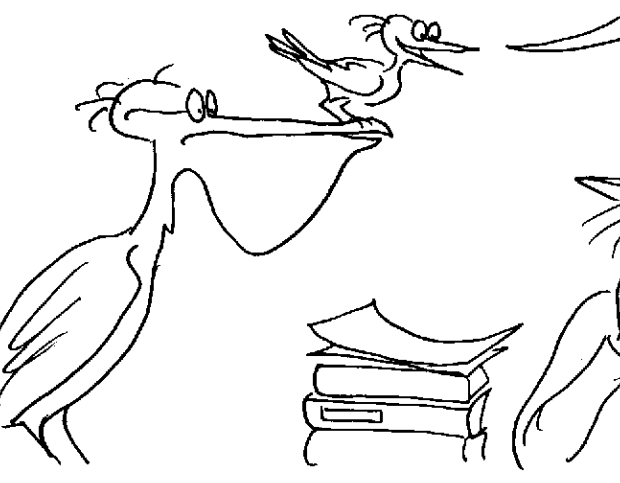
Sofiya yavuze ko uko intete ziba nto cyane, ni nako iyo fenomene yihuta.



Noneho rero, IGITEMBA, ni ubwoko bw'umusenyi w'intete nto cyane, zishobora kunyereranaho m'uburyo bworoshye cyane !?!

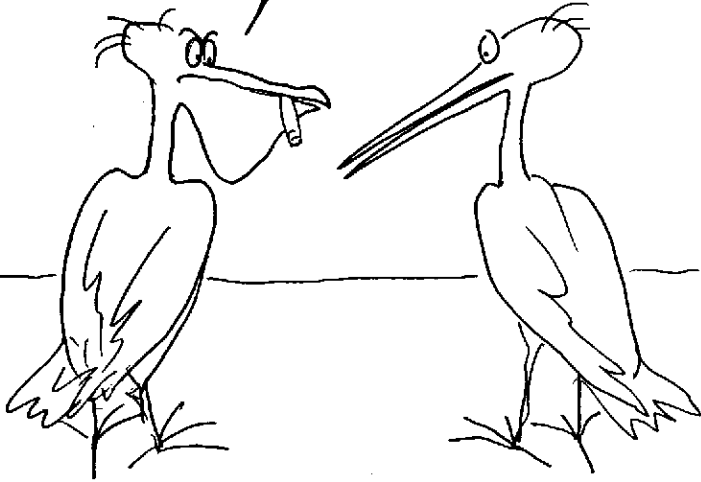


Sofiya yatubwiye ko ari uko Lukerese, mu kinyejana cya 1 mbere ya Yezu-Kiristo, yagize igitekerezo cy'ama ATOME.
(De rerum natura)

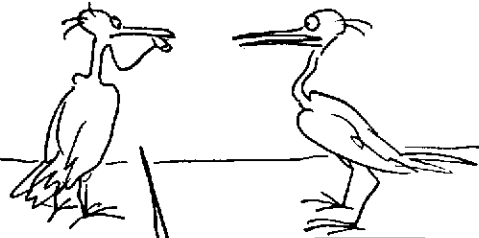


Sofiya, we azi, buri gihe, byose neza kurusha abantu bose !

Birtyo, nshuti yanjye,
kamambere zaba ari ibitemba
bifashe cyane. Kandi ngo ubanza
ikirahure ubwacyo... (*)

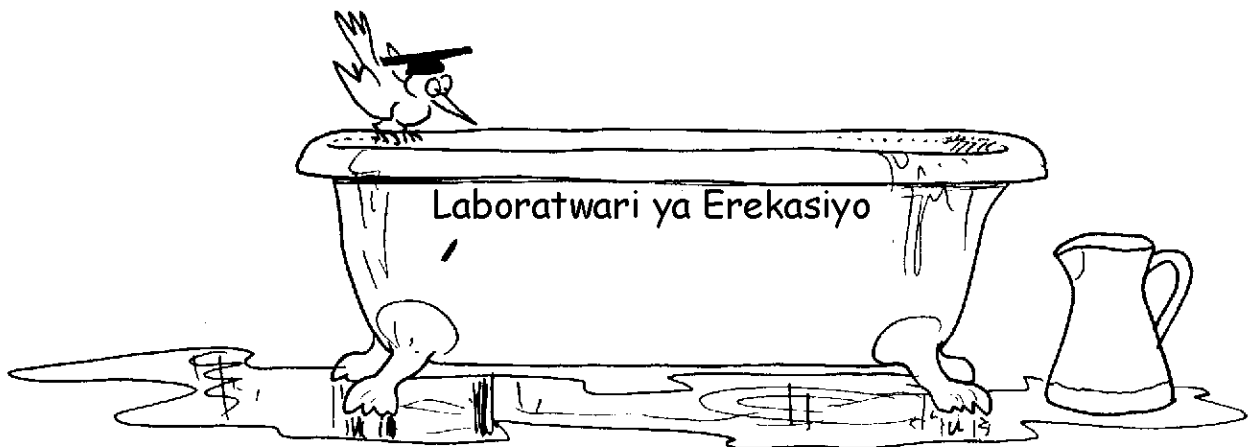



Mwashakaga
kuvuga ko... ihame
ry'Arishimedi !...



Wishaka kumvugisha ibyo ntavuze !

(*) Mu by'ukuri, Ikirahure ni IGITEMBA giteye cyane rwose bukoma.






Urareba, Anselimi, kugirango wumve neza icyo igitemba aricyo, ugomba ubwambere kwibuka ko ari itsinda rya za molekile zimeze nk'udupira duto tudundadundakandi tunyereranaho mu cyo twita AKAVUYO K'AMAMOLEKILE.

Noneho tuge kuri kawo!

Hari miliyari makumyabiri za miliyari z'utwo dupira duto muri cm^3 imwe y'umwuka duhumeka. Izo molekile ni nto cyane kuburyo tudashobora kuzibona n'amaso naho twakoresha mikorosikope yambere mu zikomeye.

UBUREMERE



Igitekerezo cy'uburemere kiriserura cyane ku buryo twahatswe kutakivugaho.

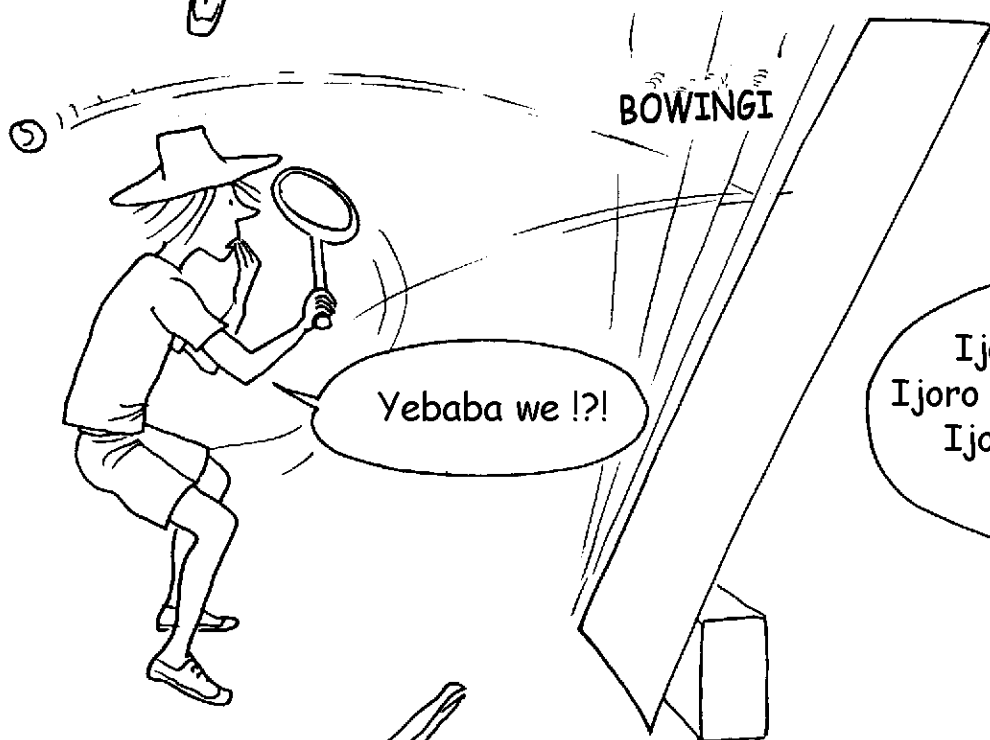
Jye simbyumva!

Ni umubare wa za molekile zuzuye mu gipimo mfatizo cya volime.

PRESIYO :



Iyi pano
ihagaze neza pe.
Ndagaruka mu mwanya
kuyifatisha neza.



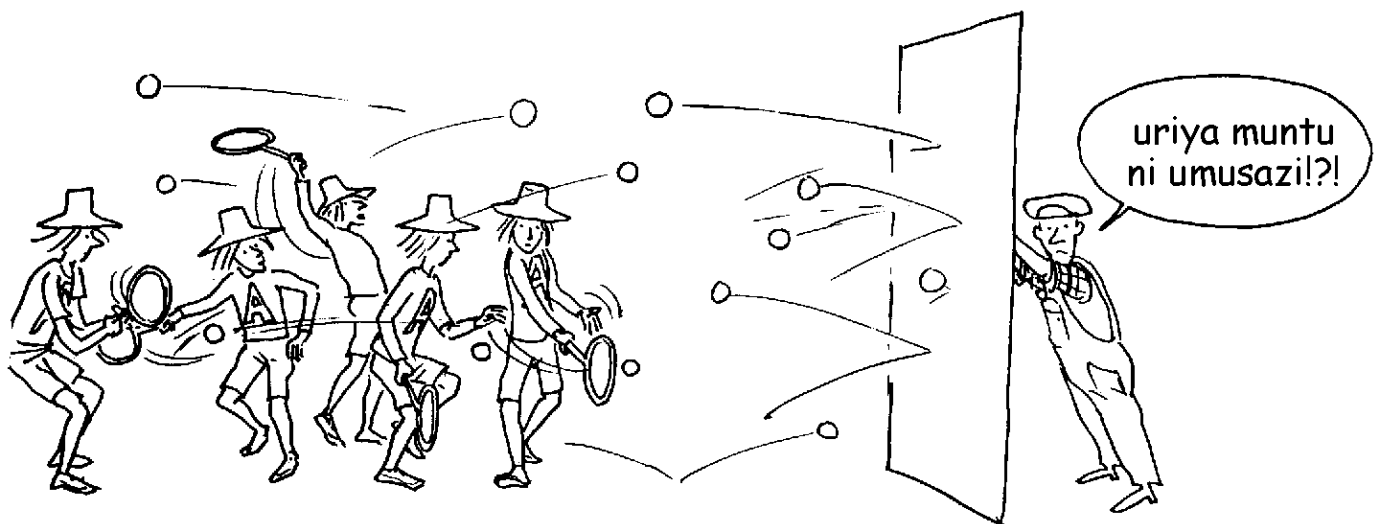
Ijoro ry'imitoma
Ijoro ryo gupfumbatana
Ijoro ry'urukundo
♪



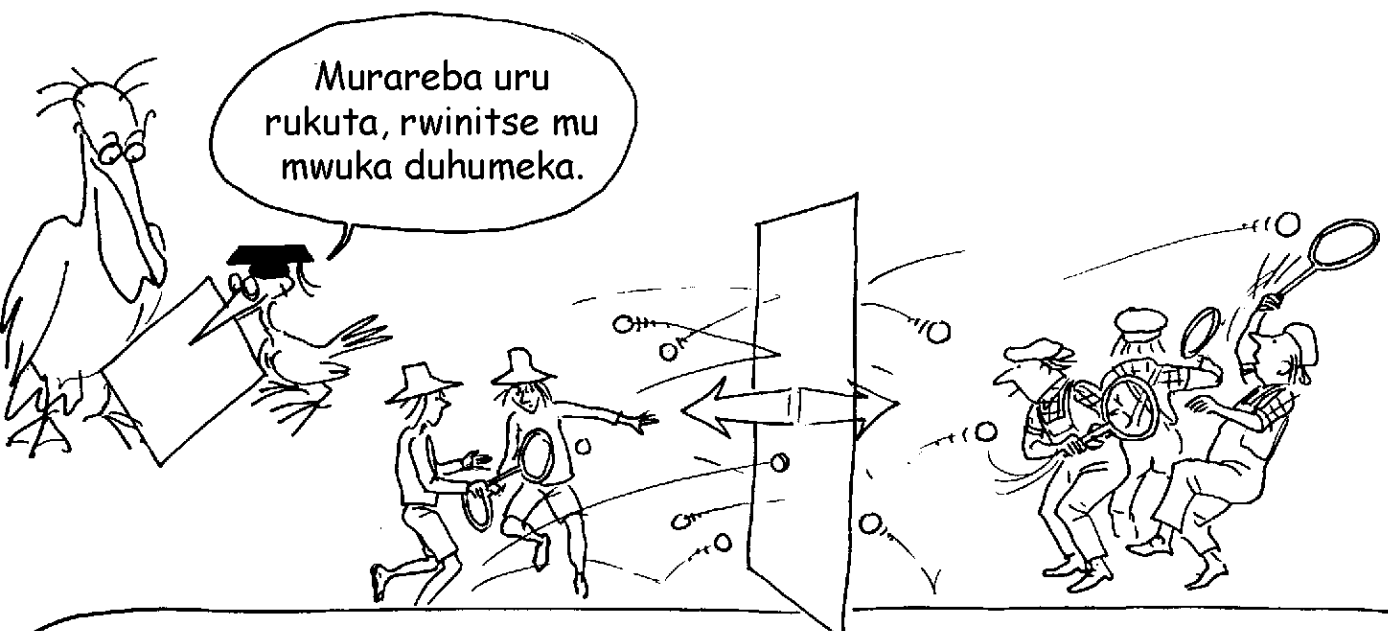
Nonese hariya, ni ubuhe
busobanuro twahakura ?



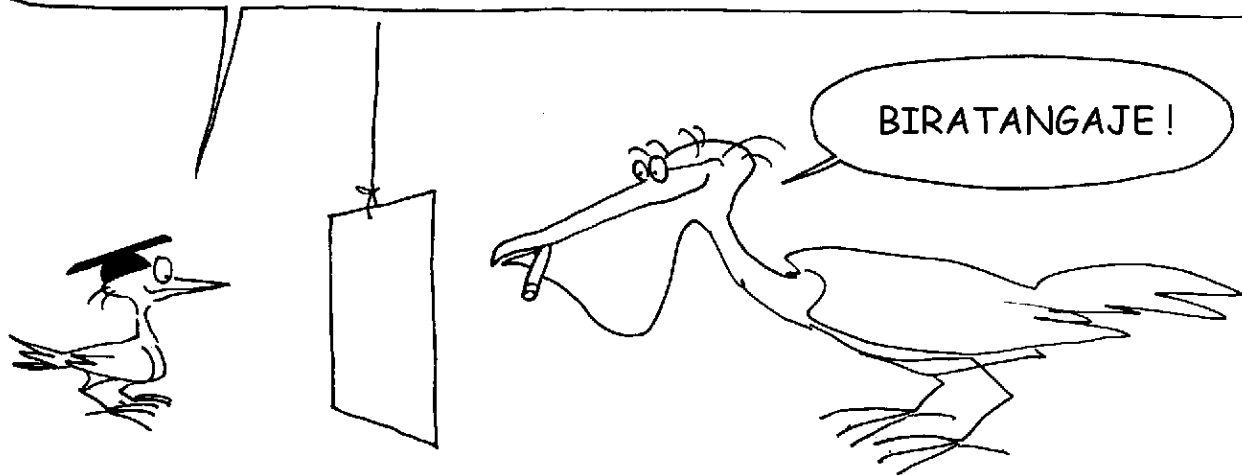
Biraje,
Biraje !



Ni isekurana ry'ama molekile ritabarika ribera k'urukuta ribyara iyo fenomene bita PRESIYO.

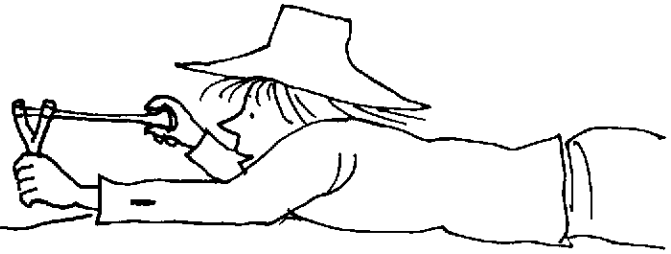


Ruguma aho ruri kuberako isunika ry'ama molekile rikorerwa kuri buri ruhande ritewe n'uko gusekurana, riteranijwe ringana n'ubusa.

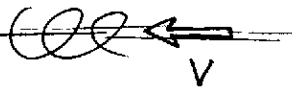


INGUFU Z'UMUVUDUKO:

Ikintu cy'uburemere m ,
kiri k'umuvuduko V ...



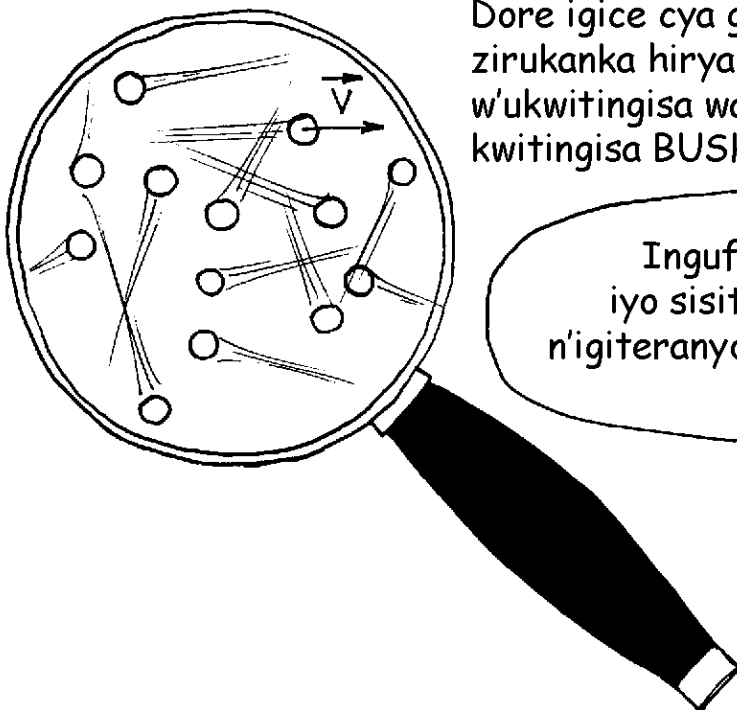
POP!



...kiba gifite, ukurikije
ubusobanuro bw'ifatizo,
ingufu z'umuvuduko zingana
na $\frac{1}{2} m V^2$

INGUFU Z'UBUSHYUHE:

Dore igice cya gaze. Molekile za yo z'uburemere m ,
zirukanka hirya no hino mu kavuyo. umuvuduko
w'ukwitingisa wazo, witwa umuvuduko wo
kwitingisa BUSHYUHE ni V .



Ingufu bushyuhe y'icyo kintu, cyo muri
iyo sisiteme, ingana, mu buryo bworoheje,
n'igiteranyo cya za $\frac{1}{2} m V^2$ (y'ingufu z'umuvuduko)
za molekile zose zikigize.



IGIPIMO CY'UBUSHYUHE:



IGIPIMO CY'UBUSHYUHE NKOMOKO bwa gaze ni igipimo cya $\frac{1}{2} m V^2$ (k'ingufu z'umuvuduko w'umwitingiso) bwa MOLEKILE imwe muri iyo gaze.

Ubuyobozi



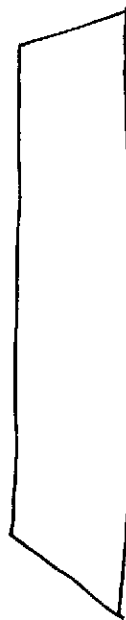
Ntushobora kujya
munsi yaho: ntushobora
kwingisa na buhoro biri munsi
y'igihe utanyeganyega, oya ?



Jyeza aho
nabyumvise !



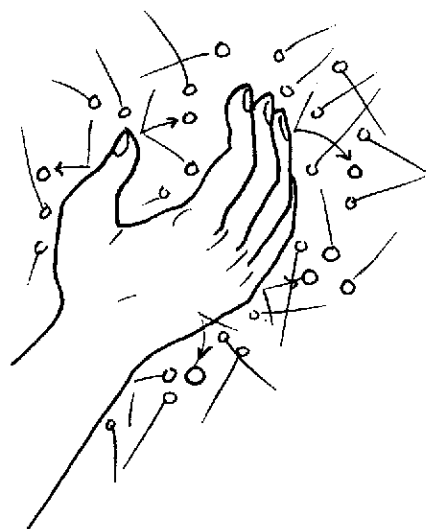
Nta tingiswa ya za molekile,
ntasekurana ku mpande zabaho,
rero nta na presiyo yaba ikiriho !



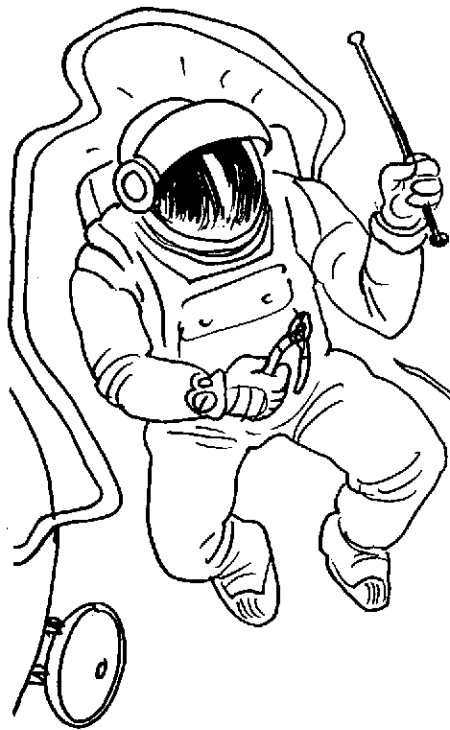
Dushyize mu magambo avunaguye:
uko hari molekile nyinshi, niko zitingisa,
zigashyuha, kandi ni nako presiyo
ya gaze yiyongera.



UBUSHYUHE



Ikintu gishyizwe mu gitamba gihura n'intabarika
y'isekurana ry'ubunzugunya ry'ama molekile.
Biryo rero, ama molekile ashobora guhana, kugurana
ingufu, UBUSHYUHE. Ububasha bwo guhanahana
ubushyuhe bwiyoungera bukurikiye uburemere
bw'igitamba.
Kubera iyo mpamvu, amazi ayobora ubushyuhe
kurusha umwuka.



Iyo umukosimonote "agenda" muri esipase, aba ari ahantu h'umwuka muke cyane (molekile icumi muri buri sentimetero kibe.) - urugero rwo kwitingisa kwa za molekile kungana n'igipimo cy'ubushyuhe bwa dogere 2500°. Ibiramambo ariko uwo mwuka ntutwika umukosimonote kuko uba ari mukye cyane ku buryo udashobora guhana ubwo bushyuhe mu buryo nyabwo.

Bururur...2500 °, ndasuherewe!

Igipimo cy'ubushyuhe kiri hejuru cyane ariko umusuko w'ubushyuhe ni muto cyane.

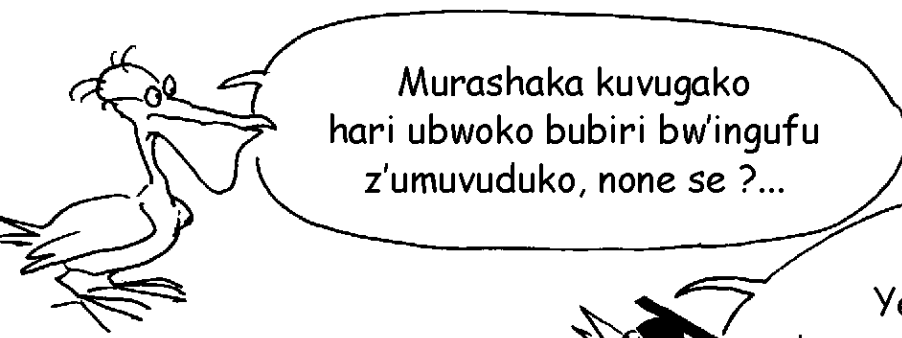
INGUFU ZA RUSANGE:



Dore itsinda, ihuriro ry'ama molekile N, ziri ku gipimo cy'ubushyuhe nkomoko T

Anselimi ajugunya icupa rya gaze yahaye UMUVUDUKO RUSANGE V

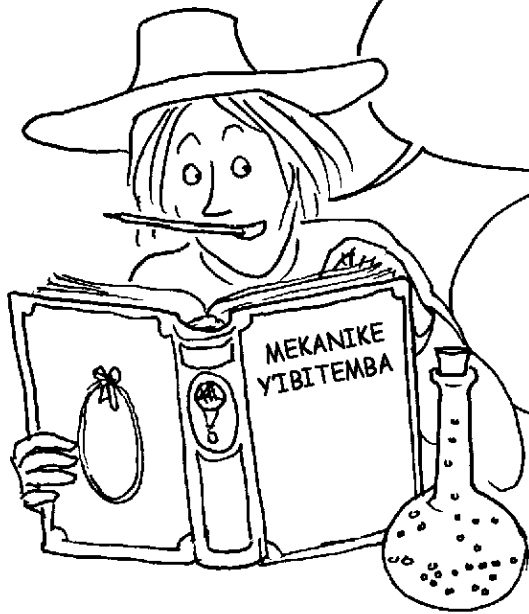
Kuri uyu muvuduko rusangi V hahurirwaho ingufu z'umuvuduko rusangi $\frac{1}{2} M V^2$.
M ikaba ari uburemere bwose bwa gaze iri mu'icupa.



Murashaka kuvugako hari ubwoko bubiri bw'ingufu z'umuvuduko, none se ?...

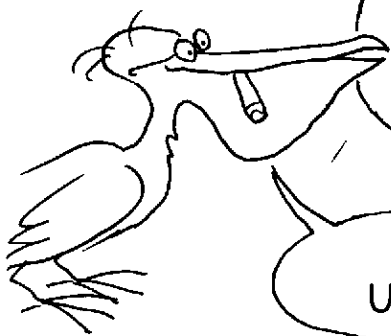


Yego kandi oya... sisiteme y'ama molekile ari muri iri cupa afite INGUFU ZOSE zingana n'igiteranyo cy'izo ngufu rusange hamwe n'ingufu z'ukwiringisa by'ubushyuhe



Ariko se , ko mekanike y'ibitemba ikomeye bihebuje !

Urashaka kuguruka ? Noneho iga kuguruka !



Byiza... Igitabo kiravuga ko, muri sisiteme ya za molekile, umuntu ashobora guhindura ingufu zo kwiringisa bushyuhe mu ngufu rusanjye.

Mu yandi magambo: UBUSHYUHE mu MUVUDUKO.

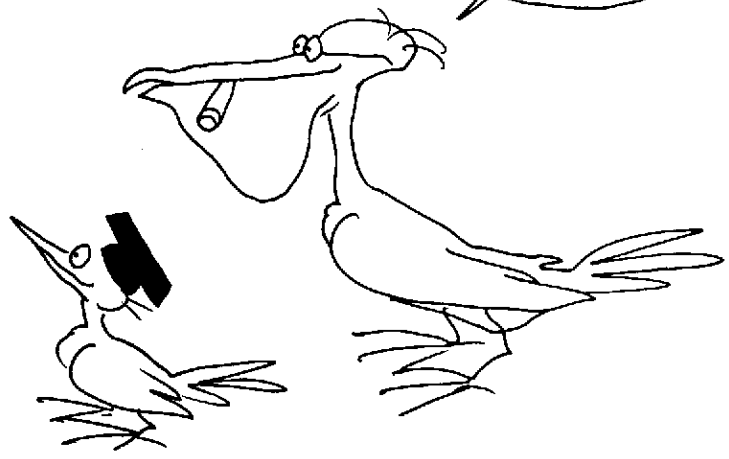




Ku byerekeranye n'ibyo, haba hakenewe gusa gukuraho umupfundikizo.

SISITEME YA MOLEKILE N:
IMBARAGA BUSHYUHE
 $N \times \frac{1}{2} m V^2$

Komeza rwose !



UBWIBIKE BW'INGUFU:



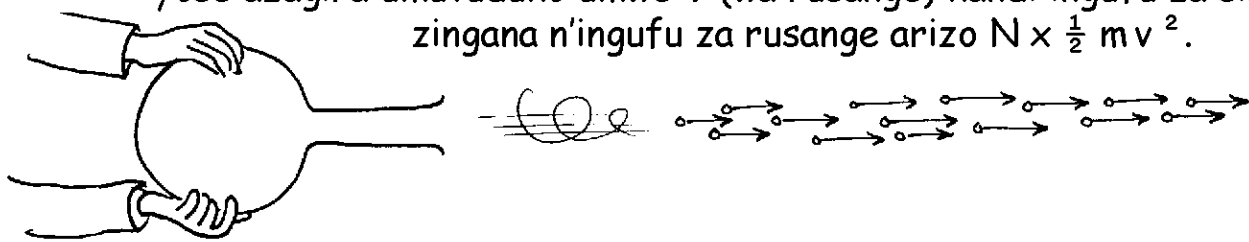
Hee !?

Mu buryo bwo kubyoroshya, twemezeko iryo kweduka ry'umwuka riba nta mbangamizi yo hanze kandi ribera ahantu hatari n'ikindi kintu na kimwe.

Ubuyobozi

$V =$
Umuwuduko
wo kwitingisa
wa molekile N

Niba iryo hinduka UBUSHYUHE -> URUGENDO ryabaye ryose, ama molekile yose azagira umuvuduko umwe V (wa rusange) kandi ingufu za sisiteme zingana n'ingufu za rusange arizo $N \times \frac{1}{2} m v^2$.



Hakurikijwe ihame ry'UBWIBIKE BW'INGUFU, ingufu zoze za sisiteme, ni ukuvuga igiteranyo k'ingufu za rusange n'ingufu z'umuvuduko wo kwitingisa (bushyuhe) nti gihinduka muri ayo mageza.

Ubuyobozi

Mbwira, nimba nasobonukiwe neza,
mu gihe kihariye k'iryo kweduka ryose, ubwibike
bw'ingufu butanga $N \times \frac{1}{2} m V^2 = N \times \frac{1}{2} m v^2$
Ni ukuvuga $v = V$?



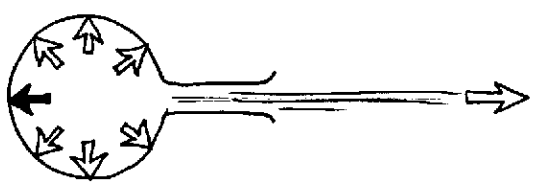
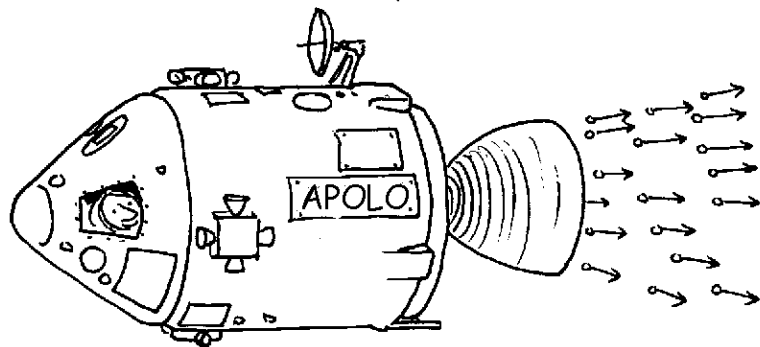
Ni byo rwose !

Ubukoreshwa bw'iryo hinduka ry'ingufu bushyuhe mu ngufu muvuduko wa rusange ni:

IYOHEREZWA RITEWE N'ISUNIKWA

Akabuno k'imoteri-ngendajuru, cyangwa "igikombe cy'igi", ni jewometiri ituma habaho ihinduka bushyuhe -> muvuduko. Imbaraga nyohereza zituruka kuri iki:

mu gihe cy'ikweduka, igiteranyo cy'imbaraga z'isunika ku gitwikiro kitangana n'ubusa.



Nasobanukiwe !

Kugirango umuntu aguruke, mu bigaragara, hakenewe guhuha umwuka uwohereza hasi.

Tugerageze ibi

Huuuume, ntabwo bikora neza cyane...

PSSHUUF!

Anselimi, reba, amababa y'inanyi ntafite iforoma y'imitaka ! Buri gihe ushaka gusobanukirwa byose ako kanya. Ugomba gukomeza...

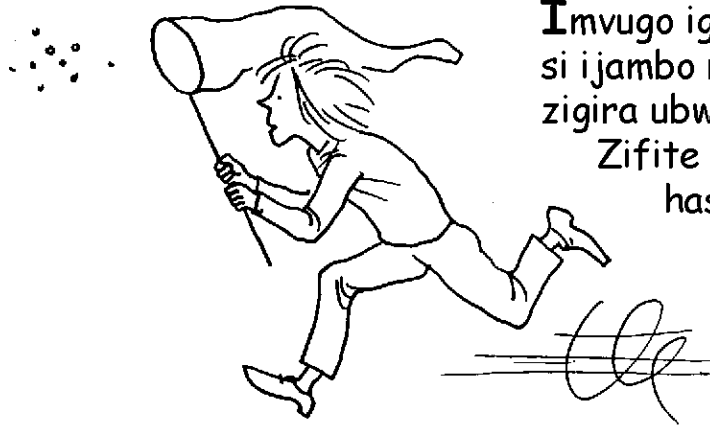
Mmmmm...

Ufite ukuri, Sofiya.

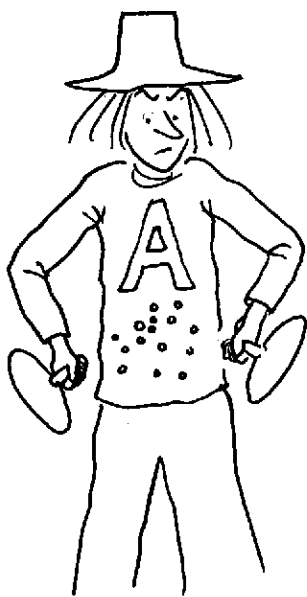
Ntabwo yicaye nabi da!

Ntabwo nawe wicaye nabi habe nagato

UBUTEMBE HAKORESHEJWE UBUREMERE BUDAHINDUKA



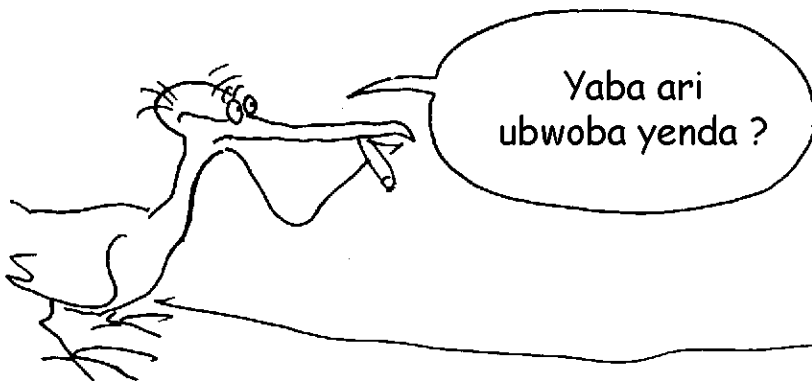
Imvugo igira iti "kwigenga nk'umuyaga"
si ijambo riva ku busa. Molekile za gaze
zigira ubwoba cyane bwo kwegerana.
Zifite ku mutima guhora ziri kure
hashoboka y'imwe n'iyindi.



Nta cyo ushobora
gukora ngo wongere
uburemere bw'umwuka
ukoresheje ubwo buryo.

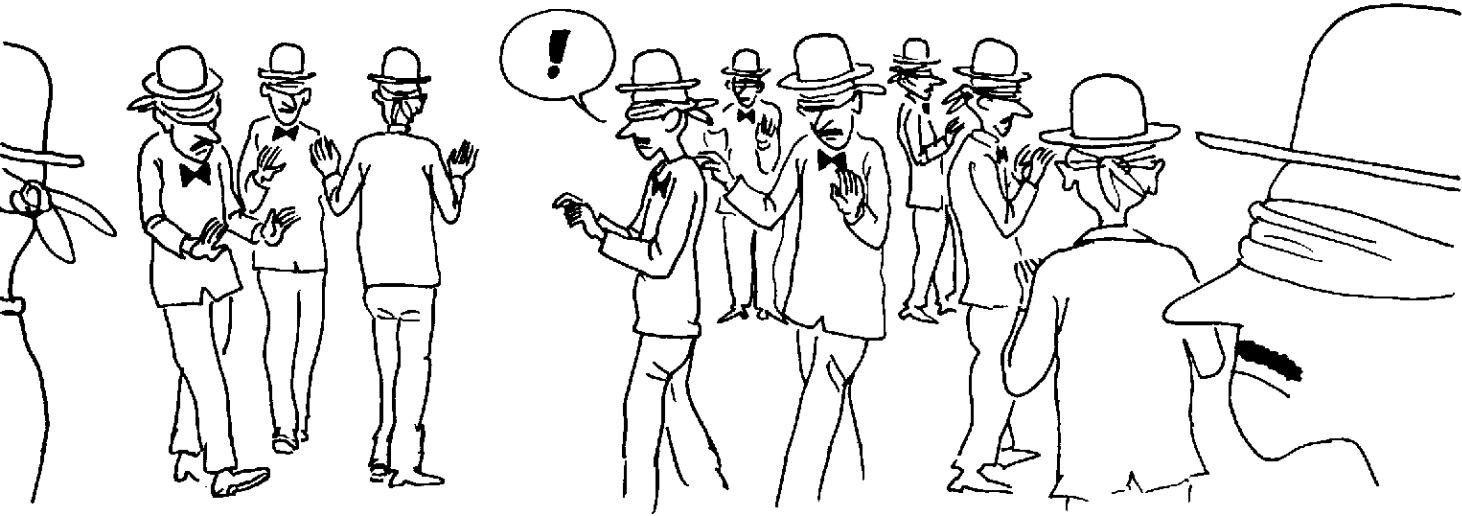
Urihombeye!
Ntabwo ubanguka bihagiye!
Twakubonye uza.

Ni iki gituma za molekile zihunga iyo ibimamiro byegeranye ?



Yaba ari
ubwoba yenda ?

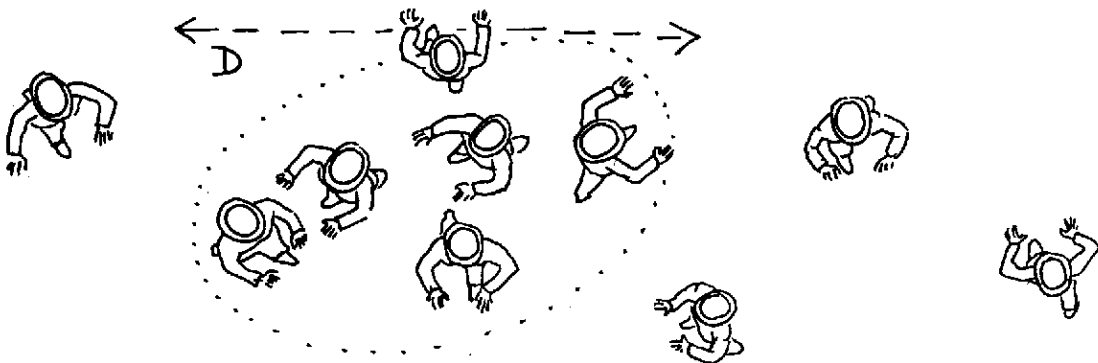
Tekereza ahantu hariho hatembera abantu batabona kubera gufungwa ibitambaro mu maso. Abo rero bafate nka za molekile noneho umuvuduko bakoresha bazenguruka aho, mu mpande zose, batazi iyo baja, uzaba igishushanyo cy'umuvuduko wo kwitingisa bushyuhe V.



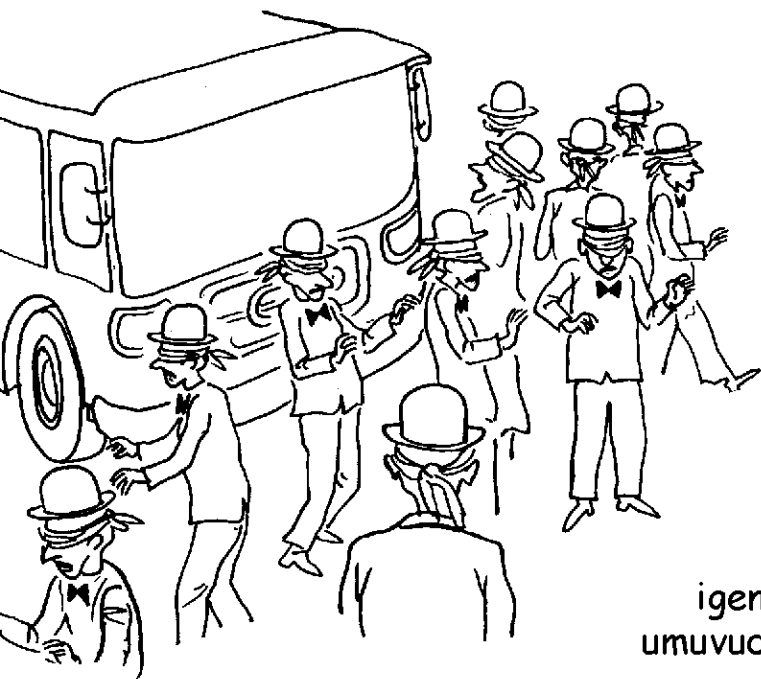
Ubireba ntaho bafite baja hazwi. Ugereraniye, nyuma y'ama dakika t, ufatiye hagati na hagati, bamaze kugenda inzira ireshya na l, baragongana. L yitwa URUGENDO RUDAHATIWE RUGERERANIJE naho t IGIHE KIDAHATIWE KIGERERANIJE.

Mu mwuka duhumeka, umuvuduko wo kwitingisa bushyuhe V, ujya kungana na 340m/idakika. Urugendo rudahatiwe rugereraniye rwa molekile rujya kungana n'igice kimwe kw'ijana k'igice kimwe ku gihumbi cya santimetero, naho umwanya uca hagati y'isekurana ebyiri zikurikiranye za molekile imwe na zigenzi zayo byegeranye ni nk'ikicumi kimwe k'igice kimwe ku gihumbi k'idakika imwe.

Nta kintu na kimwe gituma abo bantu bafunze ibitambaro mu maso begerana, ahubwo ibiramambo, urugendo rwabo rwo kwitingisa bidahwema bituma n'abegeranye kuri diyametero D bitagaranya mu kanya kangana na D/V .



Ubirebye neza usanga uwo mwanya ari wo abo bantu bakoresha mu kugenda aho hantu hareshya na D, ni ukuvuga ko ariwo bakoresha mu kuva aho hantu baba barundaniye.



Aba bantu, bikubitiyeho b'impumyi, ntibabona kure harenze imitwe y'intoki zabo.

Iyo hinjiye muri urwo ruvunge ikintu kizanye umuvuduko V uri mu nsi y'umuvuduko wo kwitingisa V, abantu bo muri urwo ruvunge bashobora kumenya, gutara ayo makuru bagenda basekurana buhoro, uko bagiye begerana. Birtyo, bashobora kwitaza icyo kintu kitarabageraho. Iyo nkuru igenda n'umuvuduko nk'uwabo, ni ukuvuga umuvuduko wo kwitingisa V.

INDURU

ni isakaro, mu UBUREMERE BUDAHINDUKA, bw'iyoherezwa rya presiyo. Ni nk'ubwoko bwa onde y'isunikana isakarana umuvuduko V.

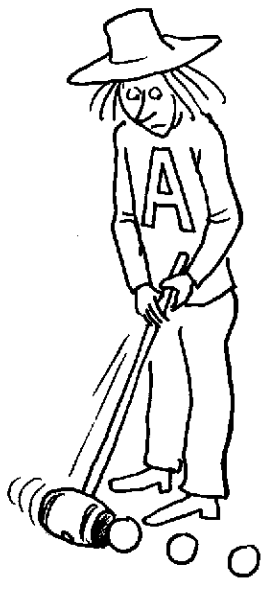


Bigomba kumvikana neza ko induru ari isakara ry'iyoherezwa kandi ko Atari isakara rya matsiyeri.

Induru ni ONDE ya PRESIYO

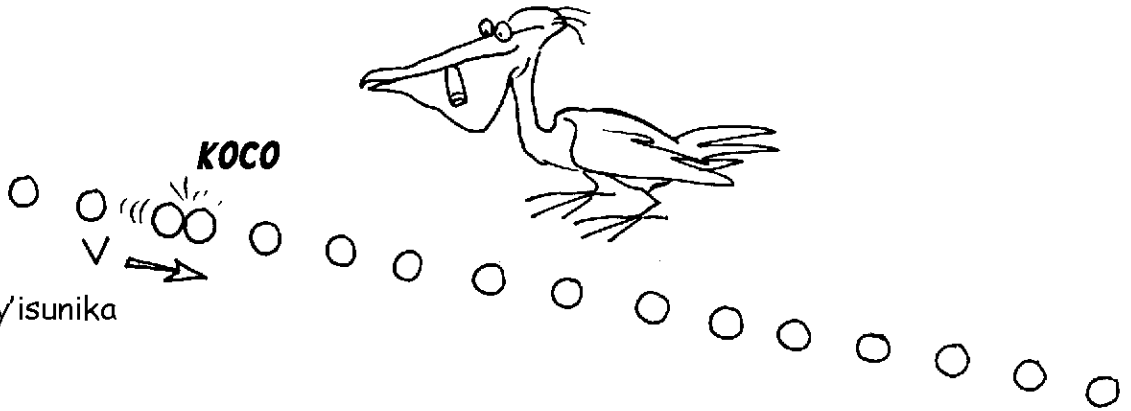


Ni kuri uwo muvuduko w'INDURU za molekile zimenyeshwa urugendo ruto urwarirwo rwose rw'imidaho ya Anselimi. Ni naho rero zishobora guhunga mu buryo bworoshye ariko zinagumana UBUREMERE BWAZO BUDAHINDUKA.



Anselimi yatondesheje ku murongo utubumbe twa krokete. Akubita aka mbere nako gakubita aka kabiri... noneho bikomeza birtyo: Igishushanyo kigenda ku murongo k'isakara ry'INDURU.

Isakara ry'isunika

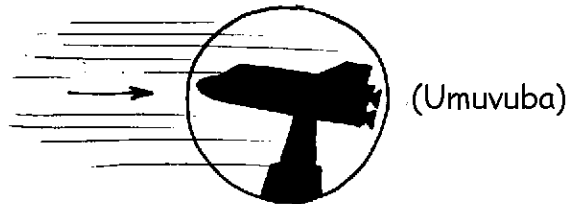


Umuvuduko ubwawo ni ikintu k'ikigereranyo.

Birtyo v , kuri twebwe, izaba muri rusange umuvuduko w'ikintu kinjira mu gitemba nacyo kiri mu buruhuko.



Cyangwa umuvuduko rusangi wa gaze igera ku kintu KITANYEGANYEGA:



IKIGABANYO $M = v / V$ KIZITWA, MU BURYO BW' UBUSOBANURO, UMUBARE WA MACH. V NI UMUVUDUKO W'INDURU.

NIBA $v < V$, NI UKUVUGA NIBA $M < 1$ ICYO GITEMBA KIZITWA ICYO MU NTERA YO MUNSI Y'INDURU. UGUHITA KUZABA GUKURIKIJE UBUREMERE BUDAHINDUKA KANDI BUZITWA « INTEGERANYA ».

Ubuyobozi

ITEGEKO RYA BERINUYI

Hano
ntihahumura neza!

Hano harahumura ifuku!
urashaka ko hahumura iki ?

Turebe, turebe,
Daniyeli Berinuyi: umufizisiye
w'umuswisi, 1700-1782

?

Nk'uko nguko,
bishobora gukunda.

Ariho ara kina uduki
hari hejuru ?

Dore, byakunze.

Ibiki se byakunzei ?!

Isisiteme ya nje itanga akayaga inikoresha.

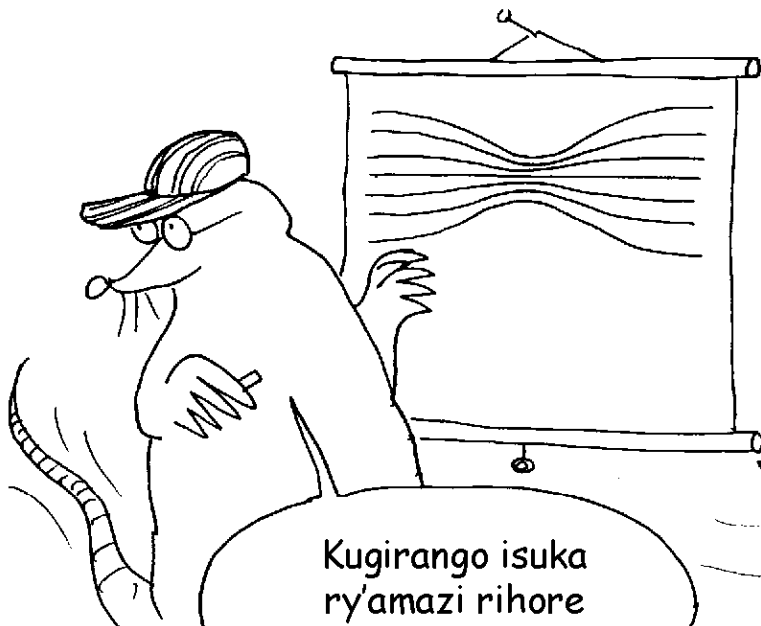
Umuyaga urahuha, ni byiza !
Urumva hari igukurura ?

?!?

Yego ariko se ni ukubera iki umuyaga wo muri uriya mwobo ukururwa ?

Umugina ni intambamyi kw'ihita ry'umuyaga. Kugirango rero uwurenge, umuyaga ugomba kongera umuvuduko.

Kongera umuvuduko, kubera iki ?



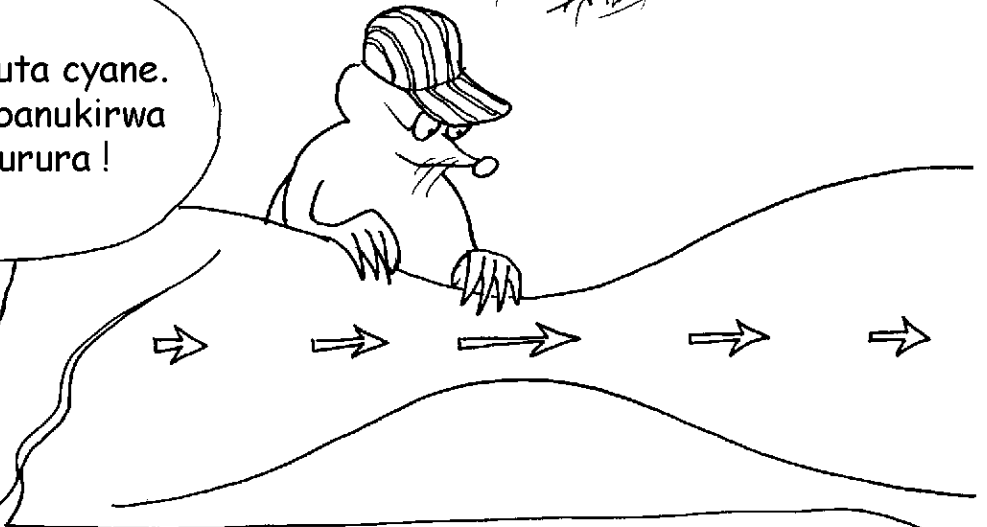
Nko mu mivuduko y'umugezi.

Yatezwe!



Kugirango isuka ry'amazi rihore ari rimwe

Byiza, birihuta cyane. Ariko sinsobanukirwa kuki hakurura!



Fata urugero rw'ikintu gitamba (ipakye ya molekile) ica mu muyoboro muto. Ingufu za cyo zizaguma ari zimwe. Ni ukuvugako iyo ubwiyongere bw'umuvuduko bukoze habaho igabanuka ry'ingufu bushyuhe, na ryo rikazana igabanuka ry'umuvuduko wo kwitingisa.

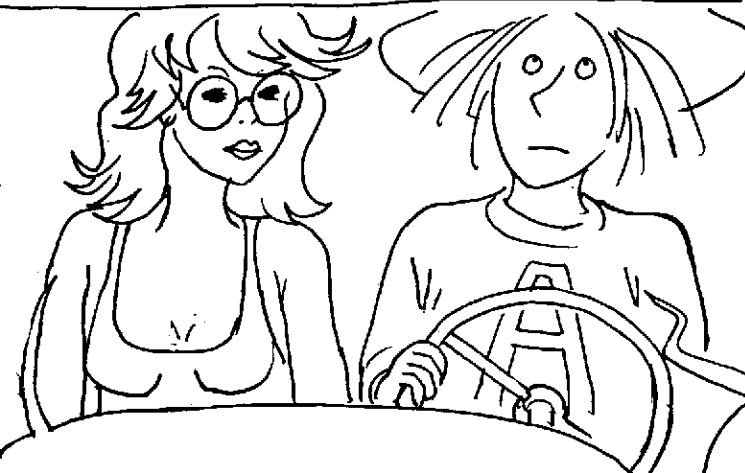
Kandi iyo umuvuduko wo kwitingisa ugabanutse, isunika na ryo riragabanuka.

Nk'uko imihindukire ya presiyo iryana n'iy'ubushyuhe n'iy'uburemere, presiyo izagabanuka.

Kandi niyo mpamvu umwuka wo mu mwobo uzakururwa.




Biteye amatsiko, iyo ihagaze, igisenge cyari kirekuye kandi cyarebaga imbere. Naho ubu turiho tugenda, cyatumbye kireba hanze.



Ni kimwe no ku mwobo w'ifuku. I 2CV isa nayo gato, si byo ?

Noneho umwuka ugomba kongera umuvuduko kugirango uce iruhande y'iyu vatiri y'uburemere budahinduka. Ubushyuhe buragabanuka, kandi presiyo na yo ikagenda irtyo noneho n'igisenge kigakururwa. Wabyumvise.



Ni ya fenomene imwe ituma umuhumuro
uzamuka muri vaporizateri yanjye

... kandi ni nayo ikurura imyotsi
iyizamura muri shomine,
bitewe n'umuyaga.


Kuva ryari
shomine zivuga ?

Ntibyumvikana,
jyewe ahubwo
nagirango umwuka waba
waritsindagiriye muri
iriya antonwari.

Itangazo rikurikiza
IHAME RYA BERINUUYI :

Presiyo n'umuvuduko bihinduka
mu buryo bucurikiranye.

Ubuyobozi

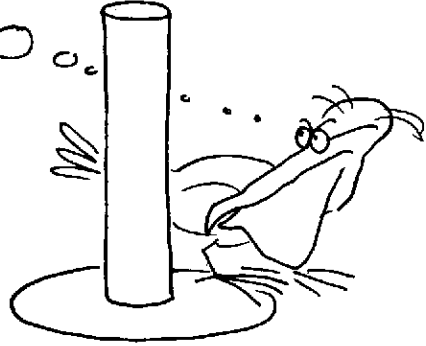


Mu by'ukuri mekanike y'ibitemba icenga ryose kenshi
ubwenge bwacu hamwe n'imyumvire yacu muri rusange.

K'ihushanye

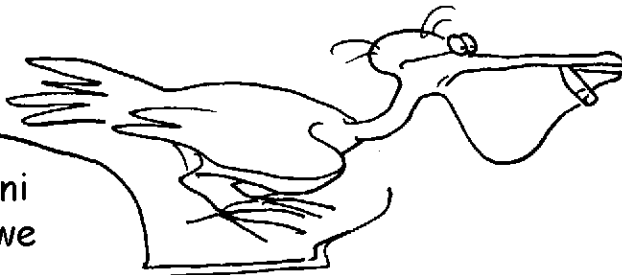
rifatiye kw'ihame rya Berinuyi:

Ntabwo ari ibigaragarira uwariwe wese. Tubirebye...



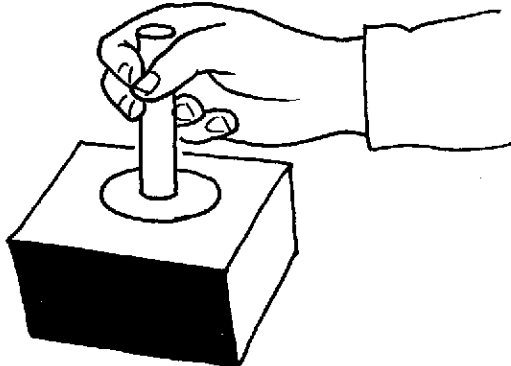
Ese kiriya ni iki ? ese kandi ni imwe muri ya mayeri ya bo !

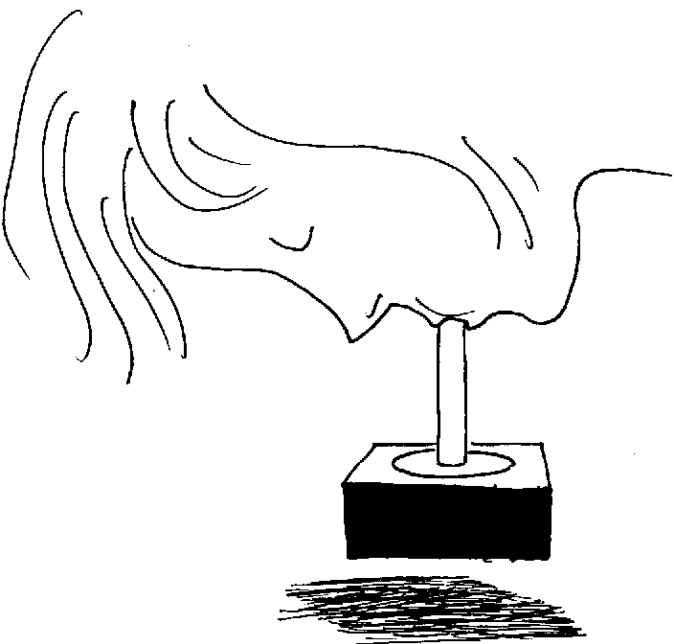
Mu bigaragara ni umuheha usanzwe wometse kuri disike imwe



ASIPIRISUFULE

Umuheha yateretse ku kibiriti !!!





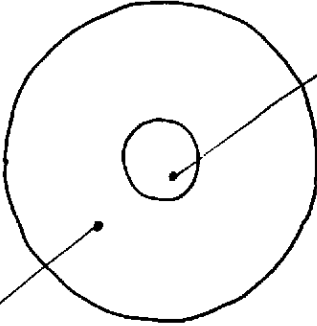
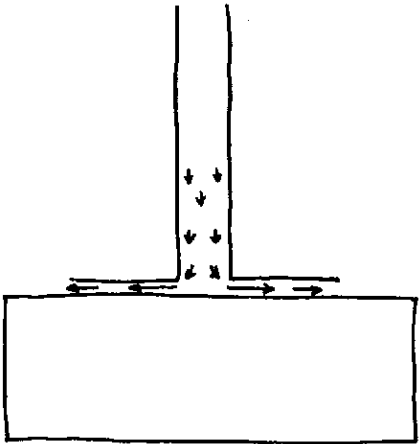
a... rahuha...
noneho agaterura
ikibiriti !!!



Amakuba...

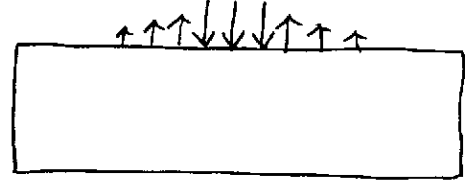
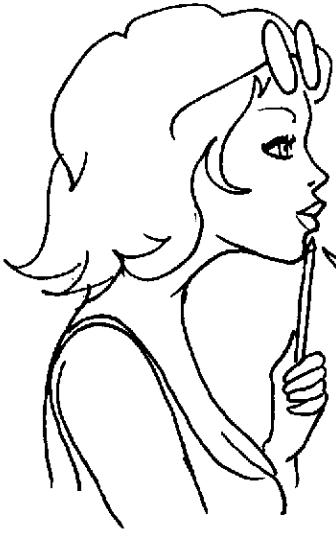
Byakorwa bite ko ukurura
umwuka kandi uhuha ?

Mwifataniro rya silenderi- disikye, umunwa ucamwo umwuka uragabanuka mu kanya gato kandi umuvuduko w'umuyaga nawo uhita wiyongera vuba cyane. Rero presiyo ihita iba nto ugereranije na presiyo ry'umuyaga wo hanze.



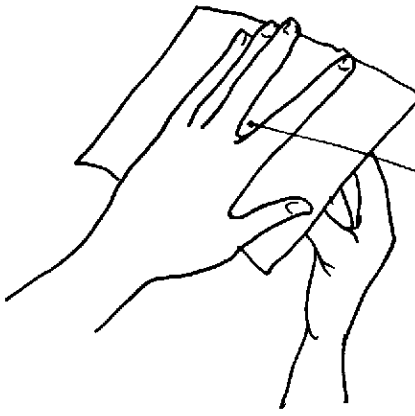
Igice cy'uruhande ry'ikibiriti gitumberanye n'uriya muyoboro wo hagati, kiri, ugereranije na presiyo yo mu mpande, kuri presiyo y'umurengera

Igihande cyo hejuru kiri, ugereranije na presiyo y'umuyaga wo hanze, mu nyota ya presiyo.



Ikiba ni uko basangako nyuma y'ibyo byose hari inunuza.

Mushobora gukora amageza nka yo mwifashishiye urupapuro rusanze:



Rufate nk'ukunguku

Huha hano, cyane rwose.

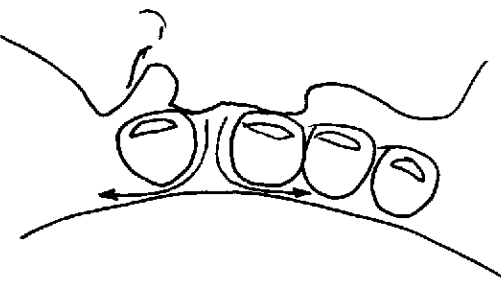


Uko uhaha, uhite urekura urupapuro. Ruzaguma akanya gatoya riyometse ku ntoki.

Ikitonderwa:

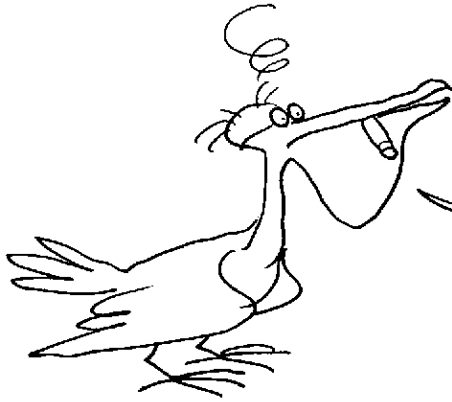
Ugomba guhaha **CYANE** !

Ubuyobozi





Waza ukaguruka gato ?



Nkurikije ibyo nabonye uno muni, mpisemwo kwigendera n'amaguru !

Igitamba, uburemere, presiyo, ubushyuhe, indwanyagikorwa, Berinuyi. Mfite amagambo mfatiro kugirango nguruke.

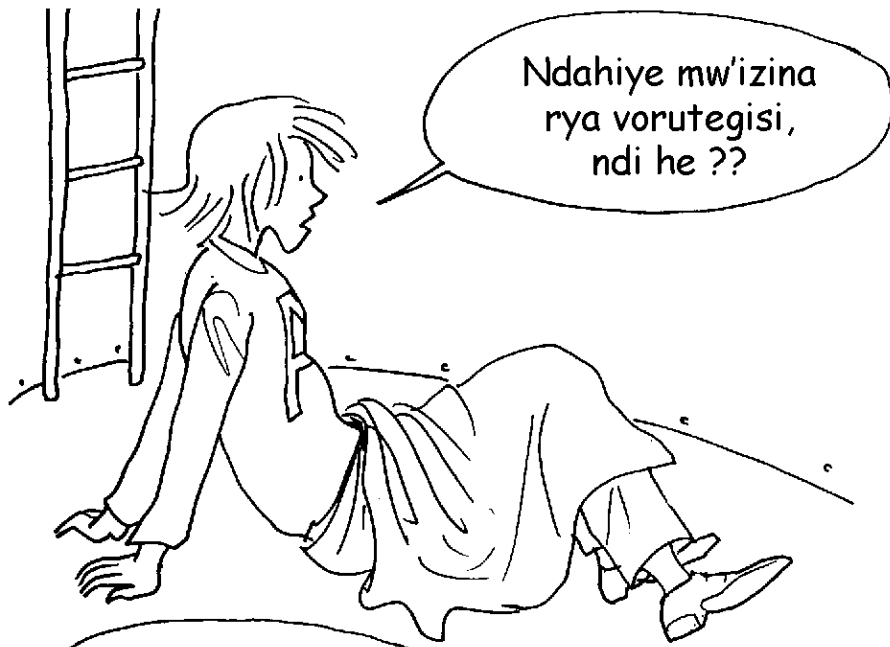


Oya, ubuze rimwe.

Irihe ?



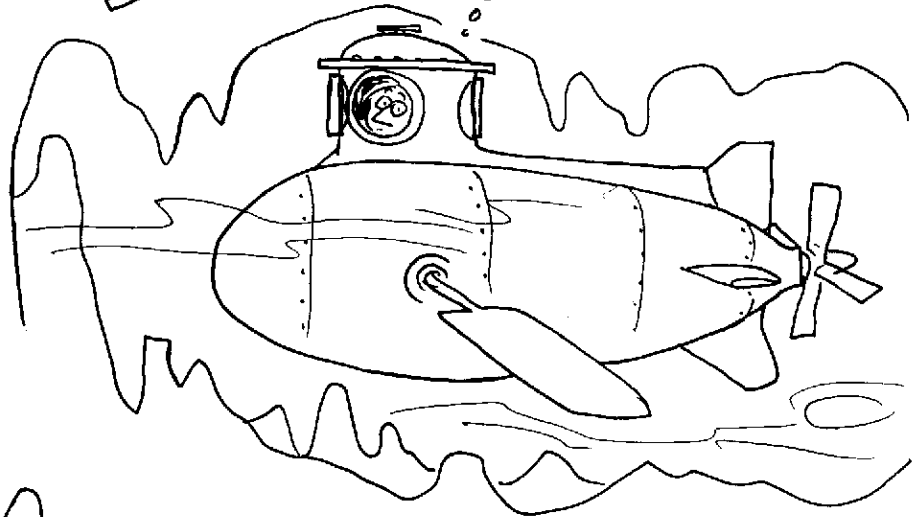
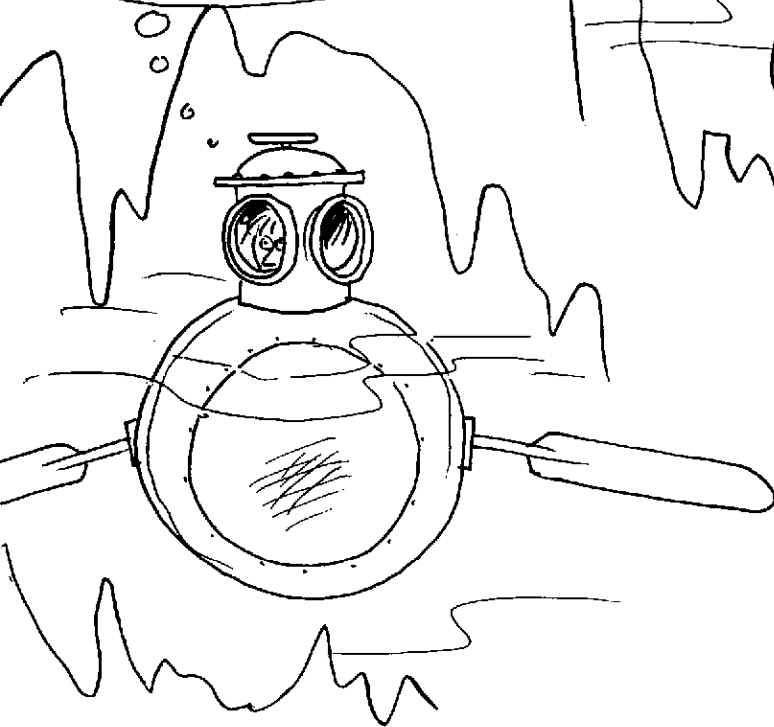
INDOTO YA LANTURULU:



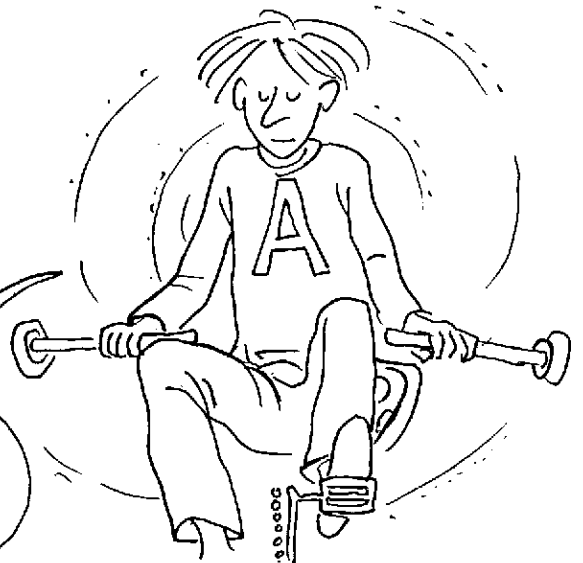
Ndahiye mw'izina rya vorutegisi, ndi he ??

Mu bigaragara ndi mu kibira. Mbega ahantu hateye inkeke !...

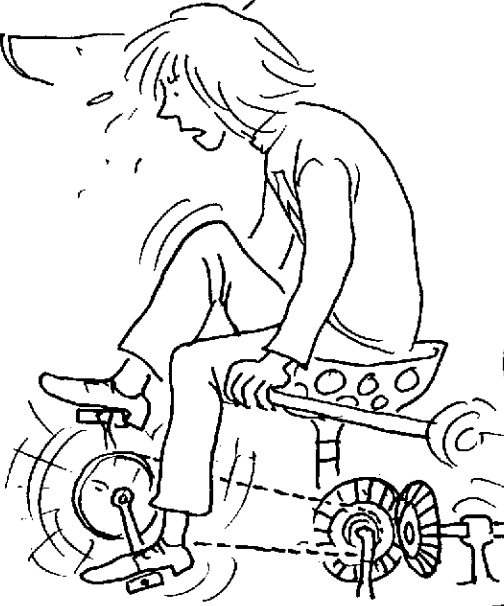
Hakwiyeko nsohoka hano hantu vuba cyane.



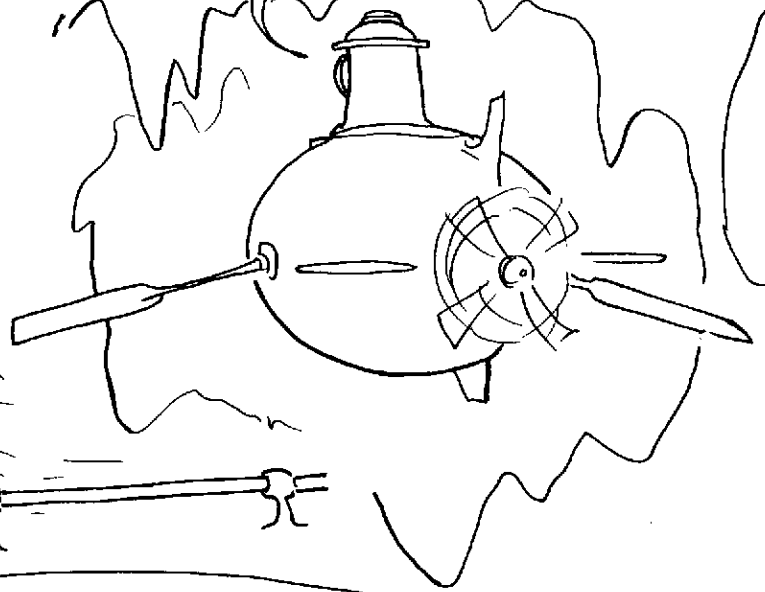
Iyi mashini ifite uburyo bubiri bw'iyoherezwa, Ingashya n'ibaba rikoreshwa na za pedale.



Satani we,
hashize isaha nyonga...



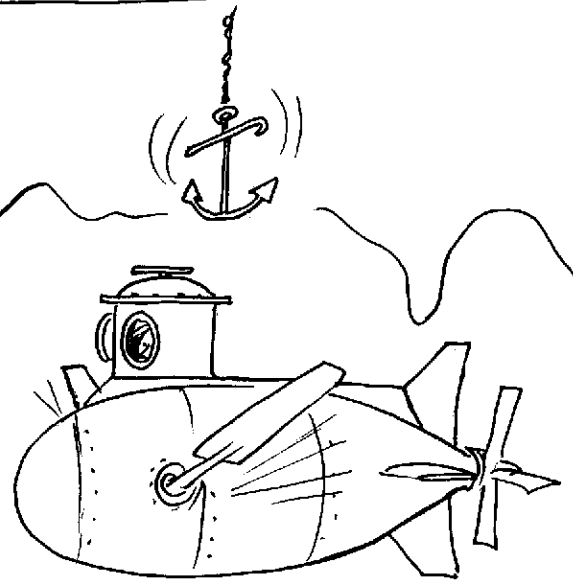
Kandi sintsimbura na gato !



Tugerageze ingashya...
nta cyo bitanga na byo...kandi nta
ntangira na nto numva !!



Ngomba kuba ndi ahantu
hatari n'ikindi kintu na kimwe ?
Oya pe, iyaba nari ahantu hatari
ikintu na kimwe, ikibira cyanjye
nticyareremba!

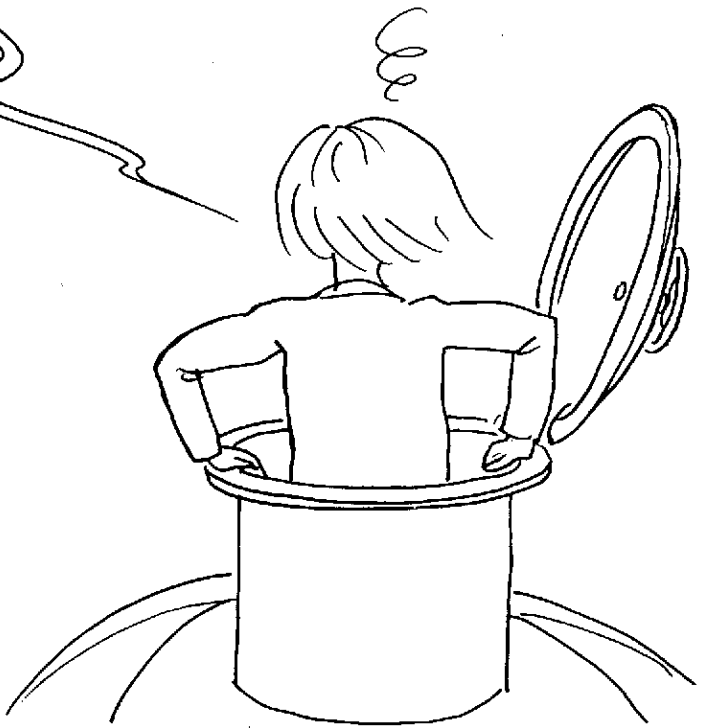


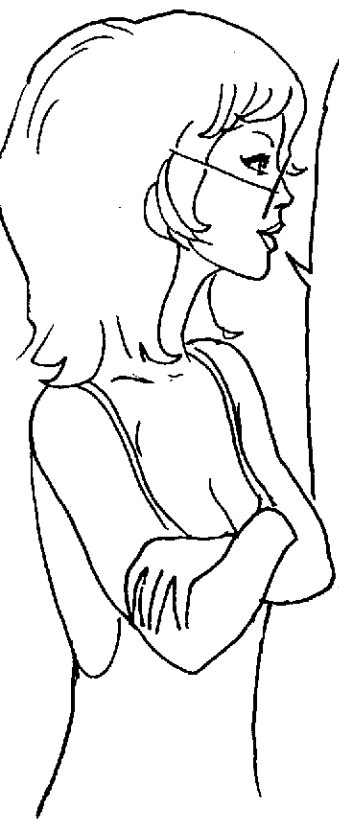


Ngaho re,
umuntu yagirango
ndiho ndazamuka

!..

Ukoresheje serwakira
zose zo kwa satani, Sofiya
nsobanurira rwose icyo
ibyho byose bivuze !

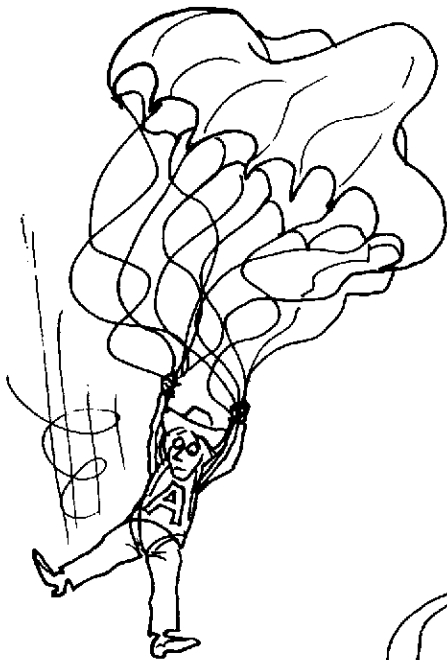




Wari uri gusa muri eliyomo y'INTEMBABUHANITSE. Ibuka inkuru y'igisanduka cy'umucanga. Itsirimana ry'utumanyu tw'umucanga ryari ryinshi cyane kuburyo umucanga watembaga biruhaniye. Aha ho biranyuranye. Mu nsi y'igipimo cy'ubushyuhe cyabazwe, kiri hasi cyane, itemba rya eliyomo riba rinini cyane kandi itsirimana rikangana n'ubusa.



Ariko se ni irihe sano hagati y'itsirimana, n'igikorwa cyo kugashya, cyo kuguruka cyangwa icyo kwisunika ukoresheje ibaba?



Warufite ukuri, mu ruhande rumwe, hamwe n'umutaka wawe. Kugirango ufate igitsikamiro ku muyaga, hakenewe ko uwukacira.



Iyo umuyaga uza kuba uri INTEMBABUHANITSE, umutaka wawe ntacyo wari kuba ukikumariye. Ibibi cyane, ntabwo wari guhagika kandi wowe wari kugwa hasi nta gitangira nk'ibuye !

Inyamaswa ya mbere yatangiye igikogwa cyo kunanara ijuru yasobanukiwe vuba ko yari ikeneye icyo ikacira, mu buryo ubu n'ubu, muri icyo kirere.

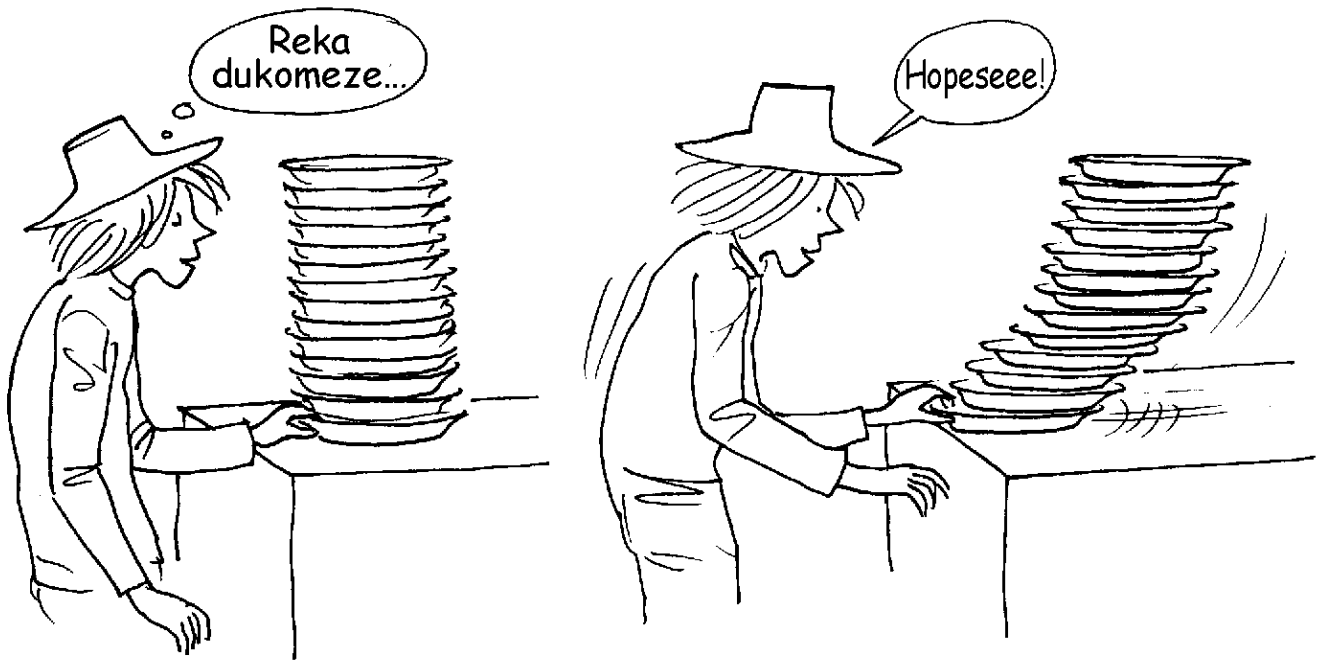
Biryo iguruka ry'ikintu kiremereye kurusha umuyaga risa n'iyirukanka rihoraho ahantu uhora ugerageza gufata igitsikamiro ku kirere gihindagurika buri kanya kandi kigucika buri gihe.

Ahubwo se ntibisaba ko uba washobora gufata igitsikamiro kuri icyo kirere.

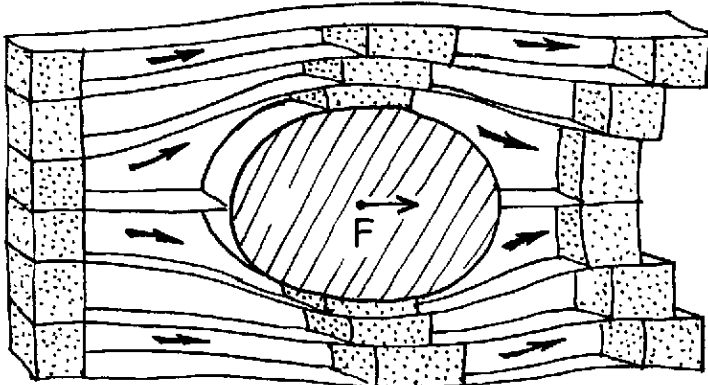
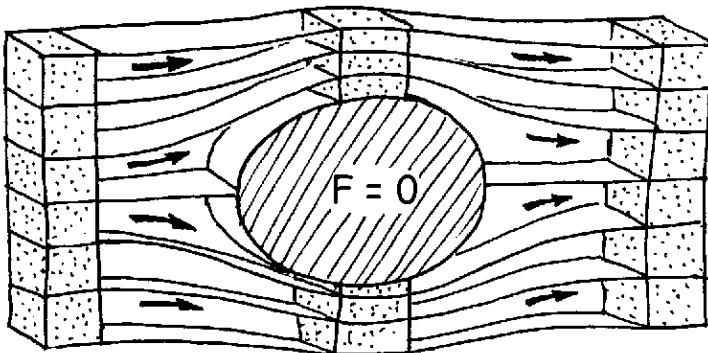
Nimbi iyi ari INTEMBABUHANITSE, amamolekile anyerera amwe ku yandi no ku bindi bintu nta TSIRIMANA na rito. Muri icyo gihe inyoni ziba ntabundi buryo zifite uretse kugendesha amaguru yazo, ama ewoliyene nayo ntaba akizengurutsa kandi n'ingendo zo mu kirere ntiziba zigishobora gukorwa uretse gukoresha imipira isunikwa hakoresheje indwanyagikorwa.

Rero umuguruko ushingiyeye ku kwitsirimama ry'imyuka.

IBITEMBA HAKO RESHEJWE ITSIRIMANA

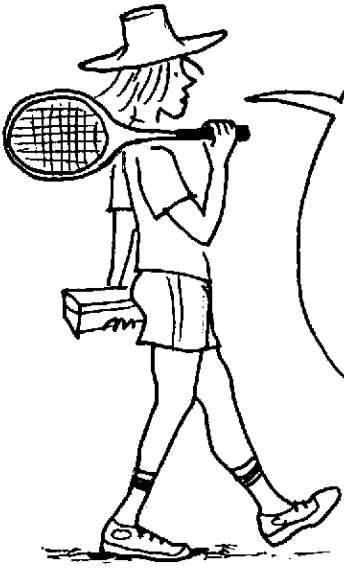


Kimwe n'aya masahani, isaso zigerekeranye z'umwuka zinyereranaho ariko zinatsirimana.



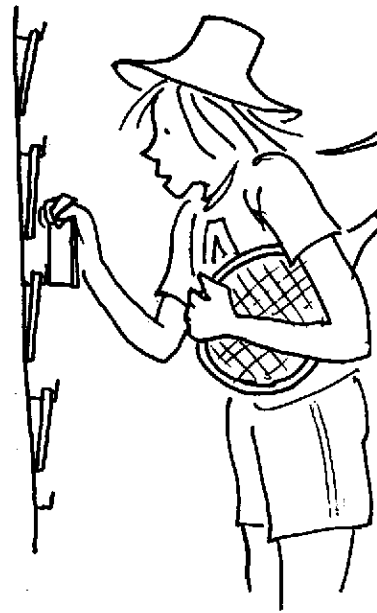
Gerageza gutekereza ikintu kitanyeganyega hageraho amamolekile twerekana nk'aho ari mu ma bwate ya kibe.

- Iyo nta tsirimana na rito rihari, kandi hamaze kuzengurukwa icyo kintu, molekile zisanga zigerekeranye zimwe ku zindi, nko ku musozi.
- Ibiramambo itsirimana rigabanya umuvuduko wa za molekile zituye hafi y'icyo kintu. Ahamanuka, ama "bwate" azaba atandukanye. Icyo kintu kigabanya umuvuduko w'umwuka, kandi umwuka nawo witsindagirana n'imbaraga F kuri icyo kintu: URUKURURANE RW'ITSIRIMANA.



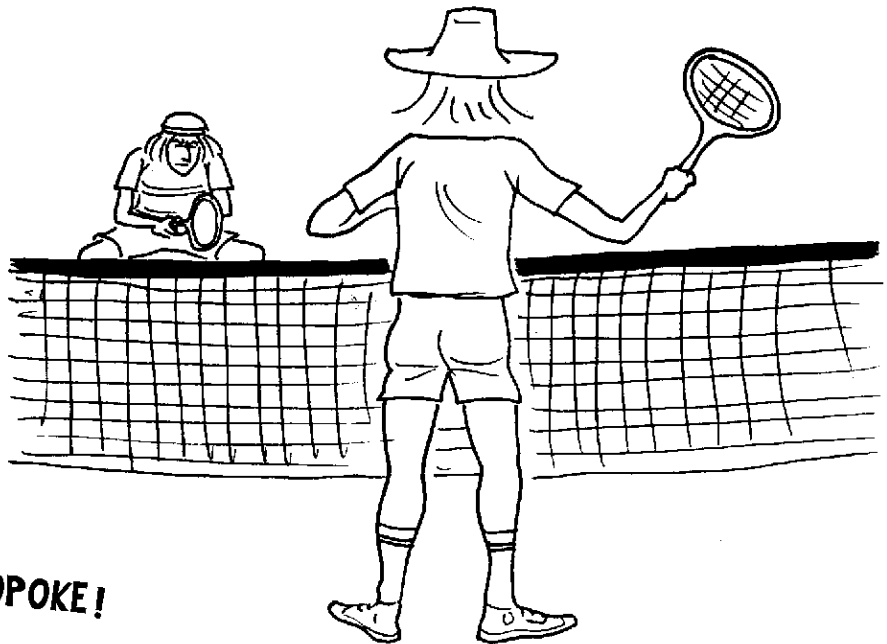
Yego, ibyo byose birakomeye rwose.
Ngiye kwinanura gato nkina tenisi.
Ibyo, byibuze ni mekanike isanzwe,
ni ibijyanye na balisitikye.
Ukubita umupira, bumu.
Kandi iyo ubaze neza,
ugwa mu kibuga.

UMUPIRA UTEWE



Ngiye kwiyandikisha.
Turebe, dore umwanya utarimwo
umuntu. Bonjourne Boruge... simbizi.

Muriteguye ?



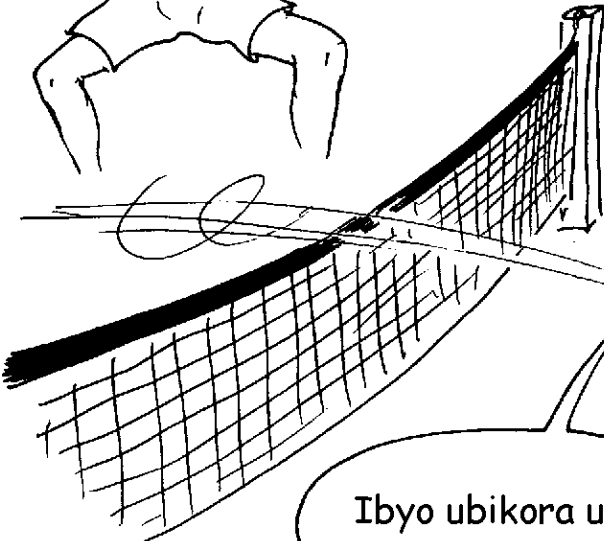
SHOPOKE!



Wa mfura we, ntanakimwe nkoraho. Uyu muntu afite uburyo bugoramyeye bwo kwegura rakete ye iyo akubise umupira. Ibyo ahubwo byakagombye kuzamura imipira.

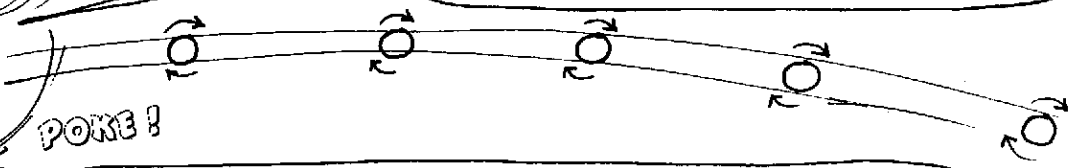


Ahubwo mu by'ukuri birayimanura!

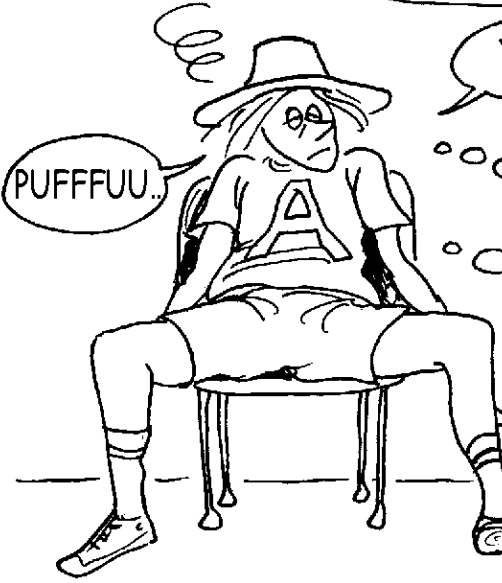


Ibyo ubikora ute?

Biroroshye: mpindukiza umupira muri iyi nzira.



Usa n'umanutse. Ibyo bituma nkubita cyane birushijeho, nkanawutera mu kibuga.



Yego... rwose pe

6-0, 6-0 ahubwo...

Kiracyeye neza nk'umutobe w'inkono



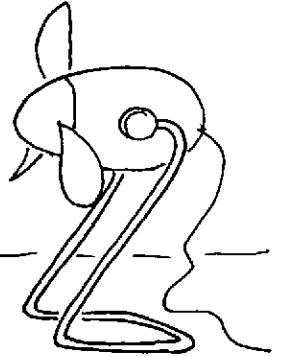
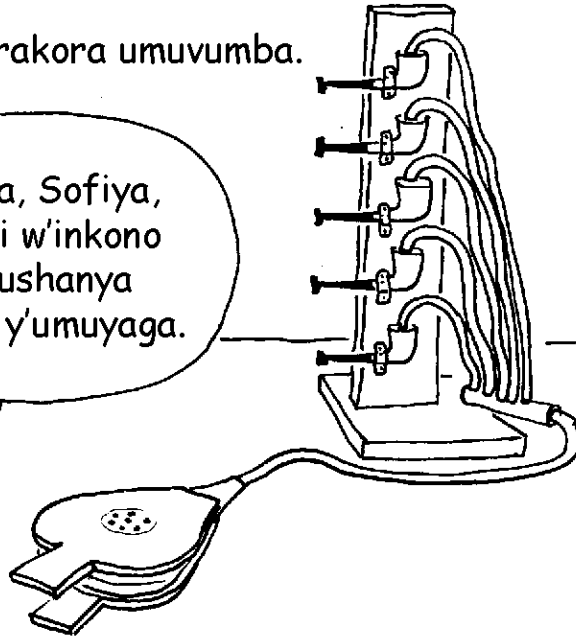


Reka tubyigeho, Boruge yohereje umupira guturuka ibumoso ujya iburyo nk'uko biri ku gishushanyo cyo k'urupapuro ruhise. Ngiye kohereza umwuka k'umupira guturuka I buryo ujya I bumoso, n'ibi bias nk'ibya mbere.

Anselimi arakora umuvumba.



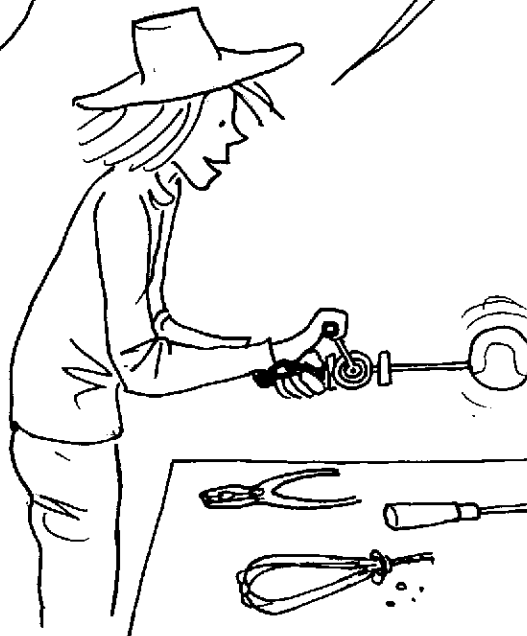
Urareba, Sofiya, umwotsi w'inkono uzashushanya imishumi y'umuyaga.



Hasigaye gusa gutunganya ukwizengurutsa k'umupira. Ibi bishobora gukunda

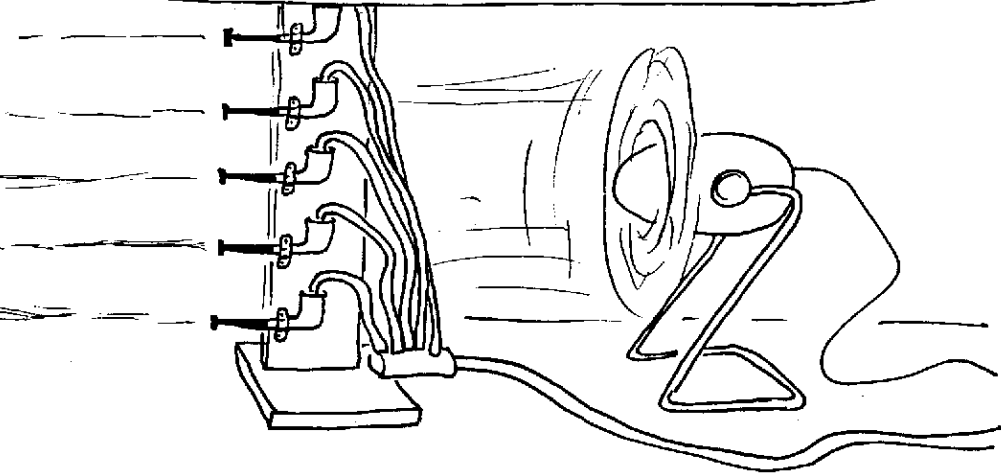


Dore, birakora neza cyane !

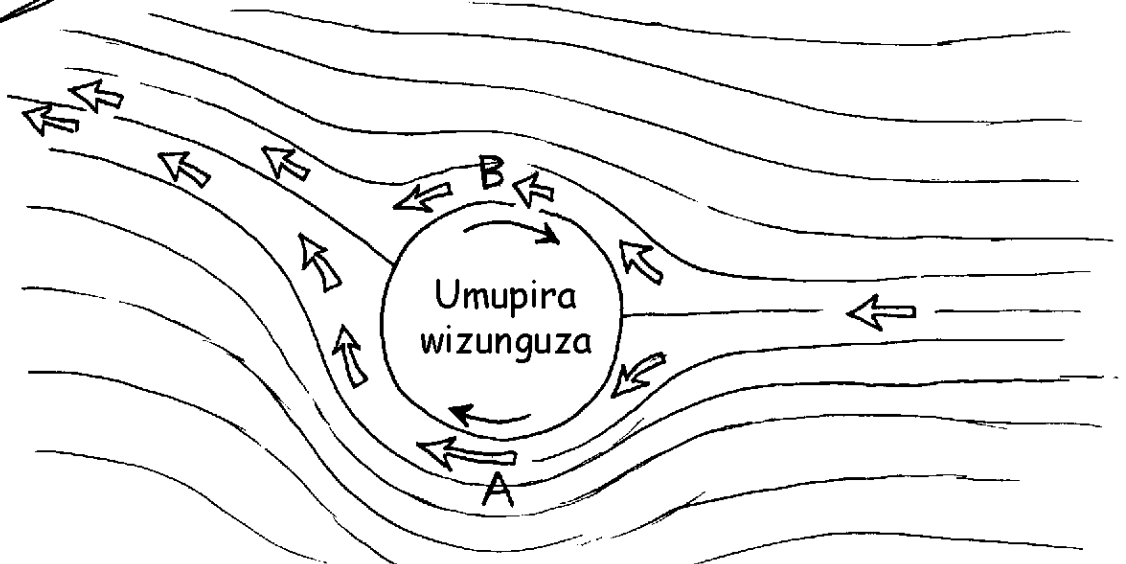




Reka ndebe, ukwizengurutsa k'umupira kohereza umwotsi hejuru kandi, muri icyo gihe numva imbaraga zikurura umupira ziwujyana hasi.

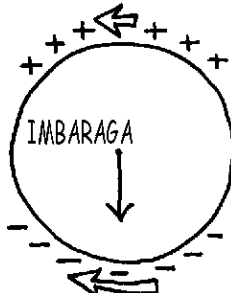


Ubusobanuro: Kubera itsirimana, kwihindukiza k'umupira gukurura umwuka. Ibi nabyo bikabyara INDEGERAMUVUDUKO muri A hamwe N'ICYUHO CY'UMUVUDUKO muri B.



Nta kindi gisigaye atari ugukoresha ihame rya Berinuyi.

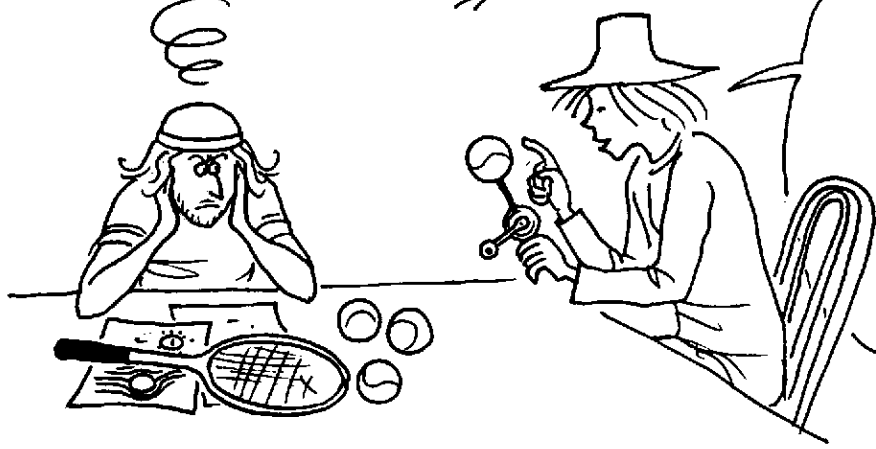
UMUVUDUKO MUTO - PRESIYO Y'UMURENGERA



Umuwuduko w'umuyaga

Presiyo n'umuvuduko bihinduka mu bucurikirane.
 Birtyo, mu nsi = ICYUHO CYA PRESIYO
 Hejuru = PRESIYO Y'UMURENGERA.
 uhereye aho ubona icyerekezo
 cy'imbaraga ayerodinamike

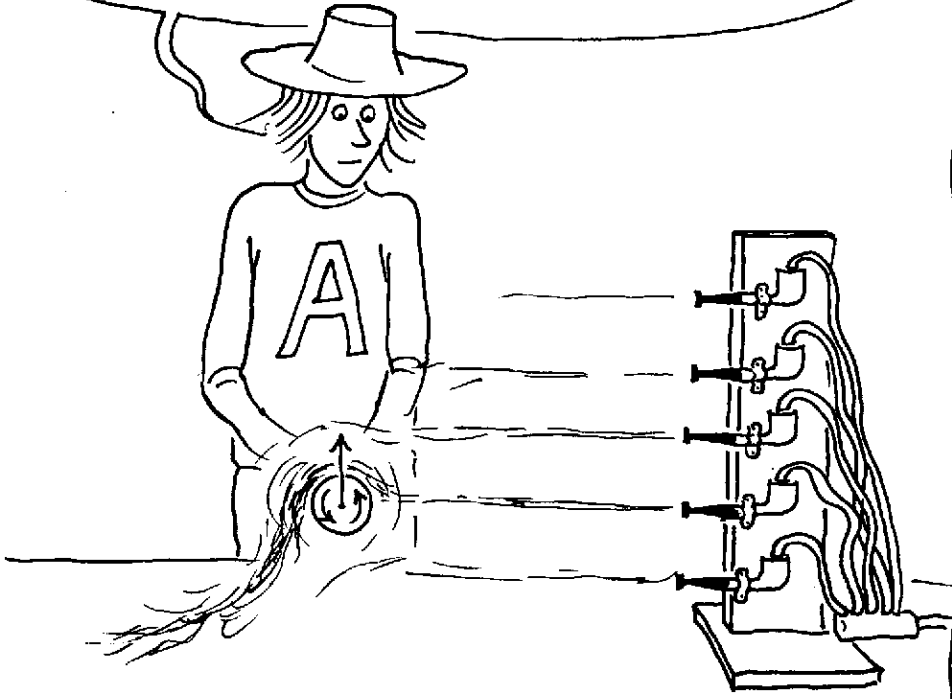
UMUVUDUKO MWINSHI - ICYUHO CYA PRESIYO



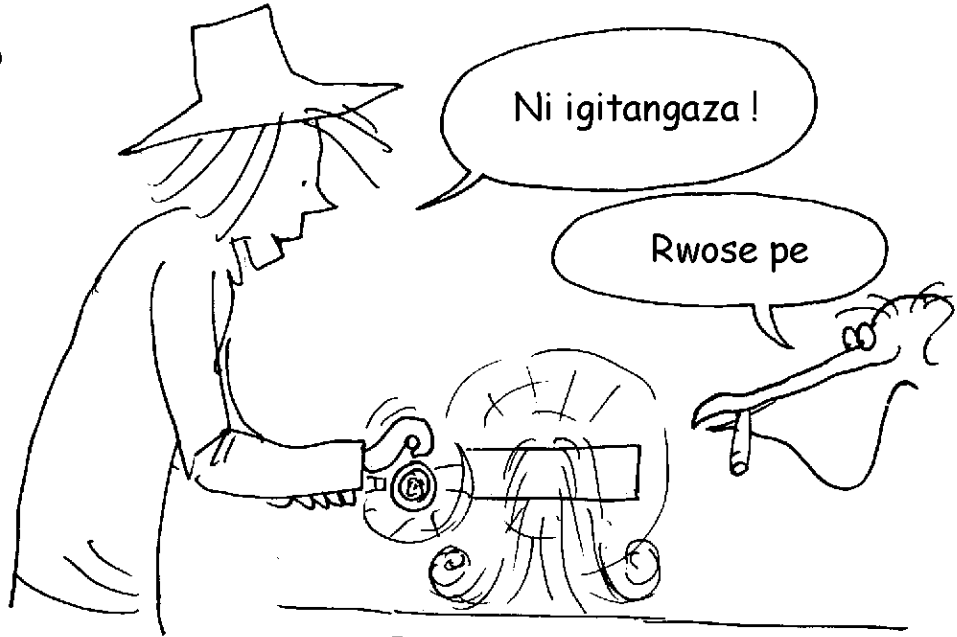
Ibi byose bishoboka kubera itsirimana ry'umwuka k'umupira. Mu muyaga NDENGERABITEMBA, ukuyemwo itsirimana, ntimushobora kandi gutera imipira yanyu.

Dore, uhinduye icyerekezo cyo kuzenguruka, umwotsi usunikwa ugana hasi kandi n'imbaraga zirihindukiza. Ibyo bimpa i GURUKISHA

Igishoboka kuri siferi yenda cyashoboka kuri silenderi izenguruka ?



ROTOR YA FELETINERI



Bavandimwe dukorana hamwe n'inshuti za nje, turebere hamwe ibibera mu NKENGERO.

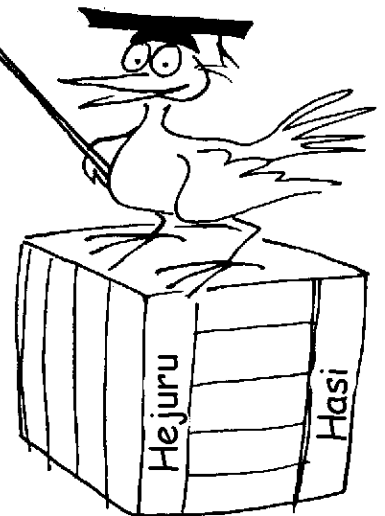
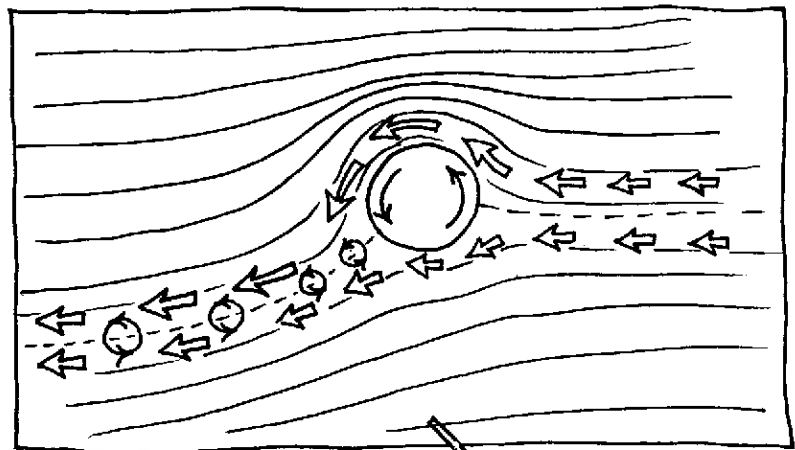
Kuzenguruka kwa sirenderi gutanga imivuduko itandukanye hagati y'itemba ryo hejuru n'itemba ryo hasi.

Hejuru ya silenderi, igihe imyiyoroso ibiri y'umuyaga ihuye, umwe witsirima ku wundi.

Ibi na byo bigira izi ngaruka:

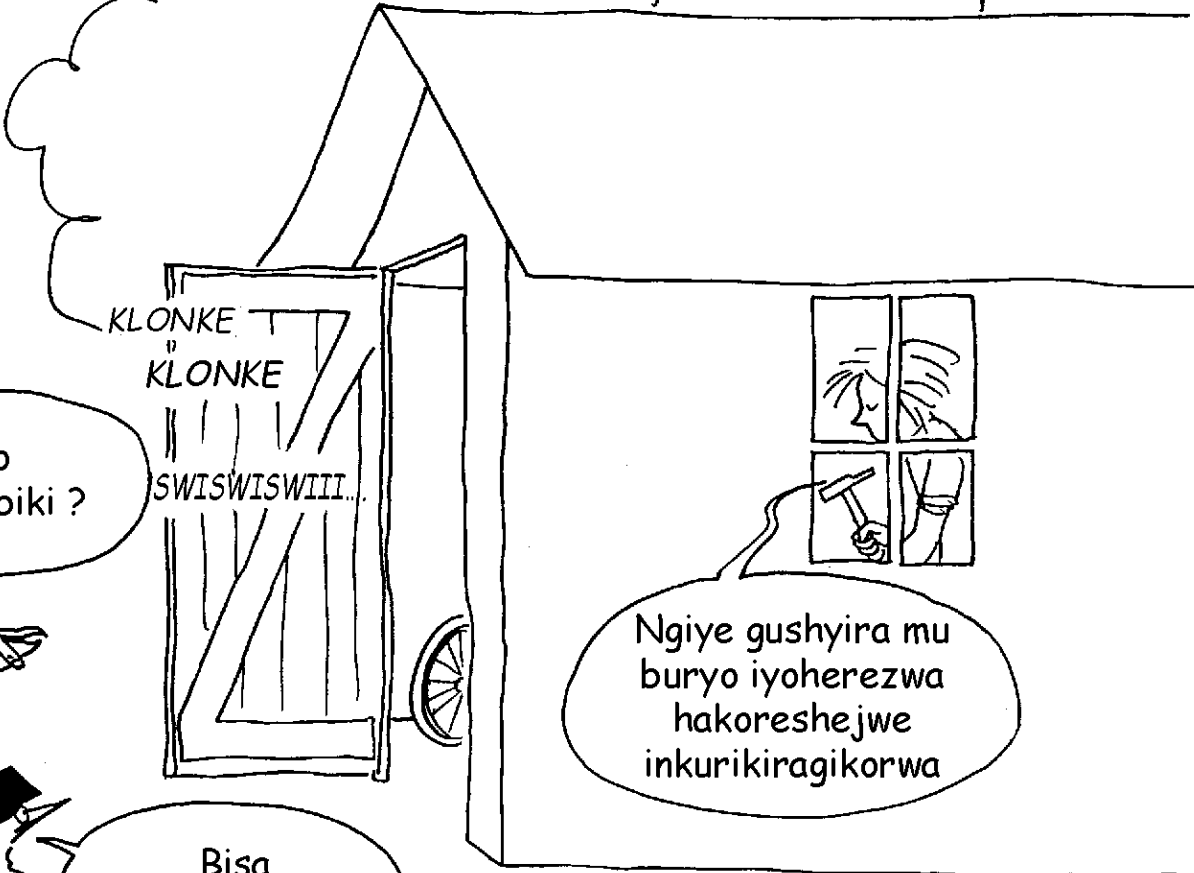
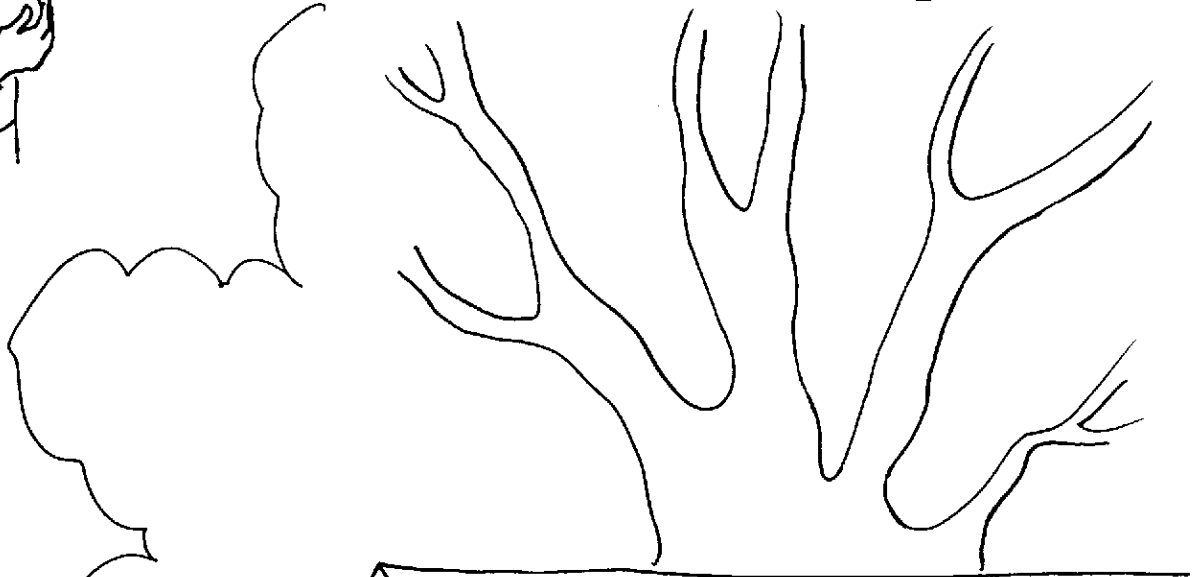
- a) zo kurema twa serwakira duto
- b) zo gukuraho buhoro buhoro ubusumbane hagati y'imivuduko.

Habaho ubudasa bwa presiyo hagati y'igice cya ruguru n'igice cyo hepfo cy'icyicaro, bufatiye k'ubusumbane bw'imivuduko (Berinuyi). Ni cyo gisobanura ubuhetame bw'inshundu z'imiyaga hirya.





Iyo nimuye, mu muyaga I silenderi izenguruka' mbona i GURUKISHA. Ibi bimpa igitekerezo: nagombaga gushobora gukora imashini iguruka.

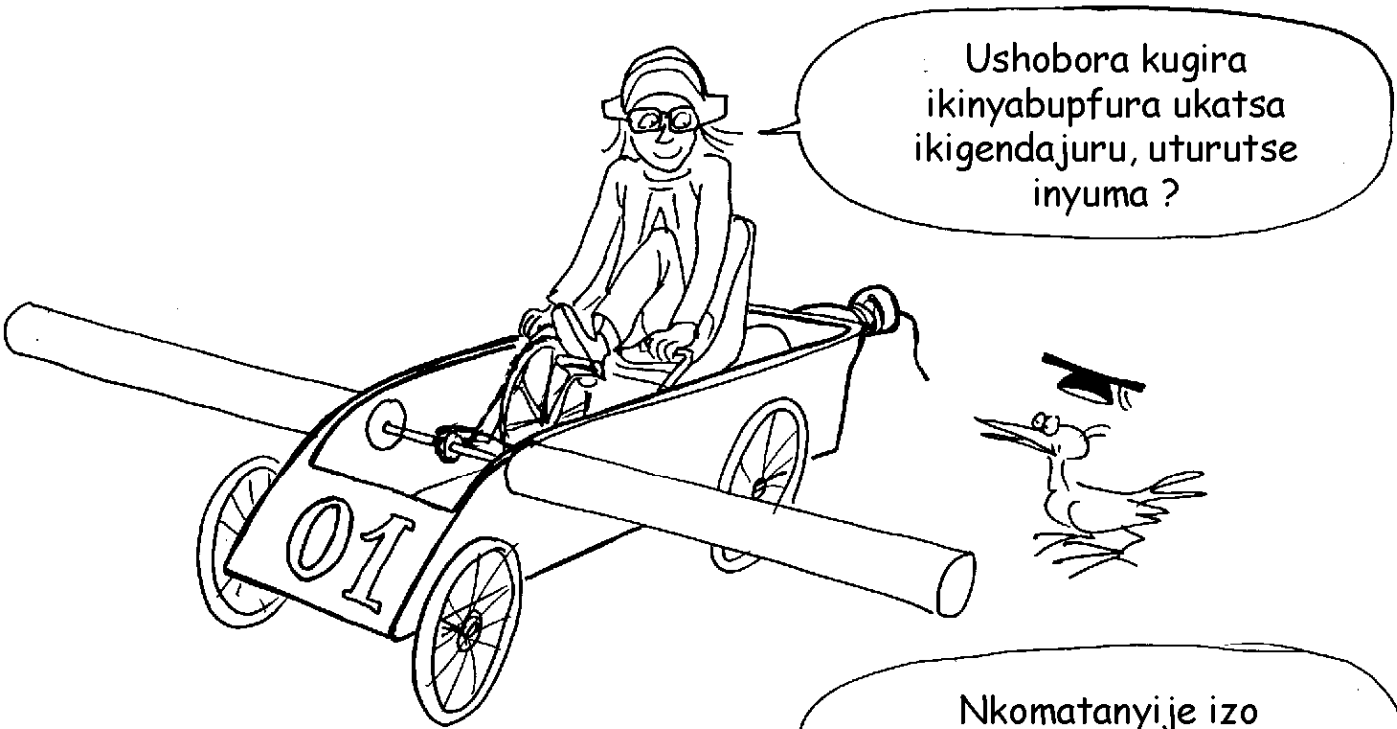


Ariho arakora ibiki ?

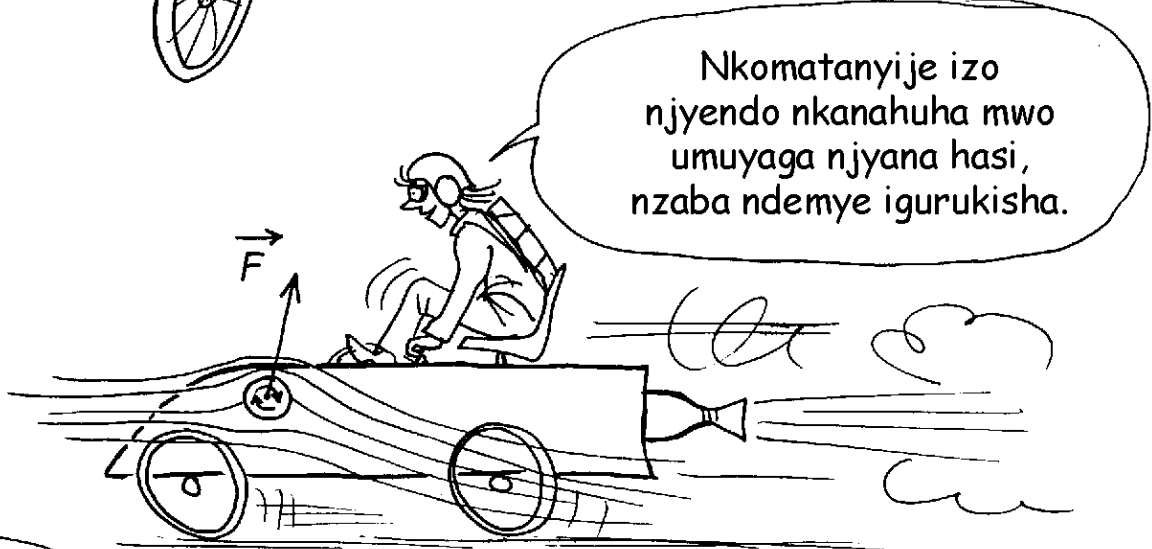
KLONKE T
KLONKE
SWISWISWIII...

Ngiye gushyira mu buryo iyoherezwa hakoreshejwe inkurikiragikorwa

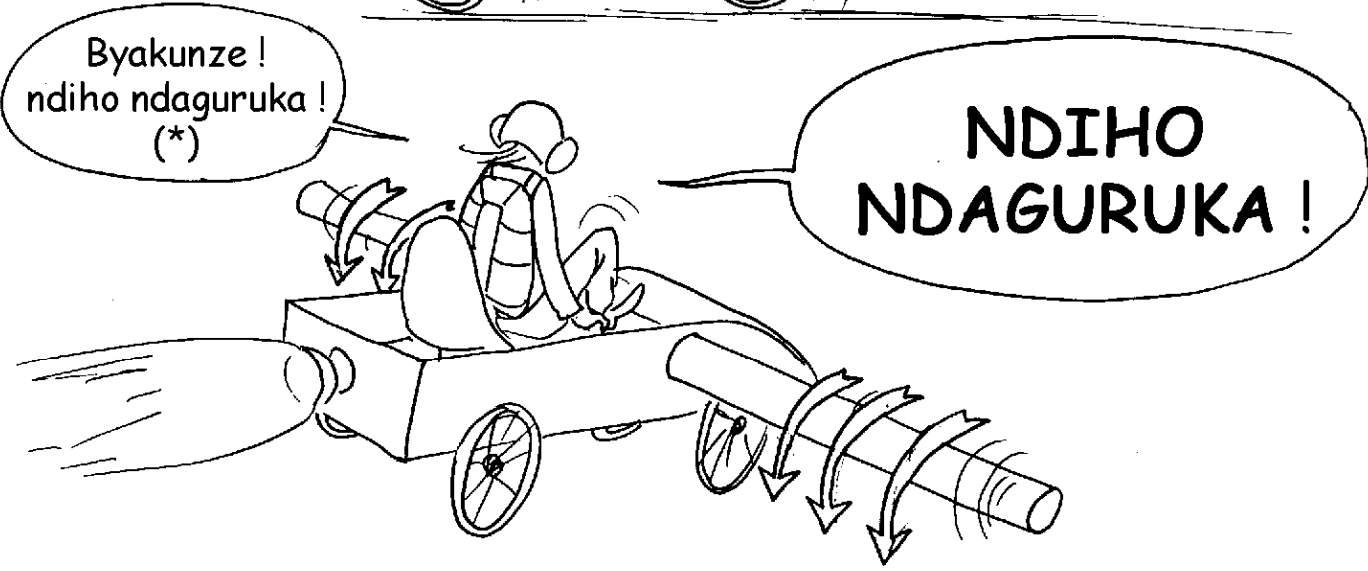
Bisa n'ibikomeye!



Ushobora kugira ikinyabupfura ukatsa ikigendajuru, uturutse inyuma ?



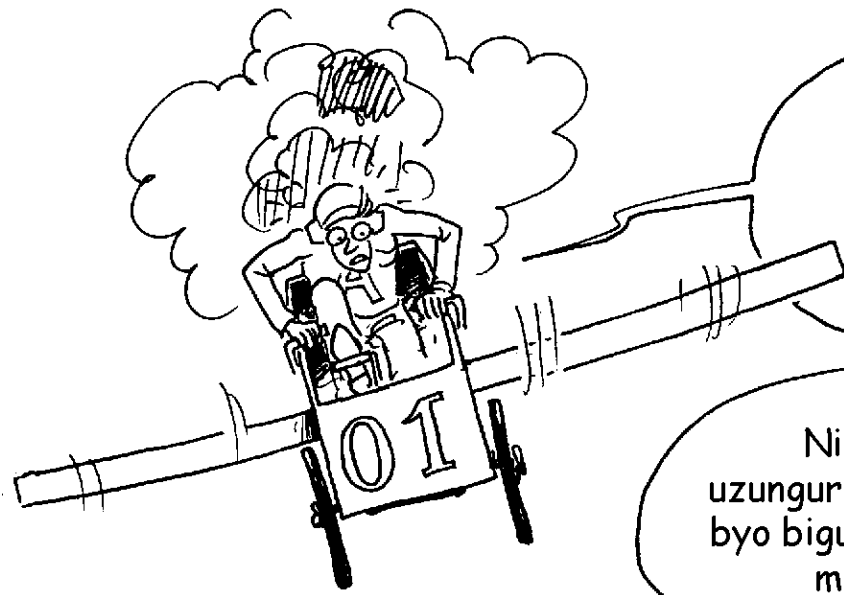
Nkomatanyije izo nyendo nkanahuha mwo umuyaga nnyana hasi, nzaba ndemye igurukisha.



Byakunze !
ndiho ndaguruka !
(*)

**NDIHO
NDAGURUKA !**

(*) nshyizemwo imbaraga nyinshi zihagije, bishobora kujyenda neza cyane !

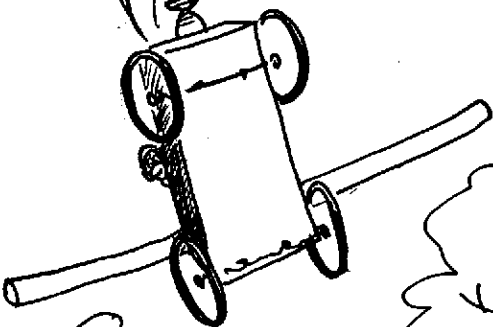


Ariko se !...
ni iki kibaye ?!?
imashini ya nje yishoye
mw'ishinga !?!

Ni ibisanzwe. Nk'uko
uzungurukisha umuyaga, ibyo na
byo bigusaba kukuzengurukisha
mu nzira inyuranye.

Ni ihame
ry'IGIKORWA-
INDWANYAGIKORWA

Ihame ry'iki !?!



Anselimi, iyaba wari wambajije ! hari uburyo
bworoshye cyane, ariko buri gihe ushaka gukora
byose wenyine! Ngwino, I kawa yatunganye.



Ahaaa,
bariya
basakasatsi !

Ni amayobera,
ibibera mu gikombe
cy'ikawa.



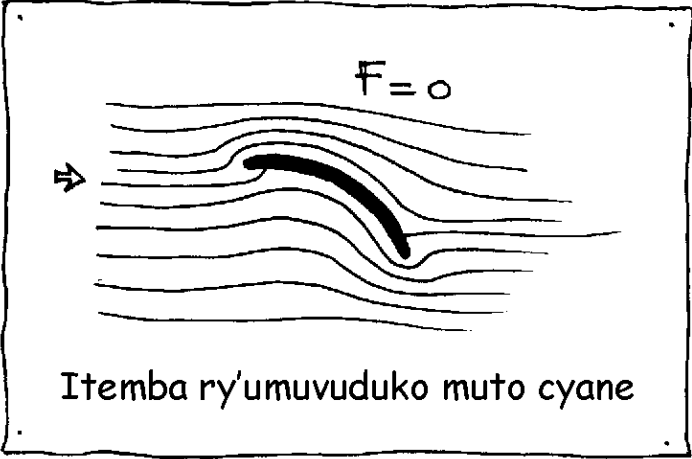
Urareba,
iyo nigijeyo ikiyiko
gacye gacye, numva gusa
indwanya nto, itewe
n'itsirimana.



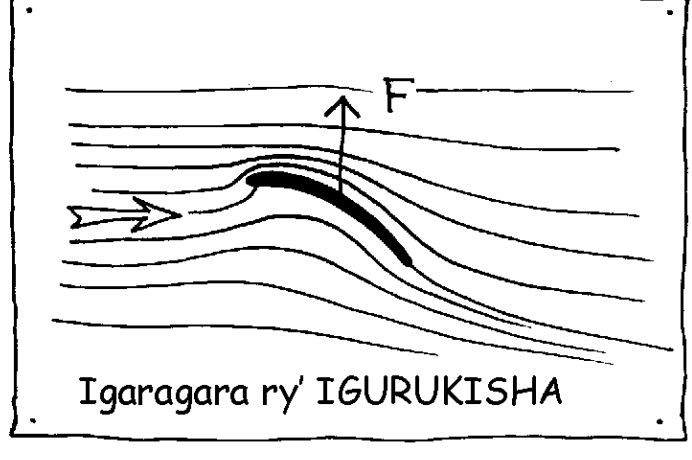
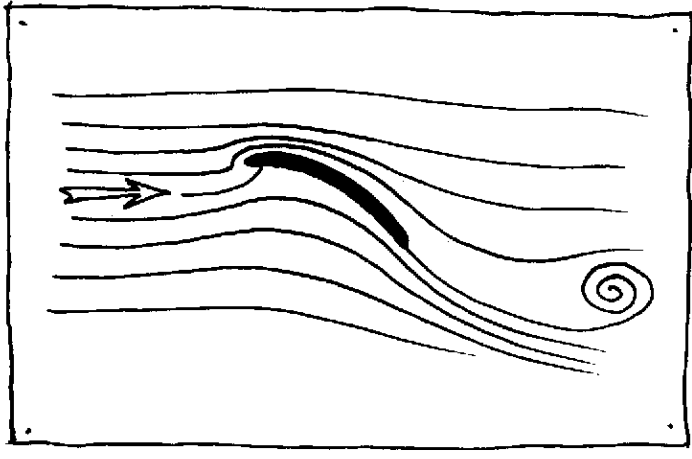
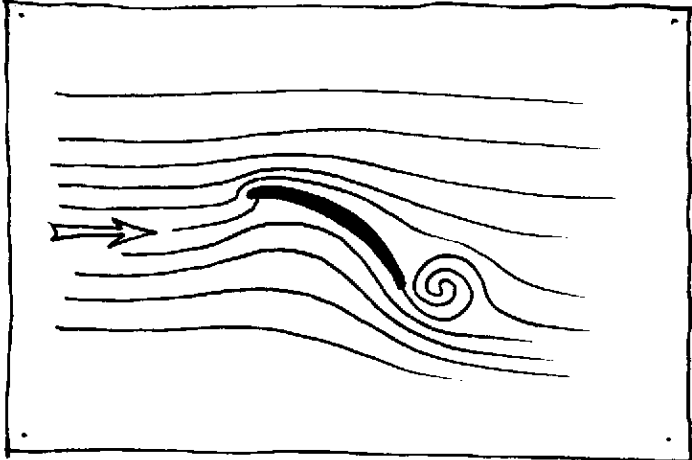
Ariko kandi
iyo nyigijeyo vuba,
serwakira
irahaguruka



Afite amaso ateye igomwe



Itemba ry'umuvuduko muto cyane



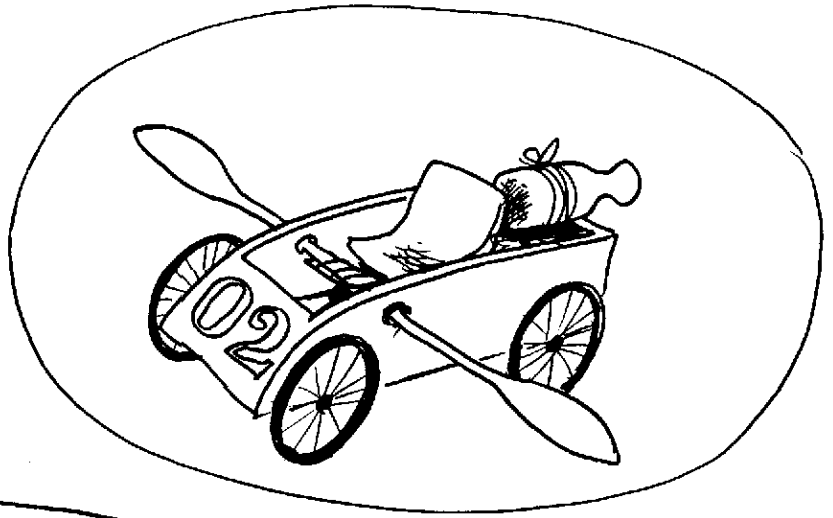
Igaragara ry' IGURUKISHA

Ku bishushanyo byo hakurya urabona uko gutemba ku mpande z'ikiyiko zihinduka iyo uhebye imivuduko mito. Serwakira iravuka hamwe na sisiteme y'umuvuduko w'indengera kuri EGISITARADOSI (hejuru) hamwe n'umuvuduko muto kuri INTARADOSI (hasi) uhahagurukira.

EGISITARADOSI - UMOVUDUKO W'INDENGERA = ICYUHO CYA PRESIYO

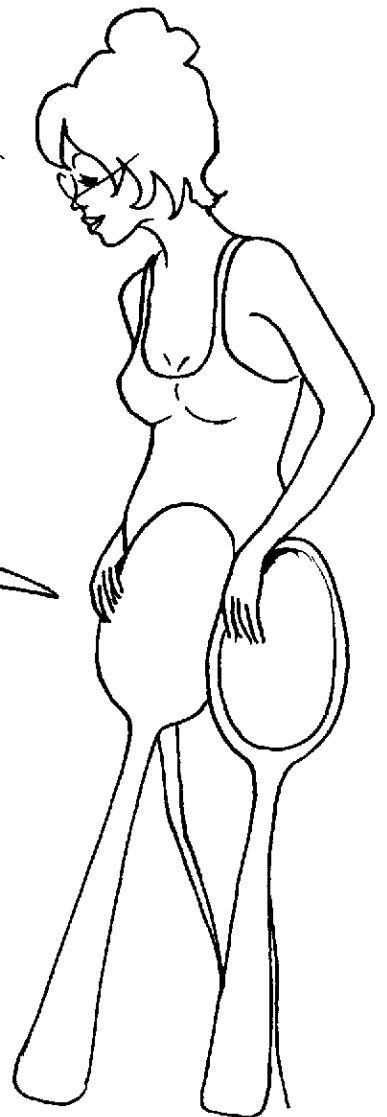
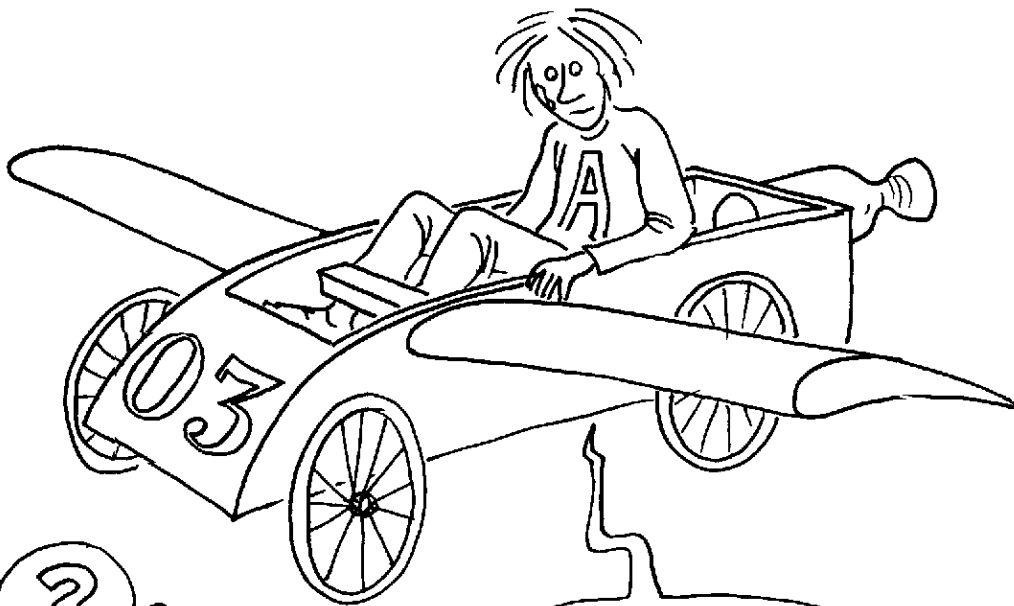
INTARADOSI - UMOVUDUKO MUTO = PRESIYO Y'INDENGERA.





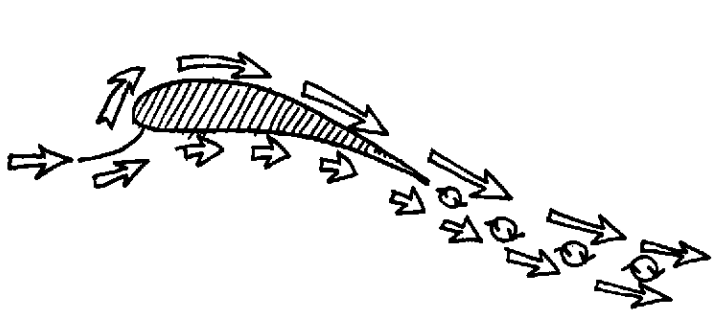
Ni igitangaza, ngiye gushobora kuguruka nkoresheje ibiyiko !

IBABA ni ikiyiko gikoze mu buryo bw'akarusho



Aho turumvikana pe, ariko se ubuzengurukire buri hehe ?



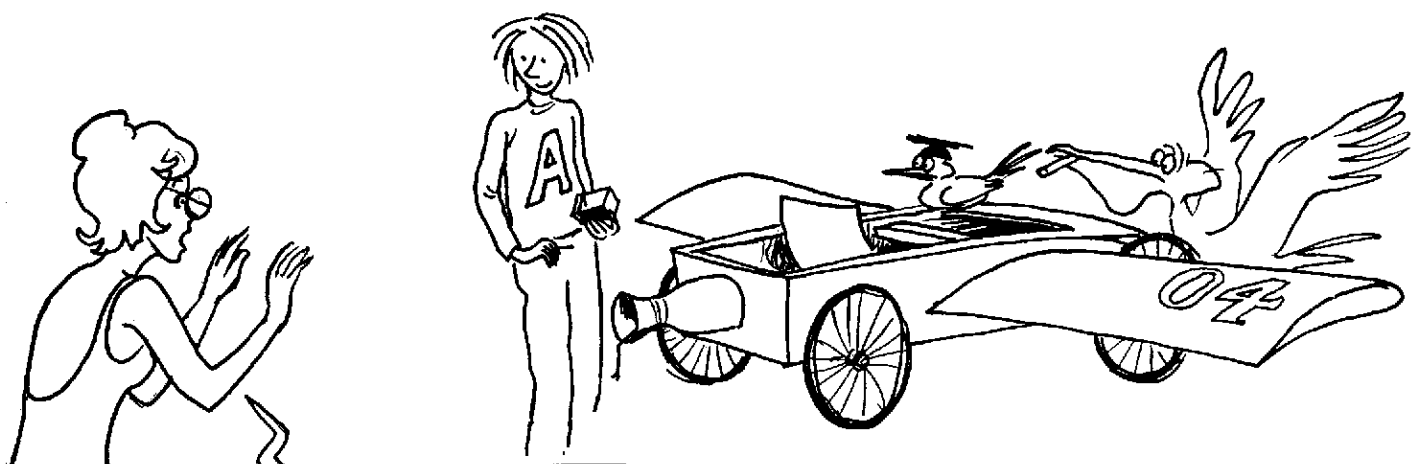


Umuntu abona epfo y'ibaba isisiteme imwe ya twa serwakira duto cyane kurusha uturi imyuma ya silenderi izenguruka. Biryo umuntu ashobora gufata ibaba nka ROTORU ITANYEGANYEGA.



IBABA cyangwa SILENDERI IZENGURUKA

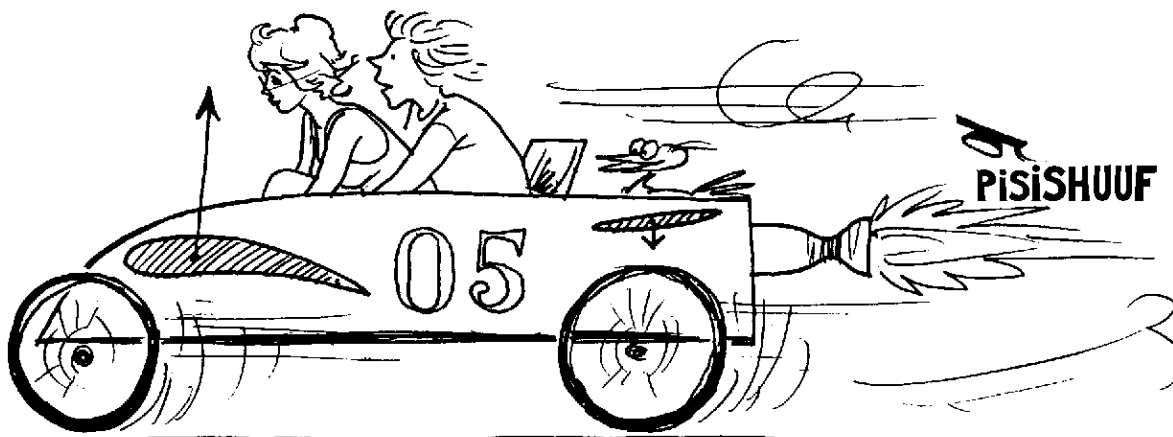
Ingaruka imwe nk'iyo ku muyaga:



Ikitonderwa! Urongera kandi ugwe. Nk'uko byagenze mu kanya gashize, iyi mashini nitangira kuzengurutsa umuyaga izahita yishinga!

Hakwiye gushyirwaho ibabamurizo.

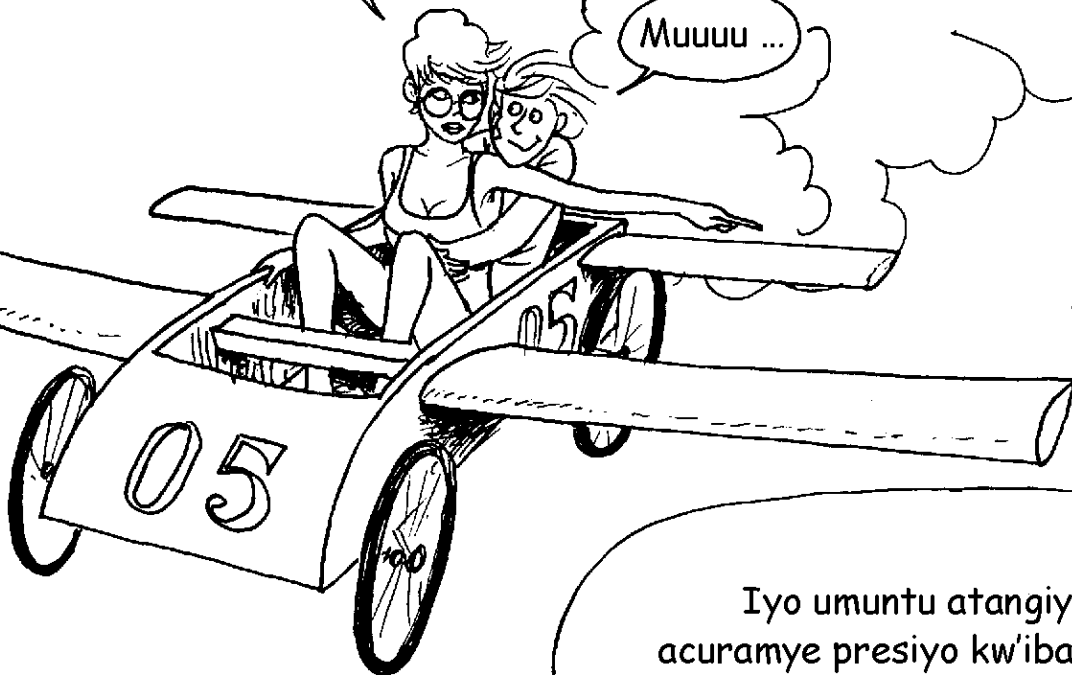




IBABAMURIZO ni ibaba rito ricuramyeye rireba mu kindi cyerekezo gitanga rero Igurukisha negatifu kandi " rirebeshya" hasi ibaba ry'INDEGE. Ibi bituma idashinga umutwe hasi.

Reba, Anselimi,
iyi sisiteme ihagaze neza;
ifashe neza k'ubutaka.

Muuuu ...



Iyo umuntu atangiye kumanuka acuramyeye presiyo kw'ibabamurizo irwana ikugarura mu murongo wo kuguruka.

Ni kimwe niyo
umuntu atangiye kuzamuka
aganisha hejuru.



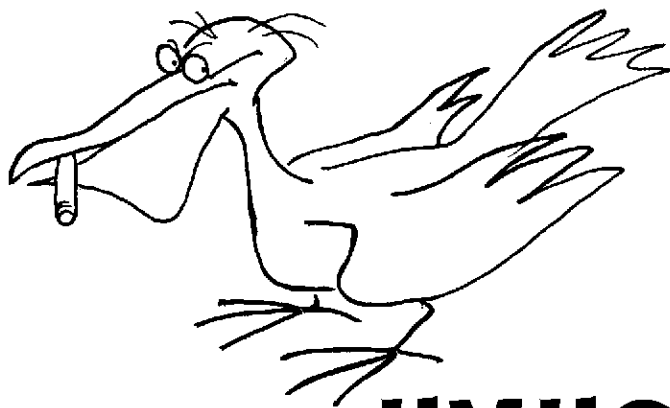
Anselimi,
ntiwumva icyo
nkubwira !

Ndabyumva pe,
ndabyumva pe...

Ni byiza cyane iyo
wumva uhagaze neza



Kandi nguko
uko Anselimi yize kuguruka.
Muri make, byari byoroshye cyane.
Kandi inyungu siyanse ibifitemwo
igenda yiyongera nk'ubuzamuke...



UMUSOZO

